

Liquidity Regulation and Financial Intermediaries*

Marco Macchiavelli[†] Luke Pettit[‡]

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Abstract

The Liquidity Coverage Ratio (LCR) requires banks to hold enough liquidity to withstand a 30-day run. We study the effects of the LCR on broker-dealers, the financial intermediaries at the epicenter of the 2008-09 crisis. The LCR brings some financial stability benefits, including a significant maturity extension of triparty repos backed by lower-quality collateral, and the accumulation of larger liquidity pools. However, it also leads to less liquidity transformation by broker-dealers. We also discuss the liquidity risks not addressed by the LCR. Finally, we show that a major source of fire-sale risk was self-corrected before the introduction of post-crisis regulations.

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[†]Federal Reserve Board. Email: marco.macchiavelli@frb.gov

[‡]Federal Reserve Board. Email: luke.pettit@frb.gov

1 Introduction

At the peak of the cycle in 2006, broker-dealers (dealers hereafter) were involved in originating, distributing and financing mortgage-related instruments, which exposed them to significant risks at the turn of the housing cycle in early 2007. To make things worse, they were financing a significant portion of these risky mortgage-related assets by rolling over overnight repos. Dealers faced severe runs once funding conditions deteriorated, resulting in the demise of several of them, most famously Bear Stearns and Lehman Brothers. Ultimately, as [Diamond \(2008\)](#) pointed out, “financial crises are everywhere and always due to problems of short-term debt”, and that there needs to be a focus on “appropriate levels of liquidity” ([Diamond \(2018\)](#)).

In the aftermath of the financial crisis, steps were taken by regulators and policymakers worldwide to address several vulnerabilities in the banking system. Notably, the Basel Committee introduced the Liquidity Coverage Ratio (LCR) which requires banks to hold enough High Quality Liquid Assets (HQLA) that can be readily converted into cash to meet the liquidity needs arising from a hypothetical 30-day run. After the Basel Committee finalized the LCR rule, each constituent country was tasked with implementing their own versions of the rule, with the U.S. implementation ending up as one of the most stringent.

Although the purpose of the LCR is clear, its effects (both intended and unintended) are not yet fully understood: we do not yet know whether the LCR made the system more resilient, and if so, along which dimensions; we also do not know whether the LCR created any unintended source of instability. An even deeper question is whether, in the aftermath of the crisis, financial institutions reduced their vulnerabilities before any new regulation forced them to, or whether they did so only once required by new regulations.

This paper addresses these questions, focusing on the effect of the LCR on foreign and domestic Primary Dealers, which are the largest broker-dealers operating in U.S. financial

markets.¹ We estimate various LCR effects using a difference-in-differences approach, by comparing the behavior of domestic dealers with that of foreign dealers—as domestic dealers face the more stringent U.S. implementation—around LCR announcement, implementation and compliance dates.

Using confidential data on dealers’ financing and inventories, together with detailed tri-party repo transactions, we uncover three main effects of the LCR on dealers. First, the LCR induces dealers to increase the maturity of triparty repos backed by lower-quality collateral, while leaving the maturity structure of repos backed by high-quality collateral unchanged. Second, the LCR leads dealers to reduce their reliance on repos as a way to finance inventories of high-quality assets, resulting in more of these inventories counting towards HQLA, thereby increasing their LCR.² Third, the LCR incentivizes dealers to cut back on trades that downgrade their own available collateral (from the client’s perspective a collateral upgrade); as a result, dealers engage in less liquidity enhancements for their clients.

Each of these changes appear to de-risk dealers’ operations to various degrees. The terming out of repos backed by lower-quality collateral seems to improve stability; repos are used by a dealer for mainly two purposes: to finance its own inventories of securities, and to finance a secured cash loan to clients (including reverse repos and securities borrowing). Since a non-negligible portion of lower-quality securities are financed in the repo market, access to longer-term repos backed by such collateral reduces rollover risk and possible fire-sale losses in a stress event. Moreover, to the extent that these longer-term repos are used to finance reverse repos, the dealer can pass some of these maturity extension benefits to its clients. Unless otherwise noted, we refer to repos as all secured funding provided to the

¹ Domestic (or U.S.) dealers refer to the domestic broker-dealer subsidiaries of U.S. financial institutions (for instance, J.P. Morgan Securities LLC); the term foreign dealers refers to domestic subsidiaries of foreign financial institutions (such as HSBC Securities (USA) Inc). For the list of Primary Dealers and other information about them, see the [FRBNY website](#).

²Securities count towards HQLA only if unencumbered; by reposing out a security, it becomes encumbered since a third party now has a right on it.

dealer (including securities lending) and, similarly, to reverse repos as all the secured funding provided by the dealer to its clients (including securities borrowing).

Next, the reduced reliance on repos to finance Treasury inventories improves dealers' stability, but only indirectly. Reliance on overnight repos to fund Treasuries does not pose direct fire-sale risk in case these repos do not roll, as Treasuries are the most liquid assets and tend to appreciate during stress events. However, having more unencumbered Treasuries increases the size of dealers' liquidity pools that can be monetized in case of a run. The importance of maintaining large liquidity pools is highlighted in several occasions in the Financial Crisis Inquiry Commission (FCIC) report; chief among them is the remark that in June 2008, "regulators' most recent stress test showed that Lehman would need \$15 billion more than the \$54 billion in its liquidity pool to survive a loss of all unsecured borrowings and varying amounts of secured borrowings."³

Reliance on repos to finance inventories becomes a source of fire-sale risk only to the extent that repos do not roll while the underlying collateral becomes illiquid (or loses significant value). In this regard, we estimate that a significant reduction in the reliance on repos to finance riskier and less liquid collateral occurred right after the 2007-09 crisis, and before the LCR was even announced. In particular, domestic dealers significantly relied on repos to finance inventories of corporate debt precrisis: about 40% of their corporate debt inventories were financed with overnight (and open) repos.⁴ In the immediate aftermath of the crisis (before the LCR is even announced) domestic dealers' reliance on repos to finance corporate debt inventories decreased from 40% to roughly 10%. This finding suggests an endogenous de-risking that occurred right after the crisis: cash lenders and dealers identified this precrisis practice as too risky and scaled it back autonomously.⁵ This finding also complements the

³For instance, see the [FCIC report](#) on pages 284, 328, and 363. The citation above is from page 328.

⁴Aside from the triparty repo data, the dataset covering the full spectrum of dealers' secured financing (FR2004) lumps together overnight and open financing transactions, as the latter can be terminated by either party the following day (similar to an overnight transaction that is not rolled over the next day).

⁵It is worth noting that the LCR rule nevertheless penalizes this practice of financing lower-quality

observation that large dealers have been more reluctant to take inventory risk postcrisis (Bessembinder et al. (2018), Goldstein and Hotchkiss (2017), and Schultz (2017)).

The third estimated LCR effect—a reduction in trades that downgrade dealers’ own collateral—has uncertain financial stability implications during a stress scenario, but reduces the everyday liquidity enhancement services provided by dealers to their clients.⁶ As the implementation of initial and variation margins for non-cleared derivatives is gradually phased-in, with the last set of market participants having to comply by September 2020, there may be significant demand for dealers to upgrade clients’ collateral for the purpose of posting margins.⁷ As a result, while the LCR reduces dealers’ ability to provide such collateral upgrades to clients, the latter are likely to increase their demand for such upgrades, potentially leading to some adverse effects.

In addition to collateral transformation, dealers also offer maturity transformation services. Using richer post-2013 data, at the expense of a shorter time dimension that does not allow for a full difference-in-difference analysis, we document in finer detail the degree of maturity transformation that dealers provide within each collateral type. The LCR penalizes excessive maturity transformation, namely the financing of more-than-30-day reverse repos through less-than-30-day repos. This LCR penalty is negatively correlated with the collateral quality: it is absent for Treasury collateral, modest for intermediate-quality (Level 2A) collateral, and more sizable for lower-quality (Level 2B) collateral. On the other hand, moderate degrees of maturity transformation within the 30-day limit are not penalized by the LCR, such as financing a 2-week reverse repo with an overnight repo.

Consistent with these incentives, we observe significant maturity transformation in excess collateral with short-term repos.

⁶Decreased collateral downgrade activity likely leads to a safer regulated banking system; however, it implies that increased risk is borne by non-regulated segments of the financial system as other entities such as hedge funds assume the risk.

⁷See the [ISDA-SIFMA July 2018](#) report on margins for non-cleared derivatives. As a reference, most interest rate swaps and credit default swaps were required to be cleared by Title VII of Dodd-Frank, which was implemented by the SEC and CFTC in 2012 (see the [final rule](#)).

of the 30-day threshold in the Treasury and agency MBS space: 45% (60%) of more-than-30-day reverse repos are funded with overnight and open repos in the Treasury (agency MBS) space. Foreign dealers, for which the LCR is less stringent, provide significant maturity transformation also in the corporate debt space, with 47% of more-than-30-day reverse repos funded overnight; this number is not significantly different from zero for domestic dealers.

The effects that we estimate, in addition to being consistent with both incentives and timelines of the LCR implementation, are unlikely to be driven by other postcrisis regulations. As discussed in more details in Section 2.3, neither the Basel III leverage ratio, nor the Volcker rule, nor the U.S. stress tests are likely to generate our results.

There are also some liquidity risks that are not fully addressed by the LCR rule, but are nonetheless present in the data. Maturity transformation within 30 days, while not always penalized by the LCR, can still expose dealers to rollover risk; this risk is present to various degrees across collateral types. For instance, in the equity space, U.S. dealers finance almost all of their 2-to-30-day reverse repos with overnight repos. There is also some non-trivial degree of negative maturity transformation in the Treasury and agency space, which actually improves the LCR. However, it may expose dealers to the risk of collateral runs ([Infante and Vardoulakis \(2018\)](#)): this happens when the collateral reversed in overnight is pledged in a longer-term repo, and the overnight reverse repo does not roll. In this instance, the client is effectively pulling the collateral away from the dealer while it is still pledged to another party, and the dealer has to find another way of sourcing that collateral.

To the best of our knowledge, this paper is the first to study how dealers' business models (the joint management of assets and liabilities) have been affected by the LCR rule. We contribute to the literature that studies changes in dealers' behavior after the 2007-09 crisis, whether or not due to new regulations. [Anbil and Senyuz \(2016\)](#) and [Munyan \(2017\)](#) use tri-party repos to show the window dressing behavior (deleveraging at month-end) of some foreign dealers in response to the Basel III leverage ratio implementation.

Other papers use the TRACE database to focus on a specific aspect of dealers' activities, namely providing liquidity in the corporate bond market. In particular, [Adrian et al. \(2017\)](#), [Anderson and Stulz \(2017\)](#), [Bao et al. \(2018\)](#), [Bessembinder et al. \(2018\)](#), [Dick-Nielsen et al. \(2012\)](#), [Goldstein and Hotchkiss \(2017\)](#), [Schultz \(2017\)](#), and [Trebbi and Xiao \(2017\)](#) study corporate bond liquidity either after the 2007-09 crisis or after the implementation of postcrisis regulations (Basel III and Volcker rule). These studies generally conclude that corporate bond liquidity has changed in non-trivial ways: while measured bid-ask spreads are not very much affected, dealers tend to take less inventory risk by pre-arranging more and more trades, which can result in longer execution times. We complement these studies by showing that dealers rely much less on repos to finance corporate inventories after the 2007-09 crisis, offering a basis for why they could be reluctant to take large inventories on their balance sheets. In addition, we also study the joint management of dealers' assets and liabilities across most collateral types (Treasuries, agencies, corporate debt, and equities), and point to the financial stability effects of the LCR on dealers.

2 Liquidity Coverage Ratio

In this section we review the LCR rule and the incentives it creates for broker-dealers. We also discuss how the U.S. implementation is more stringent than foreign ones (earlier implementation, use of daily averages, and a maturity mismatch add-on). As part of the global response to the financial crisis, a wide range of regulatory requirements were introduced, addressing distinct risks to the global banking system. Among these reforms, the LCR was created to ensure that banks had sufficient available liquidity to withstand temporary disruptions to funding markets.

2.1 Timelines and Regional Implementations

The LCR was introduced by the Basel Committee on Banking Supervision as part of its broader regulatory response to the financial crisis. The Basel Committee introduced the LCR rule in December 2010 and finalized it in January 2013; effective rule implementations were delegated to the 28 jurisdictions that comprise the Basel Committee.⁸ The main jurisdictions had similar implementation timelines, the U.S. implementing earlier than most others: for instance, the EU finalized their LCR in January 2015, taking effect in October of that year, while the U.S. finalized its LCR in September 2014, which took effect in January 2015.⁹

Most non-US jurisdictions followed the initial Basel directive of computing the LCR using averages of *month-end* snapshots over the quarter; instead, since at least December 2011, U.S. regulators issued a proposed rule that would rely on *daily averages* over the quarter.¹⁰ Therefore, U.S. banks need to satisfy the LCR rule on average each day, while most foreign banks have to satisfy the LCR only at month-end, leaving significant room for regulatory arbitrage (window dressing). Month-end reporting also applies to most foreign implementations of the Basel leverage ratio and, as [Munyan \(2017\)](#), [Anbil and Senyuz \(2016\)](#) and [Keating and Macchiavelli \(2017\)](#) indeed document, foreign banks take advantage of the month-end reporting by deleveraging at month-end, only to re-leverage the day after.

The Basel final rule also proposes a timeline for phasing in the LCR: the proposed gradual implementation would begin in January 2015 with a minimum requirement set at 60%, increasing by 10% each subsequent year until it reached 100% in January 2019. As jurisdictions implemented their own LCR rules, they also tailored their compliance timelines. Japan followed the Basel final rule timeline. The EU phase-in followed the dates set out

⁸The initial rule of December 2010 is available [here](#). The final rule of January 2013 can be found [here](#).

⁹Other jurisdictions that are relevant to our analysis are Japan, Switzerland, and the UK. The Japanese LCR was finalized in 2014 and effective in March 2015, the Swiss LCR was finalized in July 2014, effective in January 2015, and the UK implementation was finalized in June of 2015, effective in October 2015. Regional assessments by the Basel Committee are available [here](#), under the “Liquidity Risk” topic.

¹⁰For the U.S. proposed LCR rule of December 2011, see the [Federal Register](#). The U.S. final LCR rule of September 2014 is available [here](#).

in the Basel final rule, but with a jump to a 100% requirement in 2018, instead of 2019. The U.S. Implementation was more accelerated, beginning in January 2015 at 80% with 10 percentage point increases over the following two years, reaching 100% in January 2017.¹¹ Being subject to a quicker transition, U.S. banks faced a higher LCR requirement at each point in time during the implementation phase.¹² As noted above, in addition to the quicker transition, the U.S. rule requires U.S. banks to comply with the LCR rule on a daily basis, while foreign banks need to comply just at month-ends. Finally, as we discuss in the next section, the U.S. implementation also embeds an additional maturity mismatch penalty (which makes the U.S. LCR more stringent) that is not present in foreign implementations.

Although the gradual phasing-in of the LCR was intended to ease the transition, many banks appear to have pre-positioned significantly. As John Gerspach, Citigroup’s CFO noted, *“it’s not that dissimilar from how we’ve really reacted to almost every regulatory rule that’s been put out there over the course of the last six, seven years. We make sure that we get into compliance with that rule as quickly as possible. And then we approach optimization.”*¹³ Since there was likely a significant anticipation effect between the announcement of the U.S. proposed rule in December 2011 and its 80% phase-in date in January 2015, we estimate dynamic adjustments to the LCR rule. In particular, we allow for anticipation effects (Dec 2011 to Jan 2015) as well as re-optimization effects (Jan 2015 onwards).

2.2 LCR Calculation

Quantifying liquidity resilience requires fixing a stress horizon over which assumed outflows occur. As such, the scope of the LCR is confined to a 30-day window and is intended to

¹¹Switzerland followed the Basel final rule timeline; however the Swiss systemically important banks were required to be at full compliance starting in 2016. There are two such banks in our sample, not driving our results.

¹²In most of the analysis, we end our sample in July 2016, when foreign banks operating in the U.S. started to be required to form an Intermediate Holding Company (IHC) that would comply with U.S. regulations.

¹³See the [transcripts](#) of Citi 2017Q2 fixed income investor review.

capture risks on both the asset and liability sides of a bank’s balance sheet within this horizon. At its core, the LCR requires a sufficient stock of High Quality Liquid Assets (HQLA) to cover net cash outflows over a 30-day stressed period. More formally the following ratio is expected to remain above 100%:¹⁴

$$\text{Liquidity Coverage Ratio} = \frac{\text{HQLA}}{\text{Total 30-Day Net Cash Outflow}} \quad (1)$$

HQLA is comprised of three categories of eligible assets: Level 1 assets (0% haircut) count for 100% of their value, and consist of cash, reserves and securities fully guaranteed by a top-tier sovereign; Level 2A assets (15% haircut) count for 85% of their value, and consist of agency MBS, lower-grade sovereigns and the upper portion of investment grade (IG) corporate bonds; Level 2B assets (25-50% haircuts) count for 75-50% of their value, and include select equities and the lower portion of IG corporate bonds.

Total Level 2 assets can make up no more than 40% of HQLA, and 2B assets specifically cannot comprise more than 15%, insuring that there is not a concentration of lower-quality assets. Net cash outflow (cash outflow minus cash inflow) is derived from a set of assumptions that are intended to simulate funding stress, resulting in an estimated net cash outflow over a 30-day period. The components within the denominator of the LCR cover a wide range of potential outflows, including deposits, repos, and commercial paper. For example, if a bank were to rely solely on very short-term and unstable funding (say one-week commercial paper), this would be reflected in a significant net cash outflow value. There are a few important caveats. The first is that a bank cannot have a net cash outflow of zero (a complete offset by inflows) as total inflows cannot exceed 75% of total outflows. Additionally, the U.S. implementation introduced a maturity mismatch add-on which is added to the denominator

¹⁴Note that for the U.S. LCR, there is a sub-category of depository institutions that are only subject to the “modified LCR” which is a simpler implementation, and has a 0.7 factor applied to the denominator. These institutions typically exist within the \$50-250bn in assets range (as anything over \$250 in total consolidated assets is subject to the full LCR).

of the ratio, defined as:

$$\max(0, \text{peak daily outflow in 30-day window}) - \max(0, \text{cumulative net outflow on day 30})$$

This was introduced in the U.S. implementation with the intent of addressing the potential weakness in the LCR that would allow a major outflow to be only subsequently offset by an equivalent future (still within the 30-day window) inflow.

The required reporting frequency also differs notably between the two regimes. The Basel III LCR is reported to supervisors monthly, with the implicit requirement of capacity to report daily during stressed situations. Under the U.S. LCR, banks must calculate the LCR daily beginning January 1st of the year after the firm is subject to the rule. The LCR applies to the holding companies of these institutions, as well as any top-tier depository institutions subsidiaries that have more than \$10 billion in assets.

2.3 Regulatory Incentives for Dealers

The LCR's impact on repo activity stems from the importance placed on both the tenor and collateral of a dealer's repo books. In the LCR, repurchase agreements expiring within 30 days are assumed to not roll at rates (run-off rates) in line with their collateral's HQLA haircut. For example, 0% of Treasury repos (secured by Level 1 assets) are assumed to run, even those with less-than-30-day maturity. On the other hand, 15% of repos secured by agency MBS (Level 2A) and residual maturity of less than 30 days are assumed not to roll, leading to a cash outflow when the repo matures. As a portion of the repos are assumed not to roll at maturity, some cash will be returned to the lender and collateral to the borrower. For the sake of simplicity, it can be boiled down to the distinction between repos that mature before and after the 30 day threshold:¹⁵ only the former are assigned an outflow, as the latter

¹⁵The Net Stable Funding Ratio is the applicable complement, and looks at a 1 year scenario, however has yet to be implemented.

remain in place for the entire 30-day stress horizon. This translates to highly asymmetric LCR treatments of less-than-30 and more-than-30-day repos, as only the former are assumed to unwind in proportion to the assigned run-off rate. However, since a 31-day repo (that is not evergreen¹⁶) becomes a less-than-30-day repo in one day, it eventually contributes to the 30-day outflows measure.

Incentive to term out lower-quality repos. Given what we just said, the LCR incentivizes dealers to lengthen the maturity structure of their repos significantly beyond the 30-day threshold, everything else equal. This incentive is stronger for repos collateralized by lower-quality assets, since these repos are attached higher run-off rates once their residual maturity crosses the 30-day threshold.

Matched book is mostly LCR neutral. It is not necessarily the case that an overnight repo secured by Level 2 assets will deteriorate the LCR at the margin. Whether or not this is the case depends on how the collateral underlying the repo was obtained. If it is sourced through a overnight reverse repo, the symmetric application of run-off rates to both inflows and outflows renders this “matched book” trade LCR neutral: both outflows and inflows increase by the same amount, namely the run-off rate multiplied by the cash exchanged at maturity, leaving the LCR denominator unchanged. This is only true for a marginal trade; indeed, if outflows are fully matched by inflows the rule still requires the dealer to have HQLA worth at least 25% of gross 30-day outflows. At the margin though, “matched book” trades are generally LCR neutral; they improve the LCR only to the extent that reverse repo haircuts are significantly larger than the associated repo haircuts, thus generating extra HQLA, in the form of unencumbered rehypothecatable collateral.

¹⁶A 31-day evergreen repo is a repo contract that is renewed every day as a 31-day repo.

Excessive maturity transformation is penalized. On the other hand, if the same overnight repo secured by Level 2A assets serves the purpose of funding a more-than-30-day reverse repo, the LCR denominator would increase: the assumed outflow would equal 15% of the repo amount while the inflow would be zero, because the reverse repo returns cash only after the 30-day threshold that matters for the LCR calculation. Therefore, intermediation of credit is penalized by the LCR to the extent that cash is raised via less-than-30-day repos and extended via more-than-30-day reverse repos. This penalty does not apply if the collateral in question consists of Treasuries, since a zero run-off rate is applied. Significant maturity transformation across the 30-day threshold in lower-quality assets is therefore costly under the LCR.

Repo financing of lower-quality assets is penalized. The financing of securities with more-than-30-day repos is mostly LCR neutral. However, financing a security with less-than-30-day repos is penalized. Suppose that a Level 2B asset (with a 25% haircut or run-off rate) is funded with overnight repos. The LCR assumes that 25% of the repo does not roll, leading to an outflow equal to 25% of its value. The mirror image of the repo running is that 25% of the collateral is returned as an unencumbered asset, which counts towards HQLA for 75% of its value (since it has a 25% haircut). The end result is that, at the unwind of the repo, the LCR numerator increases by 18.75% (75% of 25%) while the denominator increases by 25% of the transaction value. The marginal effect on the LCR is therefore negative.

Collateral downgrades are penalized. Part of a dealers' business model involves upgrading collateral for their clients, for instance, receiving low-quality collateral in exchange for Treasuries. Some clients use upgrades to obtain eligible (high-quality) collateral for margining of derivative trades at clearinghouses. If the collateral upgrade involves an exchange of clients' securities for the dealer's own securities, the dealer ends up lowering the quality of the securities in its possession. Alternatively, dealers can engage in such trades for

arbitrage purposes. For example, suppose that Agency repos are trading at a considerable spread above Treasury repos. A dealer may take advantage of the spread by entering into an Agency reverse repo funded by the cash raised through a Treasury repo. In either case, the dealer ends up taking possession of Agency MBS in exchange for Treasuries, effectively downgrading its own collateral.

From the dealer's perspective, a collateral downgrade trade is penalized by the LCR rule. For example, consider an overnight trade where the dealer obtains Agency MBS (Level 2A) in exchange for Treasuries (Level 1). The LCR rule assumes a zero run-off rate on the Treasury repo (100% expected to roll), and a 15% run-off rate for the Agency MBS reverse repo (85% is assumed to roll). As a result, 100% of the Treasury collateral (Level 1) is locked out while, on the other side, 85% of the Agency MBS (level 2A) is locked in, and only 15% of it comes back as cash (Level 1). In practice, the HQLA pool deteriorates by 13% (85% times 15%) of the value of the Treasuries provided. Were this a more-than-30-day swap, the deterioration would be equal to 15% of the value.

Funding Treasuries internally to build HQLA. Finally, the LCR incentivizes banks to rely less on repos to finance their inventories of high-quality assets. For an asset to count towards HQLA, it needs to be unencumbered, namely not pledged as collateral to a third party. Therefore, to the extent that a dealer needs to build up HQLA, it is incentivized to finance its inventories of the highest quality assets (Treasuries) less via the repo market, and more using internal sources of cash. Suppose that a dealer needs to increase its HQLA by \$1 million; the simplest way to do it is to use \$1 million of internal cash to buy Treasuries (or Ginnies), which fully count towards HQLA and generate a higher yield than holding cash or reserves; purchasing any other asset would increase the stock of HQLA less than proportionally.

Our results are unlikely to be driven by other postcrisis regulations. As it relates to repo

activity, the primary impact of the Supplementary Leverage Ratio (SLR) is via a downward pressure on the volume of repos backed by the safest collateral (Duffie and Krishnamurthy (2016)). This is because it applies the cost of capital directly to all repurchase agreements, regardless of collateral type, making the lower-margin repo transactions the most eligible for reduction. Similar to the LCR, the SLR applies to domestic dealers on a daily basis while it applies to most foreign dealers only at month-ends or quarter-ends. Therefore, the downward pressure on repo volumes is exercised daily on domestic dealers and only at month- and quarter-ends on foreign dealers, as shown in Figure 1 (see also Anbil and Senyuz (2016)).

Additionally, the Volcker rule could have an impact on dealer inventories (Bao et al. (2018)), but not on banks' repo activity. This is due to the exemption for repo and reverse repo from consideration as proprietary trading, and therefore is unlikely to have a material impact on dealers' repo activity.¹⁷ Moreover, the Volcker rule applies to the vast majority of the Primary Dealers in our sample, and in particular to both domestic and foreign.¹⁸ Therefore, the U.S.-specific effects we estimate cannot be attributed to the Volcker rule, since it also applies to the foreign dealers in our sample.

Finally, U.S. stress tests are also unlikely to drive our results for two reasons: the primary effects have been on capital ratios, dividend payouts, and the composition of banks' loans portfolios (Acharya et al. (2018), Cortés et al. (2018), Bassett and Berrospide (2017)), and not the broker-dealers' activities discussed in this paper. Furthermore, U.S. stress tests affected both domestic and foreign bank holding companies; as such, they are unlikely to drive the differential (U.S.-specific) effects that we estimate.

¹⁷The Volcker Rule was presented for public comment in October 2011, and implemented with several exemptions in July 2015.

¹⁸Bao et al. (2018) lists in Table 7 the Primary Dealers affected and not affected by the Volcker rule. Two of the non-affected are domestic, and two are foreign. The seventeen affected dealers are split between foreign and domestic.

3 Data

We use two confidential datasets: the first one contains daily outstanding triparty repurchase agreements (repo) for each dealer, tenor, and collateral type; the second contains weekly positions and financing for each dealer, tenor and collateral type.

The first dataset contains tri-party repo information that is sent daily by the two tri-party clearing banks to the Federal Reserve Bank of New York (FRBNY), and becomes available in January 2011. For each day and each repo borrower (including both dealers and non-dealers), we know the outstanding repo volumes broken down by residual maturity in days, and collateral type. The types of collateral available include Treasuries, agency debt, agency MBS, corporate debt, equities, and private label CMO. Figure 1 displays the evolution of outstanding triparty repos backed by government collateral (Treasuries and agencies), separately for domestic and foreign dealers subject to the LCR; similarly, Figure 2 shows the time series of outstanding triparty repos backed by selected non-government collateral (equity, corporate, and private label CMO). Next, Figures 3 to 6 show the maturity structure of outstanding triparty repos. Figure 3 displays, for domestic and foreign dealers separately, the percentage of outstanding Treasury repos by residual maturity buckets (Overnight, Open, 2-5, 6-14, 15-30, 31-60, 61-90, more than 90 days). Figures 4, 5 and 6 provide similar information for agency MBS, corporate debt, and equity repos, respectively. We do not show the maturity structure of agency debt and private label CMO repos because they represent a very small fraction of daily volumes (see Figures 1 and 2).

Summary statistics for the maturity structure of triparty repos are reported in Table 1. By comparing the maturity structure of domestic (Panel A) and foreign (Panel B) dealers subject to the LCR, it is apparent that domestic dealers significantly lengthen the maturity structure of lower-quality repos, namely corporate and equity repos, over time relative to foreign dealers. On the other hand, the maturity structure of Treasury and agency repos is

less affected; one notable exception is the shift for domestic dealers from overnight to open Treasury repos. From a regulatory standpoint, open repos are effectively overnight as either party can terminate them at will. For simplicity, we exclude triparty repo borrowers that are not subject to the LCR from Figures 1 to 6, and from the summary statistics (Table 1). However, they are included in the empirical analysis that relies on triparty repo data, serving as the omitted group.

Our second dataset is the FR2004 Primary Government Securities Dealers Reports, from which we use Primary Dealers' positions and financing data (forms A and C).¹⁹ Form A collects dealers long and short positions in different types of securities including Treasuries, agency debt, agency MBS, and corporate debt. The latter category consists of dollar denominated debt securities issued by companies incorporated in the U.S. including bonds, notes, commercial paper, privately placed securities and private label MBS. We refer to the inventories that a dealer has of a certain asset as the difference between its long and short positions in that asset class. Next, Form C collects financing transactions, where financing refers to the actual funds delivered or received and is divided in "Securities In" (funds are delivered and collateral comes in) and "Securities Out" (funds are received and collateral goes out). "Securities In" refers to agreements where securities are received, including reverse repos (dealer lends cash and receives a security as collateral) and securities borrowed (reporting the cash that is lent or the fair value of the securities if securities are exchanged or pledged as collateral). "Securities Out" similarly refers to agreements to deliver securities to counterparties, including repos (dealer borrows cash and delivers securities as collateral) and securities lent (reports the cash that is borrowed or the fair value of the securities if securities are exchanged or pledged as collateral).

The granularity of this dataset evolves significantly over time along three dimensions. First, financing transactions are collectively reported as Securities Out until April 2013,

¹⁹See the [Federal Reserve website](#).

when they start to be divided into repurchase and securities lending transactions. To keep the dataset comparable over time, after April 2013 we add repos and sec lending together into securities out. Similarly, we add reverse repos and sec borrowing together into securities in. Second, up until April 2013 dealers had to distinguish between overnight and term financing only, while afterwards they are asked to separately report financing transactions with overnight, 2-to-30, and more-than-30 day maturities. The last shift in data collection occurs in January 2015, and has to do with the definition of certain collateral types: private label MBS are removed from corporate debt collateral and added to a new category called “Other Debt”; however, at the same time, Other Debt also includes state and municipal debt securities, which were not reported before. In order to keep the corporate debt collateral comparable over time, we can either exclude private label MBS or include state and municipal debt beginning in January 2015. We decide to stop tracking private label MBS from our definition of corporate debt collateral, starting in January 2015. This gap in private label MBS coverage is inconsequential due to its negligible post-crisis volumes. Results are unchanged if we choose the alternative definition of corporate collateral.

Summary statistics are reported in Table 2. The first two panels display repo and reverse repo books, together with inventories of securities (net positions), broken down by collateral types and subperiods. The first panel refers to the U.S. dealers subject to the LCR, while the second panel reflects the activities of foreign dealers subject to the LCR. The very few Primary Dealers that are not subject to the LCR are excluded. Among the general decline of dealers’ activities over time, Treasury inventories by U.S. dealers stand out for their increasing trajectory. Of note, the decline in corporate inventories over time is partly due to the change in classification of corporate debt securities across different vintages of data (see above). We can better gauge the generalized decline in corporate inventories from the bottom two panels of Table 2, which display variables in first difference (weekly changes), dropping the dates in which the definition of corporate securities changes. As a result, we

exclude discrete jumps due to the reclassification of corporate securities.

4 Empirical Strategy and Results

4.1 LCR Effects on the Term Structure of Triparty Repos

In order to identify the effects of the LCR rule on the term structure of triparty repos, we exploit the fact that the U.S. implementation of the LCR is stricter than any other foreign implementation, as previously discussed in Section 2 (accelerated phase-in, mismatch add-on, and daily averages). We therefore have three groups: U.S. LCR refers to the U.S. dealers subject to the U.S. implementation of LCR; Basel LCR refers to all dealers, foreign and domestic, that are subject to the LCR; the omitted group refers to non-Bank Holding Company affiliated dealers that are therefore not subject to the LCR rule. We are then interested in the additional effect of the more stringent U.S. implementation of the LCR on the maturity structure of triparty repos.

The time variation is offered by the announcement of the U.S. implementation of the LCR (Dec 01, 2011), and by the 80% LCR phase-in date (Jan 01, 2015 for the U.S.). In unreported results, we also look at variation around the adoption of the final U.S. rule (Sep 01, 2014); due to its proximity to the 80% LCR phase-in date of Jan 2015, results using the Sep 2014 threshold are very similar to the reported ones that use Jan 2015. The sample ends in July 2016, a month before the G-SIBs affiliated foreign dealers become subject to the U.S. implementation, in order not to bias our results towards zero. We run the following panel regressions:

$$Share(m)_{i,c,t} = \alpha + \beta_0 Basel + \beta_1 US + \beta_2 PostLCR + \beta_3 Basel \cdot PostLCR + \beta_4 US \cdot PostLCR + \varepsilon_{i,c,t} \quad (2)$$

The dependent variables are the shares of triparty repos outstanding on day t for borrower i

at various maturities m (open, less than 30 days, more than 30 days, and more than 90 days), separately for each collateral type c (Treasuries, agency MBS, corporate debt, and equities). These collateral types represent the vast majority of triparty repo volumes. *Basel* equals one for dealers subject to the LCR, and *US* equals one just for the U.S. dealers subject to the U.S. LCR; the omitted group consists of any other triparty borrower that is not subject to the LCR, mostly dealers not affiliated to a Bank Holding Company and large asset managers. *PostLCR* is one of two dummy variables: *PostLCR1* equals one after the announcement of the U.S. implementation of the LCR (Dec 01, 2011), and *PostLCR2* equals one after the U.S. LCR is first phased-in (Jan 01, 2015). To capture dynamic adjustments and re-optimization, in some specifications we use both time variations. We also check for parallel trends prior to December 2011, by interacting an indicator for October 2011 with the *Basel* and *US* dummies. Since the interaction between the Oct 2011 and the *US* dummies (called *Parallel* in the regressions) is always insignificant, the parallel trend assumption seems to hold in the data. Errors are two-way clustered at the borrower and day level.

Our results (Table 3) show that Treasury repos are not affected by the LCR, consistent with the fact that the LCR treats Treasury repos of any maturity as equal to cash. The only noticeable change is a reshuffling among domestic dealers from 1-to-30 day repos into open repos (see also Figure 3). Open repos have an embedded put option, so that the cash lender can terminate them on demand; therefore, the LCR treats them as having an effective overnight maturity. On the other hand, we find some terming out of agency (MBS) repos among domestic dealers (Table 4 and Figure 4); specifically, once the final rule is adopted, U.S. dealers reduce the share of shorter-term agency repos (with maturities of less than 30 days) by 14% and increase the share of more-than-30 day repos by 8%, relative to foreign dealers. The remainder goes to open repos (6%). The terming out of agency repos beyond the 30 day threshold is consistent with the incentives laid out by the LCR.

Furthermore, U.S. dealers significantly increase the share of corporate debt repos with

more than 30 day maturity by 15%, and the share of more-than-90-day repos by 11% relative to foreign dealers, in line with the strong incentives to term out lower-quality assets beyond the 30 day maturity threshold imposed by the LCR rule (Table 5 and Figure 5).²⁰ Foreign dealers, on the other hand, seem to mostly reshuffle part of their repos from 1-to-30 day maturity to open. Finally, we analyze changes to the maturity structure of equity repos (Table 6 and Figure 6). Similar to corporate debt, equities carry either 50% or 100% haircuts, providing an incentive for dealers to term out equity repos beyond the 30 day threshold. U.S. dealers initially responded to the announcement of the U.S. implementation by reducing 1-to-30 day repos by 25% more than foreign dealers, while at the same time increasing the share of more-than-30 day repos by 20% more than foreign dealers. It seems that U.S. dealers overshot their LCR internal target early on, because they then proceed to reverse most of the initial adjustment by dropping the share of more-than-30 day repos by 29% relative to foreign dealers, while increasing the overnight share by 21% relative to foreign dealers.

4.2 LCR Effects on Financing and Intermediation of Securities

To determine the impact of the LCR on dealers' financing and intermediation, we run a set of panel regressions. Each regression estimates what the secured funding backed by a certain collateral type is used for, namely to finance inventories, reverse repos, and collateral transformation:

²⁰ Corporate debt carries a 15% haircut if Level 2A, 50% if Level 2B, and 100% if non-HQLA.

$$\begin{aligned}
\Delta SecOut_{i,c,t} = & \alpha_0 \Delta Inv_{i,c,t} + \alpha_1 US \cdot \Delta Inv_{i,c,t} + \alpha_2 PostLCR \cdot \Delta Inv_{i,c,t} \\
& + \alpha_3 US \cdot PostLCR \cdot \Delta Inv_{i,c,t} + \beta_0 \Delta SecIn_{i,c,t} + \beta_1 US \cdot \Delta SecIn_{i,c,t} \\
& + \beta_2 PostLCR \cdot \Delta SecIn_{i,c,t} + \beta_3 US \cdot PostLCR \cdot \Delta SecIn_{i,c,t} + \mu_{i,c} + \mu_{c,t} + \varepsilon_{i,c,t}
\end{aligned} \tag{3}$$

where $\Delta SecOut_{i,c,t}$ is the weekly dollar change in collateral of type c (Treasuries, agency MBS, or corporate debt) repoed out by dealer i during week t . $\Delta Inv_{i,c,t}$ is the weekly change in the dollar value of inventories of type c securities. The collateral type of the inventories matches the collateral type of the securities going out, since one way to finance inventories of securities is by repoing them out. $\Delta SecIn_{i,c,t}$ is a 3-by-1 vector, whose three elements are the weekly dollar change in Treasuries, agency MBS and corporate debt securities coming in. We allow for different collateral types coming in and going out to capture the extent to which dealers engage in collateral upgrades or downgrades for their clients. When dealers repo out the same security that is coming in, we refer to it as a “matched book” trade instead. $PostLCR$ is one of two dummy variables: $PostLCR1$ equals one after the announcement of the U.S. implementation of the LCR (Dec 01, 2011), and $PostLCR2$ equals one after the U.S. LCR is first phased-in (Jan 01, 2015). To capture dynamic adjustments and re-optimization, in some specifications we use both time variations. Finally, $\mu_{i,c}$ and $\mu_{c,t}$ are dealer and time fixed effects, respectively. Errors are two-way clustered at the dealer and week level.

The coefficients α_3 and β_3 represent the effect of a more stringent LCR rule on dealers’ activities; recall that U.S. dealers are subject to a more stringent Basel III implementation than foreign ones (see the discussion in Section 2). The sample contains both domestic and foreign dealers subject to Basel regulations. Very few domestic and foreign Primary Dealers are not part of a Bank Holding Company, and as such not regulated by Basel III; we therefore

exclude them from the following analysis. We start the sample in August 2009, after the crisis-era liquidity facilities targeted to Primary Dealers were unwound, and we end it in July 2016. After that, many large foreign banks needed to form an Intermediate Holding Company for their U.S. operations to be subject to the U.S. implementation of the LCR.

4.2.1 Financing Inventories

Table 7 displays some adjustments to the introduction of the LCR rule. U.S. dealers significantly cut their reliance on the repo market to finance Treasuries after the U.S. LCR is phased in at the 80% level. Relative to foreign dealers, U.S. dealers finance 28% less Treasury inventories on the repo market.²¹ This move is consistent with a tendency of U.S. dealers to finance high-quality assets with internal cash, so that such Treasuries remain unencumbered and count towards HQLA; had those Treasuries been financed in the repo market, they would become encumbered and not qualify as HQLA. A similar adjustment occurs in the financing of agency MBS right after the U.S. LCR is announced. This adjustment is however only significant at the 10% level, suggesting that some heterogeneity in the way U.S. dealers adjusted their financing of agency MBS inventories. In addition to the U.S. dealers increasing the share of Treasury inventories that are considered unencumbered, they also increase the average size of their Treasury inventories, as shown in Table 2. Both facts indicate that U.S. dealers are building up liquidity pools.

4.2.2 Intermediation and Collateral Upgrades

In the pre-LCR world, U.S. dealers took advantage of the spread between agency MBS and Treasury repos by reversing in agency MBS while repoing out Treasuries (not displayed in Table 7); similar trades can also be used by dealers to provide collateral upgrades to their

²¹Pre-LCR, both foreign and domestic dealers would finance between 30% and 40% of Treasury inventories with overnight repos. As a reference point, 50% to 60% of Treasuries were financed in the repo market prior to the 2007-09 crisis – see Table 11.

clients. However, this collateral upgrade service becomes expensive from an LCR perspective, because it involves delivering Level 1 assets (carrying 0% haircuts) in exchange for Level 2A assets (carrying 15% haircuts); U.S. dealers therefore significantly scale down these trades (Table 7, columns 1 and 2, row 5), while foreign dealers fill in this gap and increase the amount of Agency MBS reverse repos associated with Treasury repos (not displayed in Table 7).²² Table 8 (row 3, column 1) further shows that such cutback in collateral upgrades occurred in the overnight tenor.

There are two additional adjustments occurring around the time of the U.S. LCR announcement. First, U.S. dealers slightly reduce the amount of Treasuries reversed in overnight that are funded by repoing out agency MBS overnight, relative to foreign dealers (Table 8 – row 1, column 3). This paring back by U.S. dealers has a small negative impact on LCR, but is more than compensated by the previously-mentioned reduction in agency MBS swapped for Treasuries. On the other hand, reducing such collateral swaps (receiving Treasuries and delivering agency MBS) likely improves dealers’ net interest margins.

Another change in intermediation that is linked to LCR incentives is the increase by U.S. dealers in the amount of term corporate reverse repos financed with term corporate repos (Table 8 – column 6, row 6); this realignment of tenors towards a “matched book” model reduces the liquidity risk associated with intermediation.

4.3 Endogenous De-risking

Prior to the crisis, a significant amount of corporate debt inventories, including private label MBS, were financed in the repo market (Macchiavelli (2019)); the crisis exposed the weakness of such strategy: when those repos did not roll, dealers may have had to sell those securities, which they were not able to finance anymore, at fire-sale prices. The deleveraging induced

²²For the sake of presenting the main LCR effects in a self-contained way, Table 7 only displays the interaction effects (post-LCR for U.S. dealers). However, the full set of coefficients is available in Table 9.

by the crisis, and the reassessment of several risks, led dealers to finance less corporate debt inventories (private label MBS almost disappeared) and to rely less and less on the repo market to finance them. This de-risking happened right after the crisis, and before the LCR had been announced, as shown in the last two columns of Table 10: the baseline coefficients pertain to the precrisis period (Jan 2004 to Jul 2007), the postcrisis coefficients capture the additional postcrisis effect, and the post-LCR coefficients estimate the incremental LCR effect on top of the postcrisis one. We focus on the last two columns that pertain to the repo financing of corporate debt collateral. Precrisis, foreign dealers repoed out just 10% of their corporate inventories, while U.S. dealers repoed out about 42% of them (or 32% more): U.S. dealers took significantly more risk, which ultimately exposed them to larger fire-sale losses.

We purposefully drop the crisis period between August 2007, when BNP Paribas halts redemptions from three affiliated funds, to July 2009, when the Federal Reserve unwinds both of its liquidity programs to sustain Primary Dealers. Indeed, this period was very chaotic, with a major deleveraging among dealers culminating with Lehman’s bankruptcy, followed by a sizable liquidity intervention aimed at supporting dealers (Acharya et al. (2017)).

After these liquidity facilities unwound, U.S. dealers are more conservative than they used to be prior to the crisis: in the postcrisis but pre-LCR period, U.S. dealers repo out just about 10% of their corporate inventories, compared to about 40% precrisis. The last two rows then show the additional LCR effects. Foreign dealers (captured in the baseline effect) increase their reliance on the repo market to fund corporate inventories, while U.S. dealers keep their behavior constant to the postcrisis period (undoing the increased reliance by foreign dealers).

4.4 Maturity Mismatch: Cash and Collateral Rollover Risk

Tables 11 to 14 use the more granular post-2013 FR2004 data that breaks down securities in and out by overnight, 2-to-30-day, and more-than-30-day tenors; this allows us to more

accurately trace the maturity mismatch in the dealers’ core function of intermediating securities and credit. These tables display the degree of maturity mismatch within each collateral type; in particular, rows five to seven can be interpreted as an “input-output” matrix: the diagonal elements (in bold font) estimate how much of the securities reversed in at a certain tenor are repoed out at the same tenor. For instance, Table 11 shows that 79% of overnight Treasury reverse repos are associated with overnight Treasury repos, 41% of Treasuries coming in at 2-to-30 day maturity are repoed out at 2-to-30 day maturity, and finally 43% of Treasuries reversed in at tenors greater than 30 days are repoed out at more-than-30-day tenors. Therefore, large diagonal elements suggest a high degree of maturity matching in the intermediation of securities (similar to the idea of a matched book). On the other hand, off-diagonal elements suggest some degree of maturity mismatch. Rows eight to ten display the additional pass-throughs for U.S. dealers.

4.4.1 Cash Rollover Risk

The lower-triangular elements (in the rows-five-to-seven block) involve financing longer-term reverse repos with shorter term repos. Table 11 suggests that dealers take significant risk–cash rollover risk–in intermediating Treasuries. Indeed, 45% of both Treasuries reversed in at more than 30 days and between two and 30 days are repoed out (financed) overnight; in these instances, dealers provide a cash loan for several days in exchange for collateral and come up with the needed cash by repoing out the same collateral overnight, then rolling over the overnight repo until the reverse repo matures. This service provided by dealers to clients operates very smoothly in normal times, but could lead to significant rollover risks during times of stress.

Table 12 replicates the same exercise for agency MBS collateral; dealers take as much cash rollover risk in the agency MBS space as in the Treasury space. Noteworthy, about 60% of reverse repos maturing in more than 30 days are funded via overnight (or open) repos.

Once again, while feasible in normal times, this strategy may expose dealers to significant risk in the event of a sudden credit crunch.

Finally, Tables 13 and 14 reproduce the analysis for lower-quality collateral, namely corporate debt and equities. Here the picture is a bit more complex. Among foreign dealers—captured in the baseline coefficients—there is some degree of cash rollover risk in the corporate debt space (47% of more-than-30-day reverse repos funded with overnight repos), and very little cash rollover risk in the equity space. On the other hand, U.S. dealers take significantly more cash rollover risk in the equity space. Of note, not penalized by the LCR but still subject to cash rollover risk, U.S. dealers fund almost 100% of the 2-to-30-day reverse repos with overnight repos in the equity space—Table 14, row 7, column 1.

4.4.2 Collateral Rollover Risk

A different type of risk arises by reversing in collateral at short tenors while repoing it out at longer terms; in these trades, captured in the upper-triangular elements of rows 5 to 7 in Tables 11 to 14, collateral is locked in a term repo and needs to be sourced at higher frequency by rolling over the associated reverse repo or sec borrowing trade (used to reverse in the collateral). If the shorter-term reverse repo (or sec borrowing) does not roll during the life of the longer-term repo, the dealer has to deliver the collateral back to the reverse repo party while that collateral is still locked in the repo counterparty account; therefore, the dealer has to borrow (or buy) the same collateral from a third party to deliver to the reverse repo party for the remaining life of the repo, or else the dealer will fail to deliver the collateral and pay the fails charge until the collateral is delivered.

The collateral rollover risk associated with a potential run by reverse repo counterparties could materialize in a stress scenario where clients of a troubled dealer demand their collateral back to potentially move their business to another dealer. There are some anecdotes of this

happening to Lehman Brothers prior to its bankruptcy.²³

Tables 11 and 12 show a statistically significant albeit moderate collateral rollover risk in both Treasury and agency MBS space: for instance, 16% of the agencies reversed in overnight are funded by repos at 2-to-30-day tenors, while 8% of them are funded by repos at more-than-30-day tenors. It is likely that these trades involve bilateral repos (or sec lending) where the dealer's client is interested in borrowing a certain security for a few weeks, and the dealer sources (reverses in) that specific security overnight or via an open trade. Importantly, this 8% of overnight agency reverse repos funded by more-than-30-day repos is not penalized by the LCR rule; on the contrary, it improves the LCR. Indeed, on the repo side, 100% of the cash is locked in for more than 30 days while, on the reverse side, it is assumed that only 85% of the cash is locked out, leading to a net inflow over the 30-day horizon.

On the other hand, there is little or no collateral rollover risk in lower-quality-collateral space (corporate debt and equities), as shown in Tables 13 and 14. There also no significant difference between U.S. and foreign dealers in terms of collateral rollover risk. Since this more granular data is not available prior to April 2013, we cannot establish whether these types of cash and collateral rollover risks have been affected by the LCR rule. Instead we provide a snapshot once LCR adjustments were already underway.

It is worth emphasizing once again that excessive collateral rollover risk, namely funding overnight reverse repos with more-than-30-day repos, improves the LCR by reducing net outflows. However, it exposes the dealer to the risk that the client pull its collateral away from the dealer by not rolling over the overnight reverse repo. In this case, the dealer has to find a way to source collateral, which can be difficult in a stress event where clients are running from a specific dealer—as happened to Lehman Brothers.

²³See a [July 2008 Reuters article](#). See also [Infante and Vardoulakis \(2018\)](#) for a theory of collateral runs.

5 Conclusion

This paper identifies and quantifies changes in the behavior of large broker-dealers as a result of postcrisis liquidity regulation. We use the fact that the U.S. implementation of the LCR is more stringent than that of foreign jurisdictions, to show the differential response of U.S. dealers relative to foreign ones to the introduction of the LCR rule. We deliver several new results. First, U.S. dealers – more strongly affected by the rule than foreign ones – significantly increase the maturity of their lower-quality-collateral repos relative to foreign dealers. On the other hand, no maturity structure effect is estimated for repos backed by the highest-quality collateral, in line with the fact that the LCR treats these repos as cash (0% haircuts). Second, the LCR induces dealers to reduce their reliance on repos to finance inventories of high-quality liquid assets, specifically Treasuries; as a result, additional Treasuries are considered unencumbered and count towards HQLA, improving the LCR. Third, the LCR leads dealers to cut back on some trades that effectively downgrade their own available collateral, and are thus penalized by the LCR rule.

Are these changes de-risking dealers' operations? The reduced reliance on repos to finance Treasuries improves dealers' liquidity pools, which can be helpful to deal with a potential liquidity crunch. On the other hand, relying on repos to finance illiquid inventories proved extremely problematic during the crisis. To this end, we show that U.S. dealers greatly reduce their reliance on repos to fund less-liquid assets right after the crisis, before the LCR is even announced, suggesting some degree of endogenous de-risking. Next, the reduction in collateral upgrades for clients may amount to a drop in the liquidity services provided by dealers.

There are also some liquidity risks that are not fully addressed by the LCR rule, but are nonetheless present in the data. Maturity transformation within 30 days, while not always penalized by the LCR, can still expose dealers to rollover risk; this risk is present

to various degrees across collateral types. For instance, in the equity space U.S. dealers finance almost all of their 2-to-30-day reverse repos overnight. There is also some non-trivial degree of negative maturity transformation in the Treasury and agency space, which actually improves the LCR. However, it may expose dealers to the risk of not being able to roll over the collateral pledged in a longer term repo if the shorter-term reverse repo does not roll, effectively pulling the collateral away from the dealer while it is still pledged to another party.

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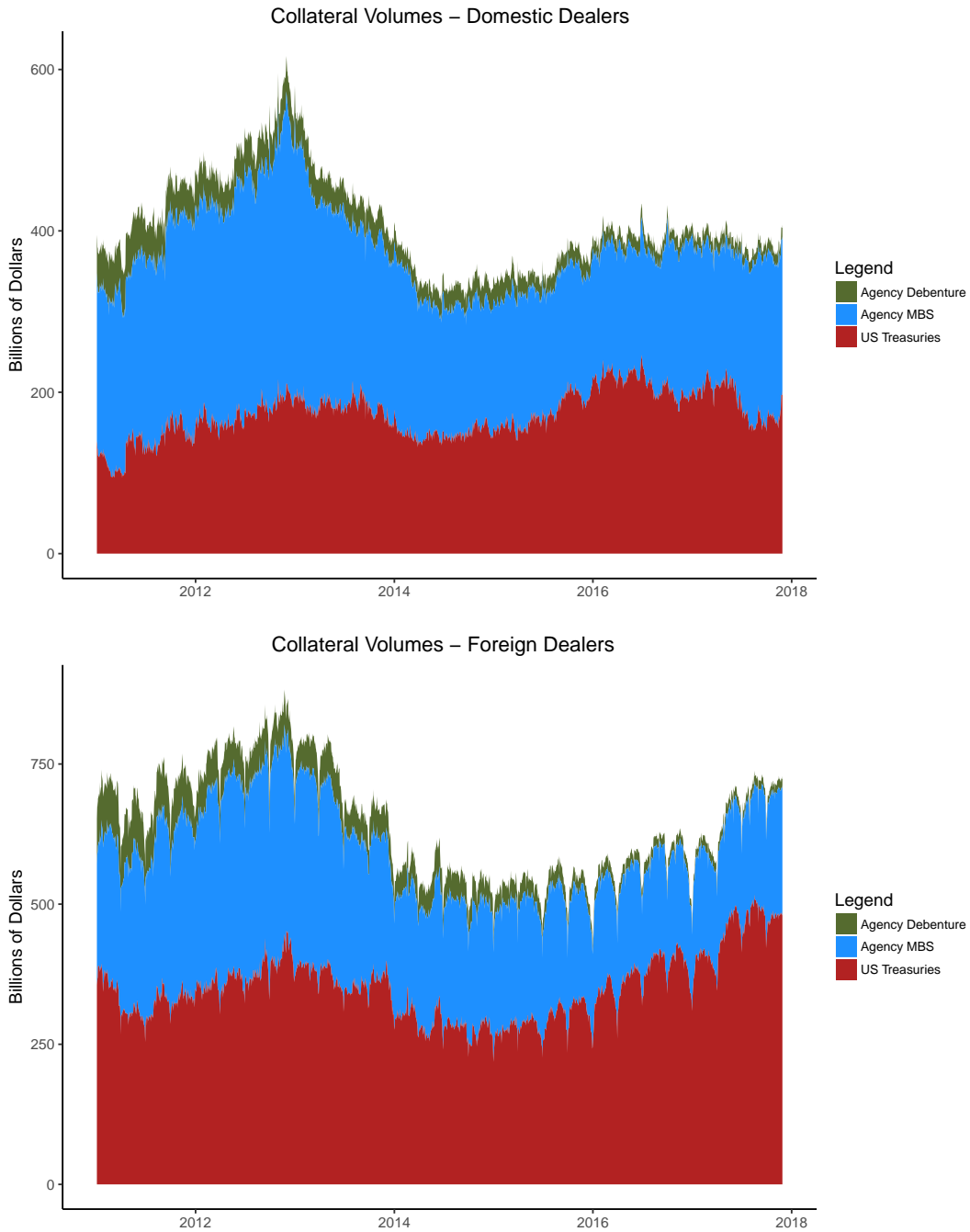


Figure 1: Triparty Repos Backed by Government Collateral – Domestic vs. Foreign

On the y-axis is the volume of government triparty repos (Treasury, agency MBS, and agency debt collateral) outstanding for domestic dealers (top chart) and foreign dealers (bottom chart) subject to the LCR regulation.

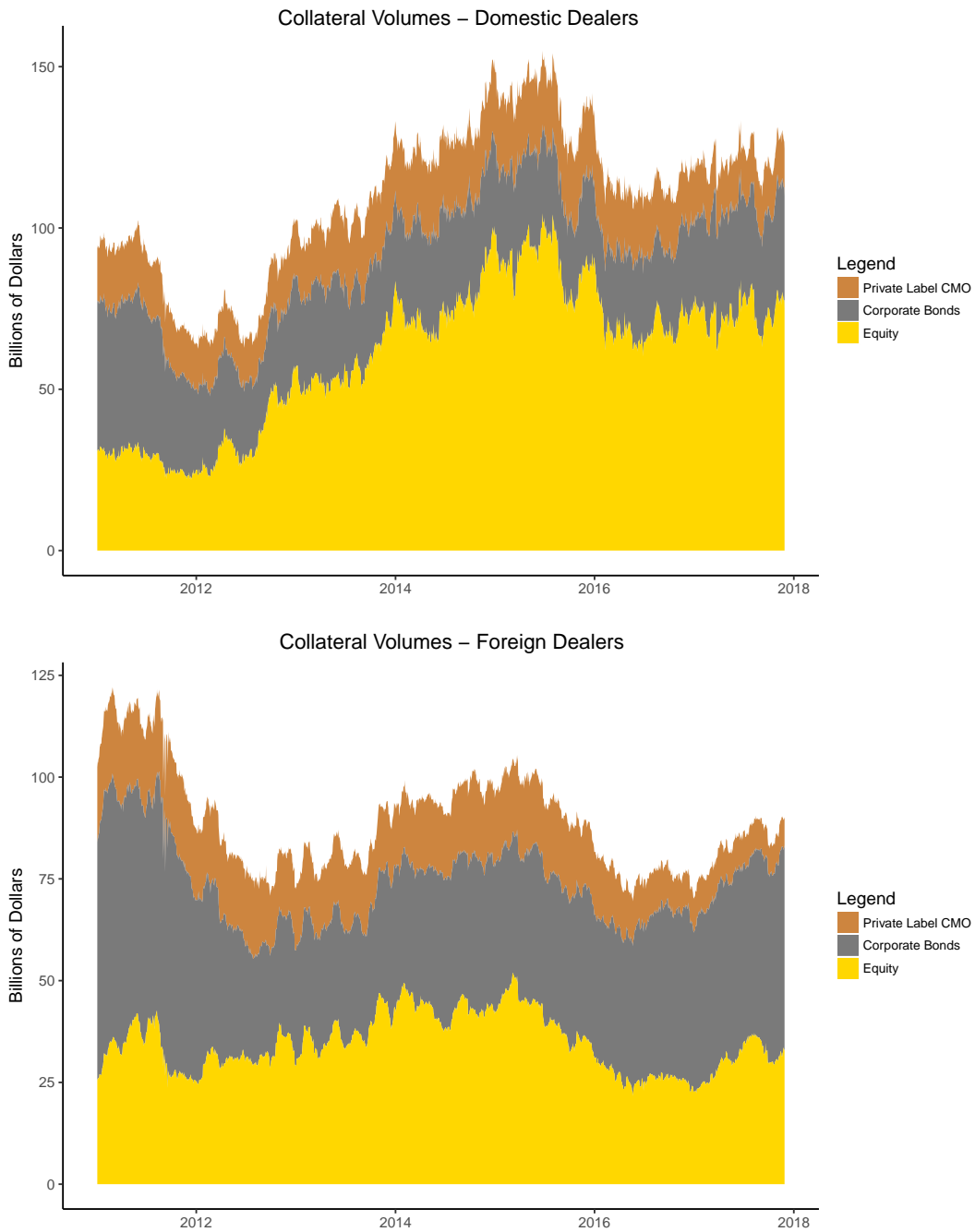


Figure 2: Triparty Repos Backed by Non-Government Collateral – Domestic vs. Foreign

On the y-axis is the volume of selected non-government triparty repos (equity, corporate, and private label CMO collateral) outstanding for domestic dealers (top chart) and foreign dealers (bottom chart) subject to the LCR regulation.

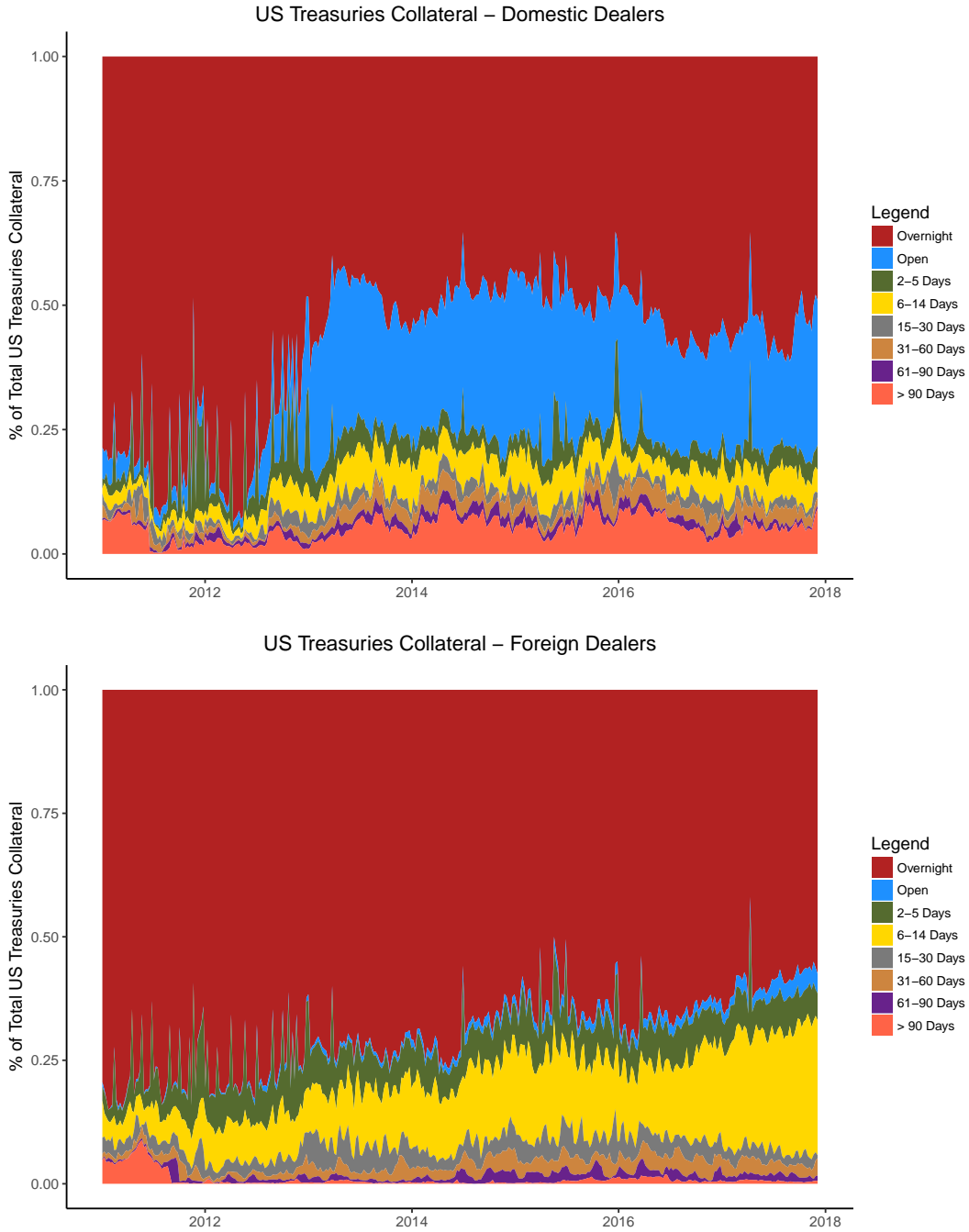


Figure 3: Maturity Structure of Treasury Triparty Repos – Domestic vs. Foreign

On the y-axis is the share of Treasury repos with certain residual maturities, listed in the legend. The top (bottom) chart reflects the maturity structure of all the domestic (foreign) dealers subject to the U.S. implementation (foreign implementations) of the LCR.

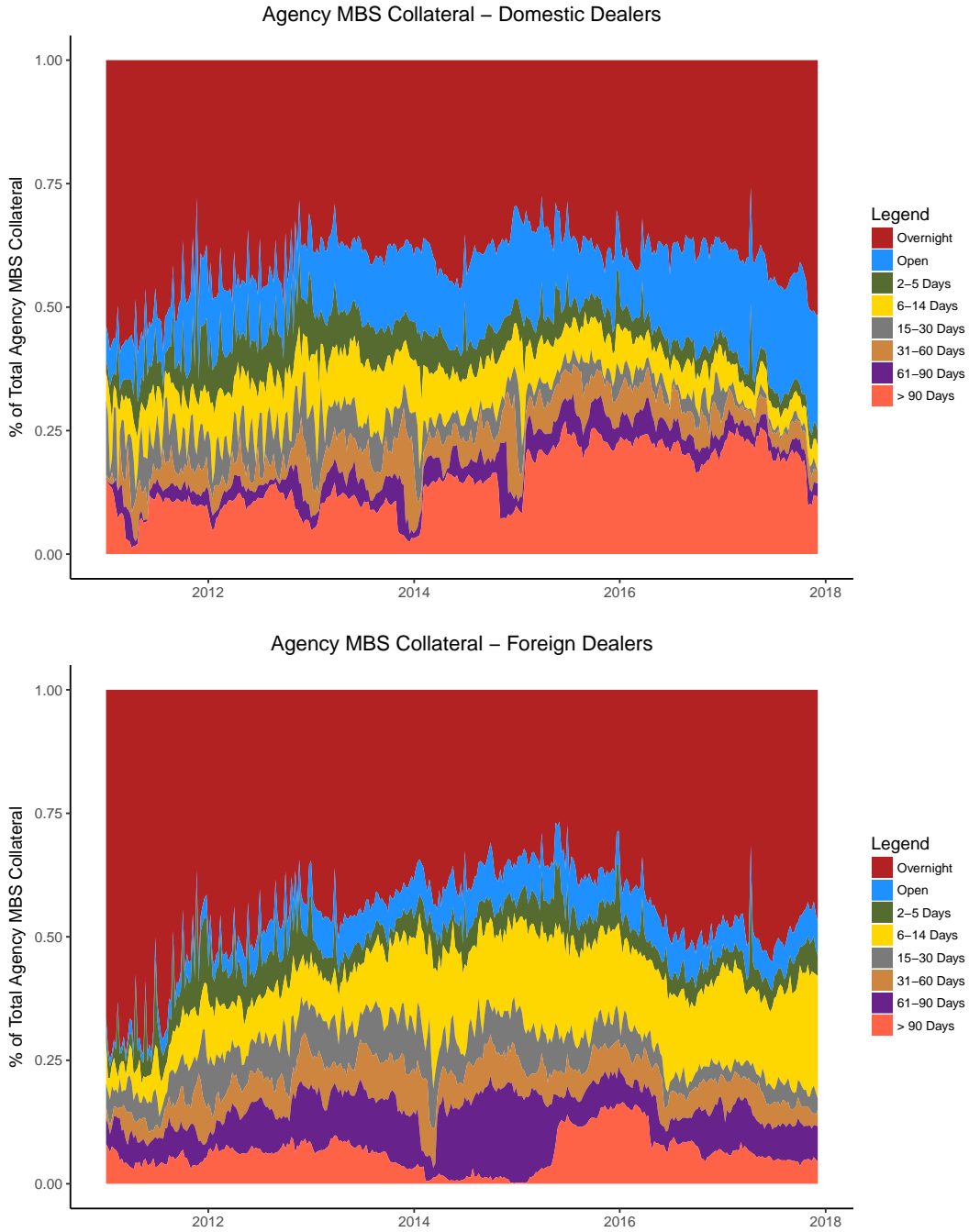


Figure 4: Maturity Structure of Agency MBS Triparty Repos – Domestic vs. Foreign

On the y-axis is the share of agency MBS repos with certain residual maturities, listed in the legend. The top (bottom) chart reflects the maturity structure of all the domestic (foreign) dealers subject to the U.S. implementation (foreign implementations) of the LCR.

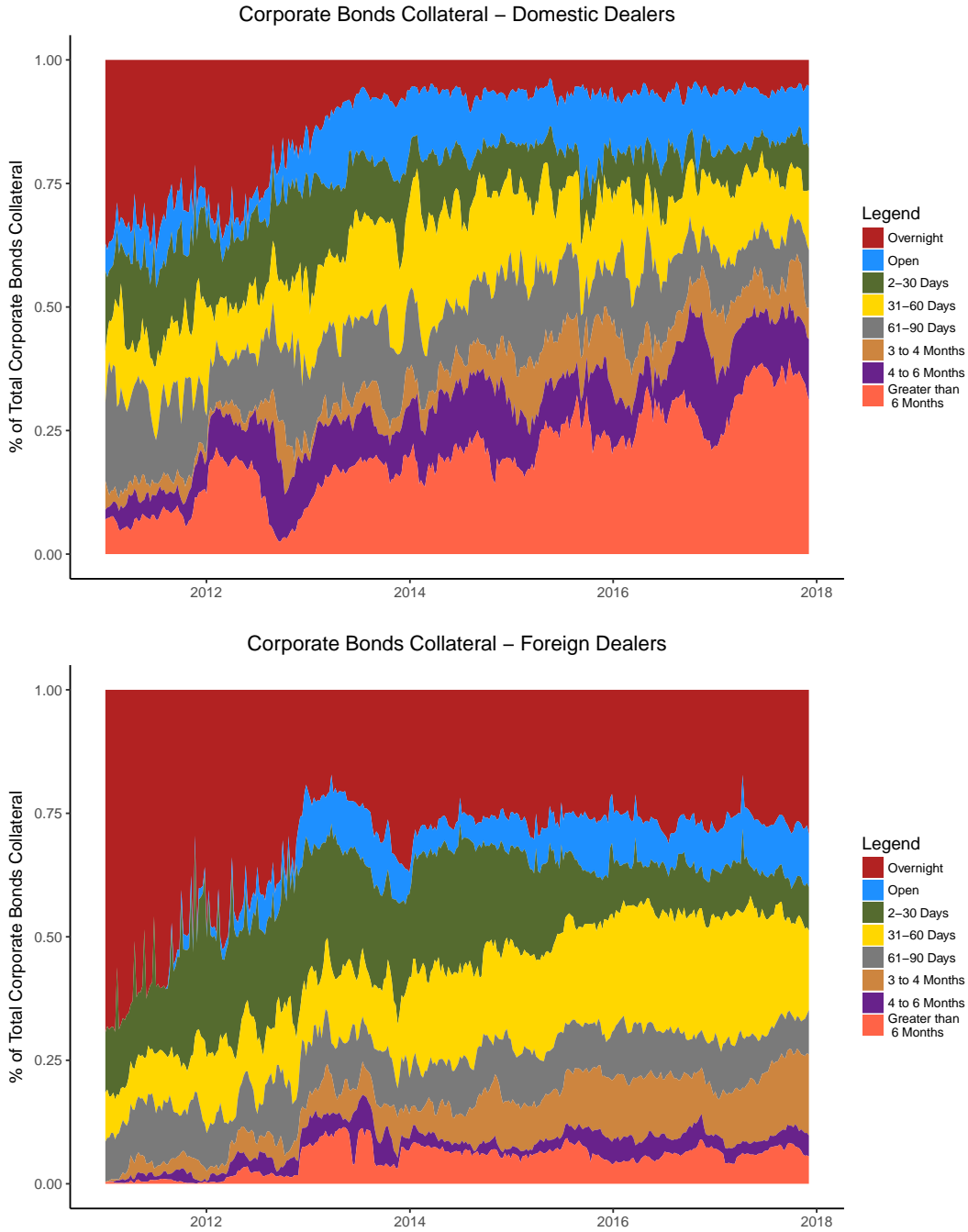


Figure 5: Maturity Structure of Corporate Triparty Repos – Domestic vs. Foreign

On the y-axis is the share of corporate repos with certain residual maturities, listed in the legend. The top (bottom) chart reflects the maturity structure of all the domestic (foreign) dealers subject to the U.S. implementation (foreign implementations) of the LCR.

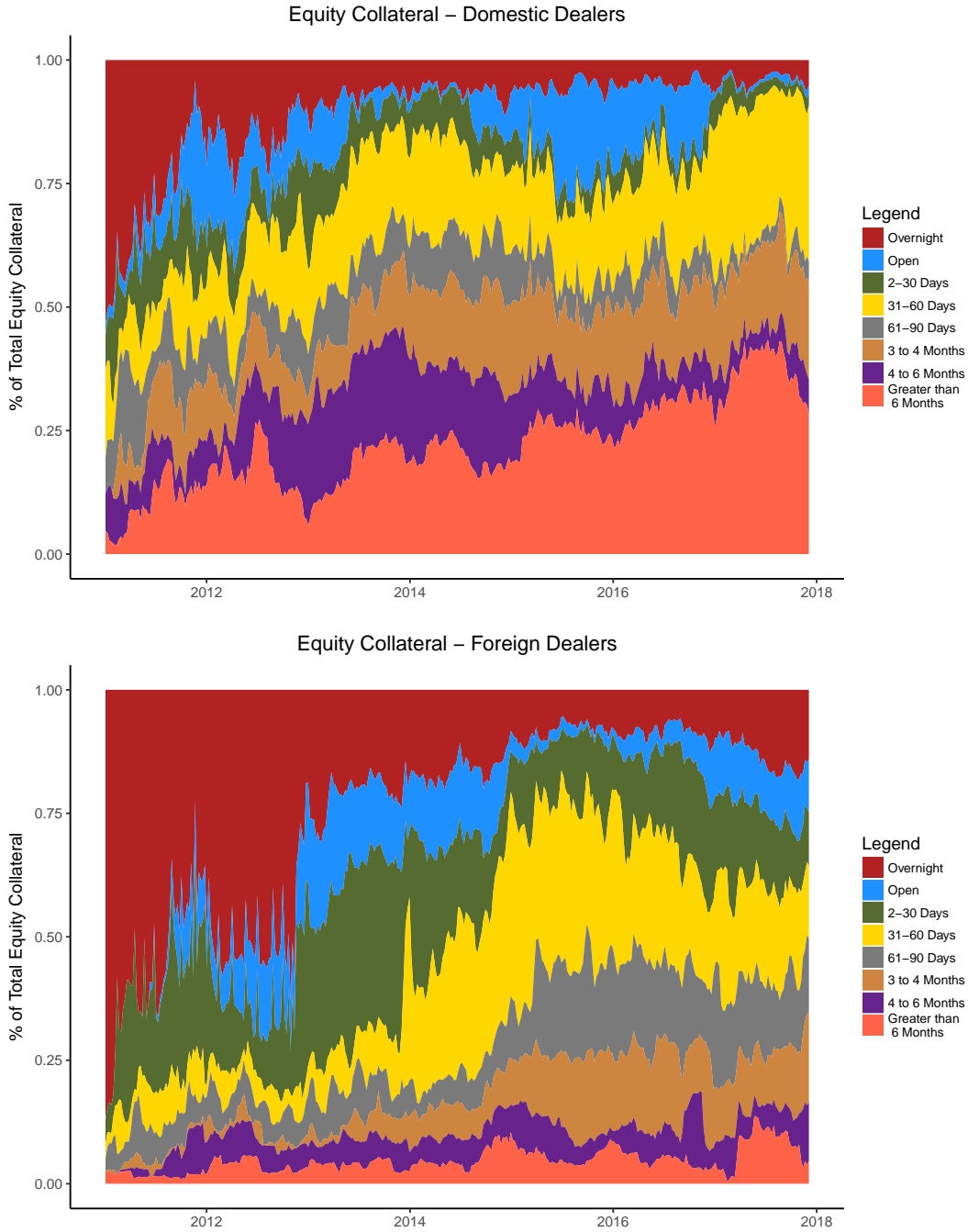


Figure 6: Maturity Structure of Equity Triparty Repos – Domestic vs. Foreign

On the y-axis is the share of equity repos with certain residual maturities, listed in the legend. The top (bottom) chart reflects the maturity structure of all the domestic (foreign) dealers subject to the U.S. implementation (foreign implementations) of the LCR.

Table 1: Summary Statistics – Maturity of Triparty Repos

The sample goes from Jan'10 to Jun'16. Jan'10–Nov'11 refers to the time period until the U.S. implementation of the LCR is announced (Dec 01, 2011); Dec'11–Dec'14 is between the announcement of the U.S. implementation and when the U.S. LCR first becomes effective, namely phased-in at the 80% level (Jan 01, 2015); finally, Jan'15–Jun'16 is between the 80% phased-in date and when foreign dealers need to constitute a U.S. intermediate holding company subject to U.S. rules. U.S. LCR refers to the U.S. dealers subject to the U.S. implementation of LCR; Foreign LCR refers to the foreign dealers subject to the various foreign implementations of the LCR. The variables represent the share of triparty repos backed by a certain collateral class that is maturing in a certain number of days. Tsy refers to Treasuries, AgyMBS to agency MBS, Corp to corporate debt, and Eqty to equities. Open refers to open trades, [1,30] to maturities between one and 30 days (open trades excluded), and [>90] to maturities beyond 90 days. The excluded category is the share maturing between 31 and 90 days.

Time periods:	Jan'10–Nov '11		Dec '11–Dec'14		Jan'15–Jun'16	
	mean	st. dev.	mean	st. dev.	mean	st. dev.
Panel A: US LCR Dealers						
Share Tsy Open	0.032	0.047	0.147	0.212	0.235	0.275
Share Tsy [1,30]	0.925	0.090	0.784	0.256	0.656	0.289
Share Tsy [>90]	0.023	0.058	0.032	0.047	0.053	0.070
Share AgyMBS Open	0.072	0.100	0.141	0.117	0.155	0.131
Share AgyMBS [1,30]	0.785	0.185	0.667	0.182	0.566	0.263
Share AgyMBS [>90]	0.080	0.128	0.095	0.114	0.162	0.215
Share Corp Open	0.075	0.063	0.107	0.154	0.117	0.176
Share Corp [1,30]	0.556	0.270	0.285	0.241	0.164	0.173
Share Corp [>90]	0.118	0.138	0.290	0.232	0.411	0.207
Share Eqty Open	0.070	0.135	0.092	0.172	0.080	0.176
Share Eqty [1,30]	0.462	0.277	0.208	0.205	0.169	0.205
Share Eqty [>90]	0.268	0.265	0.427	0.255	0.495	0.253
Panel B: Foreign LCR Dealers						
Share Tsy Open	0.073	0.235	0.042	0.157	0.036	0.104
Share Tsy [1,30]	0.901	0.247	0.916	0.208	0.901	0.195
Share Tsy [>90]	0.010	0.042	0.014	0.108	0.031	0.154
Share AgyMBS Open	0.088	0.257	0.067	0.192	0.050	0.116
Share AgyMBS [1,30]	0.786	0.312	0.765	0.285	0.811	0.255
Share AgyMBS [>90]	0.063	0.170	0.060	0.157	0.044	0.162
Share Corp Open	0.006	0.040	0.078	0.221	0.050	0.092
Share Corp [1,30]	0.793	0.254	0.672	0.336	0.585	0.327
Share Corp [>90]	0.029	0.065	0.086	0.148	0.135	0.215
Share Eqty Open	0.121	0.304	0.141	0.268	0.039	0.102
Share Eqty [1,30]	0.659	0.391	0.630	0.360	0.429	0.348
Share Eqty [>90]	0.019	0.064	0.086	0.186	0.199	0.258

Table 2: Summary Statistics – Financing and Inventories

The sample goes from Jan '04 to Jun '16. Jan'04–Nov'11 refers to the time period until the U.S. implementation of the LCR is announced (Dec 01, 2011); Dec'11–Dec'14 is between the announcement of the U.S. implementation and when the U.S. LCR first becomes effective, namely phased-in at the 80% level (Jan 01, 2015); finally, Jan'15–Jun'16 is between the 80% phased-in date and when foreign dealers need to constitute a U.S. intermediate holding company subject to the U.S. implementation. U.S. LCR refers to the U.S. dealers subject to the U.S. implementation of LCR; Foreign LCR refers to the foreign dealers subject to the various foreign implementations of the LCR. Panels A and B display variables in levels, while Panels C and D in first difference (weekly changes). Sec Out is Securities Out (dealer raises secured financing), Sec In is Securities In (dealer provides secured financing), and Inv is Inventories (long minus short positions). Tsy refers to Treasury collateral, AgyMBS to Agency MBS, and Corp to corporate debt. All variables are expressed in \$ millions.

Time periods:	Jan'04–Nov'11		Dec'11–Dec'14		Jan'15–Jun'16	
	mean	st. dev.	mean	st. dev.	mean	st. dev.
Panel A: US LCR Dealers, in levels						
Sec Out Tsy	130,340	46,033	119,495	49,940	108,345	49,432
Sec In Tsy	152,553	44,953	132,815	50,460	119,605	52,758
Inv Tsy	-3,797	8,576	5,889	7,442	6,100	8,126
Sec Out AgyMBS	67,029	23,929	65,782	21,182	38,882	15,800
Sec In AgyMBS	43,984	16,317	40,360	14,337	21,742	9,221
Inv AgyMBS	3,256	4,501	7,127	4,431	6,758	3,073
Sec Out Corp	22,257	10,149	10,026	3,174	6,991	2,510
Sec In Corp	10,930	5,376	6,605	2,428	5,437	1,542
Inv Corp	16,201	7,656	5,878	5,256	2,333	1,979
Panel B: Foreign LCR Dealers, in levels						
Sec Out Tsy	94,085	72,346	77,103	60,049	65,501	49,365
Sec In Tsy	99,659	76,574	74,162	58,176	61,942	44,832
Inv Tsy	-1,974	5,695	3,290	3,864	1,891	2,974
Sec Out AgyMBS	32,676	32,252	29,159	24,958	16,624	14,958
Sec In AgyMBS	18,211	18,542	18,518	15,222	10,129	7,922
Inv AgyMBS	2,260	3,216	2,059	3,820	2,205	3,421
Sec Out Corp	10,756	11,625	4,518	6,069	4,334	7,390
Sec In Corp	7,025	7,424	3,779	5,030	3,969	6,978
Inv Corp	5,881	10,001	1,239	1,579	546	913
Panel C: US LCR Dealers, in first difference						
Δ Sec Out Tsy	212	9,077	-194	6,924	120	6,633
Δ Sec In Tsy	238	10,230	-213	7,237	259	6,807
Δ Inv Tsy	11	3,268	-4	3,442	63	2,509
Δ Sec Out AgyMBS	81	5,782	-205	3,567	-63	1,893
Δ Sec In AgyMBS	52	5,475	-115	2,829	-87	1,473
Δ Inv AgyMBS	43	1,461	-1	1,395	2	1,664
Δ Sec Out Corp	-18	972	-5	562	-16	733
Δ Sec In Corp	-2	566	2	401	-4	571
Δ Inv Corp	-34	1,386	-12	1,035	-11	920
Panel D: Foreign LCR Dealers, in first difference						
Δ Sec Out Tsy	155	8,172	-126	6,144	56	5,362
Δ Sec In Tsy	153	8,505	-103	5,923	10	4,917
Δ Inv Tsy	8	2,438	-23	2,034	41	1,451
Δ Sec Out AgyMBS	79	4,210	-96	3,520	-67	1,912
Δ Sec In AgyMBS	82	5,120	-50	3,411	-51	1,871
Δ Inv AgyMBS	8	870	-3	750	-7	488
Δ Sec Out Corp	10	818	-4	410	-7	356
Δ Sec In Corp	11	368	1	196	-2	271
Δ Inv Corp	-5	500	-3	315	-1	341

Table 3: LCR Effects on Treasury Repos

The sample goes from Jan 03, 2011 (start of the Triparty data) to Jun 15, 2016. PostLCR1 equals one after the U.S. implementation of the LCR is announced (Dec 01, 2011) and Post LCR2 equals one after the U.S. LCR is 80% phased-in (Jan 01, 2015). U.S. refers to the U.S. dealers subject to the U.S. LCR; Basel refers to all the dealers subject to the LCR. Parallel equals one for U.S. dealers in October 2011; we also include (not shown) the interaction of Basel dealers with the October 2011 dummy. Standard errors are two-way clustered at the dealer and day level. ***, **, * indicate statistical significance at 1%, 5%, and 10%, respectively.

	(1)	(2)	(3)	(4)
	Share Open	Share [1,30]	Share >30	Share >90
Panel A: PostLCR1				
Parallel	0.005 (0.015)	0.015 (0.020)	-0.020 (0.019)	-0.014 (0.018)
PostLCR1	-0.008 (0.011)	-0.026 (0.025)	0.034 (0.026)	0.023 (0.022)
PostLCR1·US	0.132 (0.084)	-0.146 (0.095)	0.014 (0.026)	0.006 (0.024)
PostLCR1·Basel	0.020 (0.024)	-0.009 (0.036)	-0.011 (0.033)	-0.014 (0.029)
Panel B: PostLCR1 and PostLCR2				
Parallel	0.005 (0.015)	0.015 (0.025)	-0.020 (0.019)	-0.014 (0.018)
PostLCR1	0.001 (0.004)	-0.023 (0.026)	0.023 (0.025)	0.014 (0.021)
PostLCR2	-0.031 (0.029)	-0.010 (0.016)	0.041 (0.032)	0.031 (0.029)
PostLCR1·US	0.103 (0.070)	-0.111 (0.084)	0.008 (0.027)	0.004 (0.025)
PostLCR1·Basel	0.012 (0.020)	-0.005 (0.035)	-0.006 (0.031)	-0.010 (0.026)
PostLCR2·US	0.090* (0.047)	-0.107** (0.049)	0.018 (0.028)	0.005 (0.022)
PostLCR2·Basel	0.028 (0.030)	-0.011 (0.021)	-0.018 (0.034)	-0.015 (0.032)
Obs.	51,405	51,405	51,405	51,405
N. of Dealers	56	56	56	56
N. of Days	1,241	1,241	1,241	1,241
Dealer FE	Yes	Yes	Yes	Yes

Table 4: LCR Effects on Agency MBS Repos

The sample goes from Jan 03, 2011 to Jun 15, 2016. PostLCR1 equals one after the U.S. implementation of the LCR is announced (Dec 01, 2011) and PostLCR2 equals one after the U.S. LCR is 80% phased-in (Jan 01, 2015). U.S. refers to the U.S. dealers subject to the U.S. LCR; Basel refers to all the dealers subject to the LCR. Parallel equals one for U.S. dealers in October 2011; we also include (not shown) the interaction of Basel dealers with the October 2011 dummy. Standard errors are two-way clustered at the dealer and day level. ***, **, * indicate statistical significance at 1%, 5%, and 10%, respectively.

	(1)	(2)	(3)	(4)
	Share Open	Share [1,30]	Share >30	Share >90
Panel A: PostLCR1				
Parallel	0.032 (0.038)	-0.022 (0.033)	-0.009 (0.036)	-0.022 (0.031)
PostLCR1	-0.025 (0.028)	-0.081 (0.068)	0.106 (0.066)	0.053 (0.049)
PostLCR1·US	0.095 (0.067)	-0.108 (0.079)	0.013 (0.038)	0.020 (0.027)
PostLCR1·Basel	0.007 (0.062)	0.034 (0.090)	-0.040 (0.073)	-0.036 (0.053)
Panel B: PostLCR1 and PostLCR2				
Parallel	0.032 (0.038)	-0.023 (0.033)	-0.009 (0.036)	-0.022 (0.031)
PostLCR1	-0.023 (0.028)	-0.063 (0.069)	0.086 (0.066)	0.038 (0.044)
PostLCR2	-0.008** (0.003)	-0.062 (0.049)	0.069 (0.047)	0.052 (0.044)
PostLCR1·US	0.085 (0.069)	-0.064 (0.082)	-0.021 (0.044)	-0.003 (0.029)
PostLCR1·Basel	0.010 (0.063)	0.004 (0.090)	-0.015 (0.072)	-0.020 (0.050)
PostLCR2·US	0.034 (0.021)	-0.138** (0.063)	0.104* (0.057)	0.071 (0.055)
PostLCR2·Basel	-0.012 (0.018)	0.099* (0.058)	-0.087 (0.054)	-0.054 (0.053)
Obs.	52,727	52,727	52,727	52,727
N. of Dealers	55	55	55	55
N. of Days	1,249	1,249	1,249	1,249
Dealer FE	Yes	Yes	Yes	Yes

Table 5: LCR Effects on Corporate Debt Repos

The sample goes from Jan 03, 2011 to Jun 15, 2016. PostLCR1 equals one after the U.S. implementation of the LCR is announced (Dec 01, 2011) and PostLCR2 equals one after the U.S. LCR is 80% phased-in (Jan 01, 2015). U.S. refers to the U.S. dealers subject to the U.S. LCR; Basel refers to all the dealers subject to the LCR. Parallel equals one for U.S. dealers in October 2011; we also include (not shown) the interaction of Basel dealers with the October 2011 dummy. Standard errors are two-way clustered at the dealer and day level. ***, **, * indicate statistical significance at 1%, 5%, and 10%, respectively.

	(1)	(2)	(3)	(4)
	Share Open	Share [1,30]	Share >30	Share >90
Panel A: PostLCR1				
Parallel	-0.018 (0.025)	-0.022 (0.037)	0.040 (0.038)	0.001 (0.019)
PostLCR1	-0.174** (0.080)	0.037 (0.094)	0.137** (0.068)	0.035 (0.022)
PostLCR1·US	-0.029 (0.057)	-0.128 (0.088)	0.157** (0.070)	0.116** (0.047)
PostLCR1·Basel	0.240*** (0.086)	-0.224** (0.108)	-0.016 (0.087)	0.060 (0.037)
Panel B: PostLCR1 and PostLCR2				
Parallel	-0.018 (0.025)	-0.023 (0.037)	0.041 (0.039)	0.001 (0.019)
PostLCR1	-0.150* (0.086)	0.043 (0.094)	0.107* (0.063)	0.016 (0.027)
PostLCR2	-0.108 (0.084)	-0.029* (0.015)	0.137 (0.083)	0.091 (0.082)
PostLCR1·US	-0.045 (0.059)	-0.106 (0.078)	0.152** (0.063)	0.093** (0.046)
PostLCR1·Basel	0.231** (0.095)	-0.213* (0.106)	-0.018 (0.082)	0.064* (0.038)
PostLCR2·US	0.053 (0.056)	-0.064 (0.075)	0.011 (0.065)	0.071 (0.073)
PostLCR2·Basel	0.064 (0.093)	-0.028 (0.060)	-0.036 (0.097)	-0.041 (0.089)
Obs.	40,039	40,039	40,039	40,039
N. of Dealers	48	48	48	48
N. of Days	1,239	1,239	1,239	1,239
Dealer FE	Yes	Yes	Yes	Yes

Table 6: LCR Effects on Equity Repos

The sample goes from Jan 03, 2011 to Jun 15, 2016. PostLCR1 equals one after the U.S. implementation of the LCR is announced (Dec 01, 2011) and PostLCR2 equals one after the U.S. LCR is 80% phased-in (Jan 01, 2015). U.S. refers to the U.S. dealers subject to the U.S. LCR; Basel refers to all the dealers subject to the LCR. Parallel equals one for U.S. dealers in October 2011; we also include (not shown) the interaction of Basel dealers with the October 2011 dummy. Standard errors are two-way clustered at the dealer and day level. ***, **, * indicate statistical significance at 1%, 5%, and 10%, respectively.

	(1)	(2)	(3)	(4)
	Share Open	Share [1,30]	Share >30	Share >90
Panel A: PostLCR1				
Parallel	-0.013 (0.091)	-0.161 (0.118)	0.174 (0.104)	-0.016 (0.071)
PostLCR1	-0.066 (0.116)	-0.135 (0.080)	0.201** (0.074)	0.081 (0.049)
PostLCR1·US	0.086 (0.086)	-0.228 (0.143)	0.142 (0.115)	0.079 (0.050)
PostLCR1·Basel	0.026 (0.133)	0.040 (0.152)	-0.067 (0.125)	0.024 (0.067)
Panel B: PostLCR1 and PostLCR2				
Parallel	-0.013 (0.091)	-0.160 (0.118)	0.173 (0.105)	-0.016 (0.071)
PostLCR1	0.012 (0.104)	-0.120 (0.084)	0.108 (0.072)	0.040 (0.031)
PostLCR2	-0.284* (0.162)	-0.052 (0.036)	0.337** (0.139)	0.150 (0.200)
PostLCR1·US	0.053 (0.082)	-0.268* (0.139)	0.216* (0.107)	0.092** (0.045)
PostLCR1·Basel	-0.022 (0.126)	0.088 (0.150)	-0.066 (0.117)	0.034 (0.051)
PostLCR2·US	0.122 (0.097)	0.166* (0.097)	-0.289*** (0.077)	-0.061 (0.068)
PostLCR2·Basel	0.174 (0.182)	-0.181* (0.096)	0.007 (0.150)	-0.033 (0.206)
Obs.	25,062	25,062	25,062	25,062
N. of Dealers	29	29	29	29
N. of Days	1,238	1,238	1,238	1,238
Dealer FE	Yes	Yes	Yes	Yes

Table 7: Adjustments in Financing and Intermediation to LCR Implementation

The sample goes from Jul 15, 2009 (end of liquidity programs) to Jun 15, 2016, and contains all the Primary Dealers subject to the Basel LCR rule. U.S. refers to the U.S. dealers subject to the U.S. LCR; PostLCR1 equals one after the U.S. implementation of the LCR is announced (Dec 01, 2011), and PostLCR2 equals one after the U.S LCR is 80% phased in (Jan 01, 2015). Standard errors are two-way clustered at the dealer (21) and week (360) level. ***, **, * indicate statistical significance at 1%, 5%, and 10%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Collateral:	Δ Securities Out Treasury	Δ Securities Out	Δ Securities Out Agency MBS	Δ Securities Out	Δ Securities Out Corporate Debt	
	Financing Inventories					
PostLCR1·US· Δ Inv	0.027 (0.085)	0.007 (0.125)	-0.740* (0.413)	-0.747* (0.412)	-0.161 (0.101)	-0.171 (0.107)
PostLCR2·US· Δ Inv	-0.279** (0.105)	-0.279** (0.108)	0.205 (0.162)	0.181 (0.174)	0.047 (0.144)	-0.055 (0.163)
	Intermediation					
PostLCR1·US· Δ Sec In Tsy	0.042 (0.113)	0.147 (0.144)	-0.078** (0.032)	-0.099** (0.037)	0.005 (0.010)	0.006 (0.010)
PostLCR2·US· Δ Sec In Tsy	0.008 (0.078)	-0.045 (0.087)	0.037 (0.037)	0.048 (0.038)	0.007 (0.013)	0.007 (0.016)
PostLCR1·US· Δ Sec In AgyMBS	-0.527*** (0.132)	-0.502*** (0.145)	0.156 (0.153)	0.161 (0.143)	0.008 (0.006)	0.005 (0.010)
PostLCR2·US· Δ Sec In AgyMBS	-0.131 (0.195)	-0.159 (0.249)	-0.252 (0.182)	-0.287 (0.179)	0.044 (0.048)	0.043 (0.056)
PostLCR1·US· Δ Sec In Corp	0.742 (0.731)	1.050 (0.817)	0.359 (0.371)	0.575 (0.464)	0.210 (0.226)	0.164 (0.251)
PostLCR2·US· Δ Sec In Corp	0.349 (1.041)	0.018 (1.028)	-0.174 (0.260)	-0.272 (0.271)	0.289* (0.168)	0.293* (0.156)
Obs.	6,648	6,648	6,648	6,648	6,648	6,648
Adj, R ²	0.728	0.742	0.360	0.366	0.191	0.236
Dealer FE	Yes	Yes	Yes	Yes	Yes	Yes
Week FE	Yes	Yes	Yes	Yes	Yes	Yes
US-Week FE	No	Yes	No	Yes	No	Yes

Table 8: LCR Effects on Intermediation (Overnight vs Term)

The sample goes from Jul 15, 2009 (end of liquidity programs) to Jun 15, 2016, and contains all the Primary Dealers subject to the Basel LCR rule. U.S. refers to the U.S. dealers subject to the U.S. LCR, and PostLCR1 equals one after the U.S. implementation of the LCR is announced (Dec 01, 2011). Standard errors are two-way clustered at the dealer (21) and week (360) level. ***, **, * indicate statistical significance at 1%, 5%, and 10%, respectively.

Collateral: Tenor:	(1)	(2)	(3)	(4)	(5)	(6)
	Δ Securities Out		Δ Securities Out		Δ Securities Out	
	Treasury ON	Term	Agency MBS ON	Term	Corporate Debt ON	Term
PostLCR1·US · Δ Sec In Tsy ON	0.100 (0.108)	0.098 (0.081)	-0.115** (0.049)	0.011 (0.032)	0.011 (0.008)	-0.000 (0.008)
PostLCR1·US · Δ Sec In Tsy Term	-0.017 (0.177)	0.112 (0.128)	-0.059 (0.076)	0.029 (0.049)	-0.005 (0.010)	0.015* (0.008)
PostLCR1·US · Δ Sec In AgyMBS ON	-0.369*** (0.119)	-0.189 (0.142)	0.153 (0.112)	-0.043 (0.103)	0.020 (0.014)	0.001 (0.012)
PostLCR1·US · Δ Sec In AgyMBS Term	-0.330 (0.384)	0.135 (0.334)	0.413* (0.238)	-0.151 (0.146)	-0.046 (0.039)	0.031 (0.026)
PostLCR1·US · Δ Sec In Corp ON	0.232 (1.386)	0.882 (1.050)	-0.057 (0.500)	-0.073 (0.413)	0.324 (0.189)	-0.160 (0.117)
PostLCR1·US · Δ Sec In Corp Term	1.178 (1.888)	0.001 (1.412)	1.942 (1.129)	-0.822 (0.605)	0.548 (0.341)	0.545** (0.226)
Obs.	6,648	6,648	6,648	6,648	6,648	6,648
Adj. R ²	0.464	0.496	0.207	0.128	0.200	0.195
Dealer FE	Yes	Yes	Yes	Yes	Yes	Yes
US·Week FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 9: LCR Effects on Financing and Intermediation of Securities

The sample goes from Jul 15, 2009 (end of liquidity programs) to Jun 15, 2016, and contains all the Primary Dealers subject to the Basel LCR rule. U.S. refers to the U.S. dealers subject to the U.S. LCR, and PostLCR1 equals one after the U.S. implementation of the LCR is announced (Dec 01, 2011). Standard errors are two-way clustered at the dealer (21) and week (360) level. ***, **, * indicate statistical significance at 1%, 5%, and 10%, respectively.

Collateral:	(1) Δ Securities Out Treasury	(2) Δ Securities Out Treasury	(3) Δ Securities Out Agency MBS	(4) Δ Securities Out Agency MBS	(5) Δ Securities Out Corporate Debt	(6) Δ Securities Out Corporate Debt
	Financing Net Positions					
Δ Inv	0.326*** (0.051)	0.288*** (0.051)	-0.438 (0.325)	-0.399 (0.351)	0.151 (0.092)	0.154 (0.096)
US·Δ Inv	0.021 (0.081)	0.079 (0.070)	0.593* (0.323)	0.624 (0.362)	-0.051 (0.101)	-0.063 (0.102)
PostLCR1·Δ Inv	0.032 (0.053)	0.056 (0.048)	0.458 (0.373)	0.418 (0.394)	0.180*** (0.053)	0.195*** (0.060)
PostLCR1·US·Δ Inv	-0.029 (0.082)	-0.051 (0.121)	-0.682 (0.397)	-0.700 (0.409)	-0.140 (0.093)	-0.185** (0.084)
	Pre-LCR Intermediation					
Δ Sec In Tsy	0.869*** (0.049)	0.896*** (0.041)	0.051* (0.028)	0.047* (0.026)	0.002 (0.003)	0.003 (0.003)
US·Δ Sec In Tsy	-0.312** (0.119)	-0.403*** (0.116)	0.034 (0.035)	0.046 (0.036)	0.002 (0.004)	0.004 (0.004)
Δ Sec In AgyMBS	-0.089*** (0.025)	-0.077*** (0.021)	0.373*** (0.121)	0.376*** (0.117)	0.009** (0.004)	0.009** (0.004)
US·Δ Sec In AgyMBS	0.494*** (0.084)	0.440*** (0.086)	0.024 (0.166)	0.023 (0.165)	-0.012 (0.007)	-0.014 (0.009)
Δ Sec In Corp	0.381 (0.251)	0.483** (0.202)	0.189 (0.197)	0.205 (0.208)	0.986*** (0.229)	0.988*** (0.235)
US·Δ Sec In Corp	-0.659* (0.382)	-0.754 (0.446)	0.145 (0.359)	-0.015 (0.449)	-0.747*** (0.208)	-0.740*** (0.227)
	Changes in Intermediation Post-LCR					
PostLCR1·Δ Sec In Tsy	0.052 (0.045)	0.024 (0.036)	-0.014 (0.017)	-0.009 (0.018)	-0.003 (0.003)	-0.004 (0.004)
PostLCR1·US·Δ Sec In Tsy	0.045 (0.101)	0.134 (0.126)	-0.069** (0.028)	-0.087** (0.034)	0.007 (0.007)	0.009 (0.008)
PostLCR1·Δ Sec In AgyMBS	0.221*** (0.031)	0.202*** (0.023)	0.285*** (0.051)	0.280*** (0.052)	-0.004 (0.006)	-0.003 (0.006)
PostLCR1·US·Δ Sec In AgyMBS	-0.542*** (0.135)	-0.524*** (0.145)	0.120 (0.151)	0.122 (0.138)	0.015** (0.006)	0.013 (0.010)
PostLCR1·Δ Sec In Corp	-0.486 (0.434)	-0.602 (0.395)	-0.391 (0.264)	-0.423 (0.268)	-0.181 (0.240)	-0.158 (0.247)
PostLCR1·US·Δ Sec In Corp	0.918 (0.546)	1.060 (0.620)	0.287 (0.340)	0.455 (0.443)	0.370 (0.221)	0.323 (0.241)
Obs.	6,648	6,648	6,648	6,648	6,648	6,648
Adj. R ²	0.728	0.742	0.358	0.364	0.178	0.225
Dealer FE	Yes	Yes	Yes	Yes	Yes	Yes
Week FE	Yes	Yes	Yes	Yes	Yes	Yes
US·Week FE	No	Yes	No	Yes	No	Yes

Table 10: Regulation or Market Discipline? Precrisis, Postcrisis and Post-LCR.

The sample goes from Jan 07, 2004 to Jun 15, 2016, excluding the crisis period (Aug 01, 2007 to Jul 15, 2009) and contains all the Primary Dealers subject to the Basel LCR rule. U.S. refers to the U.S. dealers subject to the U.S. LCR. PostCrisis equals one after the Federal Reserve liquidity programs for Primary Dealers are unwound (July 15, 2009), and PostLCR1 equals one after the U.S. implementation of the LCR is announced (Dec 01, 2011). Observations in which the dealer is non operating in the respective collateral type are dropped. Standard errors are two-way clustered at the dealer (22) and week (545) level. ***, **, * indicate statistical significance at 1%, 5%, and 10%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Collateral:	Δ Securities Treasury	Δ Securities Out	Δ Securities Agency	Δ Securities MBS	Δ Securities Corporate	Δ Securities Debt
Δ Inv	0.556*** (0.051)	0.541*** (0.053)	-0.105 (0.078)	-0.131 (0.078)	0.095** (0.034)	0.102*** (0.033)
US· Δ Inv	0.032 (0.089)	0.047 (0.095)	-0.100 (0.150)	-0.092 (0.144)	0.340*** (0.087)	0.315*** (0.078)
PostCrisis· Δ Inv	-0.229*** (0.060)	-0.253*** (0.067)	-0.165 (0.190)	-0.073 (0.194)	0.056 (0.108)	0.053 (0.111)
PostCrisis·US· Δ Inv	-0.011 (0.105)	0.032 (0.118)	0.512** (0.207)	0.473** (0.225)	-0.392*** (0.130)	-0.379*** (0.126)
PostLCR1· Δ Inv	0.032 (0.053)	0.056 (0.048)	0.318 (0.269)	0.261 (0.270)	0.178*** (0.053)	0.193*** (0.061)
PostLCR1·US· Δ Inv	-0.029 (0.083)	-0.051 (0.121)	-0.504 (0.308)	-0.487 (0.295)	-0.139 (0.093)	-0.183** (0.085)
Obs.	9,584	9,584	7,033	7,026	8,730	8,730
Adj. R ²	0.781	0.793	0.411	0.421	0.186	0.211
Dealer FE	Yes	Yes	Yes	Yes	Yes	Yes
Week FE	Yes	Yes	Yes	Yes	Yes	Yes
US·Week FE	No	Yes	No	Yes	No	Yes
Δ Sec In controls	Yes	Yes	Yes	Yes	Yes	Yes

Table 11: Maturity Transformation within Treasuries – 2013 to 2016

The sample goes from Apr 13, 2013 (beginning of more granular data) to Jun 15, 2016, and contains all the Primary Dealers subject to the Basel LCR rule. U.S. refers to the U.S. dealers subject to the U.S. LCR. Dealer-week pairs with no repo activity are dropped. Standard errors are two-way clustered at the dealer (21) and week (167) level. ***, **, * indicate statistical significance at 1%, 5%, and 10%, respectively.

	(1)	(2)	(3)	(4)
	Total	Δ Securities Out ON	[2,30]	> 30
	Financing Net Positions			
Δ Inv	0.357*** (0.049)	0.402*** (0.075)	0.009 (0.054)	-0.059 (0.057)
US· Δ Inv	0.063 (0.119)	0.048 (0.144)	0.019 (0.059)	-0.004 (0.065)
	Intermediation			
Δ Sec In	0.936*** (0.019)			
US· Δ Sec In	-0.072 (0.059)			
Δ Sec In ON		0.787*** (0.027)	0.105*** (0.034)	0.030*** (0.008)
Δ Sec In [2,30]		0.458*** (0.075)	0.405*** (0.064)	0.083** (0.033)
Δ Sec In > 30		0.449*** (0.102)	0.104** (0.048)	0.430*** (0.114)
US· Δ Sec In ON		-0.086 (0.063)	-0.015 (0.048)	0.011 (0.016)
US· Δ Sec In [2,30]		-0.110 (0.111)	0.106 (0.101)	0.034 (0.047)
US· Δ Sec In > 30		-0.126 (0.150)	0.222 (0.142)	-0.099 (0.110)
Obs.	3,297	3,297	3,297	3,297
Adj. R ²	0.802	0.552	0.356	0.328
Dealer FE	Yes	Yes	Yes	Yes
US·Week FE	Yes	Yes	Yes	Yes
Δ Sec In (other collat)	Yes	Yes	Yes	Yes

Table 12: Maturity Transformation within Agency MBS – 2013 to 2016

The sample goes from Apr 13, 2013 (beginning of more granular data) to Jun 15, 2016, and contains all the Primary Dealers subject to the Basel LCR rule. U.S. refers to the U.S. dealers subject to the U.S. LCR. Dealer-week pairs with no repo activity are dropped. Standard errors are two-way clustered at the dealer (21) and week (167) level. ***, **, * indicate statistical significance at 1%, 5%, and 10%, respectively.

	(1)	(2)	(3)	(4)
	Total	Δ Securities Out ON	[2,30]	> 30
Financing Net Positions				
Δ Inv	0.075 (0.094)	-0.063 (0.087)	0.077 (0.074)	0.061 (0.071)
US· Δ Inv	-0.109 (0.096)	0.044 (0.098)	-0.080 (0.081)	-0.071 (0.073)
Intermediation				
Δ Sec In	0.814*** (0.034)			
US· Δ Sec In	-0.093 (0.073)			
Δ Sec In ON		0.550*** (0.059)	0.158*** (0.034)	0.082*** (0.024)
Δ Sec In [2,30]		0.467*** (0.068)	0.260*** (0.063)	0.135*** (0.029)
Δ Sec In > 30		0.589*** (0.081)	0.107* (0.061)	0.211*** (0.057)
US· Δ Sec In ON		-0.206* (0.113)	0.010 (0.099)	0.051 (0.055)
US· Δ Sec In [2,30]		0.230 (0.186)	-0.201** (0.072)	-0.052 (0.046)
US· Δ Sec In > 30		-0.130 (0.129)	-0.165 (0.115)	0.179** (0.079)
Obs.	3,217	3,217	3,217	3,217
Adj. R ²	0.559	0.228	0.097	0.117
Dealer FE	Yes	Yes	Yes	Yes
US·Week FE	Yes	Yes	Yes	Yes
Δ Sec In (other collat)	Yes	Yes	Yes	Yes

Table 13: Maturity Transformation within Corporate Debt – 2013 to 2016

The sample goes from Apr 13, 2013 (beginning of more granular data) to Jun 15, 2016, and contains all the Primary Dealers subject to the Basel LCR rule. U.S. refers to the U.S. dealers subject to the U.S. LCR. Dealer-week pairs with no repo activity are dropped. Standard errors are two-way clustered at the dealer (20) and week (167) level. ***, **, * indicate statistical significance at 1%, 5%, and 10%, respectively.

	(1)	(2)	(3)	(4)
	Total	Δ Securities Out ON	[2,30]	> 30
Financing Net Positions				
Δ Inv	0.413*** (0.058)	0.331*** (0.034)	0.035*** (0.010)	0.049 (0.062)
US· Δ Inv	-0.310*** (0.100)	-0.263*** (0.074)	-0.034** (0.012)	-0.013 (0.067)
Intermediation				
Δ Sec In	0.833*** (0.157)			
US· Δ Sec In	-0.770*** (0.176)			
Δ Sec In ON		0.810 *** (0.152)	0.042** (0.017)	0.033 (0.026)
Δ Sec In [2,30]		0.298* (0.169)	0.170 ** (0.062)	0.125 (0.116)
Δ Sec In > 30		0.466*** (0.148)	0.063 (0.039)	0.119 (0.089)
US· Δ Sec In ON		-0.792*** (0.162)	-0.036* (0.019)	0.003 (0.040)
US· Δ Sec In [2,30]		-0.118 (0.297)	-0.006 (0.083)	0.123 (0.228)
US· Δ Sec In > 30		-0.560 (0.427)	-0.174 (0.117)	0.387 (0.368)
Obs.	2,953	2,953	2,953	2,953
Adj. R ²	0.296	0.195	0.014	0.042
Dealer FE	Yes	Yes	Yes	Yes
US·Week FE	Yes	Yes	Yes	Yes
Δ Sec In (other collat)	Yes	Yes	Yes	Yes

Table 14: Maturity Transformation within Equities – 2013 to 2016

The sample goes from Apr 13, 2013 (beginning of more granular data) to Jun 15, 2016, and contains all the Primary Dealers subject to the Basel LCR rule. U.S. refers to the U.S. dealers subject to the U.S. LCR. Dealer-week pairs with no repo activity are dropped. For equity collateral only, positions are not reported, hence inventory financing is missing from this table. Standard errors are two-way clustered at the dealer (14) and week (167) level. ***, **, * indicate statistical significance at 1%, 5%, and 10%, respectively.

	(1)	(2)	(3)	(4)
	Total	Δ Securities Out ON	[2,30]	> 30
		Intermediation		
Δ Sec In	0.695*** (0.126)			
US· Δ Sec In	-0.335* (0.159)			
Δ Sec In ON		0.741*** (0.107)	0.000 (0.004)	-0.008 (0.014)
Δ Sec In [2,30]		-0.118 (0.149)	0.867*** (0.076)	-0.090 (0.107)
Δ Sec In > 30		-0.313* (0.149)	-0.011 (0.014)	0.527*** (0.081)
US· Δ Sec In ON		-0.331** (0.131)	0.004 (0.010)	-0.018 (0.045)
US· Δ Sec In [2,30]		1.108** (0.495)	-0.519*** (0.131)	0.087 (0.307)
US· Δ Sec In > 30		0.292 (0.288)	-0.027 (0.053)	-0.346 (0.217)
Obs.	1,800	1,800	1,800	1,800
Adj. R ²	0.307	0.319	0.272	0.117
Dealer FE	Yes	Yes	Yes	Yes
US·Week FE	Yes	Yes	Yes	Yes
Δ Sec In (other collat)	Yes	Yes	Yes	Yes