

November 30, 2012

## Options for Continuation of Open-Ended Asset Purchases in 2013<sup>1</sup>

### Introduction and Summary

As background for the Committee's policy discussion at the December meeting, this memo provides estimates of the effects of additional asset purchases on the economic outlook as well as on the Federal Reserve's balance sheet and income. All options assume that the maturity extension program is completed at the end of December and that \$40 billion of agency mortgage-backed securities (MBS) are purchased in December, resulting in about \$250 billion in purchases of longer-term securities from October to December 2012. The open-ended program options presented in this memo assume that additional purchases beyond 2012 cumulate to either \$500 billion or \$1 trillion, for total program sizes of \$750 billion and \$1.25 trillion, respectively.<sup>2</sup> The pace of Treasury securities purchases varies from \$25 billion per month to \$60 billion per month, while the pace of MBS purchases remains at \$40 billion per month under all purchase options examined. We also present, for comparison, results for a scenario in which there are no additional purchases of longer-term securities beyond 2012.

The model-based analysis presented below suggests that additional purchases would boost aggregate real activity and inflation moderately, thereby fostering progress toward the FOMC's objectives. As might be expected, \$1 trillion of additional purchases would have roughly twice as large an effect on the macro economy as \$500 billion of additional purchases. Of course, these estimates—which are derived using a staff model of the term premium combined with the FRB/US model—are subject to considerable uncertainty, reflecting both our limited experience with this unconventional policy tool and the unusual economic conditions we now face, and other models might yield noticeably different results.<sup>3</sup> In addition, the modeling framework used here assumes that investors know with certainty the total size and exact path of purchases under each scenario. In practice, investors' assumptions about the total size of the program would likely evolve over time in response to changes in economic conditions and as financial market participants acquire a better understanding of how the Committee will actually respond to changing economic conditions—a learning process that would tend to reduce any differences in economic effects across policies.

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<sup>2</sup> The past two Tealbooks have modeled purchase programs that commenced purchases in October 2012. In these programs, there were an estimated \$250 billion in purchases between October 2012 and end-December 2012, plus purchases at least through mid-2013. Adding these two segments together, the Tealbook scenarios implied purchase programs that ranged from about \$750 billion (\$250 + \$500) to \$1.25 trillion (\$250 + \$1,000). In all calculations, the total purchase amounts exclude reinvestment purchases from maturing MBS, agency debt, and Treasury securities.

<sup>3</sup> Under our modeling framework, the pace of purchases does not play a critical role in the financial, macroeconomic, balance sheet, or income projections given the relatively small differences in timing for programs of similar total size. If there were more significant differences between the pace of purchases assumed in the different projections, this factor could become relevant.

Regardless of the macroeconomic effects of asset purchases, the additional asset purchases would lead to a significant increase in the size of the Federal Reserve's balance sheet and, using an exit strategy based on the Committee's June 2011 principles, a higher level of reserves at the time of the first increase of the federal funds rate from the zero lower bound. As a result, Federal Reserve income would be affected—boosted in the near term by higher interest income and dampened in the medium term by higher interest expense and higher realized capital losses on a larger amount of MBS sales. In sum, we estimate, based on assumptions about future interest rates, that significant additional asset purchases would result in an appreciable decline in cumulative remittances to the Treasury between 2012 and 2025: Cumulative remittances are estimated to be \$530 billion with \$1 trillion in additional purchases and \$590 billion with \$500 billion in additional purchases, compared to about \$630 billion if purchases were terminated in December 2012. Additional purchases would also boost the likelihood of booking a deferred asset during the exit period.<sup>4</sup> The estimates below show a deferred asset that peaks at about \$4 billion in the scenarios with \$500 billion of additional purchases and \$45 billion in the scenarios with \$1 trillion of additional purchases. If purchases were to stop in December of this year, no deferred asset would be expected to be recorded.

As with our estimates of the macroeconomic effects, our estimates of the impact of additional asset purchases on Federal Reserve income are subject to considerable uncertainty. One important source of uncertainty that would affect the income estimates concerns the projected paths of short- and long-term interest rates. We illustrate the potential consequences of the latter possibility by adding shocks to the model projections that result in appreciably higher interest rates. We also consider scenarios that capture the possibility that draining reserves could prove more costly than anticipated or that MBS sales could lead to a temporary widening of the MBS-Treasury basis. The more interest rates rise, the larger and longer-lasting the deferred asset is likely to be, reflecting increased interest expense associated with reserve balances and greater realized capital losses associated with MBS sales. Of course, if interest rates were to rise more slowly than in our projections, the result would be a reduction in realized losses on asset sales and interest expense, higher cumulative remittances through the projection period, and, in the \$1 trillion additional purchases projections, most likely only a modest deferred asset. These income effects would need to be considered against the broader backdrop of economic activity associated with higher or lower interest rate paths.

The income results are also very sensitive to the decisions made regarding exit. The results shown here assume that exit proceeds in a manner that generally follows the exit strategy

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<sup>4</sup> The Federal Reserve books a deferred asset when income is not sufficient to cover expenses, including dividends, and maintain surplus at a level equal to capital paid in. The deferred asset is subsequently realized as a reduction of future remittances to the Treasury (which are accounted for as interest on Federal Reserve notes expense). Thus, it is an asset in the sense that it embodies a future economic benefit that will be realized as a reduction of future cash outflows. If the realization of the asset is expected to occur over several years, some valuation technique, such as net present value, would be applied to measure the value of the asset. This accounting treatment is consistent with U.S. GAAP and is similar to the way that private companies report deferred loss carry forwards as an asset.

principles laid out by the Committee in June 2011. As the portfolio continues to evolve, the Committee may wish to reassess that strategy given the substantial changes in the size and composition of the portfolio and the level of reserves since June 2011.<sup>5</sup> In particular, if the Committee revised its exit principles in a way that would extend the normalization period for the size of the portfolio, postpone sales, lengthen the period over which sales are conducted, contemplate sales of Treasury securities, or even forgo sales altogether, the path of the portfolio, the level of reserves, and the stream of Federal Reserve remittances could change considerably. For example, with \$1 trillion in additional purchases, the maximum deferred asset would drop by roughly \$40 billion if no MBS sales occurred and the normalization of the size of the balance sheet would be delayed by a little over a year.

While a deferred asset or very low remittances could raise communications issues or generate political controversy, such outcomes would not adversely affect the Committee's ability to implement monetary policy consistent with its dual mandate. Moreover, the decline in remittances that we report here are not substantive once placed in the context of the improved economic performance and the resulting higher tax revenues that the purchases would be expected to generate. Indeed, our analysis suggests that continuing asset purchases past this December would act to shrink the federal budget deficit over time, on net, thereby reducing the federal debt level (including the effects of Federal Reserve remittances) by between \$220 billion and \$330 billion in 2025, depending on the volume of additional purchases, largely through the greater tax revenue that results from the economic stimulus the programs create. In addition, the price level is permanently boosted as a result of the additional asset purchases because of its temporary effects on inflation, resulting in an increase in the long-run level of nominal GDP. Taken together, the drop in debt and the rise in nominal GDP cause the debt-to-GDP ratio to fall 1½ to 2¾ percentage points in 2025 relative to a scenario where purchases terminate at the end of 2012. Of course, these purely economic terms may not capture all concerns of the Committee. For that reason, we provide information on the Federal Reserve's balance sheet and income.

In the next section, we discuss some specific options for extending purchases into 2013 that the Committee might want to consider, along with a scenario that does not include purchases past year-end. For each of these options, we review the associated financial, economic, balance sheet, and income projections. We then evaluate the income risk exposures to the portfolio by considering alternative scenarios for interest rates, including an adverse scenario in which long-term Treasury yields run about 200 basis points above the October Tealbook interest rate path around the time of the liftoff of the federal funds rate from its zero lower bound, and the impact of the current exit principles on income. Last, we consider a few potential additional risks associated with exit.

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<sup>5</sup> See the August 28, 2012 memo entitled "The effect of an additional \$1 trillion LSAP on the exit strategy" for further details on the impact additional asset purchases have on the exit strategy.

## Open-ended Purchase Options

The open-ended nature of purchases in the current FOMC statement makes quantifying the economic, balance sheet, and income impacts of the programs more challenging than was the case for previous stock-based purchase programs. If the Committee announces that a particular pace and composition of purchases will be maintained until the outlook for the labor market is substantially improved, then the effect of the program on interest rates and the economy will depend crucially on market participants' assessment of the economic outlook and the ultimate size of the balance sheet. According to the October 15, 2012, Primary Dealer Survey, market participants' median expectations are most closely aligned with the \$1.25 trillion open-ended purchase program, with \$1 trillion of those purchases in 2013, although individual beliefs about the ultimate size of the balance sheet vary considerably.<sup>6</sup> Of course, to the degree that these expectations conflict with the FOMC's actual intentions, market participants will presumably adjust their expectations over time in response to FOMC communications as well as news about the labor market outlook. Such learning, however, is not considered in the scenarios below; rather, investors are assumed to be prescient about the cumulative amount of further purchases.<sup>7</sup>

Table 1 presents the key elements of the purchase options. Under each of the options, we assume that the MEP is completed in December and that purchases of \$40 billion in agency MBS continue through the end of this year, resulting in \$250 billion of purchases between October and December 2012. The policy of reinvesting principal payments on agency debt and agency MBS in agency MBS is unchanged, and maturing principal amounts from Treasury securities begin to be reinvested again at auction after the first of the year.<sup>8</sup>

The options differ in their total size, composition, and pace of purchases that begin in January 2013. Options 1 and 2 include additional purchases of roughly \$500 billion in 2013, cumulating to a total purchase program of \$750 billion, with some difference in composition and pace. Purchases in option 1 are assumed to be executed at a pace of \$85 billion per month through June 2013, with \$45 billion in Treasury securities and \$40 billion in MBS, while purchases in option 2 are executed at \$65 billion per month through August 2013, with \$25 billion in Treasury securities and \$40 billion in MBS. Options 3 and 4 assume additional purchases of about \$1 trillion starting in 2013, cumulating to a \$1.25 trillion purchase program overall, with the pace and composition of purchases the same as in options 1 and 2 but with later completion dates of December 2013 and April 2014, respectively. Option 5 considers another variation on conducting \$1 trillion in additional purchases, conducted at a faster pace of \$100 billion per month through October 2013, with \$60 billion in Treasury securities and \$40 billion in MBS,

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<sup>6</sup> The median response to the October 15, 2012, Primary Dealer Survey suggests a median expectation for a total of \$1.1 trillion in additional purchases, with a range between \$250 billion and \$2.5 trillion.

<sup>7</sup> An open-ended program where market participants' beliefs about the ultimate size of the program evolved over time was considered in the August 2012 FOMC memos by Laforte et. al. and Bowbeer et. al.

<sup>8</sup> The effect of this latter assumption is very modest, as after the completion of the MEP, there will be less than \$6 billion of Treasury securities in the SOMA portfolio that mature before January 2016.

likely close to the upper bound on feasible monthly purchases.<sup>9</sup> Finally, option 6 assumes no additional purchases after year-end.<sup>10</sup>

Under all options, Treasury securities purchased are assumed to have a weighted-average duration of approximately nine years, and MBS purchases are assumed to be concentrated in newly issued securities.<sup>11</sup> With regard to exit, redemptions of all assets begin six months prior to the initial increase in the federal funds rate, which is assumed to occur in August 2015, consistent with the October Tealbook staff forecast. Sales of MBS begin six months after liftoff and MBS holdings are eliminated over a five-year period.<sup>12</sup>

### **Financial and Economic Impact**

Several steps are involved in the staff's estimation of the financial and economic impact of the Federal Reserve asset programs.<sup>13</sup> To begin, we estimate the direct effects of the various purchase options on long-term interest rates using the staff's term premium model.<sup>14</sup> According to this model, the \$750 billion programs should initially reduce the term premium on the ten-year Treasury yield about 20 basis points relative to the scenario with no additional purchases in 2013, while the \$1.25 trillion programs have term premium effects of roughly 40 basis points. (See table 1.) Next, we assume that projected outcomes for real activity, inflation, and interest

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<sup>9</sup> Consistent with the capacity analysis in the December FOMC memo "MBS Market Functioning and Capacity Under the Open-Ended Purchase Program," the overall size and monthly pace of option 5 is not expected to result in a material disruption of functioning in the markets for either Treasury securities or MBS. After completing this \$1 trillion open-ended purchase program, SOMA's share of the MBS market is anticipated to grow from about 20 to about 30 percent. Furthermore, when including both open-ended purchases and reinvestments of principal payments on agency securities, MBS purchases as a share of "to-be-announced" (TBA)-eligible gross issuance total roughly 85 percent, a proportion that appears feasible. SOMA's share of the Treasury market with maturities greater than 4 years is expected to remain near 40 percent.

<sup>10</sup> The purchase programs for options 1, 3, and 6 are identical to Alternatives B, A, and C in the October Tealbook Book B. The first increase in the federal funds rate is assumed to be August 2015, the same as that assumed in Alternatives B and A in the October Tealbook, but one year later than that assumed for Alternative C.

<sup>11</sup> An open-ended purchase program that proceeded for longer than the period assumed in these options may require a change in the pace, asset allocation, or duration distribution of purchases as the program continued.

<sup>12</sup> In the June 2011 Minutes, the Committee stated that "Once sales begin, the pace of sales is expected to be aimed at eliminating the SOMA's holdings of agency securities over a period of three to five years.... Sales at this pace would be expected to normalize the size of the SOMA securities portfolio over a period of two to three years." While our analysis is conducted with this timing of sales in mind, the SOMA portfolio was much smaller and of different maturity composition at the time that these exit strategy principles were written, suggesting that the two- to three-year period for the normalization of the size of the balance sheet may not be feasible if purchases continue for a long enough period. In particular, assuming five years of sales, the balance sheet size is normalized within three years if \$500 billion of securities are purchased in 2013, but not if \$1 trillion are purchased.

<sup>13</sup> See the memo to the Committee, "Options for an Additional LSAP Program," August 28, 2012, for a discussion of the underlying assumptions in the simulations.

<sup>14</sup> The estimated term premium effects are based on "Term Structure Modeling with Supply Factors and the Federal Reserve's Large Scale Asset Purchase Programs" by Canlin Li and Min Wei, Finance and Economics Discussion Series paper 2012-37, Federal Reserve Board, July 2012. The effect of LSAPs implied by this model are fairly representative of those found in other studies: For example, D'Amico, English, Lopez-Salido, and Nelson (2011) report effects from LSAP2 on Treasury yields that are somewhat larger than implied by the model of Li and Wei (2012), while Swanson (2011) finds effects that are somewhat smaller.

rates under option 1—the program with additional purchases of \$85 billion per month, cumulating to \$500 billion in 2013 and \$750 billion overall—are identical to conditions in the staff forecast reported in the October Tealbook, which was judged at the time to be consistent with an asset purchase program of this size. Finally, we estimate the implications of pursuing alternative purchase options by using the FRB/US model to simulate the effects of term premium shifts equal to the difference between each option’s estimated term premium effect and the one consistent with option 1—that is, the term premiums embedded in the October Tealbook baseline forecast. Key design features of these simulations include the following:<sup>15</sup>

- Consistent with the standard specification of FRB/US, declines in the ten-year Treasury yield pass through directly to both the primary mortgage rate and corporate bond yields on roughly a one-for-one basis. In addition, lower Treasury yields reduce the discount factor in pricing equities, thereby boosting stock prices, while the foreign exchange value of the dollar falls in response to a widening in the spread between domestic and foreign long-term interest rates.
- For programs that include purchases of MBS, every additional \$100 billion of MBS purchased is assumed to narrow the spread between the MBS current coupon yield and the 10-year Treasury rate about 2½ basis points. The primary mortgage rate is assumed to decline about two-thirds of this additional effect, but with a one-quarter lag.
- The federal funds rate follows the October Tealbook baseline path through 2016 but thereafter follows the prescriptions of the outcome-based rule. This assumption appreciably reduces the degree to which an expansionary portfolio action is offset by more restrictive conventional monetary policy.
- Agents have model-consistent expectations, implying (among other things) that long-term interest rates and other asset prices reflect both the future path of the funds rate in the scenario and the term premium effect implied by the assumed purchase program.

The simulated effects of the various purchase options on the macroeconomic outlook are presented in figures 1a and 2a and summarized in table 1.<sup>16</sup> For the \$750 billion open-ended purchase program, the unemployment rate in late 2015—roughly the time of the peak macroeconomic effects of additional asset purchases—would be 30 basis points below what would occur if purchases were suspended at the end of this year, while core PCE inflation would be boosted about 20 basis points. For the \$1.25 trillion open-ended purchases, the simulated effects on real activity and inflation are about doubled, with very modest differences across the three purchase options considered.<sup>17</sup> In particular, the FRB/US model predicts that the unemployment rate would decline 50 to 60 basis points by late 2015 across the three alternatives,

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<sup>15</sup> These key assumptions are described in more detail in “Options for An Additional LSAP Program,” memo to the FOMC, August 28, 2012.

<sup>16</sup> As noted earlier, the economic effects of similarly paced programs could be different as the market learns over time what the total size of the purchase program will be.

<sup>17</sup> Although purchasing MBS reduces mortgage rates by a bit more than purchases of Treasury securities, the resulting economic effect is small because residential investment is currently a small portion of GDP.

and inflation would increase about 30 basis points, relative to projected outcomes if asset purchases ended this year.

As we noted in the introduction, the simulated financial and economic effects outlined above are highly uncertain. As the staff has emphasized for some time, predicting the likely effects of additional asset purchases is very difficult because the economic theory underlying asset purchases is only partially developed. In addition, this unconventional policy tool has been in use for only a few years, leaving us with relatively little data with which to evaluate its effects. Furthermore, the current economic environment is quite unusual in important respects, which reduces the reliability of estimates derived from models (such as FRB/US) whose dynamics are largely rooted in average historical behavior. Finally, given inherent uncertainty about the “true” model of the economy, alternatives to the staff’s term structure model and the FRB/US model might yield substantially different predictions for the effects of asset purchases.

Ideally, we would supplement our standard FRB/US-based analysis of the macroeconomic effects of asset purchases with results from other models; unfortunately, analysis of asset purchase programs using DSGE models and other approaches is at a preliminary stage.<sup>18</sup> Alternatively, we could in principle attempt to predict the likely effects of additional asset purchases using the rules of thumb and other procedures regularly employed by the staff to generate the judgmental Tealbook forecast. As a practical matter, these forecasting procedures are too cumbersome and time-consuming to be used for the plethora of analyses reported in this memo. That said, we are using these procedures to adjust the December Tealbook forecast for the effects of disappointment on the part of financial participants regarding the ultimate size of the asset purchase program.<sup>19</sup> Based on our preliminary analysis, this scoring exercise is likely to yield somewhat smaller effects of asset purchases on financial conditions and the broader economy than those implied by the simulation results reported in this memo; in particular, the predicted response of real activity is about two-thirds the FRB/US estimate, while the inflation effect is about one-third the model estimate.<sup>20</sup> Whether these alternative estimates are on

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<sup>18</sup> One example of such preliminary work using a DSGE model is provided by Michael Kiley, “The Aggregate Demand Effects of Short- and Long-Term Interest Rates,” Finance and Economics Discussion Series paper 2012-54, November 2012. Using this model, Kiley finds smaller LSAP effects than the FRB/US model.

<sup>19</sup> Specifically, the December projection will assume that market participants are surprised next year when the FOMC caps the program at \$750 billion rather than the roughly \$1.25 trillion now anticipated by investors. This surprise is assumed to cause bond yields to rise modestly in 2013 relative to what they otherwise would be, leading to somewhat less favorable financial conditions and somewhat weaker real activity. Note that carrying out the scenario analysis discussed in this memo using the (as yet unavailable) December Tealbook baseline would not alter the relative ranking of the macroeconomic, balance sheet, and income projections for the various purchase programs discussed below.

<sup>20</sup> Learning effects are another reason why the December Tealbook estimates of “disappointment” effects are likely to be less than would be implied by the differences between the effects of a \$750 billion program and those of \$1.25 trillion program reported in this memo. The latter simulations assume that the public always knows which policy is in effect, and so the response of asset prices from switching from one policy to another occurs instantly at the start of the simulations. In the December Tealbook, in contrast, the effects of disappointment on asset prices emerges only gradually over the course of 2013, reducing the adverse effects of the policy surprise on real activity.

balance more accurate than the FRB/US ones is an open question, however. We are currently reviewing both FRB/US's structure and our judgmental procedures, and plan to modify them as appropriate before the January FOMC meeting so as to make the two approaches more consistent.

### **Impact on the Federal Reserve's Balance Sheet and Income**

For each open-ended purchase program option, we project the path of the Federal Reserve's balance sheet and its income and remittances to the Treasury. As shown in the top left panels of figures 1b and 2b, variations of \$750 billion or \$1.25 trillion programs leave the level of the SOMA portfolio commensurately higher through the medium term than would be the case if no additional purchases are undertaken. The levels of Treasury securities and MBS holdings vary based on the option selected; however, the total size of the program has a significantly more pronounced effect on balance sheet and income outcomes than do the differences in the composition and pace of purchases among programs of the same cumulative size. The level of reserves follows a path similar to that of the total level of the portfolio in each of the options considered. In the \$750 billion options, reserves are approximately \$2.0 trillion at the time of the federal funds liftoff, while in the \$1.25 trillion options, reserves are \$2.5 trillion. In contrast, with no additional purchases beyond December, reserve balances are \$1.5 trillion at the time of the first increase in the federal funds rate.

The exit strategy employed results in the portfolio shrinking back to a normal size over a number of years. As noted in table 1, following \$750 billion in open-ended purchases, the portfolio shrinks to a normal size in February 2019, at the end of the three-year window for the normalization of the size of the securities portfolio that was included in the June 2011 exit strategy principles. Increasing the size of the program to \$1.25 trillion pushes back normalization in the size of the balance sheet to August 2019, about four months after the end of the three-year window. With no additional purchases after year-end, the size of the portfolio is normalized in August 2018, two-and-a-half years after the initiation of asset sales. If the FOMC wanted to normalize the size of the portfolio faster than in these projections, the pace of MBS sales would have to be somewhat more rapid. As modeled, sales of MBS are conducted at a monthly pace of about \$15 billion or \$17 billion in the \$750 billion and \$1.25 trillion scenarios, respectively. These paces of sales are about twice the sales pace assumed when the June 2011 exit strategy principles were established.<sup>21</sup> While staff currently believes such sales could be sustained without significant adverse effects on market functioning, this outcome is dependent on the state of the MBS market at that time, which is uncertain.

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<sup>21</sup> The monthly MBS sales pace assumed in these scenarios is also about double the sales pace employed by the U.S. Treasury when it sold off its portfolio of MBS from April 2011 to March 2012. These sales did not appear to have an adverse effect on market functioning.



The large size of the SOMA portfolio generates a rise in interest income that outweighs the increase in interest expense in the near term, as shown in figures 1c and 2c.<sup>22</sup> As interest rates rise and reserve balances remain sizable, however, interest expense becomes quite large and reduces net interest income. Later in the projection period, net interest income increases for all options as reserves are reduced through sales and redemptions of securities and, once the portfolio begins to grow, through purchases of Treasury securities carrying higher yields. As a result, cumulative net interest income between 2012 and 2025 nears \$1 trillion for both the \$750 billion and \$1.25 trillion purchase options. Realized capital losses from MBS sales reduce income during the same period that net interest income is projected to be low, with the size of the loss larger for the programs that include more MBS purchases. Cumulative realized capital losses associated with the \$750 billion programs are projected to be about \$65 billion, compared to roughly \$90 billion for the \$1.25 trillion programs and \$40 billion with no additional MBS purchases.

Remittances to the Treasury reflect the contours of net interest income and realized capital losses, as well as our assumptions about how currency and Federal Reserve capital grow through the projection period.<sup>23</sup> Putting the pieces together, cumulative remittances from 2012 to 2025, as reported in table 1, are projected to be about \$590 billion under a \$750 billion purchase program, somewhat lower than estimated cumulative remittances of \$630 billion with no purchases. A small deferred asset is projected for the \$750 billion programs, and it remains on the books for about 2 years. For the three \$1.25 trillion purchase programs, cumulative remittances from 2012 to 2025 are projected to total about \$530 billion. Under these larger programs, annual remittances fall to zero for around 5 years, creating a deferred asset that peaks at about \$45 billion. Even in these scenarios, however, cumulative remittances over the 2012 to 2025 period average about \$40 billion per year—well above the average level of remittances prior to the crisis of \$20 to \$25 billion.

The projections of the paths of the portfolio, reserves, and Federal Reserve income are sensitive to the exit strategy assumptions. Should the Committee decide to alter its asset sales strategy, the forecasts could change noticeably. For example, as shown in table 2, if the Federal Reserve followed a no-sales exit strategy following \$1.25 trillion of purchases, we estimate that remittances would still be at zero for a few years, but the deferred asset would be reduced

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<sup>22</sup> Interest expense on reserve balances is calculated based on the projected level of the federal funds rate. We assume that the IOER rate and the rates paid on reserve management tools—reverse repurchase agreements and term deposits—are equal to the federal funds rate. In practice, these rates, particularly the rates on reserve draining tools, may exceed the federal funds rate. As a result, interest expense could be somewhat higher than calculated, reducing remittances by the same amount. A stress test of this effect is presented later in this memo.

<sup>23</sup> We assume currency grows in line with nominal GDP. Federal Reserve capital has two components: capital paid in and surplus. We assume capital paid in grows at 15 percent per year, its annual average over the past decade, and surplus is equated to capital paid in. Under current policy, once the surplus capital from retained profits equals paid-in capital, the remaining surplus is remitted to Treasury. Although 15 percent is the decade average growth rate of capital paid in, the past few years have recorded growth near zero.

considerably. Cumulative remittances between 2012 and 2025 would be \$50 billion higher than the same program with eventual MBS sales, reflecting the fact that the lack of capital losses on sales and higher coupon income from the larger MBS holdings more than offset the increase in interest expense associated with the larger portfolio. Under the no-sales option, the size of the Federal Reserve's balance sheet is normalized through the passive redemption of maturing securities; normalization of the size of the balance sheet under this option occurs by mid-to-late 2020, about a year later than under the current exit principles. A longer period of more gradual MBS sales would have a similar effect, while other assumptions, such as that regarding a long-run level of reserves, could also have meaningful effects should the Committee wish to reconsider its assumptions.

Although cumulative remittances are smaller with a purchase program than without, the purchase programs boost real activity and prices. These actions together generate higher nominal tax revenues that are only partially offset by reduced remittances and higher (inflation-induced) nominal outlays. Thus, the programs, on net, result in a substantial reduction in Treasury debt over time despite the decline in portfolio income. Depending on the purchase program, as shown in the fourth panel of table 1, the nominal stock of federal debt would be reduced by estimated amounts that range from \$220 billion and \$330 billion by 2025 relative to outcomes if purchases were suspended at the end of this year, thereby shaving between 1½ and 2¾ percentage points off the federal government debt-to-GDP ratio. Moreover, the societal benefit of the programs are estimated to be greater than the budgetary gains, since the programs are predicted to yield a cumulative increase in real GDP between \$615 billion and \$1.1 trillion, and inflation is moved closer to the Committee's 2 percent longer-run goal through the projection period.

It is worth noting that projections for a deferred asset in the scenarios above are significantly affected by our assumptions about the growth of capital paid in. As noted above, we assume that capital paid in grows 15 percent per year over the projection period. Under the Board's policy regarding Reserve Bank surplus, Reserve Banks are directed to transfer a portion of net income to surplus so as to equate capital and surplus; any residual of net income over transfers to surplus and payment of dividends is then remitted to the U.S. Treasury. Under this framework, faster assumed growth of capital paid in leads to higher transfers to surplus and lower remittances to the U.S. Treasury and may lead to higher levels of the deferred asset. In our projections, Federal Reserve capital is generally quite large—much larger than the peak value of the deferred asset.<sup>24</sup> Alternatively, if we had projected slower growth of capital paid in, the value of the Federal Reserve's capital stock would be smaller but the magnitude of the projected deferred asset would be smaller as well. Indeed, in some scenarios, slower projected growth of capital would sharply reduce the value of the deferred asset or eliminate it entirely. This treatment of capital as an independent driver of surpluses is representative of past policy but may not be a good indication of policy in an environment where deferred assets are accruing. A reduction in surplus capital

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<sup>24</sup> The capital stock is projected to be \$110 billion in 2016, \$140 billion in 2018, and \$190 billion in 2020.

would reduce, by an equal amount, a deferred asset. Such a reduction, while not in keeping with past policy, would not appear to have any effects on monetary policy. That is, a deferred asset could be reduced or eliminated simply by setting aside less surplus capital. Of course, the projected deferred asset is also highly dependent on particular assumptions made about the exit strategy, and, more importantly, the realization of a deferred asset is very unlikely to directly affect the Federal Reserve's ability to conduct monetary policy.

### **Interest Rate Risk Analysis**

Additional asset purchases will, in general, lead the Federal Reserve to face more income risk, given the portfolio's larger size and its higher overall level of interest rate risk. As illustrated in figure 3a, which gives a number of projections for the 10-year Treasury yield, there are a variety of outlooks for the path of interest rates going forward. For example, the roughly 50 individual forecasters who make up the Blue Chip panel have a consensus projection that is broadly in line with the October Tealbook path, but have a dispersion of views. In fact, the average 10-year Treasury yield of the bottom 10 respondents is about 100 basis points less than the staff forecast during the years when MBS are assumed to be sold.<sup>25,26</sup> Although the Committee may want to focus on scenarios where interest rate projections lie above the October Tealbook path because this is suggestive of potential downside risk to Federal Reserve income, there is upside risk to the income projection as well.<sup>27</sup> If the path of interest rates followed the trajectory suggested by the bottom 10 respondents' average rate, \$1.25 trillion in total purchases like the scenario considered in option 3 would lead to modestly higher cumulative remittances and could have a very small deferred asset, though there would be a few years with near-zero remittances.

Turning to the downside risks to income of a higher interest rate environment, we consider the implications of two alternative assumptions for the future path of interest rates. In the first case, we evaluate the consequences for both a \$750 billion purchase program and a \$1.25 trillion program of a scenario in which market interest rates are 100 basis points higher after liftoff of the federal funds rate than was assumed in the previous simulations; in this scenario, for convenience, we hold other aspects of the scenario at their values in options 1 and 3, respectively. We view this outcome for interest rates as having a reasonable chance of occurring. In particular, one way to estimate a rough probability of such an event is to look at the risk-neutral probability of the 10-year swap rate, three years forward, ending up at a level of 5 percent or higher, about the same level as assumed in this shock scenario. As of November 27, 2012, this probability was approximately 6 percent. In the second case, we explore a scenario in

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<sup>25</sup> Model-based measures, such as those from Diebold-Li (2006), are slightly lower than the Blue Chip bottom-10 average projection.

<sup>26</sup> At the short end of the curve, the Blue Chip forecast anticipates a steeper rise in the federal funds rate over the next five years than the staff, implying that the Blue Chip rates would project higher interest expense on reserves; in the long run, when reserve balances reach a nominal level and interest expense is low, the staff forecast and the Blue Chip projections are similar.

<sup>27</sup> Figure 3b illustrates the interest rate shock scenarios analyzed below.

which the Committee implements a \$1.25 trillion program, and immediately after its completion the pace of recovery picks up substantially, inflation rises markedly, and term premiums increase, causing the 10-year Treasury yield to climb to 6 percent by the end of 2015 and to remain at or above that level through the end of the decade—a somewhat persistent shift of about 200 basis points relative to the interest rate path without the shock. The probability of this occurring, based on the risk-neutral probability of the 10-year swap rate, three years forward was 3 percent as of November 27, 2012. Aside from investigating the implications of this adverse bond-rate scenario for portfolio income and capital losses, we also use it to consider risks arising from higher costs to the use of draining tools and larger losses from asset sales because of a widening in the MBS-Treasury basis.

In the first scenario, following liftoff, the federal funds rate and 10-year Treasury yield are about 100 basis points above the initial interest rate paths and this higher level of interest rates persists for the remainder of the projection period. Leaving unchanged the exit strategy assumptions, for both the \$750 billion and \$1.25 trillion options, as shown in figures 4a and 4b and the bottom of table 1, the assumed interest rate shock results in the creation of a substantial deferred asset. This reflects greater realized losses on MBS sales and greater interest expense. In the smaller asset purchase program, the deferred asset persists for 5 years and reaches a maximum size of \$40 billion; on the other hand, cumulative remittances rise slightly relative to a scenario with no interest rate shock as a result of higher seigniorage revenues at the end of the projection period. In the larger asset purchase program, the deferred asset lasts 6½ years and reaches a maximum size of about \$125 billion, and overall cumulative remittances decline by about \$30 billion relative to a scenario without an interest rate shock. In these projections, the Federal Reserve’s capital stock remains larger than the deferred asset throughout the exit period.<sup>28</sup>

Potentially, interest rates could surprise to the upside by more than in the 100 basis points shock case, particularly if the pace of the economic recovery were to pick up unexpectedly and inflation pressures were to intensify markedly, leading to both an unmooring of inflation expectations and an increase in the inflation risk premium demanded by investors. In the scenario shown in figure 5a, all these factors begin to emerge in early 2014, immediately after the Committee is assumed to have completed a \$1.25 trillion asset purchase program.<sup>29</sup> In

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<sup>28</sup> Cumulative remittances through 2025 under the \$750 billion option are actually a bit larger than without the interest rate shock because the Treasury securities purchased once the portfolio is normalized are at much higher yields, which boosts cumulative net interest income in the later years of the projection. Cumulative remittances under the \$1.25 trillion option, alternatively, are reduced by \$30 billion reflecting both larger interest expense and larger losses associated with MBS sales. If purchases cease at year-end 2012 and there is a 100 basis point interest rate shock, cumulative remittances to Treasury between 2012 and 2025 are about unchanged, at \$700 billion; however, the path of remittances changes (it is lower in earlier years and higher in later years).

<sup>29</sup> To implement this scenario, the FRB/US model is hit with a set of large, persistent positive shocks to the various components of household and business spending starting in early 2014. The simulation also features large persistent shocks to wages and prices and an “unmooring” of long-run inflation expectations, in the sense that the public’s estimate of the FOMC’s implicit inflation target is assumed to respond to movements in actual inflation in a manner similar to that seen prior to the early 1990s. Finally, the simulation incorporates shocks to the term premium

response to stronger real activity and rising inflation, the Committee begins to tighten policy during the second half of 2014 and pushes the federal funds rate to 6 percent by 2018; this tight stance of policy eventually proves sufficient to restore price stability but only after several years. Under these conditions, the yield on the 10-year Treasury security reaches 6 percent in late 2015 and averages about 6½ percent through the rest of the decade, roughly 200 basis points above the no shock interest rate paths, and up by a cumulative 475 bps from the end of 2012.

As shown in figure 5c and reported in table 2, in this adverse bond-rate scenario, remittances are halted for nearly eight years, and cumulative remittances over 2013 to 2025 total \$440 billion. This results in a very large deferred asset, which peaks near \$180 billion—somewhat above the projected capital stock of the Federal Reserve. We should note, however, that stochastic simulations of the FRB/US model suggest that the likelihood of a scenario this extreme is quite low because it involves such a large and persistent upward shift in long-term interest rates; as noted above, market quotes are also consistent with a low probability of this event. In fact, the estimated probability of such an outcome based on FRB/US is negligible unless long-run inflation expectations become unanchored and begin responding to movements in actual inflation as experienced prior to the mid-1990s (although this assessment may not adequately make provision for all the disturbances that could potentially hit the economy).<sup>30</sup> And while this scenario involves a marked rise in nominal federal debt relative to the no-shock scenario, that increase is more than accounted for by persistently higher inflation and the steadily rising level of prices, which is not directly attributable to the additional asset purchases. In fact, the federal debt to GDP ratio in this scenario is still a full percentage point lower in 2025 than in the no-shock scenario despite the large reduction in cumulative remittances to the Treasury, because stronger real activity causes the increase in nominal tax revenues to outpace the growth in nominal outlays.

As noted earlier, the projections for income, remittances, and the deferred asset depend importantly on a variety of exit strategy assumptions, including the assumption that MBS are sold over five years. For example, if MBS were not sold, and instead held until principal repayments were received, the deferred asset would be much lower. As shown in figure 5c, capital losses would not be recognized because there would be no sales; however, net interest expense would be a bit larger and elevated over a longer period of time with the MBS remaining in the portfolio and reserve balances consequently significantly larger. The size and timing of the interest expense is an important determinant of the size and time path of the deferred asset. By not selling MBS, the peak value of the deferred asset is reduced to \$50 billion in this

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embedded in long-term interest rates to compensate for increased inflation uncertainty. These shocks are roughly calibrated to generate the type of macroeconomic conditions most likely to accompany a sustained 200 basis point rise in long-term interest rates, based on stochastic simulations of the FRB/US model.

<sup>30</sup> For example, the stochastic simulations do not take into account such possibilities as the loss of safe-haven status for Treasury securities or a shift in the long-run stance of fiscal policy, and so likely understate the probability of this event to some degree.

simulation, \$130 billion lower than the same scenario with no sales. Additionally, the size of the portfolio is normalized only a little over a year later than in the projection with MBS sales because a large volume of the Treasury securities held in the SOMA will be maturing at that time. As a result, alternative exit strategies could have a significant impact on the path of remittances. Alternative approaches to asset sales, such as the pace at which MBS are sold or sales of Treasury securities in addition to or in place of sales of MBS, offer additional flexibility that could potentially alter the path of Federal Reserve income.

There may be other factors that interact with the handling of exit in a way that has important effects on our income projections. In order to illustrate these factors, we provide some partial equilibrium analysis of the effect that additional costs associated with draining reserves and selling MBS might have on remittances and the deferred asset.

First, it may be the case that there are increased interest costs during exit, perhaps due to capacity constraints in the reverse repurchase market, a lack of demand for term deposits, or a higher spread between the interest rate paid on reserve balances and the target federal funds rate. Our standard analysis assumes that the rate paid on interest-bearing Federal Reserve liabilities—reserves, term deposits, and reverse RPs (RRPs)—is equal to the federal funds target rate. To illustrate the effect of these added costs, we assume that the Federal Reserve is faced with paying 50 basis points over the projected federal funds target rate on reserve draining liabilities—RRPs and term deposits—once exit begins.<sup>31,32</sup> As the size of the balance sheet is normalized, the 50 basis point shock is assumed to decay until interest costs are again equal to the federal funds rate. As reported in the top left panel of table 3, the result of this wedge is a decrease in cumulative net interest income of about \$30 billion relative to the adverse bond-rate scenario. The result is a peak value of the deferred asset that is nearly \$20 billion larger, standing near \$200 billion by the end of 2019.

Second, and separate from the costs of draining reserve balances, the announcement of MBS sales may trigger increases in MBS yields relative to comparable Treasury rates. To model such a shock, we assume that the spread between MBS yields and Treasury yields widens by 50 basis points.<sup>33</sup> This type of shock leads to higher realized capital losses during the period over which sales are conducted.<sup>34</sup> As shown in the bottom panel of table 3, capital losses average about \$4 billion more per year than in the adverse bond-rate scenario. Cumulatively, this higher loss from

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<sup>31</sup> The level of this shock is calibrated to one standard deviation of the historical spread between the federal funds rate and selected one- and three- month money market rates.

<sup>32</sup> Note that this higher cost is applied to the total quantity of reserve balances outstanding at any point in time. Presumably, not all reserve balances would need to be drained in order to keep the funds rate near the rate paid on excess reserves. As a result, these calculations likely represent an upper bound for the added expense of draining reserves.

<sup>33</sup> The level of this shock is roughly equivalent to about a two standard deviation move in the spread. Alternatively, this shock is between one-third and one-half of the change in spreads observed at the peak of the financial crisis and much larger than any other move since 1998.

<sup>34</sup> In addition, the higher MBS rates will lead to slower prepayment speeds. Fewer prepayments compound the capital losses since they imply more cumulative sales.

MBS sales causes the deferred asset to reach a peak of about \$200 billion. Of course, if severe disruptions emerged in the MBS market as a result of the Federal Reserve's sales, the Committee could choose to scale back or stop its sales of MBS.

## **Conclusion**

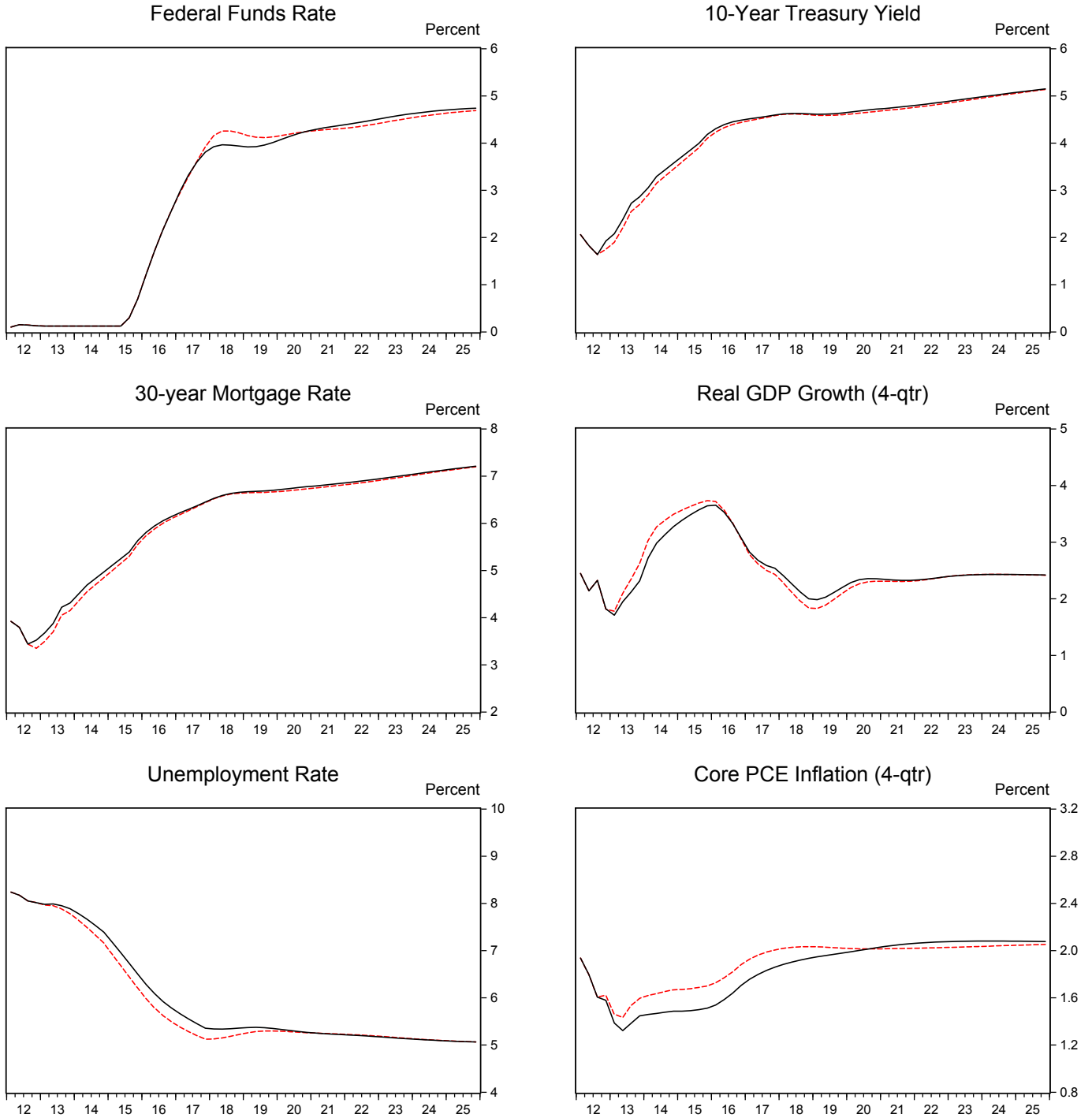
This memo provides estimates of the effects of additional open-ended asset purchases on the economic outlook as well as on the Federal Reserve's balance sheet and income. Based on staff models, the additional purchases would boost aggregate real activity and inflation moderately. The programs would also significantly increase the size of the Federal Reserve's balance sheet, which affects income. With the staff's standard exit strategy assumptions and interest rate paths, the programs are projected to reduce cumulative remittances somewhat and to result in a deferred asset.

From an economic standpoint, the implications of reduced remittances and deferred assets should be viewed within the context of the consolidated position of the government. The net effect of the stronger growth and lower remittances on the overall fiscal position of the government is generally positive in our projections—the larger programs lead to lower debt and debt-GDP ratios in the out years. Of course, the Committee may see political costs or risks associated with different paths for remittances and deferred assets. As we noted, that the paths of remittances and the size of any deferred assets are strongly affected by the employed exit strategy.

Finally, the assumptions underlying our estimates of Federal Reserve income are subject to considerable uncertainty, especially with regard to the projected paths of interest rates and the choice of policy actions during exit. We note that our estimates are also affected by assumptions about the growth of capital paid in, which ultimately reflects relationships on how low net income is allocated over time. We focus on the downside risks to Federal Reserve income associated with a higher interest rate environment by adding interest rate shocks to the model projections, including shocks that address the possibility that draining reserves could prove more costly than anticipated or that MBS sales could lead to a widening of the MBS-Treasury basis. The more interest rates are projected to rise, the larger and longer-lasting the deferred asset is likely to be. However, we also note that if the Committee chose to change the exit strategy to one in which MBS are sold over a period longer than five years or in which no sales are conducted, the projected peak value of the deferred asset would be smaller and, in some scenarios, reduced to zero.

**Figure 1(a)**  
**\$750 Billion Programs: Macroeconomic Effects**

--- Options 1 and 2: \$500B Additional Purchases  
 — Option 6: No Purchases

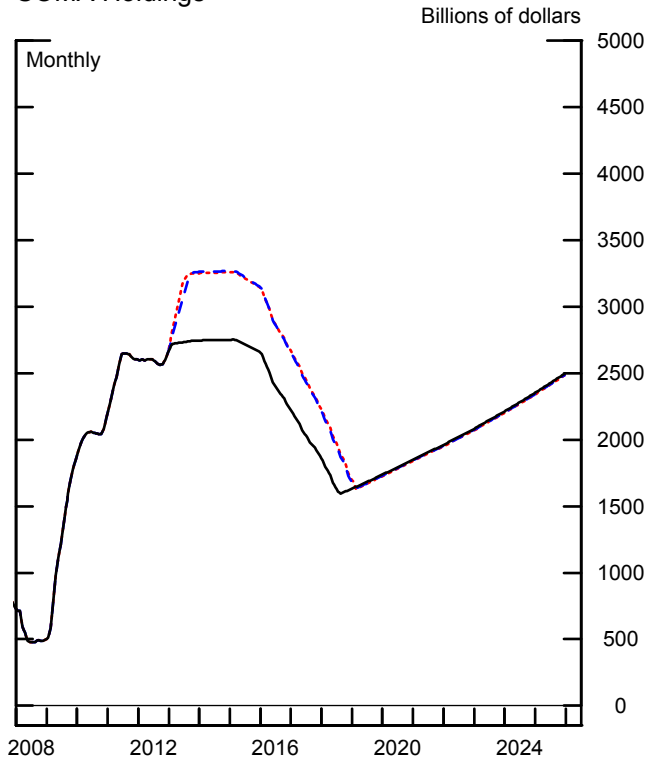




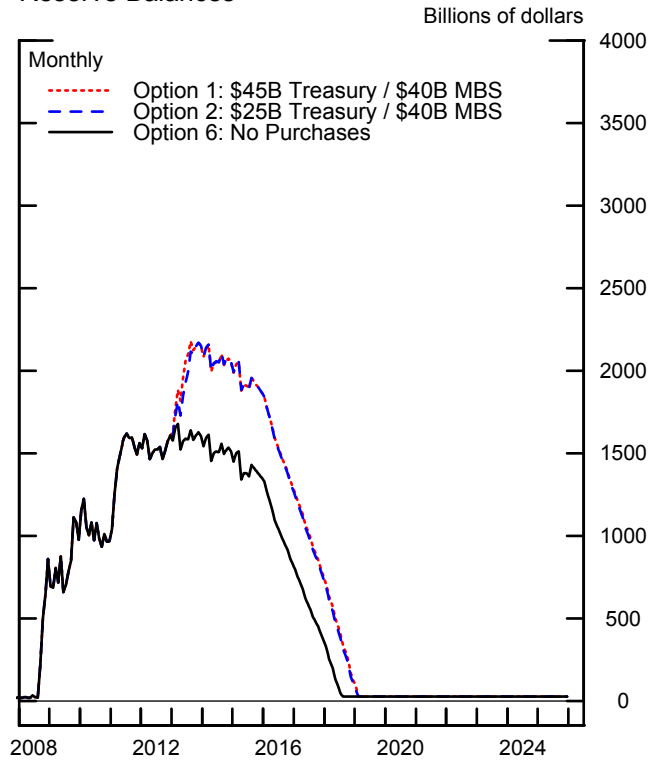
**Figure 1(b)**

**\$750 Billion Programs: Select Balance Sheet Items**

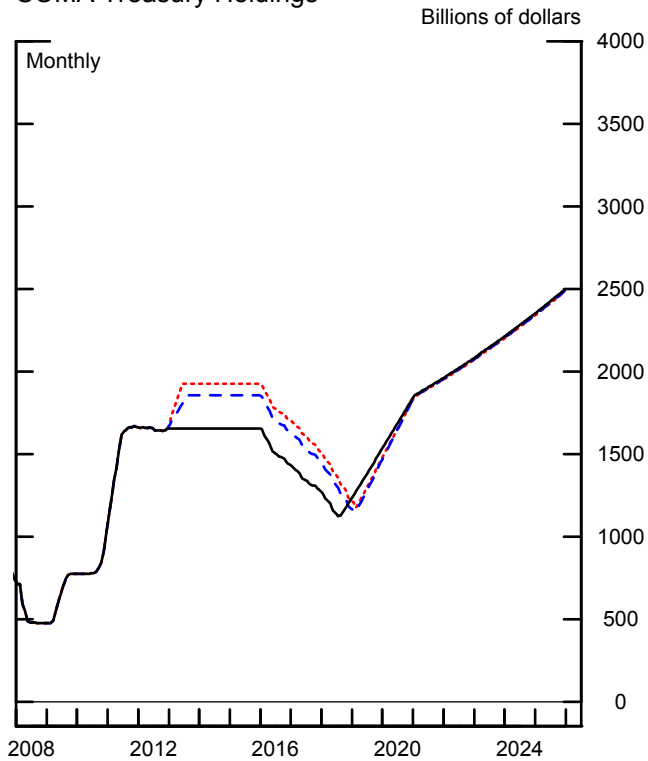
SOMA Holdings



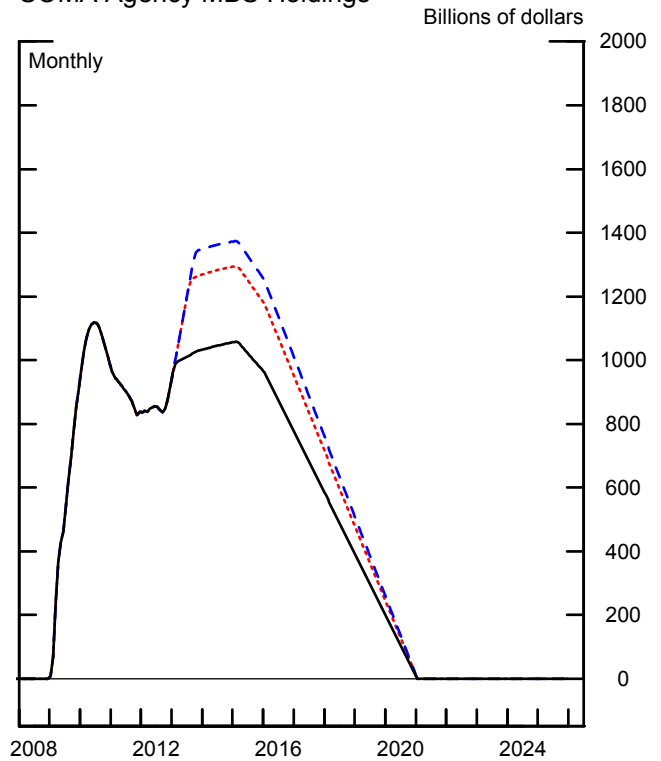
Reserve Balances



SOMA Treasury Holdings

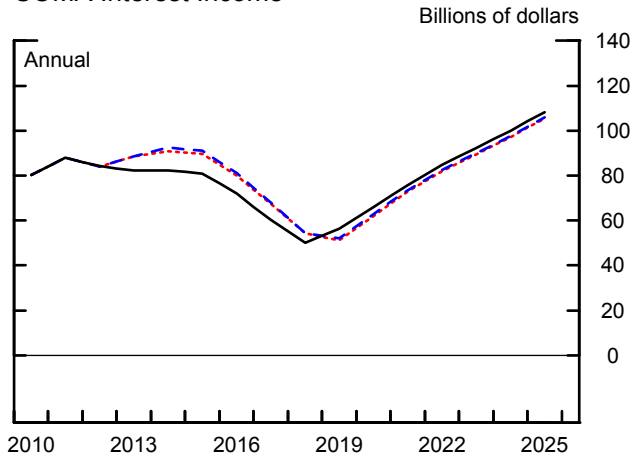


SOMA Agency MBS Holdings

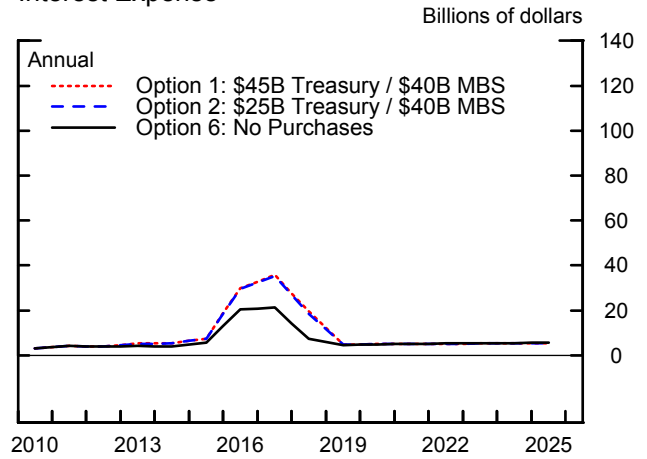


**Figure 1(c)**  
**\$750 Billion Programs: Income Projections**

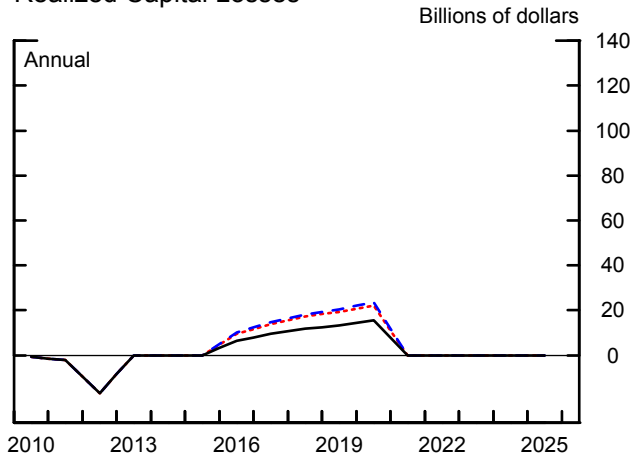
SOMA Interest Income



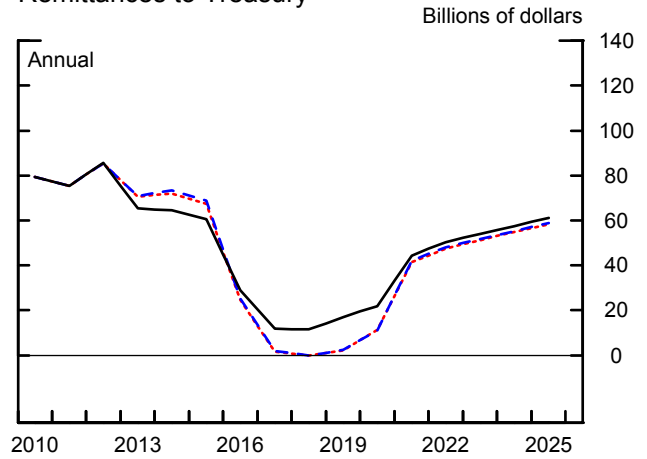
Interest Expense



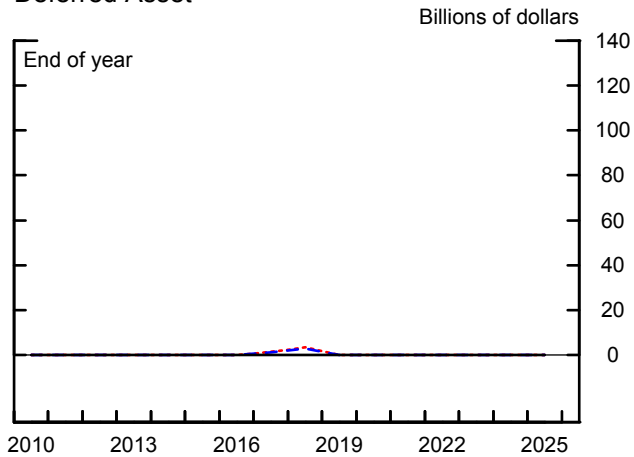
Realized Capital Losses



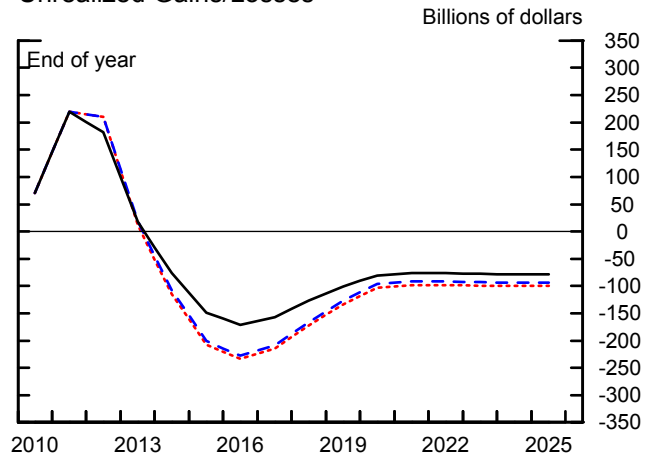
Remittances to Treasury



Deferred Asset

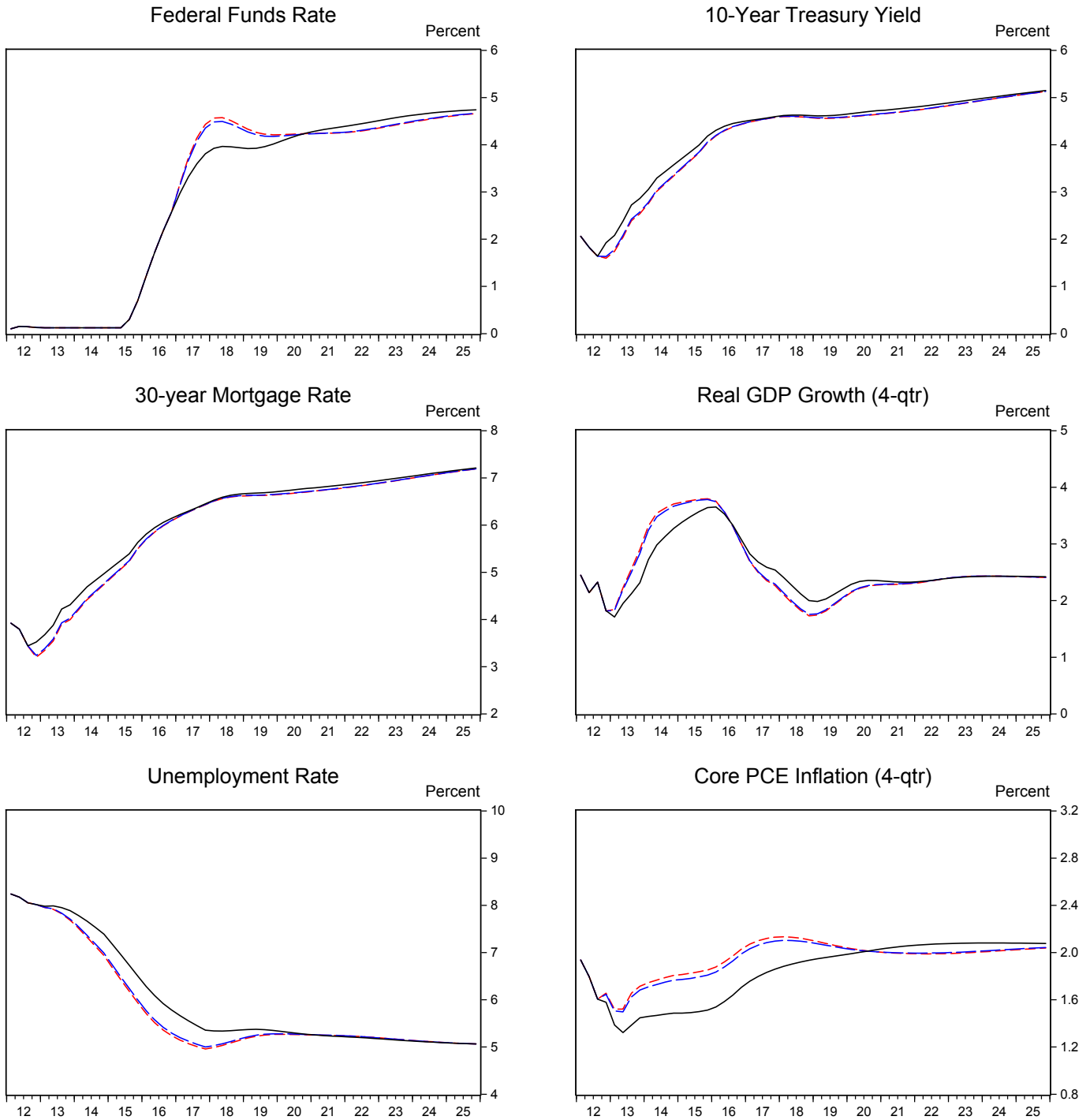


Unrealized Gains/Losses



**Figure 2(a)**  
**\$1.25 Trillion Programs: Macroeconomic Effects**

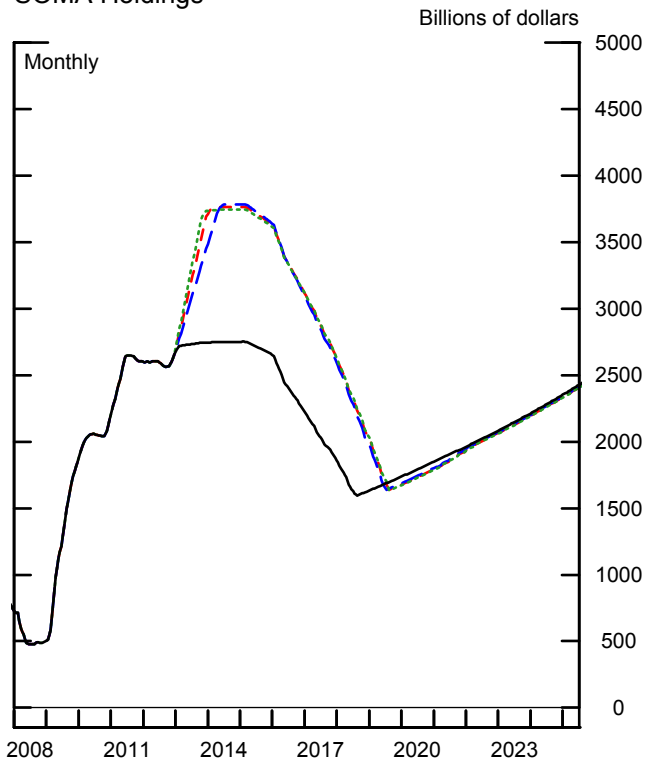
- Options 3 and 5: \$1T Additional Purchases, Faster Pace/Greater Treasury Share
- Option 4: \$1T Additional Purchases, Slower Pace/Greater MBS Share
- Option 6: No Purchases



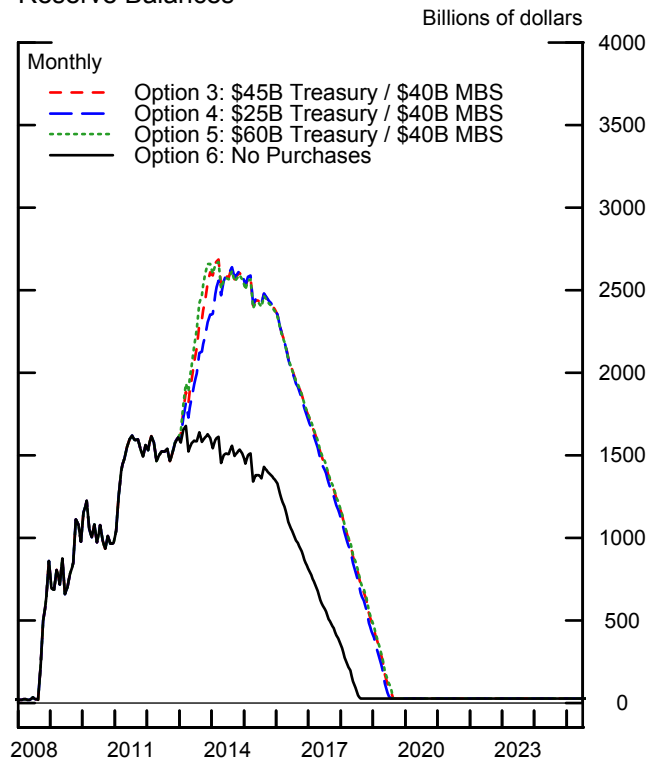
**Figure 2(b)**

**\$1.25 Trillion Programs: Select Balance Sheet Items**

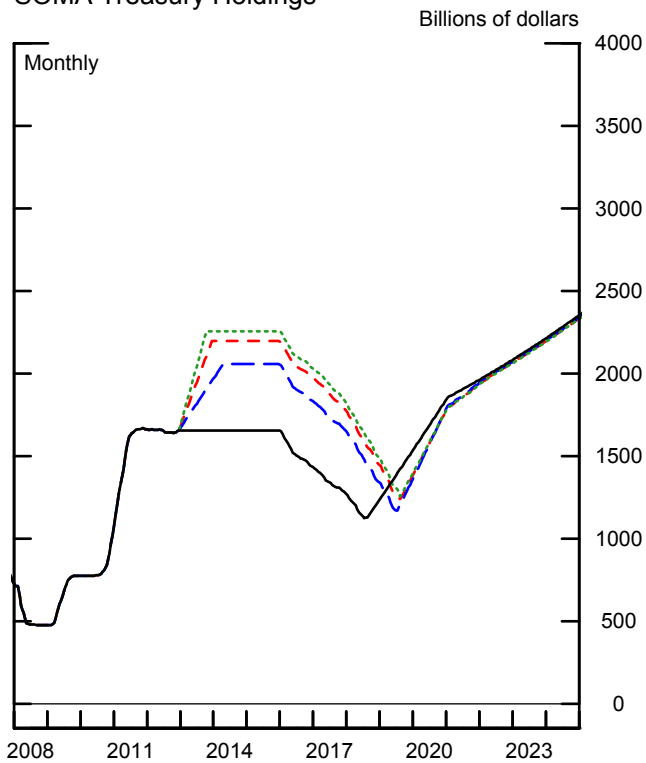
**SOMA Holdings**



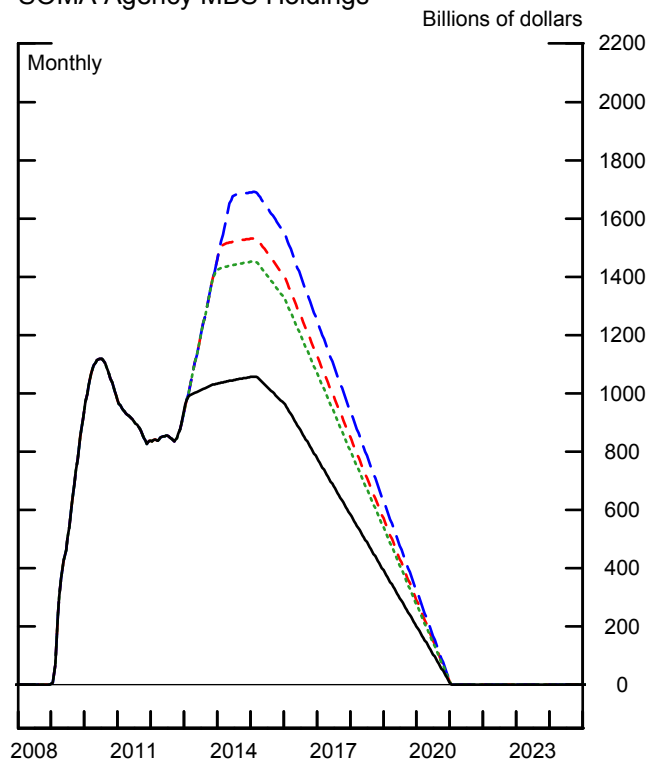
**Reserve Balances**



**SOMA Treasury Holdings**



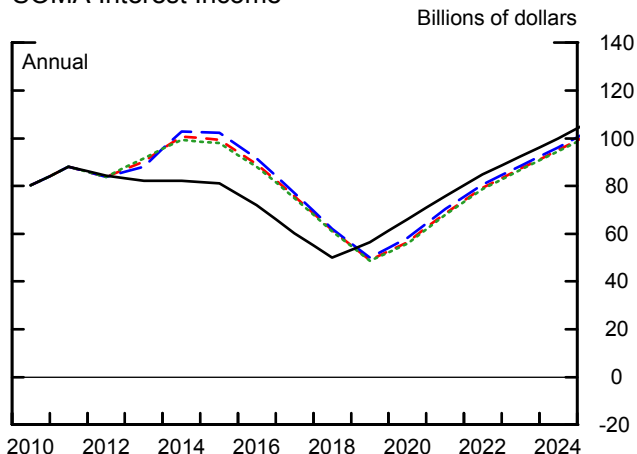
**SOMA Agency MBS Holdings**



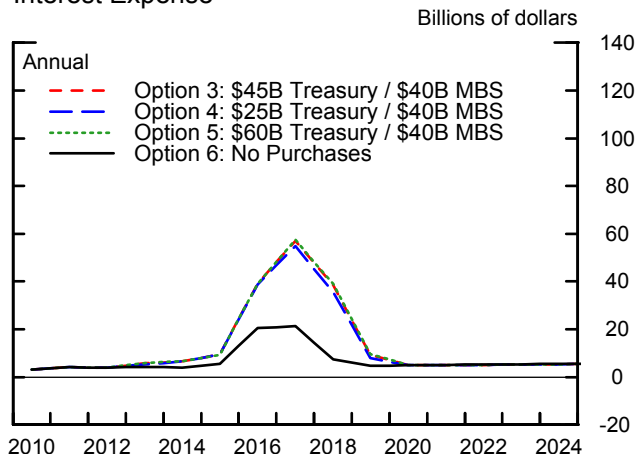
**Figure 2(c)**

**\$1.25 Trillion Programs: Income Projections**

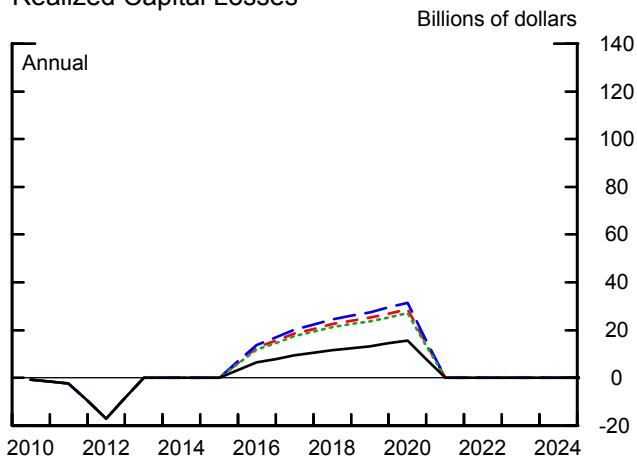
SOMA Interest Income



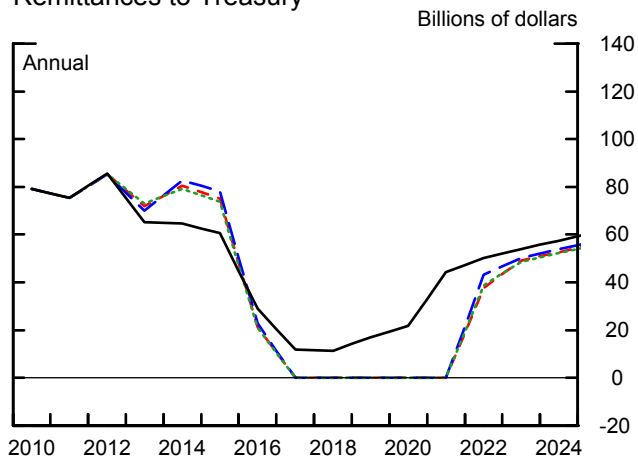
Interest Expense



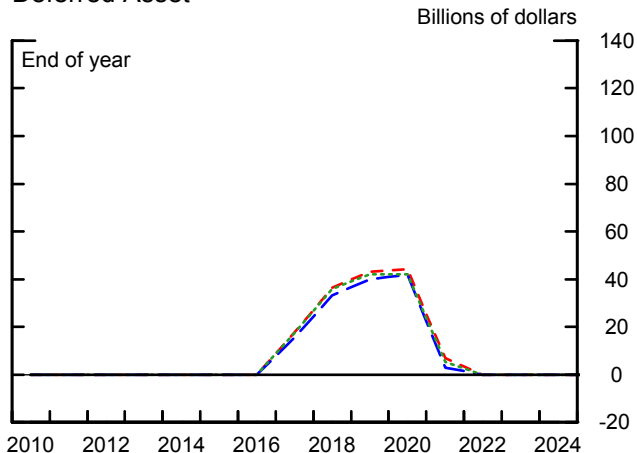
Realized Capital Losses



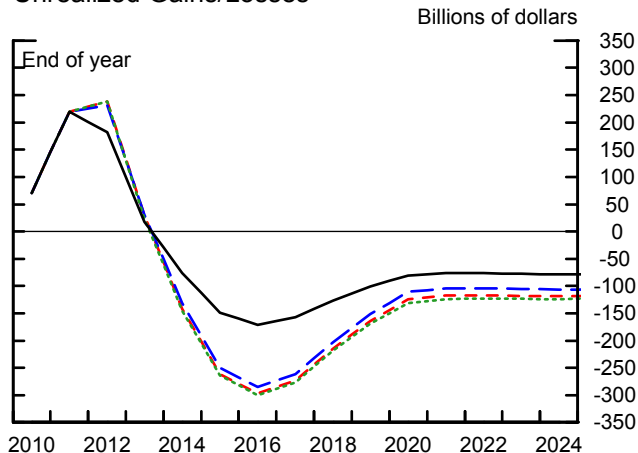
Remittances to Treasury



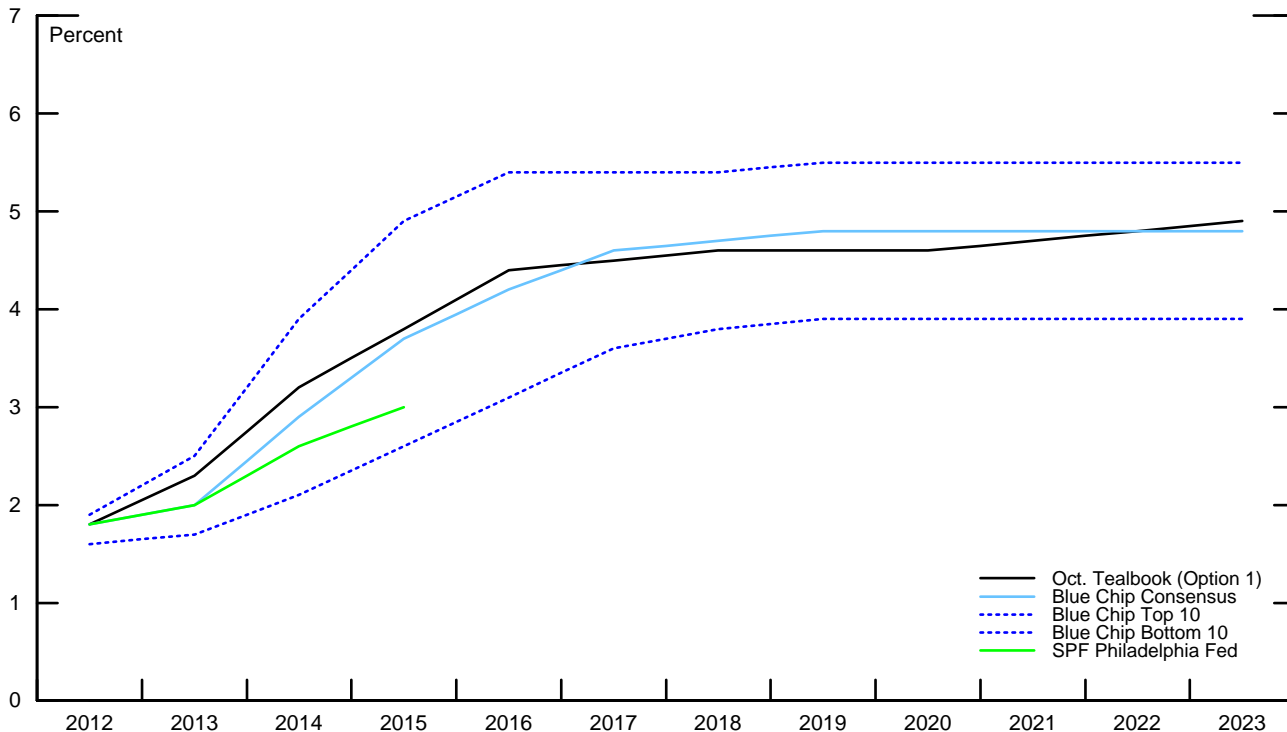
Deferred Asset



Unrealized Gains/Losses

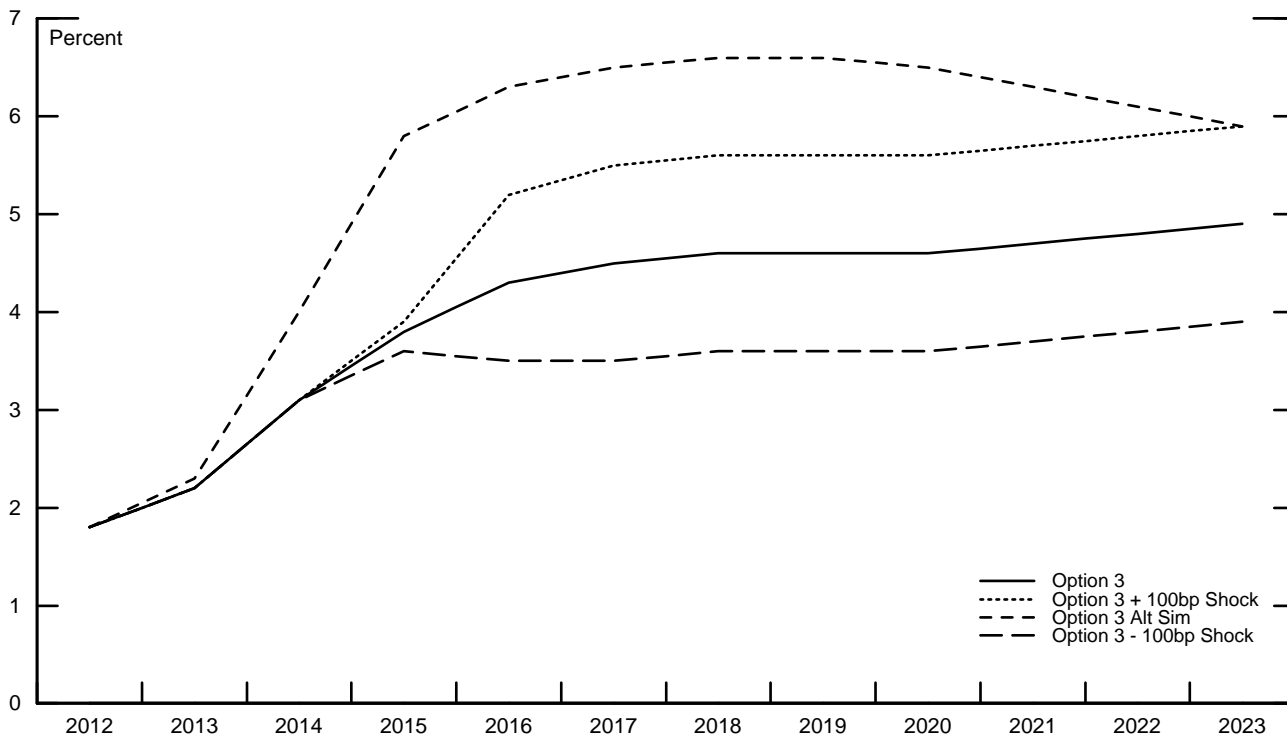


**Figure 3(a) Survey-based projections of 10-year Treasury Yields**



Note: The October Tealbook and Blue Chip projections are annual averages. The Blue Chip projection, an average from 56 respondents, is a combination of the November 2012 short-run and October 2012 long-run forecasts. The SPF projection from November 9, 2012 is an annualized year-over-year forecast.

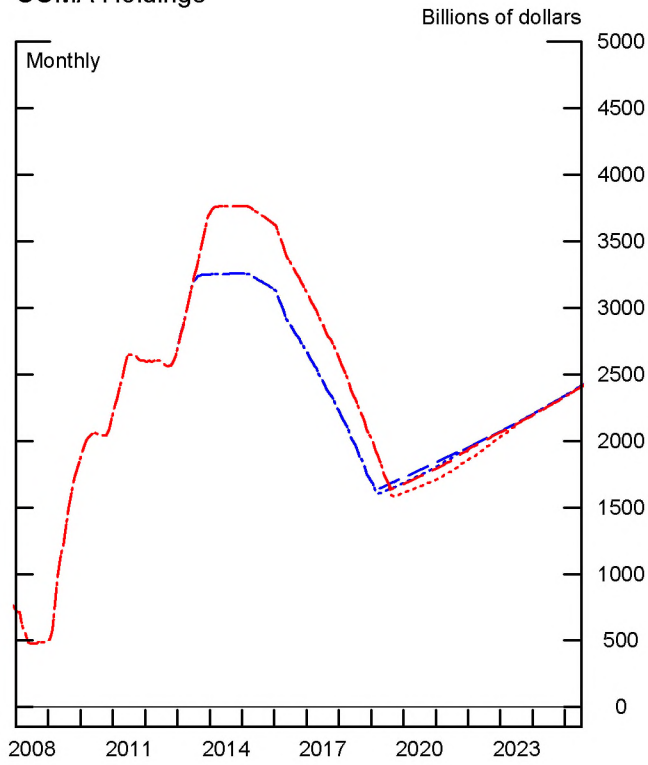
**Figure 3(b) Projections of 10-year Treasury Yields for Option 3**



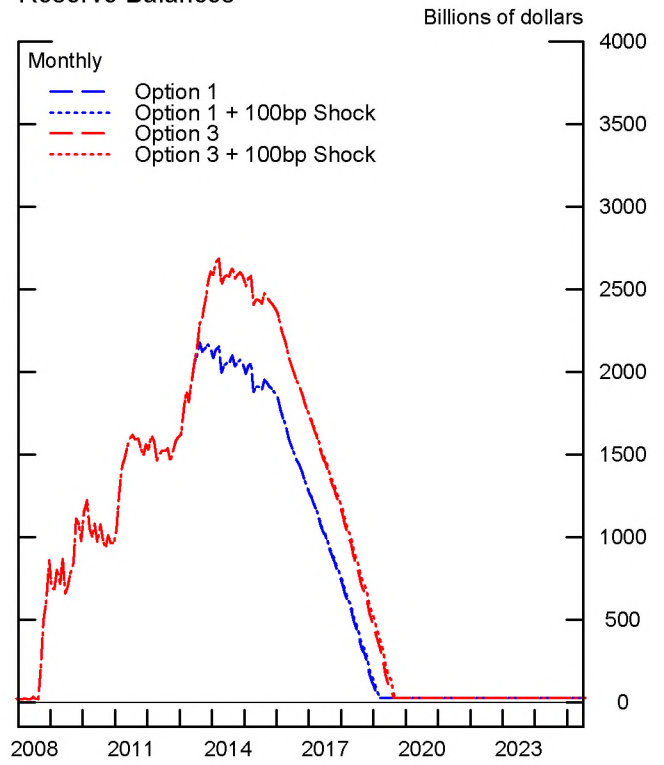
**Figure 4(a)**

**Interest Rate Shock: Select Assets and Liabilities of the Balance Sheet**

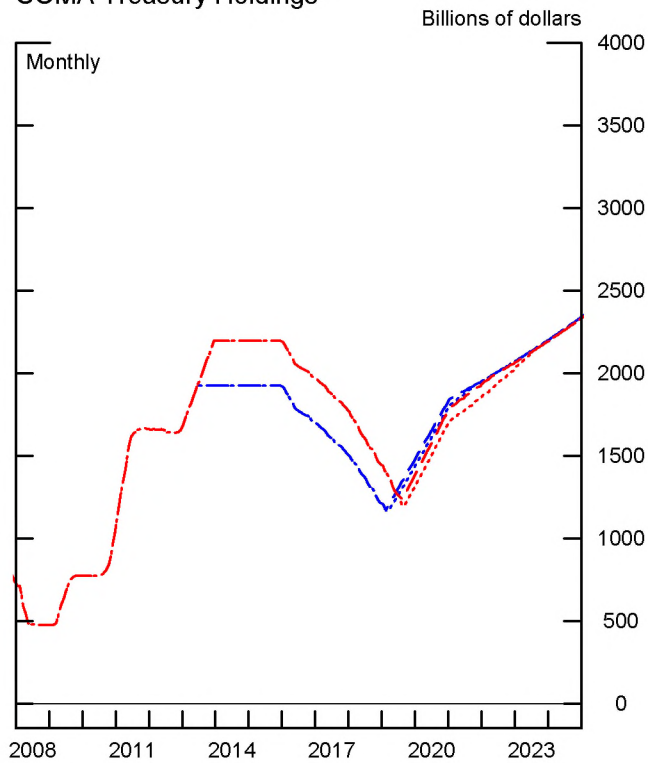
**SOMA Holdings**



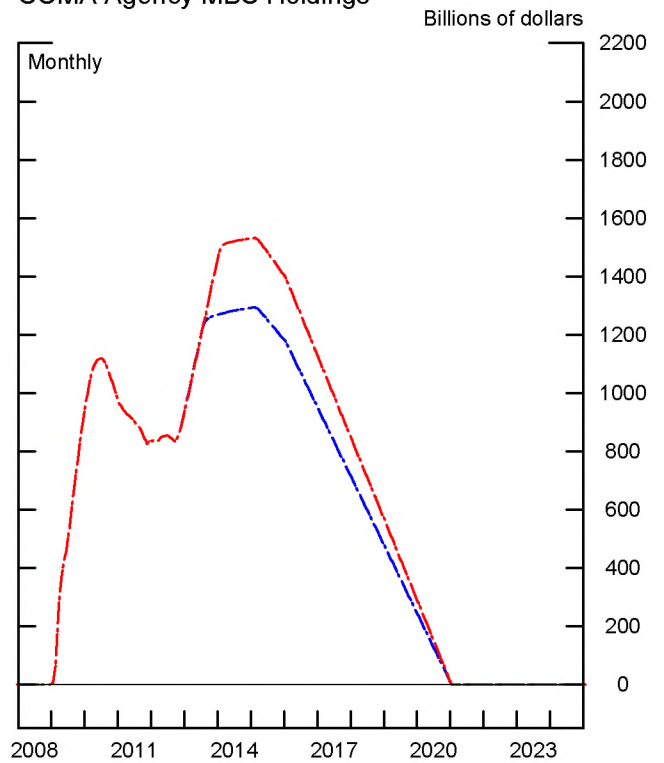
**Reserve Balances**



**SOMA Treasury Holdings**

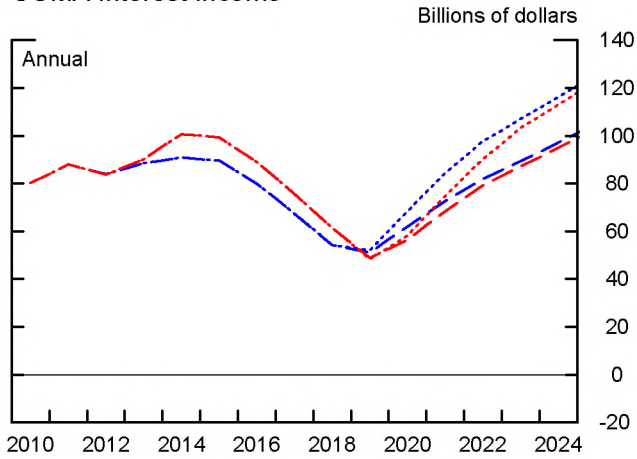


**SOMA Agency MBS Holdings**

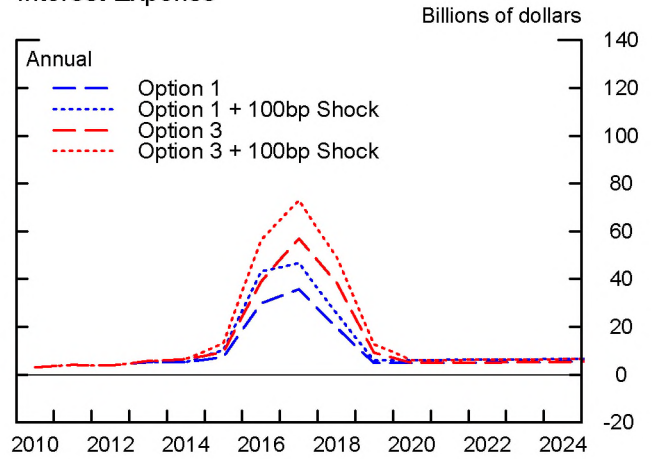


**Figure 4(b)**  
**Interest Rate Shock: Income Projections**

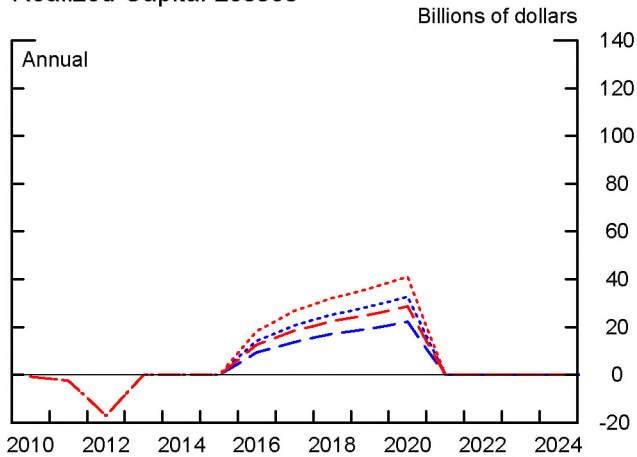
**SOMA Interest Income**



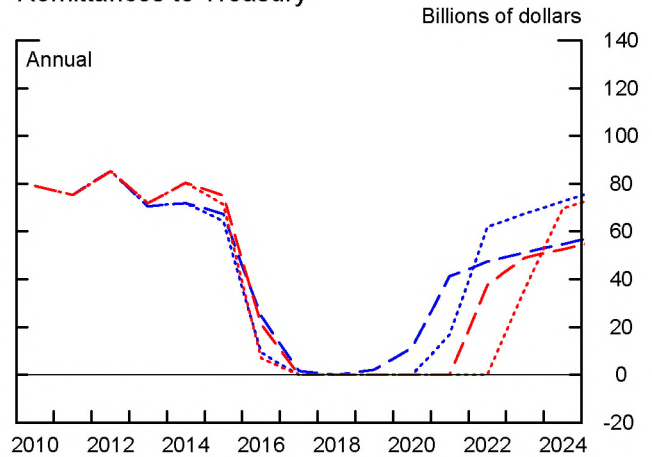
**Interest Expense**



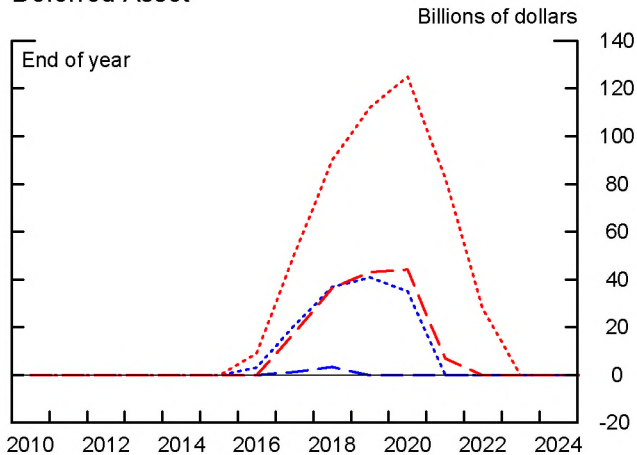
**Realized Capital Losses**



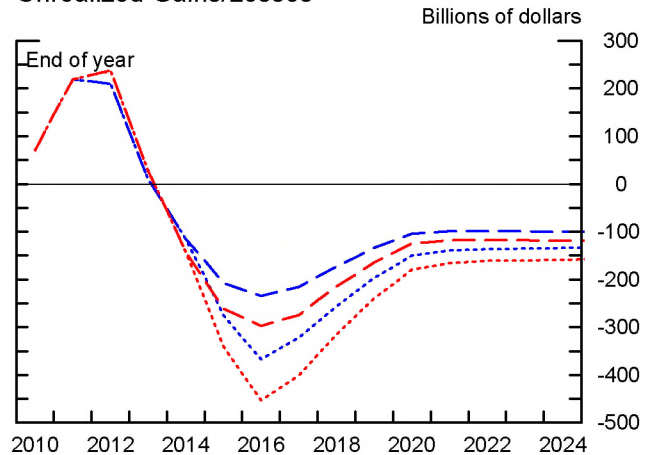
**Remittances to Treasury**



**Deferred Asset**



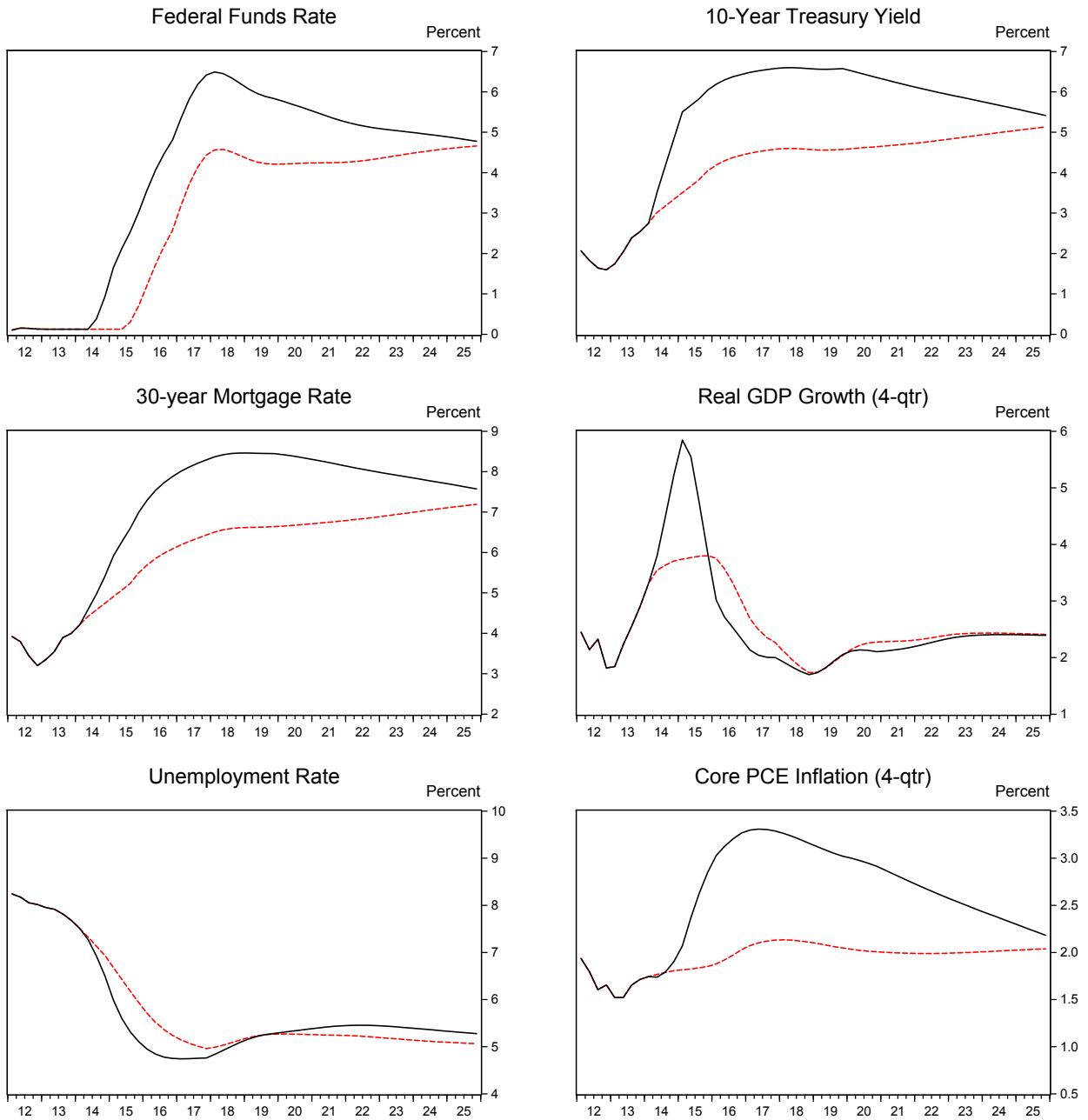
**Unrealized Gains/Losses**





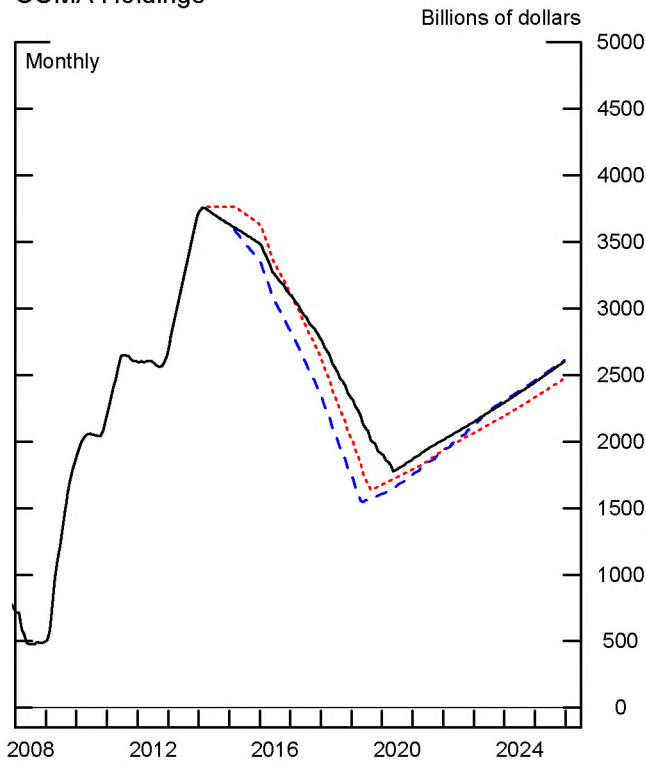
**Figure ) (a)**  
**Adverse Alt Sim: Macroeconomic Effects**

--- Option 3  
 — Option 3 with Alt Sim

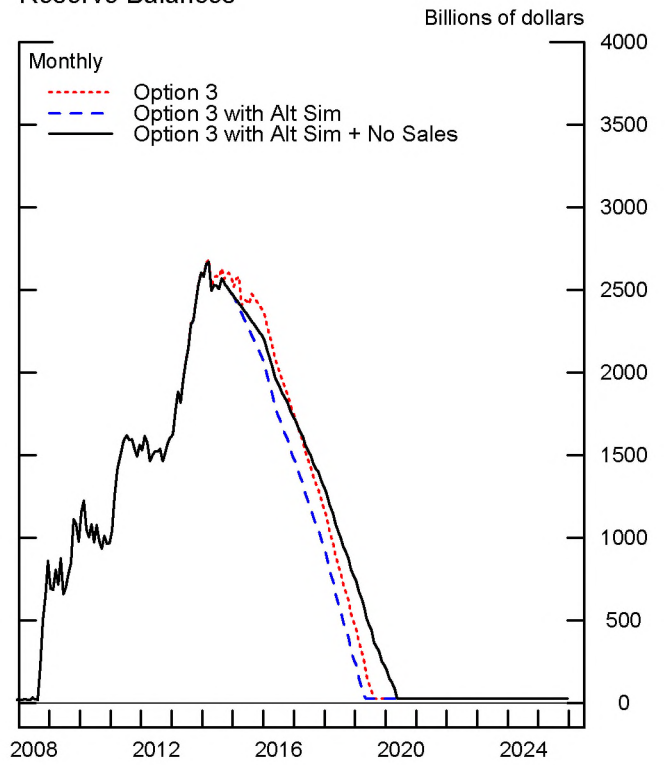


**Figure 5(b)**  
**Adverse Alt Sim: Select Balance Sheet Items**

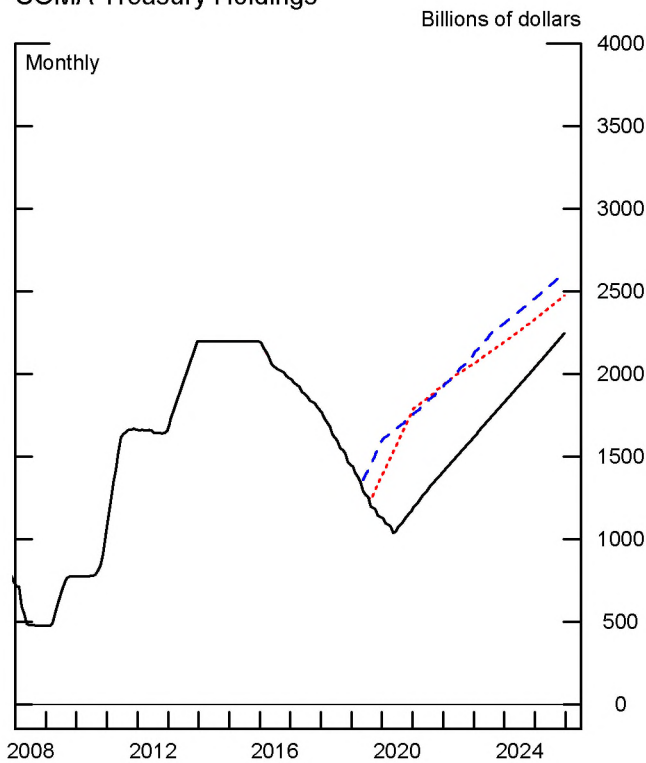
**SOMA Holdings**



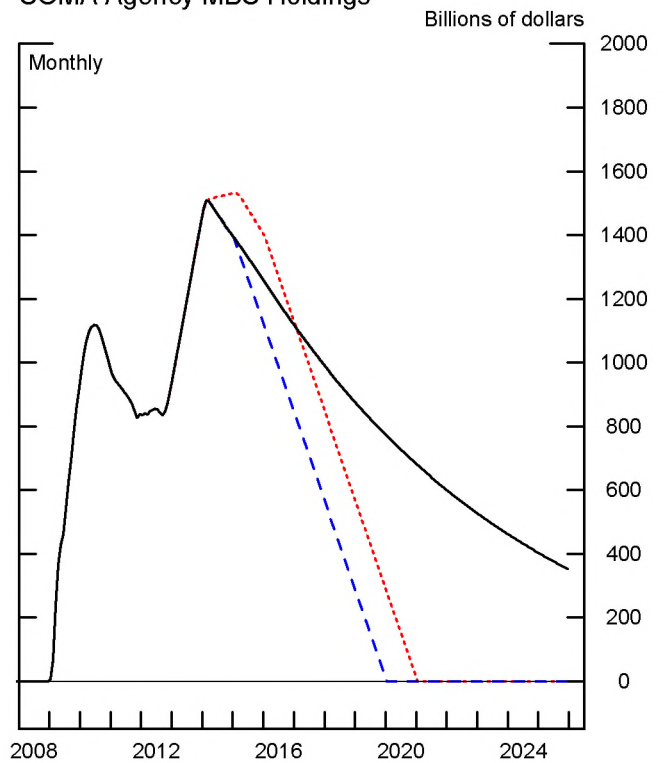
**Reserve Balances**



**SOMA Treasury Holdings**

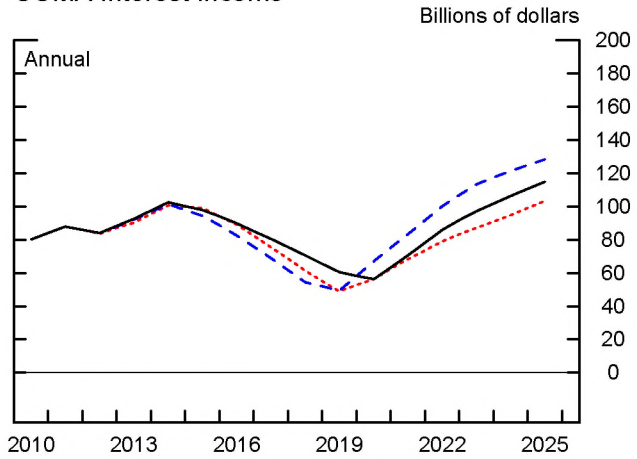


**SOMA Agency MBS Holdings**

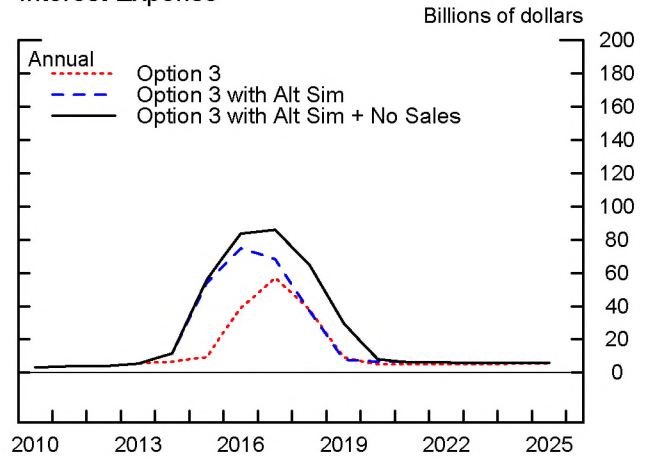


**Figure 5(c)**  
**Adverse Alt Sim: Income Projections**

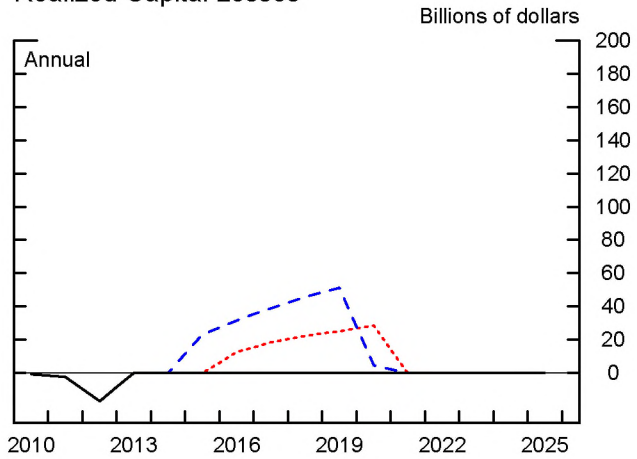
**SOMA Interest Income**



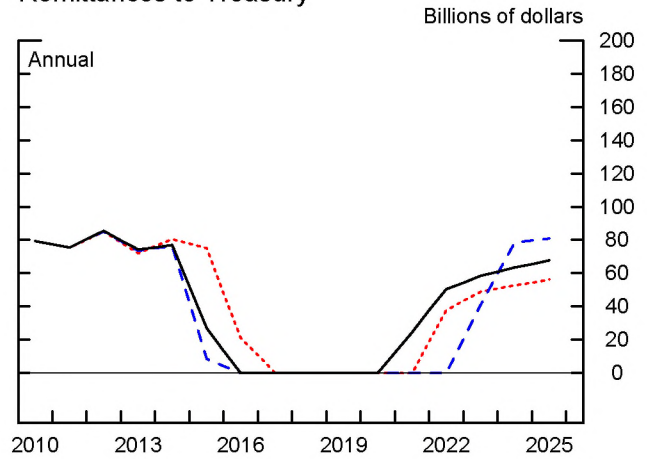
**Interest Expense**



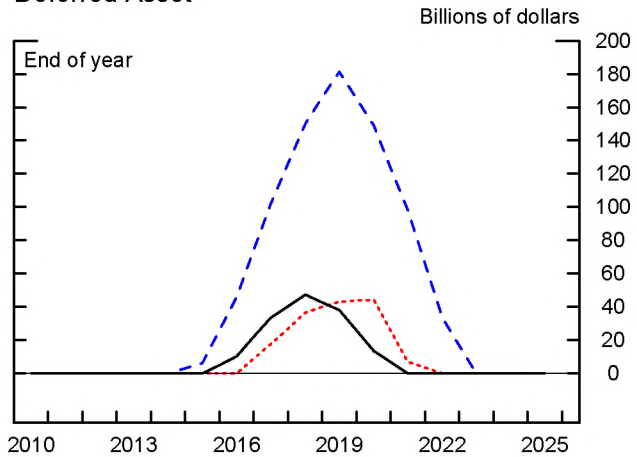
**Realized Capital Losses**



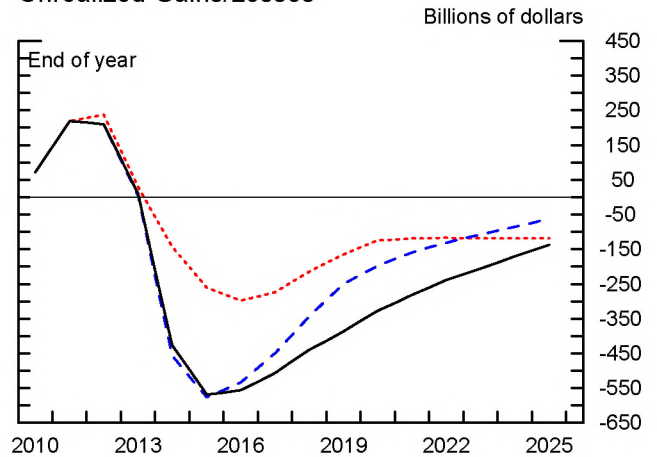
**Remittances to Treasury**



**Deferred Asset**



**Unrealized Gains/Losses**



**Table 1 - Key Scenario Assumptions and Projections**

	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
<b>Total Purchases since Oct. 1, 2012 (\$ billions)</b>	750	750	1250	1250	1250	250
<i>Treasury Share of 2013 Purchases (percent)</i> <sup>1</sup>	53%	38%	53%	38%	60%	
<i>MBS Share of 2013 Purchases (percent)</i>	47%	62%	47%	62%	40%	
Monthly Pace of Purchases (\$ billions)	85	65	85	65	100	
<b>Balance Sheet<sup>2</sup></b>						
Reserves at Liftoff (\$ billions)	2000	2000	2500	2500	2500	1500
SOMA Peak Size (\$ billions)	3300	3300	3800	3800	3800	2800
SOMA Normalization Month	Feb-19	Feb-19	Aug-19	Aug-19	Aug-19	Aug-18
SOMA Size at Normalization (\$ billions)	1,630	1,630	1,640	1,640	1,640	1,600
MBS Sales (monthly average, \$ billions)	14	15	17	18	16	11
<b>Income (2012-2025)</b>						
Cumulative Remittances (\$ billions)	590	590	530	540	530	630
<i>Net Interest Income (\$ billions)</i>	970	980	940	960	930	990
<i>Cumulative Capital Losses (\$ billions)</i> <sup>3</sup>	65	70	90	100	84	40
Maximum Deferred Asset (\$ billions)	3.9	3.6	45	42	43	0
Number of Years Deferred Asset	2.1	2.0	5.0	5.0	5.0	0
<b>Maximum Financial and Economic Impact</b>						
Term Premium (bps)	-21	-20	-41	-36	-41	
Change in Stock of Federal Debt in 2025 (\$ billions)	-220		-300		-330	
Change in Unemployment Rate (through 2015, in bps)	-30	-30	-57	-51	-57	
Change in core PCE Inflation (through 2015, in bps)	18	18	34	30	34	
<b>Income with 100 bp Interest Rate Shock</b>						
Cumulative Remittances (\$ billions)	600		500			700
<i>Net Interest Income (\$ billions)</i>	1020		950			1070
<i>Cumulative Capital Losses (\$ billions)</i> <sup>3</sup>	100		140			70
Maximum Deferred Asset (\$ billions)	41		120			0.5
Number of Years Deferred Asset	5		6.8			1.0

<sup>1</sup> Purchase distribution of nine years.

<sup>2</sup> Lift-off for all scenarios is August 2015, redemptions begin at t - 6 and MBS sales begin t + 6 and continue for five years (through Jan-21).

<sup>3</sup> Includes \$17 billion in capital gains from 2012 MEP sales.

**Table 2 - Key Scenario Assumptions and Projections for Interest Rate Shocks**

<b>Total Purchases since Oct. 1, 2012 (\$ billions)</b>	750		1250				250		
<i>Treasury Share of Purchases (percent)</i> <sup>1</sup>	53%		53%						
<i>MBS Share of Purchases (percent)</i>	47%		47%						
Monthly Pace of Purchases (\$ billions)	85		85						
	Option 1	100 bps shock	Option 3	100 bps shock	No Sales	Alt. Sim.	Option 6	100 bps shock	
<b>Balance Sheet<sup>2</sup></b>									
Reserves at Liftoff (\$ billions)	2,000	2,000	2,500	2,500	2,500	2,600	1,500	1,400	
SOMA Peak Size (\$ billions)	3,300	3,300	3,800	3,800	3,800	3,800	2,800	2,800	
SOMA Normalization Month	Feb-19	Mar-19	Aug-19	Sep-19	Sep-20	May-19	Aug-18	Aug-18	
SOMA Size at Normalization (\$ billions)	1,630	1,600	1,640	1,580	1,780	1,480	1,600	1,560	
MBS Sales (monthly average, \$ billions)	14	14	17	17	0	17	11	11	
<b>Income (2012-2025)</b>									
Cumulative Remittances (\$ billions)	590	600	530	500	580	440	630	680	
<i>Net Interest Income (\$ billions)</i>	970	1020	940	950	880	940	990	1070	
<i>Cumulative Capital Losses (\$ billions)</i> <sup>3</sup>	65	100	90	140	-17	180	40	70	
Maximum Deferred Asset (\$ billions)	3.9	41	45	125	6.1	180	0	0.5	
Number of Years Deferred Asset	2.1	5.0	5.0	6.8	2.0	7.8	0	1.0	
<b>Economic Impact</b>									
Change in Stock of Federal Debt in 2025 (\$ billions)	-220		-300			2,235			

<sup>1</sup> Purchase distribution of nine years.

<sup>2</sup> Lift-off in the Alt Sim is August 2014, implying redemptions begin Feb-14 and MBS sales are conducted from Feb-15 to Jan-20.

<sup>3</sup> Includes \$17 billion in capital gains from 2012 MEP sales.

**Table 3 - Scenario Projections for Alt Sim and Additional Adverse Shocks**

Interest Expense (\$bn, annual)					Remittances (\$bn, annual)					Deferred Asset (\$bn, end of Year)				
	Option #3 (No Shock)	100bp Shock	Alt Sim	Alt Sim + Funding Shock		Option #3 (No Shock)	100bp Shock	Alt Sim	Alt Sim + Funding Shock		Option #3 (No Shock)	100bp Shock	Alt Sim	Alt Sim + Funding Shock
2013	6	6	6	6	2013	72	72	74	74	2013	0	0	0	0
2014	7	7	12	24	2014	81	81	76	64	2014	0	0	0	0
2015	9	13	54	63	2015	75	71	9	4	2015	0	0	6	11
2016	39	57	75	81	2016	21	7	0	0	2016	0	9	46	57
2017	57	73	68	72	2017	0	0	0	0	2017	18	51	102	116
2018	38	49	38	39	2018	0	0	0	0	2018	36	90	150	166
2019	9	13	8	8	2019	0	0	0	0	2019	43	112	181	198
2020	5	6	7	7	2020	0	0	0	0	2020	44	125	149	167
2021	5	6	6	6	2021	0	0	0	0	2021	7	82	98	118
2022	5	6	6	6	2022	38	0	0	0	2022	0	28	34	56
2023	5	6	6	6	2023	49	36	41	16	2023	0	0	0	0
2024	5	7	6	6	2024	53	70	79	76	2024	0	0	0	0
2025	5	7	6	6	2025	56	75	81	79	2025	0	0	0	0

Capital Losses (\$bn, annual)					Remittances (\$bn, annual)					Deferred Asset (\$bn, end of Year)				
	Option #3 (No Shock)	100bp Shock	Alt Sim	Alt Sim + MBS Shock		Option #3 (No Shock)	100bp Shock	Alt Sim	Alt Sim + MBS Shock		Option #3 (No Shock)	100bp Shock	Alt Sim	Alt Sim + MBS Shock
2013	0	0	0	0	2013	72	72	74	74	2013	0	0	0	0
2014	0	0	0	0	2014	81	81	76	76	2014	0	0	0	0
2015	0	0	-23	-26	2015	75	71	9	7	2015	0	0	6	8
2016	-13	-18	-32	-35	2016	21	7	0	0	2016	0	9	46	51
2017	-19	-27	-39	-43	2017	0	0	0	0	2017	18	51	102	111
2018	-23	-32	-46	-50	2018	0	0	0	0	2018	36	90	150	165
2019	-25	-36	-51	-56	2019	0	0	0	0	2019	43	112	181	202
2020	-29	-41	-4	-5	2020	0	0	0	0	2020	44	125	149	171
2021	0	0	0	0	2021	0	0	0	0	2021	7	82	98	123
2022	0	0	0	0	2022	38	0	0	0	2022	0	28	34	61
2023	0	0	0	0	2023	49	36	41	10	2023	0	0	0	0
2024	0	0	0	0	2024	53	70	79	76	2024	0	0	0	0
2025	0	0	0	0	2025	56	75	81	79	2025	0	0	0	0

All scenarios are based on projections of \$1 trillion additional purchases. Lift off for the no shock and 100bp shock is August 2015, while lift off for the 200bp shocks is August 2014. For all scenarios redemptions begin 6 months before lift off and sales begin 6 months after lift off.