The Demand for Safe and Short-Term Assets and Financial Stability: Some Evidence and Implications for Central Bank Policies[1]

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1. Introduction

Over the intermediate and longer term, the FOMC will be making a number of decisions about its balance sheet concerning tools to facilitate exit from accommodation and the monetary policy framework that it will subsequently adopt. Several of those decisions—such as whether to maintain a standing reverse repo facility or whether to implement policy using a floor or corridor system—will also affect the quantity and mix of short-term liquid assets that will be available to financial market participants. This memorandum argues that there may be financial stability implications associated with the public supply of such assets that the FOMC should also take into account when making those upcoming decisions.

In particular, a number of researchers have recently argued that the growth of the shadow banking system in the years preceding the crisis was driven by rising demand for "money-like" claims—short-term, safe instruments (STSI)—from institutional investors and nonfinancial firms.[2] In so far as savers are willing to accept low returns on STSI, these instruments are a profitable way to fund longer-term assets. Such funding, often through a series of intermediaries, increases maturity and liquidity transformation by the financial system, potentially contributing to systemic risk.

Greenwood, Hanson, and Stein (2013) (GHS) present evidence that this money premium on STSI is especially large at the short end of the Treasury yield curve. They argue that this premium reflects the extra "moneyness" of short-term Treasury bills, above and beyond the well-established "convenience premium" that reflects the liquidity and safety attributes of both shorter-term and longer-term Treasuries. In particular, because Treasury bills provide a certain return within a short time frame, they do not entail liquidity risk and are an attractive asset for money funds or corporate cash managers. Similarly, unlike longer-term Treasuries, short-term Treasury bills are not exposed to interest rate risk.[3]

While government securities comprise an important part of the supply of STSI, financial intermediaries also take advantage of this money premium when they issue certain types of collateralized short-term debt, such as repo or asset-backed commercial paper (ABCP), as noted

[1] Mark Carlson, Burcu Duygan-Bump, Fabio Natalucci, Bill Nelson, Marcelo Ochoa, Jeremy Stein, and Skander Van den Heuvel.

[2] Examples include Greenwood, Hanson, and Stein (2013), Gorton, Lewellen, and Metrick (2012), Gorton and Metrick (2011), and Stein (2012).

[3] The money premium is different than a liquidity premium. For example, short-term Treasury bills are more liquid than Treasury notes and bonds with the same remaining maturities and consequently have lower yields (Amihud and Mendelson 1991). However, both are similarly money-like at short-horizons: a money market fund can hold a 3-month Treasury bill as well as a Treasury note with 3 months remaining maturity, even if the latter is much less liquid.

in Gorton and Metrick (2011), Gorton (2010), and Stein (2012).[4] As they argue, this "private money creation" was a big part of the growth in the shadow banking sector in the years preceding the crisis, where seemingly safe maturity and liquidity transformation led to the run-like behavior in financial markets observed during the financial crisis.[5]

In this note, we take the demand for STSI as given and examine the extent to which public short-term debt and private short-term debt might be substitutes in meeting this demand.[6] To test this substitutability hypothesis, we examine whether outstanding amounts of different private money market instruments appear to be negatively correlated with the outstanding amounts of Treasury bills.

Ultimately our underlying motivation is to understand whether the supply of public short-term debt (e.g., Treasury bills, fed issued repo, or possibly reserve balances) can be used as a policy tool to manage maturity transformation by the private sector and hence improve financial stability. We posit that if the relationship between public and private short-term debt issuance is causal and robust, greater provision of public STSI by the Federal Reserve, using its balance sheet and monetary policy framework, may result in less private STSI, potentially improving financial stability. Note that this analysis represents an initial foray into this question and should accordingly be read with a sizeable degree of caution. Many caveats apply and several critical ones are summarized at the end of this note.

2. The hypothesis and evidence to date

As mentioned in the introduction, both public and private short-term STSI seem to carry a money premium that lowers their yields, where the premium is driven by their liquid, short-term, and "safe" nature—their money-like attributes. To capture this "money-premium" GHS define the z-spread as the difference between actual short-term Treasury bill yields (with maturities from 1 to 26 weeks) and fitted yields, where the fitted yields are based on a flexible extrapolation of the Treasury yield curve from Gurkaynak, Sack, and Wright (2007), which is calibrated using only notes and bonds with remaining maturities greater than three months. As shown below in Figure 1, they find that four-week bills have yields that are roughly 40 basis points below their fitted values; and for one-week bills, the spread is about 60 basis points.[7] This z-spread can be

[4] Lucas (2013) argues that the interaction of Regulation Q and the U.S. inflation of the 1970s drove business deposits out of the regulated commercial banks and into the shadow banking sector.
[5] See a detailed discussion of the shadow banking system and financial stability in Tarullo (2012), available at: http://www.federalreserve.gov/newsevents/speech/tarullo20120612a.htm.
[6] While we take the demand for STSI as given, it is important to note that this demand is likely to continue to be high and even grow given upcoming regulatory changes, such as DFA requirements that certain OTC derivatives are centrally cleared and the Basel III liquidity regulations. This increased demand will further add to the potential sources of pressures going forward.
[7] Note that the exact magnitude of the z-spread should be viewed with some caution due to issues around fitting the yield curve in the very front end.

interpreted as the additional convenience premium Treasury bills command because of their short-term maturities.

Another way to think of this money premium is in terms of the realized one-month holding excess return to buying Treasury bills. If the premium results in very low yields at the front of the curve, then buying bills with longer maturities and holding them as they become more money-like should be profitable. In particular, one-month holding return should be high relative to the overnight rate and should increase sharply but at a decreasing rate as maturities grow and the securities become less money-like. Figure 2 illustrates this point. The figure presents the average realized one-month holding period return on a Treasury bill with *n* weeks to maturity in excess of the one-week rate, calculated as follows:

$$xr_{t\to t+4}^{(n)} = \left(p_{t+4}^{(n-4)} - p_t^{(n)}\right) - r_{t-1\to t+3}^{w}, \qquad (1)$$

where $p_t^{(n)}$ is the log price of a *n*-week Treasury bill, and $r_{t-1\to t+3}^{w}$ is the average one week bill rate over the month. The statistics are computed using weekly security-level data on Treasury prices from the FRBNY Price Quote System (PQS), and the holding period return is measured in annual percentage points. As would be implied by the money premium hypothesis, this holding return is indeed concave—increasing steeply at the very short-end of the yield curve. To be clear on the interpretation of the figure, it implies that the ex post realized return to buying and holding a 3-month bill for one month is 34 basis points greater than that on one-week bills; the corresponding differential for buying and hold 6-month bills for one month is 54. Relative to the risks involved, these are extremely large return differentials, far too large to be accounted for by standard risk/return based asset-pricing models.

The second key argument in the literature is that public and private assets of this type are to some degree substitutes in meeting the demand for STSI, although for a number of reasons the public securities are preferable to private ones. As a result, the money premium of a particular set of safe and liquid instruments will, in turn, depend in part on the total supply of STSI, including the supply of public STSI. For instance, when there are more Treasury bills, the money premium is reduced for all private STSI as well as for Treasury bills (that is, yields are higher), because both public and private short-term debt instruments meet the demand for STSI. If, in addition, private issuance of short-term debt responds positively to this money premium, then increases in the issuance of Treasury bills should also lead to a decline in private short-term debt issuance.

This reasoning suggests the following testable hypotheses about an exogenous shift in the supply of Treasury bills:

1. Increases in the supply of Treasury bills should lead to a decrease in the money premium of Treasury bills (higher yields).

2. Increases in the supply of Treasury bills should lead to a decrease in the money premium of the private STSI (higher yields).
3. Increases in the supply of Treasury bills should lead to a reduction in the quantity of private STSI.
4. Increases in the supply of Treasury bills should lead to a decrease in the spread between the yields on private STSI and Treasury bills. (Yields on both Treasury bills and private STSI increase, but because of the greater moneyness of Treasury bills relative to private STSI, the money premium on Treasury bills is expected to react by more to changes in supply such that Treasury bill yields rise by more than those on private STSI resulting in a narrower spread.)

Evidence to date on these implications seems fairly consistent with the underlying hypothesis as well as the results from the earlier literature that more broadly studies the relationship between the supply of government debt and interest rate spreads.[8] Greenwood, Hanson, and Stein (2012) show that a one-percentage-point increase in the ratio of Treasury bills to GDP (roughly half of a standard deviation) leads to a 5.6 basis point narrowing in the 2-week z-spread. They also find that the effect is strongest for very short-term Treasury bills, even after controlling for potential endogeneity between money demand and Treasury bill issuance.[9] Gorton, Lewellen, and Metrick (2012) provide some rough evidence that government debt and bank debt may indeed be substitutes in meeting the demand for STSI. Krishnamurthy and Vissing-Jorgensen (2012) show that the spread between second-tier and first-tier commercial paper (CP) falls when the supply of Treasuries expands, which suggests that top-tier CP is indeed a potential substitute for Treasuries. Sunderam (2012) analyzes the extent to which ABCP is money-like and shows that shocks to money demand increase the spread between ABCP and Treasury bill yields, and increases in Treasury bill supply decrease this spread. Moreover, he shows that the financial sector increases their issuance of ABCP in response to positive money demand shocks.

3. Empirical analysis

In this section, we extend the existing evidence to a broader range of private STSI and examine the extent to which an increase in public STSI leads to a reduction in private STSI or a narrowing of the money premium. We begin by estimating simple univariate regressions that relate the level of private STSI to the level of Treasury bills. Next, we turn to a more dynamic analysis to better understand how changes in the quantities are related to each other. Finally, we investigate the impact of Treasury bill issuance on money market rates and spreads.

[8] Examples include Cortes (2003), Longstaff (2004), Reinhart and Sack (2000).
[9] In particular, they adopt an instrumental variables strategy based on the high-frequency variation in short-term government financing patterns due to seasonal fluctuations in tax receipts. In the first stage of their regressions, they regress the changes in Treasury bills/GDP ratio on a series of week-of-year dummies. In the second stage, they regress the change in the z-spread on the fitted change in the Treasury bill supply from this first stage regression.

Univariate, level analysis on quantities

Tables 1 and 2 report the results of regressions of the outstanding amounts of selected money market instruments (as a share of nominal GDP) on the outstanding amounts of current (table 1) or lagged (table 2) Treasury bills (divided by nominal GDP) using monthly data up to 2007 to capture the dynamics that prevailed before the crisis. We include month and year fixed effects to control for seasonal effects and time trends. Specifically, we consider the behavior of the following private money market instruments: All financial CP, which includes both issuance by financial companies as well as asset-backed CP; all non-financial CP; total time deposits; financial CP and ABCP separately; and non-Treasury assets of prime money market funds.[10] In each case, an increase in the amount of Treasury bills is associated with a material decline in the amount of the private money market instrument.[11] The effect is statistically significant for all instruments, with the exception of prime money market fund assets.

Multivariate VAR analysis (in changes) on quantities

To improve our understanding of the dynamics of the relationship between outstanding amounts of Treasury bills and private safe and liquid assets, we estimated a series of vector autoregressions (VARs). These VARs allow us to investigate the timing of the responses of various money market instruments to changes in the outstanding amount of Treasury bills in a setting that also allows us to control for other factors, such as the state of the economy, which could also affect issuance of money market instruments and Treasuries.

In all our VAR specifications, the dependent variables are the growth of Treasury bills outstanding and the growth of a particular money market instrument. We order these variables so that the growth of Treasury bills can affect the growth of the money market instrument contemporaneously but not the other way around.[12] For most specifications we use the same monthly data up to 2007 as in the univariate regressions. The different specifications include an increasing number of controls, starting with only lags of the dependent variables, then adding monthly dummies (to control for seasonal effects), and finally adding macro-economic controls as exogenous factors in the VAR alongside the monthly dummies (unemployment, growth of industrial production, and PCE inflation).

Results for these three specifications using all financial commercial paper (CP) are in Figures 2-4. In general, as shown in the bottom left panel of all the figures, we find that an increase in the

[10] Combining these instruments allows us to construct a consistent time series dating back to late-1976.

[11] We also looked at the impact of changes in the outstanding amounts of longer-term Treasury securities. In some cases, larger outstanding amounts of these securities were also associated with reductions in the outstanding amounts of private money market securities. However the effects were smaller than for Treasury bills and the effect was statistically significant for fewer types of private securities.

[12] In some cases, especially when the monthly dummies are not included, we find that a shock to financial CP affects the growth rate of Treasury bills. It is not clear how to interpret this finding. It is possible that there is some underlying factor affecting both series. Consistent with this notion, when monthly dummies and macro-economic factors are included this effect is notably diminished.

growth rates of Treasury bills tends to depress the growth rates of financial CP over the following two months. We find a similar response when using the growth of large time deposits (not shown). We do not find a significant response for the growth of non-financial CP or in the growth of money fund assets (excluding Treasury securities). The findings may owe to financial institutions, which tend to have some of the most flexibility in terms of managing their liabilities, having the strongest response to shifts in bill issuance.[13]

These results are broadly consistent with those from the levels regressions and with the hypothesis that increases in Treasury bills outstanding result in a reduction in the growth of other money market instruments.

Supply of Treasury bills and the money premium

We also estimate the impact of the growth rate of Treasury bills on money market rates and spreads. According to the fourth hypothesis described in section 2, greater availability of Treasury bills would result in a smaller money premium, thus narrowing the spread between yields on instruments such as financial CP and Treasury bills, as the latter provide more monetary services per dollar invested and thus have a higher and more sensitive money premium.

We estimate VARs involving rates and spreads using weekly data, as we expect prices to respond fairly quickly. We focus on the spread between rates on 30-day financial commercial paper and on the 4-week Treasury bill, as the money premium in Treasury bills tends to be more pronounced for shorter maturities. Since 4-week Treasury bills have not been issued for quite as long a time, we confine our sample period to October 2001 to June 2007.[14] Consistent with the STSI hypothesis, we find some evidence that increased Treasury bill issuance results in a narrowing of the spread between financial CP and Treasury bill rates (Figure 5).[15]

Additionally, we also examined the relationship between the supply of Treasury bills and one-month holding excess returns at the front end of the yield curve, a direct test of the first hypothesis from section 2. Specifically, we estimate the following regression:

$$xr_{t\to t+4}^{(n)} = \beta_0 + \beta_1 Bills/GDP_t + d_t + \varepsilon_{t\to t+4}, \qquad (2)$$

[13] These results are generally robust to using weekly data, although in the weekly VARs the peak response of private issuance to Treasury bill growth is typically estimated to be a few weeks out, rather than two or three months as in the monthly VAR.

[14] With the shorter sample period, we include monthly dummies in the VARs but do not include the macroeconomic variables.

[15] We also looked the spread between rates on three-month commercial paper and Treasury bills, but did not find any robust relationship. With the three-month rates, we can use monthly data and extend the series back in time much further. In this case, the effect has a negative sign but is only statistically significant after four months, a much longer time lag than we would expect.

where $xr_{t\to t+4}^{(n)}$ is the one-month holding period excess return on a Treasury bill with n weeks to maturity as defined in equation (1) above, and d_t is a vector of monthly dummy variables. The results from these regressions are shown in Table 3 and Figure 6, and the uniformly negative coefficients on the bill-supply term suggest that an increase in Treasury bill issuance results in a decline in the money premium. Moreover, this effect is larger at the shorter horizons where the instrument is more money like. Both of these results are consistent with the money premium hypothesis.

4. Discussions with market participants

As part of our investigation into the relationship between the supply of Treasury bills and demand for private substitutes, we talked to several major issuers of, and investors in, very short-term financial instruments. If issuers of private short-term debt are systematically able to raise funds more cheaply when the amount of Treasury bills outstanding is lower, it would seem likely that they would pay attention to the Treasury bill issuance calendar. Similarly, we were interested to see if investors in short-term debt reduce their demand for private debt in response to increased issuance of public debt.

Issuers

On the issuer side, we spoke with officials responsible for corporate funding at GE Capital, JP Morgan Chase, Bank of America, and Goldman Sachs. The first three are major issuers of financial CP and certificates of deposit and Goldman Sachs advises issuers of such instruments. The officials unanimously indicated that they never consider the Treasury bill issuance calendar when deciding whether and when to issue CP and were generally skeptical of the hypothesis that greater Treasury bill issuance would lead to reduced issuance of private short-term debt. They characterized their decision to issue as driven primarily by differentials between loan growth and deposit growth, although they also noted that opportunistic issuance can be rate-driven.

They did, however, point to some mechanisms through which Treasury bill supply could influence private CP issuance. In particular, these issuers indicated that they do react to investor interest, or lack thereof, in their paper. If investor demand were influenced by Treasury bill issuance, then CP issuance could be affected indirectly by Treasury bill supply. In addition, they noted that their issuance can be influenced by conditions in the repo market: If repo rates are high, CP issuance might be delayed because CP rates would also be high. Because heavy Treasury bill issuance, for example around the tax season, can drive up repo rates by increasing dealer inventory and thus financing costs, opportunistic CP issuance in such circumstances would result in a negative correlation between Treasury bills and financial CP. At a longer frequency, they noted that when the economy is growing briskly, financial CP picks up because

loan growth outstrips deposit growth, while Treasury bill issuance may fall off because tax receipts go up and nondiscretionary expenditures fall.

Several of the issuers also noted a change in liquidity risk management following the financial crisis that has resulted in a more opportunistic approach to CP issuance. In particular, they had revised up sharply their assessment of the liquidity risks associated with CP, and regulatory changes have made CP less attractive. Consequently, they expected to use CP less as a consistent source of funding. They also suggested that empirical results based on pre-crisis correlations might no longer hold.

Investors

On the investor side, we spoke with State Street and Fidelity, two of the largest players in money markets. They noted that the demand for Treasury securities and high-quality assets in general continued to be very strong, and that they expected such demand to persist and possibly even increase as a result of various ongoing regulatory changes (e.g. money market fund reform, Basel III liquidity rules). They agreed that there was potentially some substitutability between public and private instruments. They added, however, that it might take an implausibly large change in yields to induce shifts in demand of economically meaningful magnitudes. For instance, in their view an investor would always choose to invest in private STSI because it has a higher risk-adjusted yield but might also hold some Treasury bills to satisfy liquidity demands that cannot be met by private STSI. In that case, investors might increase or decrease the share of Treasury bills somewhat in response to relative yields, but not by a large amount.

5. **Policy Options**

To the extent that there is a durable tendency for the money premium on STSI to decline (and yields to increase) when the supply of STSI rises, the Federal Reserve might decide to intervene to reduce the incentive for the shadow banking system to create such instruments, especially as the demand for STSI is anticipated to increase in the future as a result of a number of regulatory changes as mentioned above.[16] The policy options come in two forms: Those that increase the supply of STSI (and thus affect the money premium indirectly) and those that target the money premium directly.

[16] For the purposes of this note, we focus exclusively on the policy options available to the Federal Reserve, taking the Treasury bill supply as given. But, another natural policy response would of course be for the Treasury to tilt its issuance more towards short maturities and supply more Treasury bills as discussed in GHS.

Twist again

First, in a future period when the FOMC's balance sheet has returned to a normal composition, the Committee could engage in another maturity extension program (MEP). Selling short-term Treasury securities and buying longer-term Treasury securities would increase the public supply of short-term Treasury securities, which are more STSI-like than long-term Treasury securities.

Indeed, Federal Reserve's sales of shorter-term securities during the MEP contributed to noticeably higher repo-rates. Just as with the original MEP, however, any additional twisting could only continue as long as the Federal Reserve had shorter-term securities to sell. Therefore, it would inherently be a temporary program that might be a useful response to a transitory increase in the STSI-premium.[17]

Maintain a large balance sheet

A policy that the Federal Reserve could implement and that would permanently boost the supply of public STSI would be to maintain a large balance sheet financed with Federal Reserve liabilities that are, in turn, safe and liquid assets for financial institutions. The Federal Reserve could execute such a policy in a few ways. First, the Federal Reserve could conduct its monetary policy using a floor system with large holdings of less-liquid or longer-term assets financed by correspondingly large amounts of reserve balances. While reserve balances can only be held by depository institutions, the reserve balances might in principle satiate the demand of depository institutions for liquid assets, who should, in turn, sell their other liquid assets, such as Treasury securities, to non-depository financial institutions.[18] Because the total supply of STSI would go up, the STSI premium should fall.[19]

The Federal Reserve could also boost the supply of STSI while still operating monetary policy using a corridor, rather than a floor, framework in a variety of ways. For example, the Federal Reserve could finance its asset holdings with the relatively small amount of reserve balances

[17] It is unclear if the elevated repo rates were the direct result of increased supply of STSI or other factors. For example, market participants attributed the higher rates to the primary dealers' inventory of securities expanding to higher-than-desired levels as a result of MEP. While dealers tended to buy the securities the Federal Reserve was selling and then later find a buyer, the dealers needed to finance the increased holdings of securities in funding markets.

[18] The Federal Reserve could also facilitate the transfer of increased liquidity benefits of elevated reserve balances to the nonbank sector by creating segregated cash accounts as described in McAndrews (2013). The accounts would enable banks to offer customers deposits that were completely collateralized by reserve balances and that are therefore completely safe. Such accounts would be a form of public STSI that could in principle displace private STSI.

[19] As with operation twist, the assets held by the Federal Reserve could simply be longer-term Treasury and agency securities. If the Federal Reserve further wished to maximize not only the public supply of safe short-term assets, but of safe assets more generally, it could hold as the primary asset on its balance sheet Term Auction Facility (TAF) loans rather than government securities. Banks would pledge illiquid assets to the discount window, so TAF lending would increase the availability of liquid assets for the financial system. However, this policy addresses a somewhat different set of issues—namely the total supply of available safe assets, rather than the supply of STSI specifically.

consistent with maintaining the federal funds rate in the middle of the corridor defined by the interest rate on excess reserves and the discount rate while holding a large volume of additional assets financed by reverse repurchase agreements.[20] Reverse repurchase agreements with the Federal Reserve would be a very safe and attractive investment that could be held directly by cash managers and money market mutual funds, boosting the supply of STSI. This approach could also help, for example, if an increased leverage ratio may make it harder for broker-dealers to do a lot of repo against Treasuries, which would deprive money funds of a good short-term investment. Reverse repurchase agreements with the Fed could essentially fill in this demand.

6. Conclusions and Some Caveats

Our analysis provides some suggestive evidence in support of the hypothesis that increasing the supply of public STSI might reduce the attractiveness of private STSI, and help improve the stability of the financial system. For example, the regressions results confirm that there may indeed be some substitutability between private and public STSI, so that greater provision of STSI by the Federal Reserve, for example through overnight reverse repurchase agreements, could meet the demand for STSI and help crowd-out creation of private STSI.

However these results should also be interpreted with care as there are a variety of caveats and confounding factors. An important confounding factor, for example, is that Treasury bill yields also reflect the variety of "special services" bills offer, which are importantly different from "money services". For example, a holder of a Treasury bill can use it as collateral in money market transactions. This "specialness" suggests that the Treasury bills and private STSI may be only imperfect, partial substitutes. However, to the extent that a money market fund, which might be the marginal investor in STSI, can be influenced to hold public STSI instead of private STSI, these policies could still be helpful even if the yield on Treasury bills is lower not because of their moneyness but rather because of their specialness.

Another confounding issue is the ongoing changes in the regulatory and supervisory environment that will affect the demand and supply of STSI. For instance, the liquidity coverage ratio in Basel III bank regulatory rules may discourage the creation of private STSI by banks, the financial institutions found here to be the most responsive to changes in the supply of public STSI. Money market fund reforms may affect demand for STSI either by leading such institutions to demand even shorter-term securities or by changing the size and composition of the industry. Many of these regulatory changes and their repercussions for the demand for high-quality safe assets may lead to an increase in private STSI, through for example collateral optimization and transformation services. Until the regulatory changes are fully implemented, attempts to quantify the impact of changes in public STSI on private STSI will be very challenging and using policy to influence the money premium will be extremely difficult.

[20] The Federal Reserve could also conduct policy using a corridor system while still providing a large amount of reserves by having banks establish voluntary reserve requirements as in the Bank of England's pre-crisis policy framework.

Moreover, it is possible that some of the financial stability risks associated with the private issuance of STSI could also be mitigated with regulatory, supervisory and macroprudential policies. Policy options in this realm could include improved regulation of money market mutual funds, increased margin requirements in securities financing transactions, and capital or liquidity requirements that increase with financial institutions' reliance on short-term wholesale funding.[21] Such policies could both help improve the safety of private creation of STSI and limit its volume to some extent. They could also be used in conjunction with the policy options outlined in this note. For example, a higher leverage ratio would discourage broker dealer's reliance on repos backed by Treasury securities. But, if this is the only policy, there would be a very strong incentive for the repo to migrate elsewhere in the less regulated part of the system. If the Federal Reserve were to meet this demand say through overnight repos, this would reduce such regulatory arbitrage incentives.

As with the introduction of any policy, efforts to influence the issuance of private STSI will inherently change the relationship between the public and private STSI, as suggested by the Lucas critique, and will presumably entail unintended consequences. For example, a TAF-like program, or a reverse repo program, that included private assets as eligible collateral, could lead to increased issuance of those eligible securities.

More work will need to be done to address some of these caveats and related concerns.

[21] See Stein (2013) for a discussion.

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Table 1: Levels Regression, Monthly Frequency: Private Debt/GDP on Bills/GDP

	(1) All Financial CP	(2) All Non-Financial CP	(3) Total Time Deposits	(4) Financial CP	(5) ABCP	(6) MMF Assets - Treasuries
bill_gdp	-0.306***	-0.127***	-0.465***	-0.371***	-0.196	-0.130
	(0.0434)	(0.0260)	(0.0526)	(0.0557)	(0.109)	(0.178)
Constant	44.40***	17.28***	102.0***	76.51***	76.50***	65.12***
	(3.576)	(2.226)	(5.257)	(4.437)	(9.107)	(17.64)
Observations	368	368	374	78	78	150
R^2	0.996	0.972	0.972	0.932	0.928	0.976

Table 2: Levels Regression, Monthly Frequency: Private Debt/GDP on *Lagged* Bills/GDP

	(1) All Financial CP	(2) All Non-Financial CP	(3) Total Time Deposits	(4) Financial CP	(5) ABCP	(6) MMF Assets - Treasuries
L.bill_gdp	-0.312***	-0.136***	-0.464***	-0.360***	-0.252*	-0.239
	(0.0432)	(0.0265)	(0.0501)	(0.0645)	(0.118)	(0.184)
Constant	45.34***	18.24***	102.2***	76.10***	81.31***	76.06***
	(3.661)	(2.287)	(5.044)	(5.248)	(9.925)	(18.40)
Observations	368	368	373	78	78	150
R^2	0.996	0.973	0.974	0.923	0.930	0.976

Notes: Each column represents a different left-hand-side variable corresponding to a different definition of private debt. All financial CP is the sum of Financial CP and ABCP. The sample period is 1976-2007 for columns 1 and 2 , 1975-2006 for column 3, 2001-2007 for columns 4 and 5, and 1995-2007 for column 6. All the regressions include month and year fixed effects. Standard errors are in parenthesis. * $p<0.05$,** $p<0.01$,*** $p<0.001$.

Table 3: Supply of Treasury Bills and the money premium

Panel A: Sample Jan 1988– Sept 2012

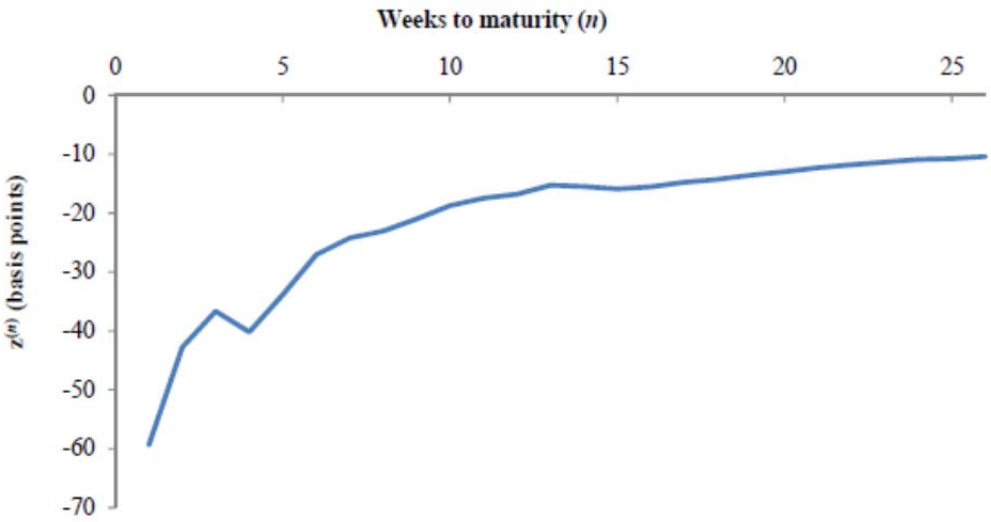
	4-week	5-week	6-week	10-week	13-week
β_1	-0.014	-0.023	-0.029	-0.035	-0.035
t-stat	-1.235	-1.720	-2.048	-2.027	-1.674
$H_0 : \beta_1 \geq 0$					
p-value	0.109	0.043	0.020	0.021	0.047

Panel B: Sample Jan 1988– Dec 2007

	4-week	5-week	6-week	10-week	13-week
β_1	-0.051	-0.046	-0.047	-0.038	-0.041
t-stat	-1.812	-1.485	-1.456	-0.959	-0.872
$H_0 : \beta_1 \geq 0$					
p-value	0.035	0.069	0.073	0.169	0.192

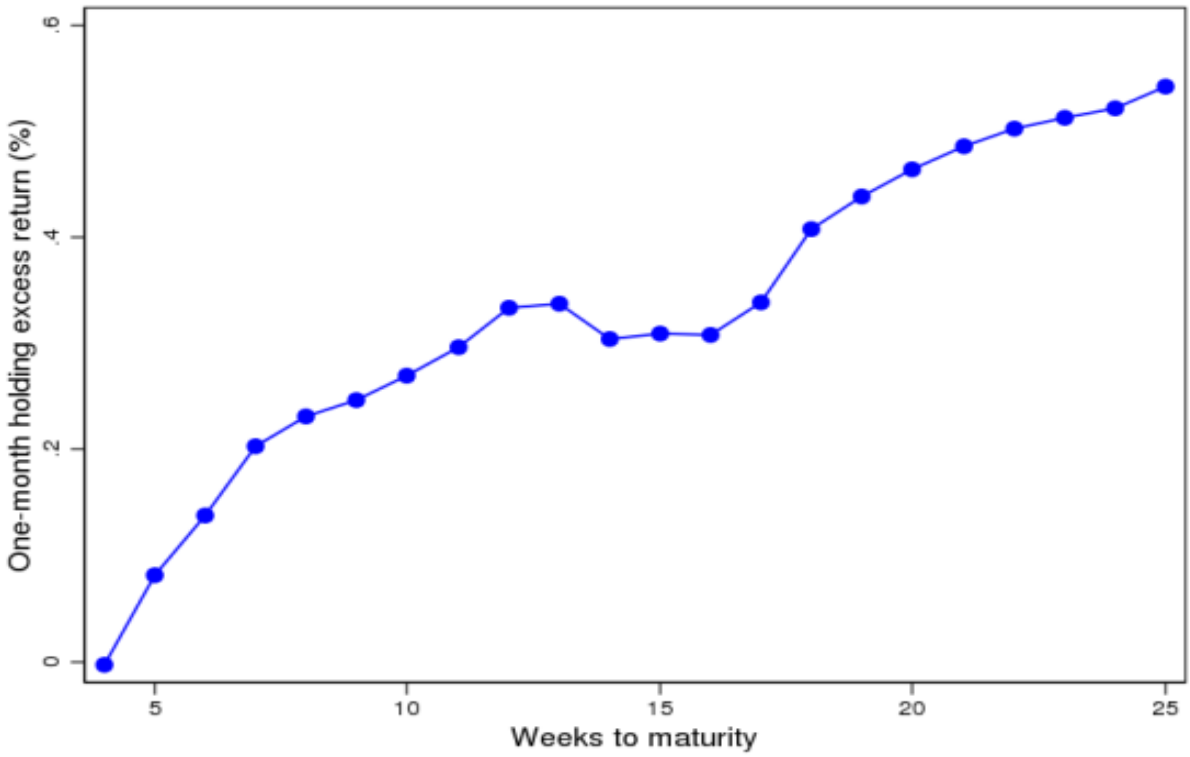
Notes: This table presents the estimated coefficient on Treasury bills along its *t*-statistic obtained from a regression of the one-month holding period excess return on a Treasury bill with *n* weeks to maturity on the supply of Treasury bills as share of GDP. The *t*-statistics are computed using Hodrick GMM correction for overlapping observations. The holding period return is measured in annual percentage points using weekly observations, and the T-bills to GDP is measured in percentage points. The holding period return is computed using security-level data on Treasury prices from the FRBNY Price Quote System (PQS).

Figure 1: The "money premium" on short-term Treasury Bills, 1983-2009, by weeks to maturity



Notes: This figure is taken from GHS. It plots the average spread, over the period 1983-2009, between actual Treasury-bill yields ("on-cycle" Treasury bills with maturities from 1 to 26 weeks) and fitted yields, based on a flexible extrapolation of the Treasury yield curve from Gurkaynak, Sack and Wright (2007).

Figure 2: Average Excess One-Month Holding Period Return to Buying Treasury Bills



Jan 1988 – Dec 2007

Notes: This figure presents the average one-month holding period return on a Treasury bill with *n* weeks to maturity in excess of the one-week rate, as defined in equation (1). The statistics are computed using weekly observations. The holding period return is measured in annual percentage points, and it is computed using security-level data on Treasury prices from the FRBNY Price Quote System (PQS).

Figure 2: Growth of Treasury bills and of All Financial CP
(No controls)

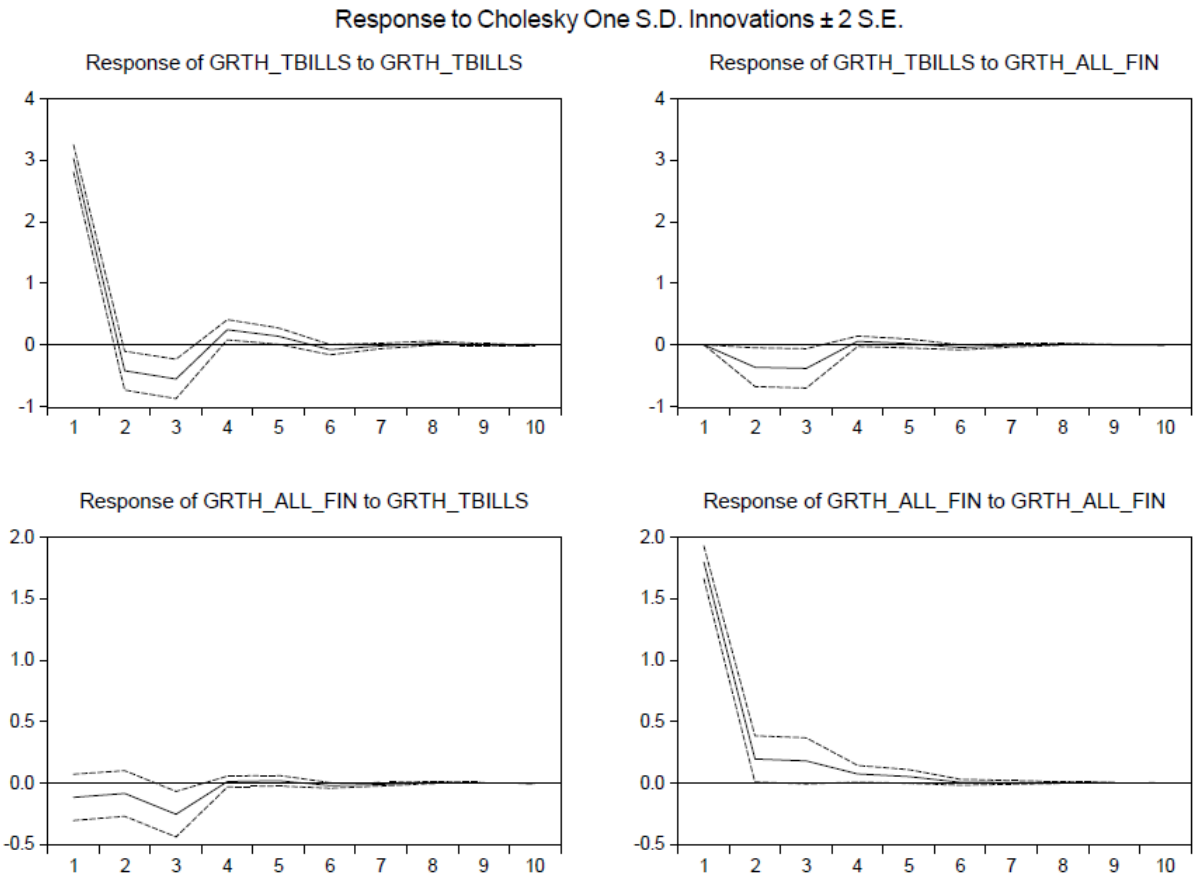


Figure 3: Growth of Treasury bills and All Financial CP
(Includes only month dummies)

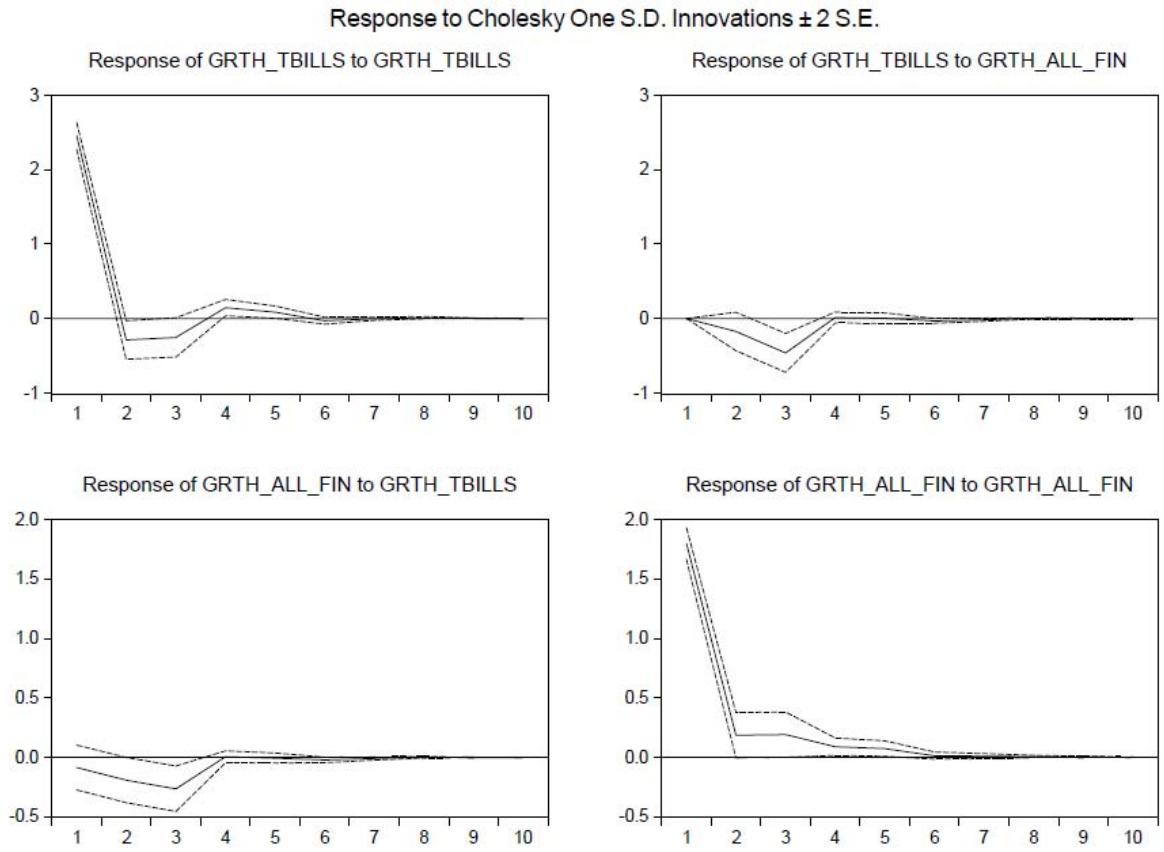


Figure 4: Growth of Treasury bills and All Financial CP
(Includes month dummies and macro factors—unemployment, IP growth, and inflation)

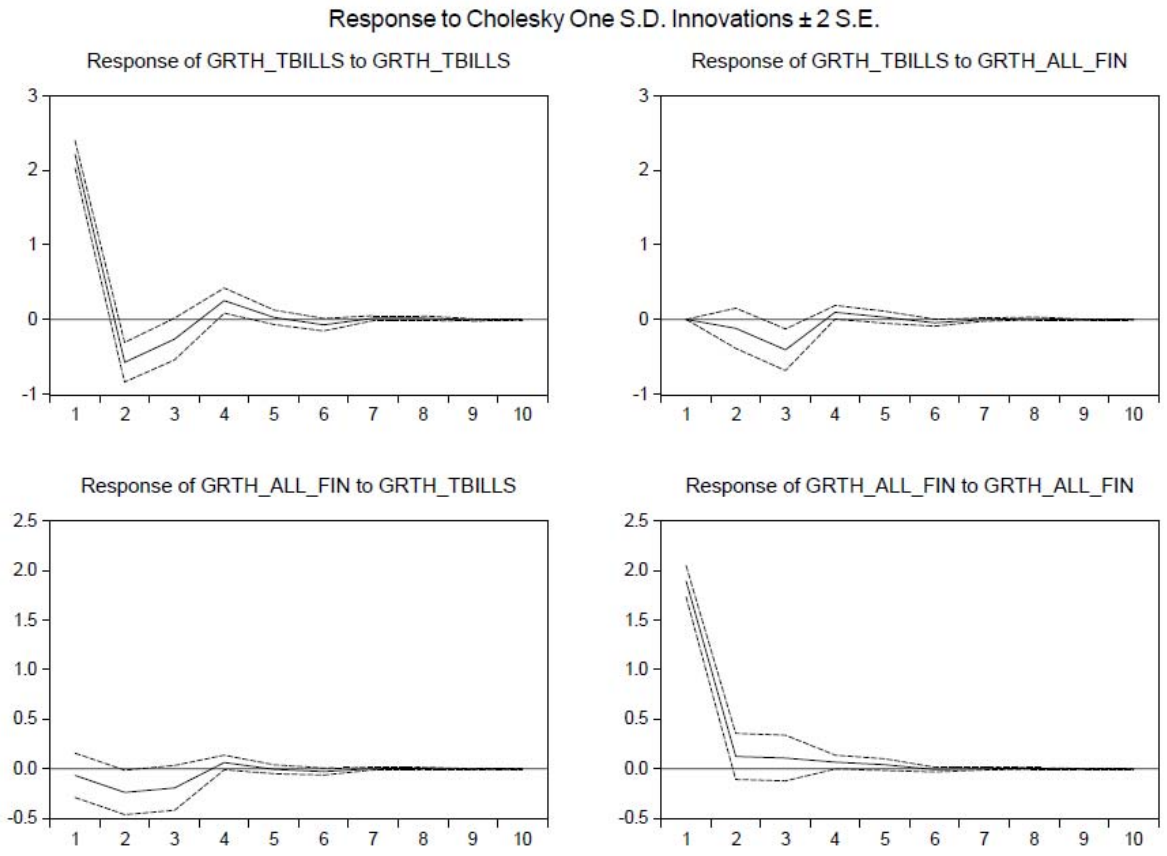


Figure 5: Growth of Treasury bills and Interest Rate Spreads
(Includes month dummies, shows only the response to the shock to Treasury bills)

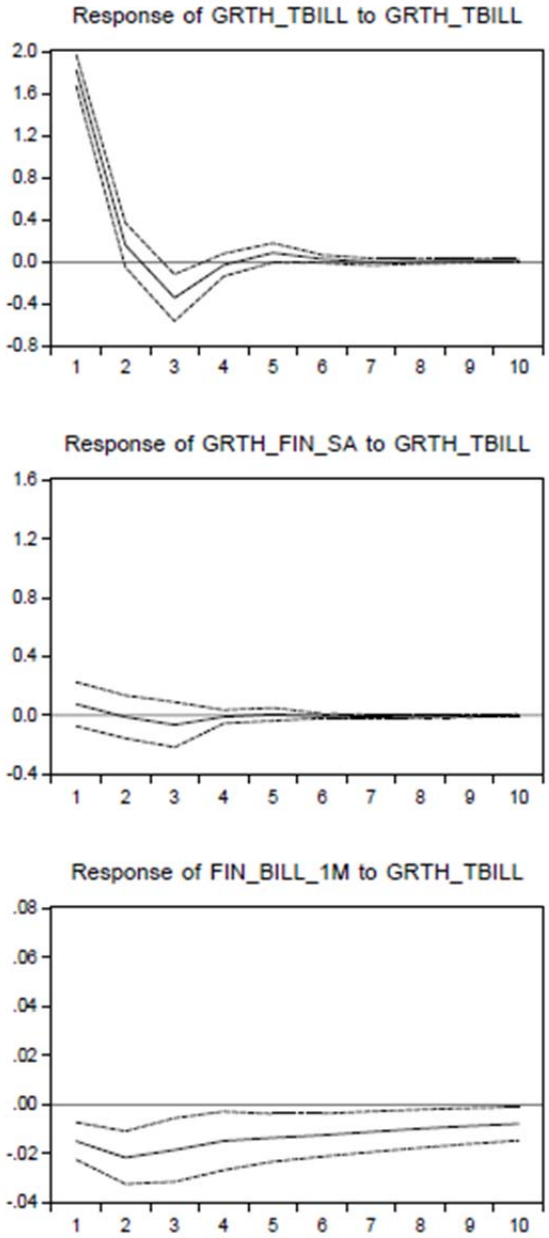
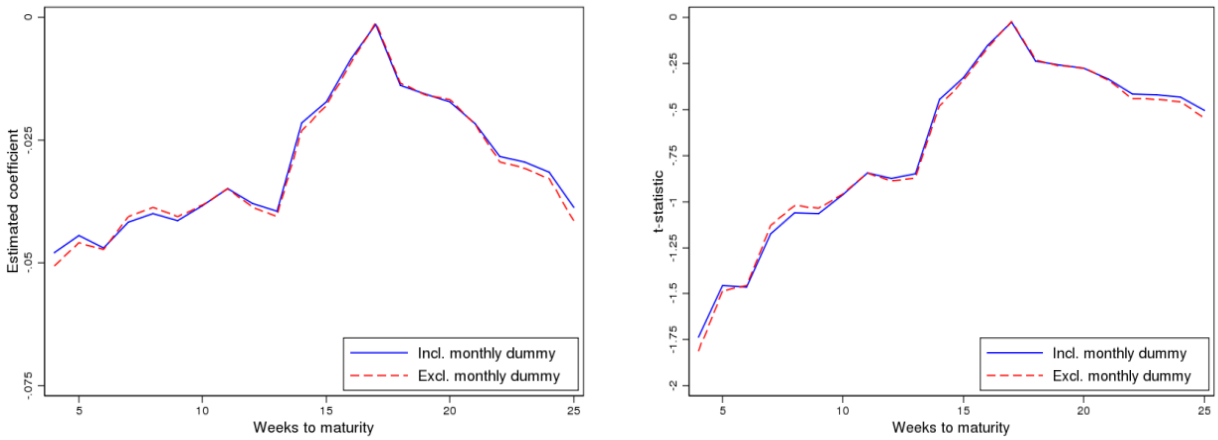


Figure 6: Supply of Treasury bills and the money premium



(a) Treasury bill supply coefficient
Jan 1998 – Dec 2007

(b) *t*-statistic
Jan 1988-- Dec 2007

Notes: The left column displays the estimated coefficient on Treasury bills as share of GDP and the right column displays its *t*-statistic obtained from a regression of the one-month holding period excess return on a Treasury bill on the supply of Treasury bills as share of GDP. The results are reported with and without monthly dummy variables as controls. The *t*-statistics are computed using Hodrick GMM correction for overlapping observations. The holding period return is measured in annual percentage points, and the T-bills to GDP is measured in percentage points. The coefficients are computed using weekly observations. The holding period return is computed using security-level data on Treasury prices from the FRBNY Price Quote System (PQS).