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Money Markets: Regulations¹

Executive summary

The new suite of financial regulations directed at banks, nonbanks, and markets over the past six years have been promulgated to increase the safety and resiliency of the financial system. The financial crisis demonstrated that the largest financial institutions must hold higher and better quality capital and must reduce their reliance on unstable short-term wholesale funding. Reforms put in place since the crisis have contributed to improved financial stability by requiring banks to hold larger buffers of capital and liquidity. In particular, relative to the period prior to the crisis, these regulations should discourage heavy reliance on short-term funding and other risky asset-liability management practices. Moreover, large financial institutions must maintain capital buffers that are more commensurate with the risks they are assuming, both for themselves and for the overall financial system. The Federal Reserve has also transformed its supervision of the largest financial firms through the creation of the LISCC structure. The LISCC undertakes annual horizontal reviews of large firms' capital planning and liquidity risk management, strengthening the incentives for financial institutions to better manage their credit and liquidity risks.

Outside of the regulated banking system, the shadow banking system contributed to the financial crisis by fueling a credit market boom and an over-leveraged financial system. The maturity mismatch and leverage of the shadow banking system made it sensitive to market confidence and vulnerable to runs. Fire sales and deleveraging by shadow banks – in particular, by money market mutual funds -- spread the crisis and made it more severe. Since the crisis, the regulatory framework for money market mutual funds has been strengthened. Notably, money market mutual funds are now subject to liquidity regulation and, in October 2016, some funds will begin to report a floating, rather than a fixed, net asset value.

These regulations have implications for money markets and financial institutions. Moreover, firms have made changes on their own to their risk management practices that may affect money markets. For example, markets for short-term funding might be expected to decline in size and individual institutions may find it less attractive to expand their balance sheets without a commensurate increase in capital and liquidity positions. There is some evidence of these types of effects on money markets. For example, since Q2 2013 primary dealers have reduced their repo and reverse repo activity by around 20 percent, while the five largest U.S. bank holding companies (BHCs) have increased their holdings of Treasuries by about 10 percent in aggregate and have actively discouraged certain types of deposits. Also, the patterns of flows in money markets and the associated impact on rates and volumes on and around period-end dates appear to have been influenced by the foreign regulatory environment. That said, isolating the exact magnitude of the impact of regulations relative to other factors is difficult.

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In this note, we focus on regulatory changes that should have the greatest impact on money markets. These include the supplementary leverage ratio (SLR), the expanded FDIC assessment base, the liquidity coverage ratio (LCR), the net stable funding ratio (NSFR), and money market mutual fund (MMMF) reforms. In aggregate, and all else equal, the ensemble of these regulations could have a variety of effects including:

- Exert downward pressure on unsecured money market rates and volumes
- Shift activity on a relative basis from unsecured money markets to secured money markets
- Increase the volatility of money market rates, particularly on and around period-end dates
- Steepen the term structure of money market interest rates
- Increase demand for central bank reserves, U.S. Treasury securities, and other safe assets
- Shift bank issuance away from very short-term debt and shift money fund demand toward it
- Reduce arbitrage activity and increase segmentation in money markets

Assessing the overall implications of these changes is challenging, but our sense at this stage is that the net effects of new regulations on the liquidity and functioning of money markets and on the implementation of monetary policy, while significant in a local sense, do not present any issues for money markets effectively transmitting the policy stance of the FOMC. The new regulatory environment along with changes in business models are factors that will likely have implications for various design elements of the monetary policy operating framework that best achieves the FOMC's monetary policy objectives. In particular, it is possible that the effects of regulatory changes on some aspects of the monetary policy implementation framework could become greater over time. In that event, policymakers may want to contemplate adjustments to the monetary policy framework that recognize and support the benefits of the new regulatory framework in fostering a more resilient financial system.

Overview of select regulations

This section considers five new regulations that could have effects on money markets.² These regulations accord to a large degree with those analyzed in a BIS paper published in 2015.³

Supplementary Leverage Ratio (SLR) and Enhanced SLR: All banking organizations with at least \$250 billion in total consolidated assets or at least \$10 billion in on-balance sheet foreign exposure must comply with the SLR. The SLR requires bank holding companies to maintain a supplementary buffer ratio of Tier 1 capital to total leverage exposure of 3 percent.⁴ The Enhanced SLR applies to large global systemically important banks (G-SIBs) and their insured depository institution (IDI) subsidiaries; it requires a buffer capital requirement of 5 percent for G-SIBs and 6 percent for their IDIs. The U.S. implementation of the SLR is more robust than the current international standard in several respects, although the Basel Committee is in the process of introducing an additional leverage requirement for G-SIBs. In particular, the U.S. implementation requires an extra 2 to 3 percentage point capital requirement for G-SIBs, and mandates that on balance sheet exposures are measured at a daily frequency while off balance sheet exposures are measured at a monthly frequency. Cross-jurisdictional differences in how institutions measure the denominator (daily/monthly averaging vs. period end) have important implications for certain money market segments, as discussed in the following section.

The SLR is intended to restrict banks from building up leverage, providing a backstop to risk-based capital requirements. Unlike risk-based capital requirements, the SLR is insensitive to credit quality and other risks, meaning that the same amount of capital must be held against safe assets, such as central bank reserves and outright holdings of, and reverse repos backed by, U.S. Treasury securities, as for loans to businesses and households.⁵ The numerator of the SLR is Tier 1 capital. The denominator of the SLR measures a bank's total leverage exposure, which includes all on-balance sheet assets and certain off-balance sheet exposures, and so is focused on the asset side of bank balance sheets. Note that U.S. banks also must comply with the long-standing leverage ratio of 4 percent minimum Tier 1 capital measured relative to on-balance sheet assets. Nevertheless, the Enhanced SLR will always be more binding than the long-standing tier 1 leverage ratio given its higher calibration and larger footprint in its denominator to include off-balance sheet exposures.

Liquidity Coverage Ratio: All banking organizations with at least \$250 billion in total consolidated assets or at least \$10 billion in on-balance sheet foreign exposure must comply with the LCR. Banking organizations with at least \$50 billion but less than \$250 billion in total consolidated assets and less than

² These regulations were chosen based on an internal assessment of the scope of potential impact on various money market segments and their relevance to monetary policy implementation and transmission.

³ Committee on the Global Financial System/Markets Committee, CGFS papers #54, "Regulatory change and monetary policy."

⁴ Tier 1 capital is a bank's core capital and consists mainly of common stock, retained earnings and may also include non-redeemable non-cumulative perpetual preferred stock. Total leverage exposure includes not only assets on the balance-sheet but also derivative positions, securities financing transactions and other off-balance-sheet exposures. The SLR and enhanced SLR become effective starting January 1, 2018.

⁵ This risk insensitivity is the characteristic that makes the SLR more relevant for the money markets than the risk-based capital requirement. For the G-SIBs, the CCAR may in fact impose a more binding constraint than the SLR for the *overall* capital requirement, although not necessarily for money markets *specifically*, depending on whether money market exposures are among the adjustments taken to satisfy the CCAR. The next section develops this more fully.

\$10 billion in on-balance sheet foreign exposure must meet a less stringent version, known as the “modified” LCR.⁶

The LCR is intended to strengthen the liquidity positions of large financial institutions by requiring them to self-insure against funding difficulties. Institutions must hold a minimum amount of unencumbered, high-quality liquid assets (HQLA) to withstand net cash outflows over a 30-day period of significant stress.

⁷ The amount of HQLA required depends on the relative riskiness of firms’ contractual and contingent funding profiles. The U.S. implementation of the LCR is more robust than the international standard by restricting HQLA to a narrower range of assets, setting a more conservative net cash outflow measure, and forcing compliance on an accelerated timeframe.

The numerator of the LCR measures a bank’s stock of HQLA. Consequently, the numerator focuses only on unencumbered assets. The LCR encourages banks to hold higher-quality, relatively more liquid assets including central bank reserves, U.S. Treasury securities, and, to a lesser extent, agency MBS. The denominator of the LCR measures cash outflows net of inflows. Because of this combination of outflows and inflows, the denominator depends on assets and liabilities, as well as a bank’s off-balance sheet contingent liquidity exposures.

Key features that determine inflow and outflow rates for unsecured funding and lending include counterparty type and maturity of the instrument. Outflow rates are also influenced by FDIC insurance coverage. In unsecured markets, the LCR encourages banks to term out their unsecured funding beyond 30 days and to shorten the maturity profile of their unsecured lending to less than 30 days. It also treats borrowings unsecured from retail and small business counterparties more favorably relative to those from financial counterparties.

The key feature that determines the inflow and outflow rates for secured transactions is the quality of collateral. In that sense, the LCR encourages banks to borrow against higher-quality collateral relative to lower-quality collateral. Moreover, the outflow rate on a secured transaction is capped by the outflow rate on a comparable-maturity unsecured transaction with the same counterparty.

⁶ U.S. firms will be required to be fully compliant with the LCR by January 1, 2017. The U.S. banking agencies have not yet proposed a separate LCR rule for foreign banks and their U.S.-based intermediate holding companies (IHCs), but have indicated their intention to do so. Absent a separate rulemaking, the IHCs would become subject to the full or modified LCR to the extent they have U.S.-based subsidiary depository institutions and they exceed \$50 billion in assets on a consolidated basis. IHCs that meet these criteria and become subject to the full LCR would have until April 2017 to comply, while IHCs that become subject to the modified LCR would have until July 2017 to comply. Notwithstanding the applicability of the U.S. LCR rule, the consolidated foreign bank would need to comply with its home jurisdiction’s version of the LCR.

⁷ There are three categories of HQLA, based principally on asset class and liquidity characteristics. Level 1 assets include excess central bank reserves, U.S. Treasuries, Ginnie Mae debentures, and foreign sovereign debt securities with a 0 percent risk weighting. Level 2A assets include claims on U.S. government sponsored entities, agency MBS, and foreign sovereign debt securities with a 20 percent risk weighting. Level 2B assets include non-bank investment grade corporate debt securities and certain common equities. There are caps and haircuts for Level 2A and Level 2B assets.

Net Stable Funding Ratio: The Federal Reserve, along with the other federal banking agencies, issued a proposed NSFR rule in May 2016.⁸ All banking organizations with at least \$250 billion in total consolidated assets or at least \$10 billion in on-balance sheet foreign exposure would have to comply with the NSFR. Banking organizations with at least \$50 billion and less than \$250 billion in total consolidated assets would have to meet a less stringent version, known as the “modified” NSFR.⁹

The NSFR is intended to reduce the likelihood that disruptions to banks’ funding sources will compromise banks’ liquidity position. To mitigate the risk of funding stress over a one-year horizon, banks will be required to structure their liabilities to be consistent with the liquidity characteristics of their assets, derivatives, and commitments. This requirement should discourage excessive reliance on short-term wholesale funding and encourage better bank management of funding risk.

The numerator of the NSFR measures a bank’s available stable funding. It is based only on the liability/equity side of bank balance sheets. It takes into account the contractual maturity of its liabilities and the propensity of providers to withdraw funding for that liability. Reflecting this latter factor, capital and liabilities are weighted according to relative stability. For example, capital, a stable funding source, receives a higher weight than wholesale funding, a less stable one.¹⁰

The denominator of the NSFR measures a bank’s required stable funding. It is based only on the asset side of bank balance sheets. It takes into account the liquidity characteristics of a bank’s assets and off-balance sheet exposures. Required funding for assets and off-balance sheet exposures are weighted according to relative liquidity. For example, unencumbered, shorter-term, highly liquid assets receive lower requirements, while encumbered, longer-term, and less liquid assets receive higher ones.^{11, 12}

Money Market Mutual Fund Reform: The Securities and Exchange Commission (SEC) has adopted a number of amendments to the rules governing money market mutual funds (MMMF) in recent years. The first set of reforms, issued in 2010, established stricter liquidity, credit quality, and maturity requirements for holdings. These changes are intended to reduce the risk of investor runs and to make MMMFs more resilient to stress by reducing liquidity, credit, and interest rate risks of their portfolios. This set of reforms

⁸ U.S. firms would be required to be fully compliant with the NSFR by January 1, 2018. The U.S. banking agencies have not yet proposed a separate NSFR rule for foreign banks and their IHCs, but have indicated their desire to do so. Absent a separate rulemaking, the IHCs would become subject to the full or modified NSFR to the extent they have U.S.-based subsidiary depository institutions and they exceed \$50 billion in assets on a consolidated basis. IHCs that meet these criteria would need to comply with the U.S. NSFR on the same timeline as domestic BHCs (as proposed, January 1, 2018). Notwithstanding the application of the U.S. NSFR rule, the consolidated foreign bank would need to comply with its home jurisdiction’s version of the NSFR.

¹⁰ Banks receive credit for 50 percent of any funding provided by central banks and financial institutions that is an operational deposit or has a residual maturity between six months and one year and 0 percent for any funding with residual maturity less than six months, even if provided by a central bank.

¹¹ Banks are not required to hold any funding against all central bank reserves and all claims on central banks with residual maturities of less than six months. Banks are required to hold stable funding representing 5 percent of the value of some unencumbered Level 1 assets, including U.S. Treasuries. Banks are required to hold stable funding representing 10 percent of the value of unencumbered loans to financial institutions with residual maturities of less than six months, where the loan is secured against Level 1 assets and where the bank has the ability to freely rehypothecate the received collateral for the life of the loan. Banks are required to hold stable funding representing 50 percent of the value of loans to financial institutions with residual maturities between six months and one year.

¹² There is a 5 percent required stable funding factor for Treasury securities; reserves have a 0 percent required stable funding factor.

has increased MMMF demand for safe and highly liquid assets, especially at specific maturities, such as overnight and one week.

A second set of SEC reforms, issued in 2014, is aimed at further reducing the risk of investor runs by requiring a floating net asset value for institutional prime and tax-exempt MMMFs, and granting non-government MMMF boards of directors the ability to impose redemption fees and suspend redemptions temporarily. MMMFs will have had a transition period of two years to implement these reforms, which will go into effect in October 2016.

FDIC Assessment: In April 2011, the FDIC broadened the base for levying deposit insurance premiums from essentially all domestic deposits to average consolidated total assets less average tangible equity during the assessment period. The FDIC also amended the formula for calculating assessment rates to incorporate the size, complexity, and risk of the insured institution. The regulation applies only to domestic IDIs and not to branches and agencies of foreign banking organizations (except the handful of branches that are federally insured), which has had important implications for certain money market segments, as discussed in the following section.

The intent of the revised assessment base is to strengthen the FDIC's insurance reserve fund and to impose a cost on large banks that is more commensurate with the risk they pose to the system. Similar to the SLR, the revised assessment base is insensitive to credit quality and other risks, meaning that every asset contributes equally to a bank's assessment.

Assessing the impact of select regulations on money market segments

These new or enhanced regulations have altered—and may continue to further alter—the effective cost and benefit of transacting or intermediating in money markets for affected institutions. By altering participants' behavior, these regulations can affect money market functioning along many dimensions. That said, as mentioned above, some firms would likely have made some changes to their risk management practices even without these regulations. At the individual market level, regulations may alter the supply of or demand for an instrument, or both, and thus influence market volume, rates and rate volatility. These changes in volumes and rates could also lead to changes in spreads across instruments, which then may make more uncertain the links between policy rates and other interest rates.

This section presents information on the possible cumulative effects of regulations. In most cases, it focuses on the direction of these effects, rather than the magnitude. To the extent effects have been observed to date, the magnitudes have been modest.

Against that backdrop, table 1 summarizes some of these possible effects first by presenting the qualitative stand-alone effect of each of the above five regulations on trading volumes (V), the level of rates (r), and volatility of rates (s).¹³ In deriving the expected directional impact of each regulation on these money market variables, it is assumed the other regulations analyzed here are held constant.¹⁴ Money markets are divided into segments along dimensions that receive different regulatory treatment. That is, we analyze the

¹³ Volatility here generally refers to the volatility of rates, but in many cases the volatility of both rates and volumes moves in the same direction.

¹⁴ However, some effects of the higher risk-based capital requirements introduced in recent years are taken into account when relevant for assessing the impact of the five select regulations analyzed here.

impact on each market segment according to its tenor, whether it is secured or unsecured, and if it is secured, the type of collateral that underlies the transaction. Specifically, maturity points are chosen to coincide with those relevant for the LCR (30 days), the NSFR (6 months), and MMMF reforms (overnight, 7 days, and 60 days). The last set of columns in Table 1 then present an assessment of the combined effect of these regulations. Because several of the regulations have conflicting effects on money market rates, volumes, and volatility, their cumulative effect on these variables can be ambiguous. Moreover, the combined effect can change signs over time, depending on which regulation(s) dominate at a particular point in time as they become binding on certain market participants.

Table 1: Impact of Regulatory Reforms on Money Markets

		SLR/FDIC			LCR			NSFR			MMMF			Cumulative		
		V	r	σ	V	r	σ	V	r	σ	V	r	σ	V	r	σ
Unsecured <30 days	\1	↓	↓	↑	↓	↓	↑	↓?	↑	↑?	↑	↓	?	↓?	↓	↑?
Unsec. >30 days < 6 mon.	\2	↓	↓	↑	?	↑	↑	↓?	↑	↑?	↑	↓	?	↓?	?	↑?
Unsec. > 6 mon. < 1 year		↓	↓	↑	?	↑	↑	↓	↑	↑	↓	↑	↑	↓	↑?	↑?
Secured HQLA <30 days	\1	↓	↓	↑	?	↓	?	↓	↑	↑	↑	↓	?	?	↓	↑?
Sec HQLA >30 days < 6 mon.	\2	↓	↓	↑	?	↑	?	↓	↑	↑	↑	↓	?	↓?	?	↑?
Sec HQLA > 6 mon. < 1 year		↓	↓	↑	?	↑	?	?	↑	?	↓	↑	↑	↓?	?	↑?
Secured non-HQLA <30 days	\1	↓	↓	↑	?	↓	?	↓	↑	↑	↑	↓	?	↓?	↓	↑?
Sec nHQLA >30 days < 6 mon.	\2	↓	↓	↑	?	↑	?	↓	↑	↑	↑	↓	?	↓?	↓?	↑?
Sec nHQLA > 6 mon. < 1 year		↓	↓	↑	?	↑	?	?	↑	?	↓	↑	↑	↓	?	↑

Notes:

V: Volumes, r: Rates, and σ : Rate volatility.

1. The maturity points relevant for money market mutual fund reforms are overnight and 7 days.

2. The maturity point relevant for money market mutual fund reforms is 60 days.

↑?, ↓?: indicate the likely direction of change but subject to uncertainty.

?: the direction of change is too uncertain to sign.

SLR and FDIC assessment

The first set of three columns reports the likely effects of both the SLR and the updated FDIC assessment. These two regulations are analyzed together because they both raise the cost of enlarging the balance sheet without regard to the risk of assets or liabilities. The SLR increases the (shadow) value of equity capital, so long as the regulation is binding.¹⁵ In other words, banks that must comply with the SLR will demand higher rates of return on their exposures than otherwise because they have to hold more capital than previously. By comparison, the expanded FDIC assessment base effectively raises the cost of debt (aside

¹⁵ For the G-SIBs, the requirement for more capital stemming from the risk-weighted capital requirements or the CCAR is reportedly more binding for some firms than the SLR. This may be true for even more firms once the G-SIB capital surcharge takes full effect. To the extent that curtailing exposures in money markets is among the adjustments that are or will be made by the G-SIBs to reduce their CCAR-induced extra capital need, then CCAR supplants the SLR as the capital requirement most relevant for the money markets. On the other hand, in that case, note that our qualitative conclusions about the impact of the SLR analyzed here then apply to the CCAR.

from domestic deposits which were previously subject to the assessment).¹⁶ By raising the cost of expanding the balance sheet, these regulations incentivize a reduction in both the demand- and supply-sides of money market activity. Additionally, for a given balance sheet size, the risk-blind nature of these regulations will likely induce substitution out of low-return assets (such as money market instruments) into higher-return assets, also discouraging money market activity. These regulations thus discourage banks from supplying cash to money market counterparties (which would result in banks holding such instruments on the asset side of their balance sheet) and from demanding cash (which would be on the liability side of their balance sheet) to fund money market instruments and HQLA in general.^{17, 18}

With supply and demand both falling, volumes would decline. However, it is difficult to determine the ultimate effect on rates. In some situations, if we consider that risk-based capital requirements for the GSIBs discourage short-term wholesale borrowing, the demand effect could dominate, which may lead to lower rates as well.^{19, 20} Qualitatively speaking, these effects are expected to be present in both unsecured and secured money market instruments and across all tenors because both regulations treat all exposures at any maturity equally. Nevertheless, the quantitative impact may be relatively greater for lower-return instruments, which are likely to be shorter-dated and/or relatively safer. As suggestive evidence, since 2013, banks have reduced their repo and reverse repo activity and trading volumes in both secured and unsecured overnight transactions. Lower volumes may be associated with higher bid-ask spreads and greater volatility, although such effects have not been economically meaningful to date.^{21, 22}

¹⁶ It is possible that the marginal source of funding for some banks is domestic deposits, in which case the expanded FDIC assessment base may not change or may even lower their cost of funding, though this is unlikely for large banks. Also note that the FDIC assessment is risk insensitive only as far as money market instruments are concerned, since the assessment rate is higher for some loan and security categories deemed high risk.

¹⁷ “Supply” and “demand,” refer to the supply of and the demand for funds (often also referred to as cash). The price of funds is interest rate (i.e., yield); demand for funds is a decreasing function of rate while supply is an increasing function of rate. This maps naturally into the discussion of the regulations’ impact on rate and volume. Note the distinction from the supply of and the demand for a financial asset, in which case the price variable becomes the price of the asset (e.g., a bond), which moves opposite to its yield.

¹⁸ These effects would be weakened if the risk-based capital requirement is more binding at the margin than the SLR. Nevertheless, risk-blind capital requirements would generally disadvantage low-risk/low-return assets.

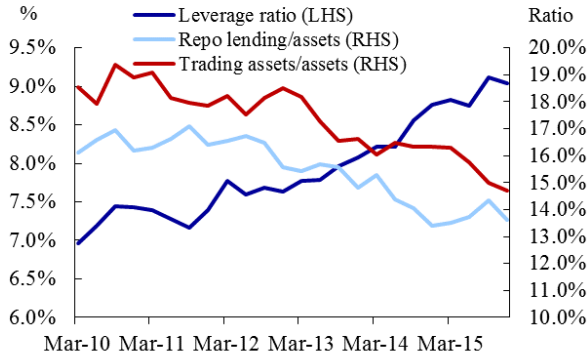
¹⁹ In particular, one of the determinants of the capital surcharge imposed on G-SIBs is a firm’s reliance on short-term wholesale funding. This facet of the capital regime becomes fully effective in 2019.

²⁰ Of course, this pattern may not hold in every market. For example, the demand for some borrowing may be inelastic, such as Treasury’s demand for borrowing in the form of bill issuance. In this case, only the desire to lend by banks would contract, which could push up rates on Treasury securities. In addition, it could be that money funds have a perfectly elastic deposit supply curve. In this case, banks’ demand for deposits would contract, but rates would remain steady.

²¹ To the extent the bid-ask spread in money markets mostly stems from dealers’ operating cost, lower volume implies wider spreads and higher volatility. In contrast, bid-ask spread due to asymmetric information can lead to positive correlation between trading volume and price volatility in some models (e.g., Admati and Pfleiderer, 1988).

²² Though persistently higher volatility has not been observed to date, this may partly result from an offsetting effect due to the extraordinarily low level of interest rates.

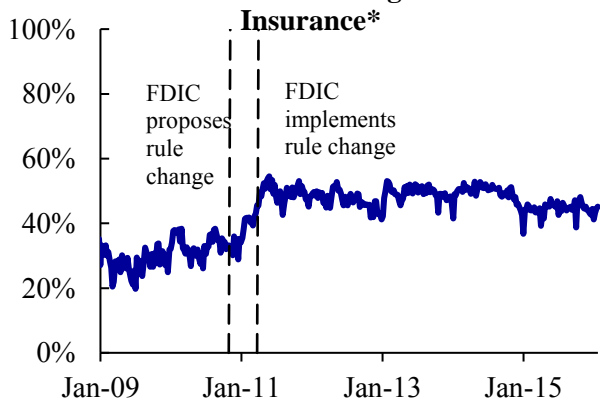
Figure 1: Capital Markets-Intensive G-SIBs Balance Sheet Trends



Source: Bloomberg, Call Reports; Note: Leverage ratio is Tier 1 Capital to total assets, differing from the SLR, which includes off-balance sheet and other adjustments. Banks included are Bank of America, Citigroup,

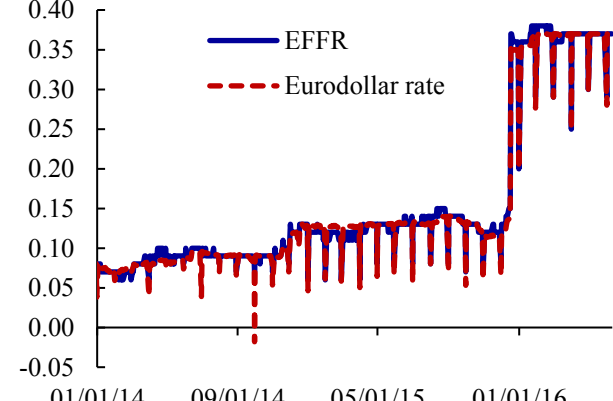
Particular features of these two regulations have already materially affected money markets. With respect to the FDIC assessment, its application only to primarily domestic IDIs has altered the relative demand for central bank reserves among domestic and foreign institutions. Foreign banking organizations (FBOs) do not face this fee and thus more often borrow federal funds or Eurodollars and hold the resulting reserve balances in their account with the Federal Reserve in order to earn interest on excess reserves (IOER). FBOs are willing to pay a higher rate for market funding relative to domestic depository institutions because FBOs can still earn a positive spread on their reserve holdings even borrowing at this rate. Not surprisingly, the share of reserves held by FBOs increased following the announcement of the revision in late 2010, and rose even further upon implementation in April 2011 (Figure 2).²³

Figure 2: Foreign Banks' Share of Reserves Around Change to FDIC Insurance*



*Based on weekly H.8 releases of domestic and foreign-related banks' cash assets

Figure 3: Effective Federal Funds and Eurodollar Rates

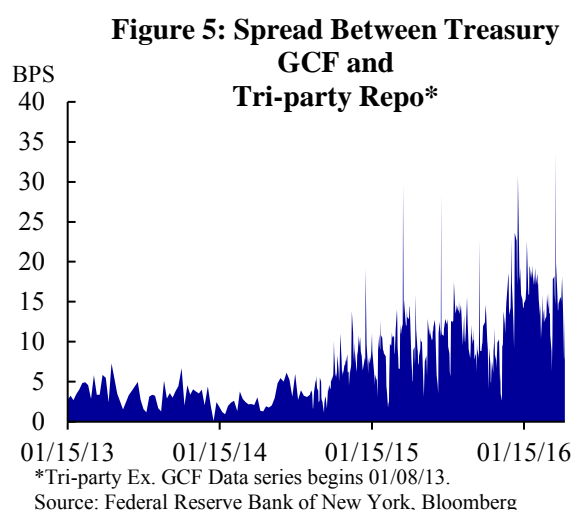
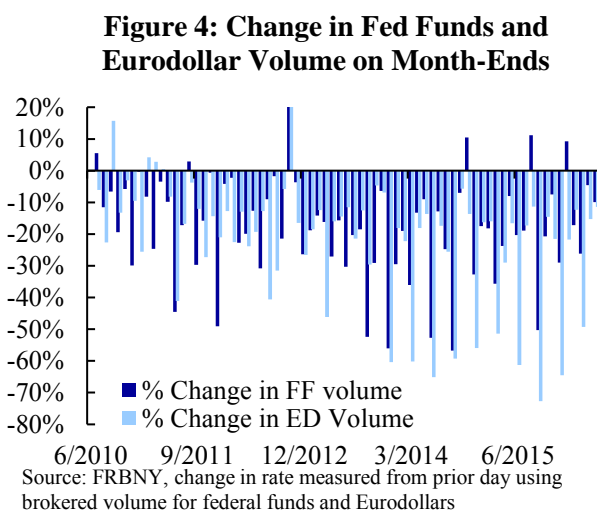


Source: FRBNY, Eurdollar rate calculated from brokered data

With respect to the SLR, cross-jurisdictional differences in how institutions measure the denominator (daily averaging vs. period end) have significantly influenced the composition of participants in certain segments

²³ Also see McCauley, Robert and Patrick McGuire, "Non-U.S. Banks' Claims on the Federal Reserve." BIS Quarterly Review, March 2014.

of money markets. In particular, for many FBOs, the calculation is based on a period-end calculation, while for domestic institutions, the calculation uses a period-average calculation. The (inferior) period-end calculation has brought about changes in the level, volatility, and correlation of money market rates on and around period-end dates. This has some implications for other money market participants and the Federal Reserve’s open market operations. Specifically, on non-period-end dates FBOs tend to borrow relatively large quantities of fed funds or Eurodollars and place the proceeds at the Federal Reserve to earn IOER. Since the denominator of the leverage ratio is calculated only on period-end dates for many FBOs, they typically curtail this activity on and around these dates. Because of their large presence as borrowers in the fed funds and Eurodollar markets to engage in IOER arbitrage, these activities by FBOs consistently lower unsecured money market rates and volumes on reporting dates, highlighted by a notable decline in the effective federal funds and overnight Eurodollar rates (Figures 3 and 4). That said, these temporary and relatively predictable patterns do not seem to pose a serious concern for interest rate control. By symmetric logic, in markets such as the secured GCF repo market, where the suppliers of funds tend to be dealers whose parent companies are subject to leverage ratio constraints, rates tend to rise on and around period-end dates.^{24, 25} The wider spread between GCF and triparty repo rates observed on non-period-end dates can be regarded as a form of compensation required by large dealers to intermeditate between small dealers and lenders (e.g., MMMFs) (Figure 5).



LCR

The second set of three columns of the table shows effects of the LCR. Since the denominator of the LCR measures net cash outflow over a 30-day period, the analysis in Table 1 divides money markets into two segments: below and above 30 days. With respect to unsecured funding markets, the LCR should encourage banks to term out their demand for such funding to beyond 30 days while shortening their supply of such funding to tenors shorter than 30 days. This implies that for bank participants in the less than 30 days

²⁴ These are presumably activities not in violation of the Volcker rule’s prohibition of proprietary trading.
²⁵ FBOs with at least \$50 billion U.S. non-branch assets will be required to form Intermediate Holding Companies (IHCs). These IHCs will be subject to substantially the same U.S. capital and liquidity requirements as domestic BHCs. Some non-bank dealers will reportedly be most affected by this change. As a result, IHC implementation will likely mitigate but may not eliminate the excessive volatility on and around period-end dates.

market segment, the LCR reduces demand for unsecured funding but raises supply (though in the current environment, the most important lenders in the less than 30-days market segment, Federal Home Loan Banks and MMMFs, are not subject to the LCR). Notably, however, the LCR's maturity mismatch add-on, which ensures the denominator of the ratio represents a bank's worst day of cumulative net outflows within the 30 day horizon, would discourage increases in short-term lending that are funded with liabilities of shorter maturities. This constraint could limit the LCR's positive effect on the supply of unsecured funding maturing in less than 30 days.²⁶ The combined effect should lead to an unambiguous decline in rates but an ambiguous impact for volumes.²⁷ Considering that risk-based capital requirements discourage short-term wholesale borrowing, the demand effect will likely dominate, leading to lower volumes as well.²⁸ This, in turn, implies greater volatility, as discussed above. The LCR should have the opposite effect on banking organizations' demand for, and the supply of, unsecured funding with maturities beyond 30 days, resulting in higher rates in this market segment, but an ambiguous impact on volumes. Again, because risk-based capital requirements discourage short-term wholesale borrowing, lower volume may be more likely and volatility may be greater.

The denominator of the LCR distinguishes an institution's funding counterparties and accords different treatment depending on the type of counterparty, which could impact flows and dynamics in money markets. Specifically, funding provided by non-financial corporates, sovereigns, and central banks receives more favorable treatment than does funding from financial counterparties such as banks, securities firms, and insurance companies. This has resulted in lower outflow rates for the former categories of counterparties relative to the latter categories. These distinctions apply to all unsecured borrowing and to secured borrowing that is not backed by Level 1 or 2A assets.²⁹

With respect to secured funding transactions, outflow rates of funding (which enters the denominator) are commensurate with the haircut on the asset funded (which enters the numerator). Transactions in which repo maturing within 30 days is used to raise cash against securities that are already held on balance sheet would have an essentially neutral, though very slightly negative impact on an institution's LCR, with the negative impact principally due to a lower quantity of funds received than the quantity of assets encumbered, owing to haircuts.^{30, 31} This effect tends to be small and depends on the institution's current LCR position, the LCR category of collateral and the haircut demanded by the market. Transactions in

²⁶ Also note that the subsequent discussion largely ignores the possibly complex and uncertain effect of the LCR due to any one of its multiple thresholds becoming binding at some point: 1) the inflow rate is capped at 75 percent of the outflow rate; 2) the share of non-Level 1 HQLA is capped at 40 percent; and 3) the share of Level 2B HQLA is capped at 15 percent.

²⁷ These directional assumptions are for the LCR in isolation. Of course, these would react with incentives for other money market participants.

²⁸ As noted previously, one of the determinants of the capital surcharge imposed on G-SIBs is a firm's reliance on short-term wholesale funding.

²⁹ This favorable treatment for non-financial entities relative to financial counterparties is partially offset by lower inflow rates on lending to non-financial entities relative to financial counterparties.

³⁰ If an institution's LCR is greater than 100 percent, an equal increase in the numerator and the denominator reduces the ratio slightly.

³¹ Note that in the U.S. version of the LCR, the 40 percent cap on Level 2 HQLA is imposed against either the reported HQLA stock or the adjusted stock after unwinding all "collateral transformation" embedded in the secured funding, lending, and collateral swap books within a 30-day horizon, whichever is more stringent. Therefore, secured transactions cannot improve a bank's LCR.

which repo maturing within 30 days is used to finance the acquisition of non-Level 1 securities would result in a lower LCR, potentially discouraging this method of financing non-Level 1 collateral.

The LCR incentivizes extending maturities on secured borrowing transactions beyond 30 days while discouraging secured lending transactions beyond 30 days. Thus, the change in secured rates in each segment should have the same sign as the similar-maturity unsecured segments, described above. The impact on volumes in secured markets, however, is ambiguous because of simultaneous changes in demand and supply as described for unsecured markets. This in turn implies uncertain effects on volatility as well.

NSFR

The third set of three columns of the table present the effects of the NSFR. Relative to the LCR, the NSFR will generate more complex effects because its calculation depends on more parameters: the type of the counterparty and whether a loan is secured by a Level 1 asset that can be rehypothecated (e.g., a U.S. Treasury security). The NSFR discourages running down cash to supply credit at all tenors, since any loan raises the quantity of required stable funding (RSF, denominator) and thus lowers the NSFR, especially if the loan is to a financial entity for over six months, while cash has a zero RSF. It incentivizes banks to extend the tenor of their demand for funds beyond six months (if borrowing from a financial firm) and to demand more funding from nonfinancial entities, both of which raise the quantity of available stable funding (ASF, numerator) and, in turn, the NSFR. The substitution of funding demand toward nonfinancial sources, however, is unlikely to offset the decrease in demand from financial sources, so overall demand for funding will likely decline. Hence, for unsecured money market instruments with tenors below six months, the supply of funds from banks subject to the regulation may fall while the demand for funds may also decline.³² Since the reduction in supply is unambiguous and likely to dominate, below-six-month unsecured rates will likely increase. Volume in this market segment is likely to decline (clearly so if both supply and demand shrink) but can be ambiguous. For the unsecured segment with tenors above six months, the NSFR exerts an even more negative effect on supply but encourages demand. With demand rising and supply falling, these rates will clearly rise; volumes are ambiguous, though they will likely decline because the reduction in supply should dominate. It is possible that the combination of these effects could create kinks in the yield curve around the six-month and one-year maturity points. Lower volumes would likely result in higher volatility.

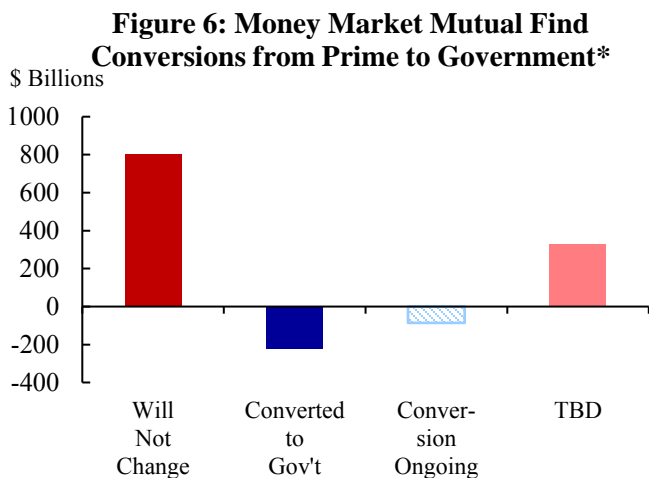
For secured funding markets with tenors below six months, the NSFR should reduce the supply of funding (i.e., discourage the supply of credit via reverse repos), and increase the demand for funding from nonfinancial counterparties. The negative effect on supply will likely dominate, since nonfinancial firms tend not to lend via repos. As a result, rates in this market segment would rise while quantity falls, implying higher volatility. These effects should manifest mostly for secured transactions to fund new asset purchases and for matched-book repos. The NSFR's effect on supply is also negative for secured funding transactions with maturities more than six months, although it may exert a more positive effect on demand for funds from nonfinancial entities. Consequently, rates on secured funding beyond six months will rise too, but the

³² Since institutions subject to the NSFR are not major lenders of fed funds and Eurodollars, in practice supply may hardly decline in these market segments. The fact that nonfinancial firms' holdings of repo and CP constitute a rather small share of their liquid asset portfolios suggests that their supply of funds in these market segments tend to be small and inelastic.

effect on the volume of such transactions may be ambiguous. Thus, the impact on the volatility of rates is also ambiguous. Funding demand for repos with maturity greater than six months will rise more for lower quality assets (Level 2B HQLA or non-HQLA) because the NSFR penalizes encumbering Level 1 and Level 2A HQLA, so both rates and volumes of such transactions may fall less relative to those in other secured transactions.

Money market mutual fund reforms

The fourth set of three columns of the table present effects of the MMMF reforms, which should induce money funds to desire safer, more liquid, and shorter-maturity assets (especially at overnight and one-week tenors). These changes should raise the supply of cash for shorter-dated high-quality money market instruments (e.g., repos backed by HQLA, Treasury bills, A1/P1-rated commercial paper) relative to longer-dated lower-quality instruments, leading shorter-term rates to fall relative to longer-dated rates, thereby steepening money market yield curves. Volumes in shorter-dated high-quality instruments should increase relative to volumes in longer-dated lower-quality instruments. The absolute level of volumes may decline even for shorter-dated private liabilities because there will likely be fewer prime institutional fund assets, as the imposition of a floating NAV and redemption gates and fees diminishes the value of prime funds to their customers, incentivizing investor migration out of prime funds and conversions of prime funds into government funds.³³ In fact, around a dozen prime funds (including several retail prime funds) have already converted to government funds, representing a shift in assets under management of roughly \$250 billion, and further migration will likely take place as the October 2016 deadline for implementation approaches (Figure 6).



*Categories aggregate information from public MMF complex announcements. The first fund conversion from prime to government occurred on 11/1/2015.
 Source: AUM data from SEC Form N-MFP as of 3/31/16

³³ This statement implicitly assumes that all of the prime MMF funds migrate to government MMFs.

The volume of private liabilities should fall if the decline in demand by MMMFs results in higher borrowing costs for issuers that prompt them to scale back short-term borrowing or to shift to other sources of funding. The effect on the volume of government liabilities depends on the issuance response of the public sector. The supply of cash for official sector liabilities should increase relative to private sector liabilities, thus lowering rates on government securities and widening yield spreads to private securities. These effects should be magnified for instruments with maturities greater than seven and 60 days, possibly creating kinks in the term structure.

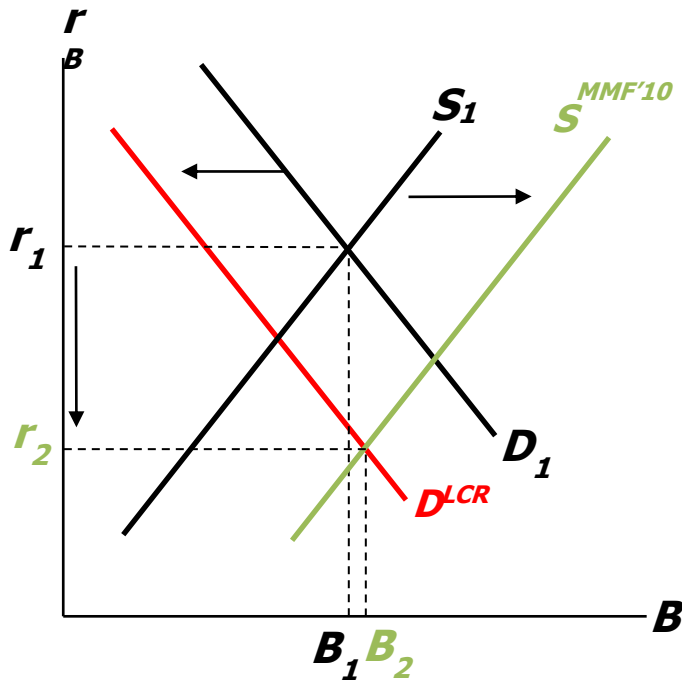
Cumulative effects of regulations and interaction with design elements of the Federal Reserve's framework

The final set of three columns presents qualitative judgments of the cumulative impact of the above regulations on rate, volume and rate volatility for each market segment. Assessing the likely cumulative effects of these regulations is difficult, partly because the regulations, each individually optimized for a specific objective, have offsetting effects in many cases. There are chiefly two sets of conflicts: i) between the SLR and FDIC assessment on the one hand and the set of liquidity regulations on the other, with the former discouraging whereas the latter encouraging the holding of HQLA,³⁴ implying opposite effects on the rate and volume in the relevant market segments as detailed above; and ii) between the set of liquidity regulations on banks and the regulations on MMMFs, which are frequently on opposite sides of money market transactions. For example, the LCR together with the 2010 MMMF reforms will unambiguously lower the rate on daily or weekly unsecured borrowing, but the combined effect of these regulations on volume is ambiguous—higher if the MMMF reforms increase supply more than the LCR lowers demand, and vice versa, as shown in Figure 7. In the case of such conflicts, knowing which regulation or set of regulations will likely dominate would help determine the sign of the combined effect, but there is as yet insufficient evidence to make such assumptions. Therefore, only the following broad assessments can be offered at this point:

- Volumes in all segments of money markets are more likely to be lower than otherwise, especially at maturities beyond six months, in instruments not secured by HQLA. Movements in rates and private market volumes on period-end dates are likely to be particularly acute.
- Money market yield curves are likely to steepen around threshold maturities specified in the regulations and could become kinked, especially around the 30-day and six-month maturity points;
- Volatility in most, if not all, market segments is likely to rise, particularly on and around period-end dates. This is a result of lower volumes and greater fluctuations in the composition of the marginal market participant, which implies greater variation in the marginal willingness to borrow or lend.

³⁴ Note that the CCAR may be more binding than the SLR for money market activities, as discussed above, although they should have qualitatively similar effects whichever becomes more binding.

- **Figure 7. Cumulative Effects of the LCR and 2010 MMMF reforms**



Notes: The LCR reduces the demand for short-term funding, i.e., shifts in the demand curve from D_1 to D^{LCR} . Meanwhile, MMMF reforms introduced in 2010 shifts out supply of funding (to satisfy MMMFs' need for daily and weekly liquidity), i.e., shifts the supply curve from S_1 to $S^{MMF'10}$. Together, these changes will lower yield in this segment of money markets, but the effect on volume can be ambiguous. Depicted in this chart is the case where the supply in demand dominates so that there is an increase in volume. Otherwise, there would be a decline in volume.

Besides the effects on rates, trading volume and volatility at the individual market level, the regulations in general also make it more costly (either directly or indirectly) to deploy funds to arbitrage rate dispersions across markets. These effects may contribute increase volatility as well.