

# Internet Appendix: The Scarcity Value of Treasury Collateral: Repo Market Effects of Security-Specific Supply and Demand Factors

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# I. Treasury Auction Cycle

There are three important periodic dates in the Treasury auction cycle: the auction announcement date, the auction date, and the issuance date. There is usually about one week from the announcement to the auction. During a typical auction cycle, the supply of Treasury collateral available to the repo market is at its highest level when the security is issued, therefore the repo specialness spread should be close to zero. As time passes, more and more of the security may be purchased by holders who are not very active in the repo market, consequently the security's availability may decline over time and the repo specialness spread may increase. When forward trading in the next security begins on the auction announcement date, holders of short positions will usually roll out of the outstanding issue, implying that demand for that specific collateral should decrease and that the repo specialness spread will rapidly decline (see Fisher (2002)). Keane (1995) documents that the repo specialness spread for on-the-run securities exhibits this repeated pattern, that is, it climbs with the time since the last auction until around the announcement of the next auction, after which it declines sharply.

Figures 1 and 2 show the auction cycle patterns in our sample for securities auctioned monthly (2-, 3-, 5-, and 7-year maturities) and quarterly (10-year maturities), respectively. In Figure 1, it is easy to note the same pattern documented by Keane (1995). In contrast, Figure 2 shows that the quarterly auction cycle of the 10-year note looks quite different, mainly because the Treasury has introduced two regular reopenings following each 10-year note auction. Therefore, it is possible to observe three separate auction sub-cycles: the most dramatic run-up in specialness spread takes place before the first reopening; a second run-up, similar in shape but smaller in magnitude, immediately follows and peaks just before the second reopening; and finally, during the third sub-cycle the specialness spread is practically

flat. This would suggest that the increased availability of the on-the-run security after each reopening strongly diminishes the impact of the seasonal demand for short positions around these dates (Sundaresan (1994)).

<< Figures 1 and 2 here >>.

In order to control for these auction-cycle effects, we construct a set of dummy variables that track the time elapsed since issuance for both the monthly and quarterly cycles.

## II. Analysis with Clustered Standard Errors

To account for possible correlations across the regression errors of collateral with comparable maturities, we also run the analysis with clustered standard errors. Table 1 shows the results of this robustness exercise. The first column shows estimates from the first column in Table 3 of the paper, using the heteroskedasticity-consistent standard errors, as a term of comparison. The second and third columns show the results from specifications where we allow for clustering within one- and three-year maturity buckets for each security. The results are robust to the type of standard error used, as the statistical significance of the estimated coefficients is practically unchanged. We perform the same exercise for the maturity subsample regressions presented in Tables 4 and 5 of the paper and obtain similar results (not shown). This is not surprising if, as already documented in Table 6 of the paper, there is an extreme form of imperfect substitution that limits the transmission of quantity shocks across similar securities, reducing cross-sectional correlations.

<< Table 1 here. >>

### III. Preliminary Evidence on Reverse Repo Facility

In the conclusion of the paper, it is mentioned that, in principle, the Fed’s overnight reverse repo (ON RRP) facility could prevent near-zero or negative SC and GC repo rates and help firming the floor for key money market rates by increasing the availability of Treasury collateral to a wide range of market participants. Figure 3 attempts to illustrate this point.

<< Figure 3 here. >>

The top panel of Figure 3 plots two of the most relevant overnight money market rates—the effective FFR and the GCF Treasury repo rate—together with the repo rate set by the Fed for its ON RRP operations, which started at the end of September 2013. This panel shows that, although the operations’ amounts are capped, the Fed’s reverse repo rate has generally been providing a floor for other money market rates, even during quarter- and year-end periods.<sup>1</sup> Those are episodes when demand for Treasury securities increases, likely due to risk-shifting window dressing by intermediaries, who alter portfolios at disclosure dates to underrepresent their riskiness (e.g., Musto (1997), Griffiths and Winters (2005)). Indeed, as shown in the bottom two panels, which plot the aggregate volume and the number of participants at each Fed ON RRP operations, demand for Treasury securities and participation at this facility have spiked at the end of each quarter. This evidence is merely suggestive; we leave more definitive analysis of ON RRP’s efficacy to future research.

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<sup>1</sup>A clear exception is September 30, 2014, when the recently introduced \$300 billion cap was binding.

## References

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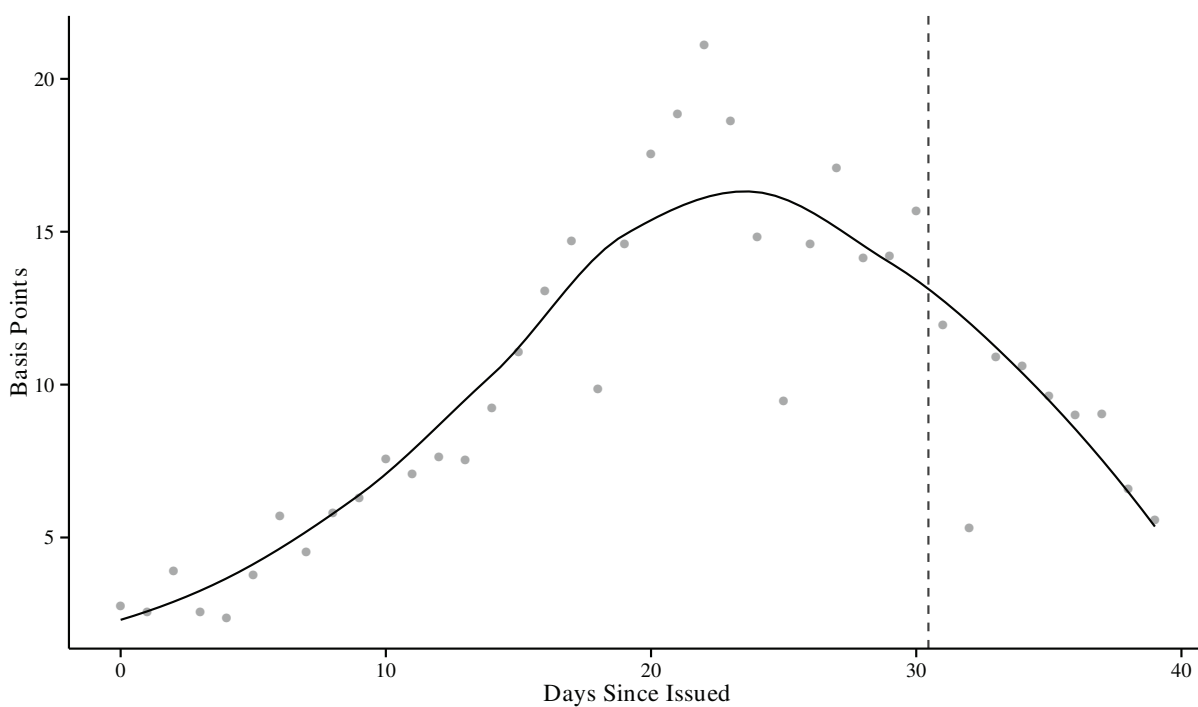
**Table 1: Clustered  $t$ -statistics; One-Day Changes in SC Repo Rate**

Table 1 reports estimation results of our baseline specification obtained for three types of standard errors. The first column shows estimates obtained using the heteroskedasticity-consistent standard errors. The second and third columns show the results from specifications where we allow for clustering within 1- and 3-year maturity buckets for each security.  $t$ -statistics in parentheses. Repo rates are measured in basis points. Percents bought and sold are measured as a percentage of privately held amount outstanding. Repo volume spread is our proxy for short positions and is standardized and measured in standard deviations. Bid-ask spreads are measured in cents. Bids left uncovered at the SLP is measured as a percentage of privately held amount outstanding. Maturity is measured in years.  $\Delta$ -variables are one-day changes in values. We also control for time and auction-cycle dummies, maturity, and maturity squared, which are not shown for brevity. \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% levels, respectively.

Variable	Robust 1	1-yr Cluster 2	3-yr Cluster 3
PERCENT_BOUGHT_OFF-THE-RUN	-0.0846*** (-6.54)	-0.0846*** (-6.47)	-0.0846*** (-6.10)
PERCENT_SOLD_OFF-THE-RUN	0.0492*** (3.93)	0.0492*** (3.71)	0.0492*** (3.69)
PERCENT_BOUGHT_ON-THE-RUN	-0.224*** (-4.43)	-0.224*** (-4.42)	-0.224*** (-4.41)
PERCENT_SOLD_ON-THE-RUN	0.0342 (0.08)	0.0342 (0.08)	0.0342 (0.08)
REP_VOLUME_SPREAD	-0.0279* (-1.71)	-0.0279* (-1.72)	-0.0279* (-1.70)
LAGGED_ΔBID-ASK_SPREAD	0.00433 (0.69)	0.00433 (0.67)	0.00433 (0.64)
SLP_UNCOVERED_BIDS_ON-THE-RUN	-0.0218 (-0.62)	-0.0218 (-0.62)	-0.0218 (-0.62)
SLP_UNCOVERED_BIDS_OFF-THE-RUN	-0.00429 (-1.35)	-0.00429 (-1.33)	-0.00429 (-1.34)
LAGGED_REPO_SPREAD	0.0422*** (3.25)	0.0422*** (3.23)	0.0422*** (3.08)
$N$	85,257	85,257	85,257
$R^2$	0.745	0.745	0.745
Adj. $R^2$	0.743	0.743	0.743

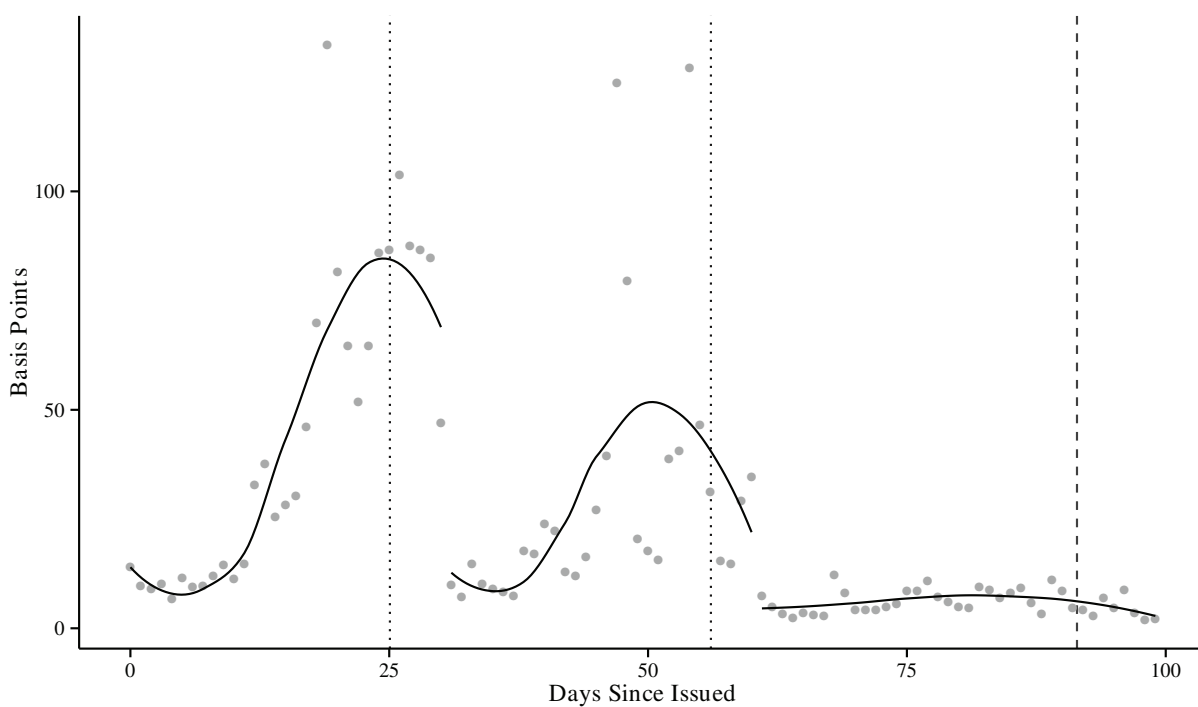
**Figure 1: Repo Specialness Spread for Treasury Securities with a 1-month Auction Cycle**

The figure plots average daily repo specialness spread for Treasury securities with 2-, 3-, 5-, and 7-year maturities. Grey dots are the average specialness spread on each day since the issue date, and the line is a fitted LOESS (locally weighted scatterplot smoother) curve. The vertical dashed line marks the average time of the auction of the next security with the same maturity.



**Figure 2: Repo Specialness Spread for Treasury Securities with a 3-month Auction Cycle**

The figure plots average daily repo specialness spread for 10-year Treasury securities. Grey dots are the average specialness spread on each day since the issue date, and the line is a fitted LOESS (locally weighted scatterplot smoother) curve. Vertical dotted lines mark the average times of reopening auctions, while the vertical dashed line denotes the average time of the auction of the next 10-year security.





**Figure 3: Overnight Money Market Rates and Characteristics of the ON RRP Facility**

The top panel shows the FFR and GCF repo rate together with the rate offered at the Fed's ON RRP facility. The bottom two panels show some of this facility's summary statistics. The shaded area denotes the U.S. government shutdown of 2013. The vertical dashed line in the top panel indicates the time of the introduction of a \$300 billion cap on the total daily operation size. The cap's size is indicated by the horizontal dashed line in the middle panel.

