When the Fed Buys a Treasury Security, the Debt Does Not Go Away

Bill Nelson and Robert Lindgren | Jan. 5, 2021

When the Fed buys a Treasury security, the debt does not go away. The Treasury security is a borrowing by the Treasury from an investor in exchange for a promise to repay the funds, plus interest, as scheduled. When the Fed buys the Treasury security, it is transformed into deposits of a depository institution at the Federal Reserve, also known as "reserve balances." A deposit at the Federal Reserve, in turn, is a borrowing by the Fed from a depository institution (commercial bank, thrift or credit union) in exchange for a promise to repay the funds, plus interest, on demand. The Fed's assets go up by the amount of the purchased security and its liabilities go up by the increase in reserve balances. The consolidated borrowing of the U.S. government, including the Fed, is unchanged.

Although the total consolidated amount of Federal debt does not change, there are two important differences between these types of borrowings. First, anybody can own a Treasury security, but only a depository institution (henceforth "bank") and a few government agencies can have a deposit at the Fed. As shown below, this means that when the Fed buys the security, the reserve balances created can crowd out other bank assets, including bank lending. Second, Treasury securities are often long-term borrowings while deposits at the Fed are ultra-short-term borrowings (they are payable on demand). The maturity mismatch leaves the Fed, like a similarly situated bank, subject to significant losses if interest rates rise unexpectedly. Not only that, but the Fed will lose money even if everything evolves exactly as expected because term premiums are currently estimated to be negative.

IMPACT ON BANK LENDING WHEN THE FED PURCHASES TREASURY DEBT

A few months ago, in a blog post available here, we develop and use a very simple model of the economy to represent the relationship between equilibrium interest rates on reserve balances, Treasuries, bank loans, and deposits at banks, as well as Fed, bank and household holdings of these instruments. The model consists of a household that uses its wealth and bank loans to fund investments in deposits and Treasuries; a bank that uses deposits to fund investments in Treasuries, loans to households and reserve balances; and the Fed, which just uses reserve balances from banks to fund purchases of Treasuries. The household and the bank both seek to hold balanced portfolios of assets and respond to relative interest rates on their assets and liabilities.

In the previous blog, we considered what happens to bank loans when the Fed buys part of the existing stock of Treasuries.[1] In this blog, we consider the case where the stock of Treasuries goes up, with household wealth increasing by a corresponding amount, and the Fed either buys or does not buy the additional Treasury securities.[2] The model is provided in the appendix, with additional details provided in the earlier blog.

As shown in the top panel of the exhibit below, the model estimates indicate that when Treasuries increase by $100 and the Fed doesn't buy them, households use the additional wealth ($100) to buy most of the Treasuries

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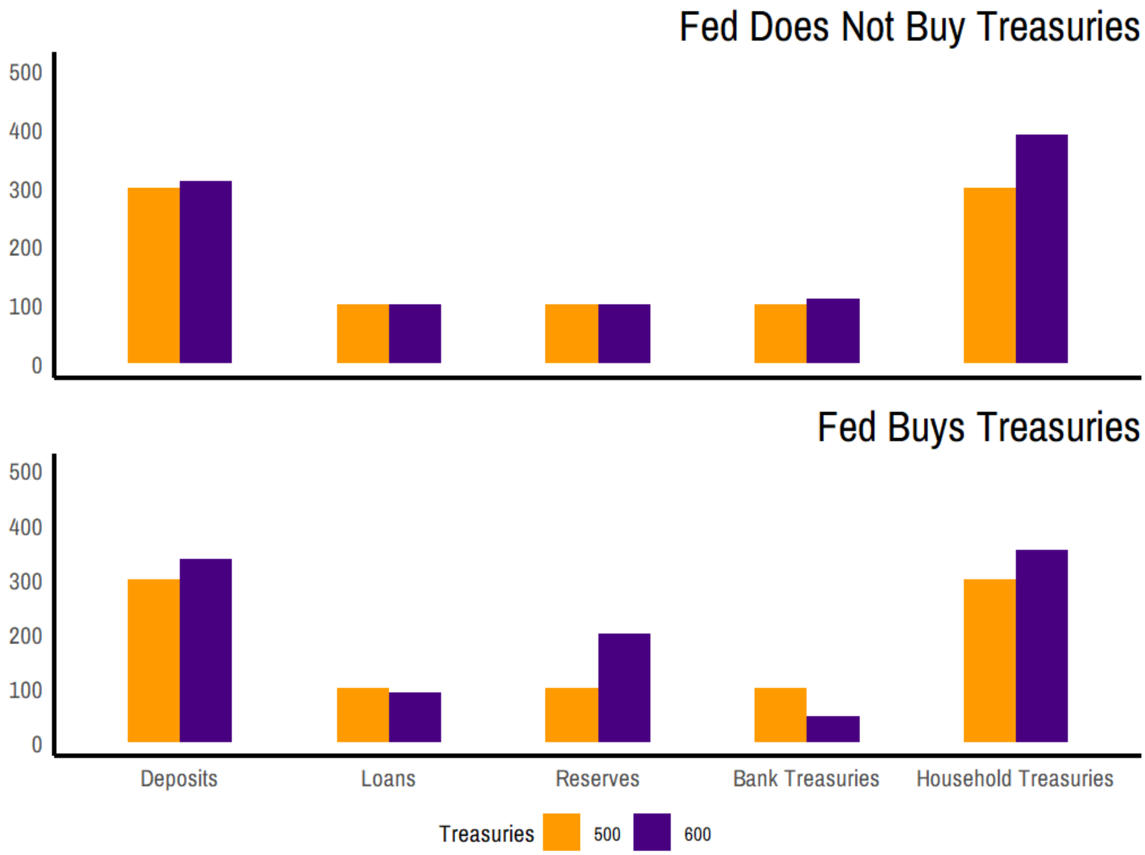
[1] The post demonstrated that a leverage ratio requirement reduced the effectiveness of QE.

[2] Think of households and the federal government as a consolidated entity. The funds raised by the sale of Treasuries end up in household wealth.

($90) and deposit the rest ($10). Banks use the additional deposits to buy Treasuries ($10). Bank lending is largely unaffected and reserve balances are, of course, unchanged (because the Fed's balance sheet does not change).

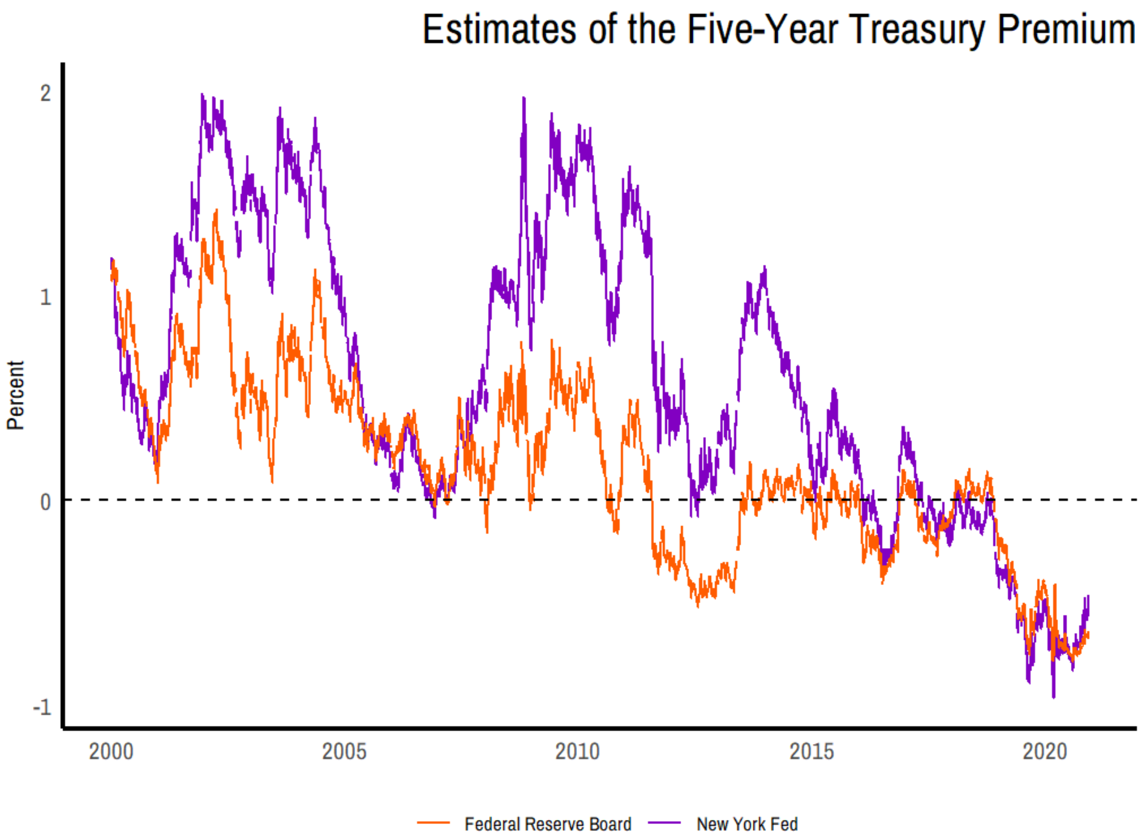


As shown in the bottom panel of the exhibit, when the Fed buys the additional Treasuries, there is a corresponding increase in reserve balances. To fund and make room for the added reserve balances, banks increase deposits by 12.5 percent and decrease loans and Treasury holdings by 8.9 percent and 53.4 percent, respectively. On the household side, the $100 increase in wealth combined with the decrease in lending results in households having an additional $90 in in funds which they divide between Treasuries and deposits, increasing them by 17.8 percent and 12.5 percent. We emphasize that the numbers, and the model, are just illustrative.

In short, when the Fed doesn't buy the Treasuries, the household buys most of them. When the Fed buys the Treasuries, banks have to "hold" them in the form of higher reserve balances. In order to make room on their balance sheets, banks then hold fewer Treasuries and lend less to the real economy. If the bank must satisfy a leverage ratio requirement, and the leverage ratio does not exclude reserves, the effects are similar but a bit larger (not shown). Importantly for the next section, if the Fed doesn't buy the Treasuries, the interest rate it pays on reserve balances (the "Interest on Reserve Balances rate" or "IORB rate") ends up below the Treasury rate, so the Fed makes profits; if the Fed does buy the Treasuries, the IOR rate ends up above the Treasury rate, so the Fed makes losses.

IMPACT ON FEDERAL INTEREST EXPENSE OF THE FED'S PURCHASES

Currently, for the last few years, and for the foreseeable future, it is expected to be cheaper to borrow long-term than to borrow short-term and roll over the short-term debt. Long-term interest rates consist of two pieces: 1) the average (roughly) expected short-term interest rate until maturity, and 2) a term premium. The Fed's holdings of Treasury securities have an average maturity of about five years. Both the Federal Reserve Board's (see here) and the New York Fed's (see here) estimates of the term premium are about -50 basis points. These estimates have been negative for a couple years and the forward term premiums estimated by the models indicate term premiums will remain negative for five or more years.



When the Fed buys Treasuries, it is converting, on average, five-year Treasury securities into overnight borrowing. Because the term premium is negative, it is expected to be more expensive, on average, to borrow overnight, rolling over the borrowing, for the next five years than to borrow at the five-year Treasury rate now.

The difference in interest expense is material. Between Sept. 11, 2019 and Dec. 2, 2020, the Fed has increased its holdings of Treasury securities by $2.5 trillion. Given the five-year term premium, the Fed purchases are projected to raise taxpayers' interest expense by $62 billion over the next five years.[3] And the Fed's purchases of Treasury securities are continuing at a pace of $80 billion a month.[4]

[3] These estimates do not account for the likelihood that the high levels of reserve balances will require an IOR rate above market rates. The added expense will drive Fed profits even lower.
[4] The Fed is also buying $40 billion in agency MBS each month.

APPENDIX: A SIMPLE MODEL OF A BANK, A HOUSEHOLD AND THE FED

The model has three participants: a bank, a household and the Fed. The bank holds reserves R, Treasuries T^B, and loans L as assets and its only liability is deposits D. There is no equity. The household holds Treasuries T^H and deposits as assets funded with wealth W and bank loans. The Fed holds Treasuries T^F as assets and reserves as a liability. The total supply of Treasuries is fixed at T.

Y^i is the bank's demand for asset or liability item i. X^i is the household's demand for asset or liability item i. The interest rate on each liability and asset item i is r^i. The spread of that interest rate over the interest rate the Fed pays on reserves is s^i. The Fed picks T, R, and r^R. The interest rate should be thought of as having been adjusted for risk as well as any additional services (such as payment services) provided by the financial instrument.

In the baseline case, the model is parameterized so that the following balance sheets are an equilibrium when all interest rates are equal.

Federal Reserve			
Assets		Liabilities	
Treasuries	$100	Reserves	$100

Household			
Assets		Liabilities and Wealth	
Deposits	$300	Loans	$100
Treasuries	$300	Wealth	$500

Bank			
Assets		Liabilities	
Reserves	$100	Deposits	$300
Loans	$100		
Treasuries	$100		

We assume that the bank's demand for deposits increases in the spread between what the bank can earn on its assets, on average, and what it has to pay to get deposits. Hence the bank picks deposits to satisfy

$$\log(Y^D) = \left(b_0 + b_D\left(\frac{r^L + r^T + r^R}{3} - r^D\right)\right) \qquad (1)$$

We set the bank's starting demand for deposits (i.e., size) to $300, so we choose b_0 such that $Y^D = e^{b_0} = 300$. The bank's sensitivity to the interest rate spread is determined by b_D, which we set to 5. If a bank's assets and liabilities offer a net interest margin that is 1 percentage point above zero, the bank would choose to be 5 percent bigger than its preferred size of e^{b_0}.

The bank divides the funds it raises as deposits between loans, Treasuries and reserves. It prefers to have equal amounts of each ($Y^L = Y^T = Y^R = \frac{1}{3}D$), but it increases and decreases the shares of loans and Treasuries depending on the relative interest rates.

$$Y^L = \left(\frac{1}{3} + b_L\left(r^L - \frac{r^T + r^R}{2}\right)\right)D \qquad (2)$$

$$Y^T = \left(\frac{1}{3} + b_T\left(r^T - \frac{r^L + r^R}{2}\right)\right)D \qquad (3)$$

We set b_L and b_T equal to 5. If, for example, the interest rate on loans is 1 percentage point higher than the average yield on other bank assets, the bank sets the loan share of its balance sheet 5 percentage points above one third (so 0.38 instead of 0.33).

The bank's demand for reserves is then what remains after subtracting the bank's loans and Treasuries from its deposits.

$$Y^R = D - L - T^B \qquad (4)$$

Clearly, if interest rates are equal then the bank will also choose to hold one-third of its deposits as reserves.

The household adjusts its demand for loans in response to the difference between the average yield on the assets in which it can invest and the interest rate it pays on loans.

$$\log(X^L) = \left(a_0 + a_L\left(\frac{r^D + r^T}{2} - r^L\right)\right) \qquad (5)$$

We set a_0 such that $X^L = e^{a_0} = 100$ so that in the baseline state the household borrows \$100. Similar to the calibration of the equation for bank demand for deposits, we set a_L to 5.

The household divides its wealth and loans between deposits and Treasuries. When all interest rates are equal it chooses to have equal amounts of each but it increases and decreases the shares depending on the relative interest rates. Specifically, the household chooses the share of its portfolio to invest in Treasury securities according to:

$$X^T = \left(\frac{1}{2} + a_T(r^T - r^D)\right)(W + L) \qquad (6)$$

Note that when the interest rates on deposits and Treasuries are equal, the bank chooses to invest half its funds in Treasury securities. As for the bank equation, we set a_T equal to 5.

Using the household balance sheet equation to solve for deposits yields

$$X^D = W + L - T^H \qquad (7)$$

Note that equation (6) and (7) indicate that the household will choose to invest half its resources in deposits if the deposit and Treasury rates are equal.

Each of the equations is unchanged if all the interest rates are increased or decreased by the same amount. Consequently, each can be rewritten in terms of spreads over the interest rate the Fed pays on reserves.

$$\log(Y^D) = \left(b_0 + b_D\left(\frac{s^L + s^T}{3} - s^D\right)\right) \qquad (8)$$

$$Y^L = \left(\frac{1}{3} + b_L\left(s^L - \frac{s^T}{2}\right)\right)D \qquad (9)$$

$$Y^T = \left(\frac{1}{3} + b_T\left(s^T - \frac{s^L}{2}\right)\right)D \qquad (10)$$

$$\log(X^L) = \left(a_0 + a_L\left(\frac{s^D + s^T}{2} - s^L\right)\right) \qquad (11)$$

$$X^T = \left(\frac{1}{2} + a_T(s^T - s^D)\right)(W + L) \qquad (12)$$

The Fed's balance sheet identity is

$$T^F = R \qquad (13)$$

And the fixed total quantity of Treasury securities is

$$T = T^F + T^B + T^H \qquad (14)$$

Equations 4, 7, 13, and 14 imply that wealth and the total supply of Treasuries must be equal (and equal $500).

To calculate the impact of an increase in Treasury debt, we raise Treasury debt and household wealth to $600 billion and resolve the equations. We consider two cases: In the first, the Fed does nothing; its assets (Treasuries) and liabilities (reserve balances) remain unchanged at $100. In the second, the Fed buys all the additional Treasury securities; its assets and liabilities each increase by $100 to $200. The results are discussed in the note above.