

Converting LIBOR Contracts to New Benchmarks: An Auction-and-Protocol Approach

Darrell Duffie
Graduate School of Business, Stanford University

GRI and IEOR Financial Engineering Practitioners Seminar

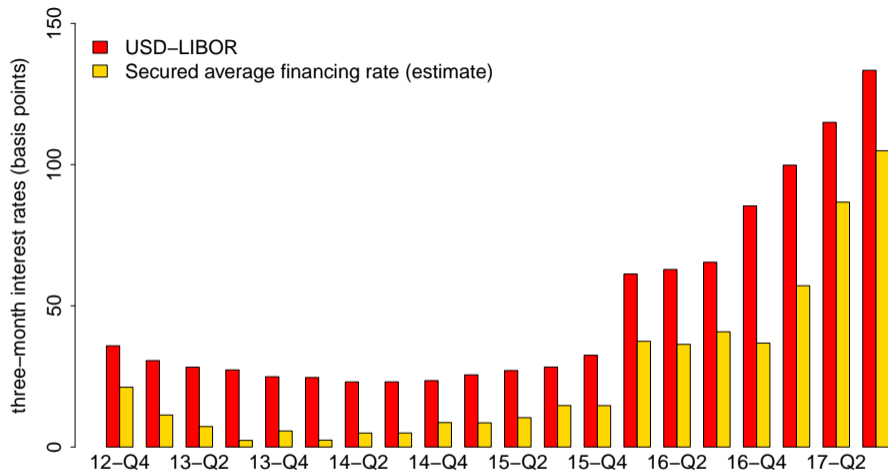
A joint event of the Global Risk Institute, Industrial Engineering and Operations Research at Columbia Business School, NYU Tandon School of Finance and Risk Engineering, NYU Courant Institute of Mathematical Sciences, Bloomberg LP, and the International Association of Quantitative Finance (IAQF)

New York, October 24, 2017

EXTREMELY PRELIMINARY: COMMENTS WELCOME

A Compelling Global Transition

- ▶ Phase 1. Choice of new reference rate benchmarks, now complete except for euros.
- ▶ Phase 2. Making the transition involves two key remaining design problems:
 - a. For new overnight reference rates like SOFR, settlement terms for floating-rate coupons at tenors beyond one day.
 - b. Conversion of legacy IBOR contracts. I propose consideration of an auction-and-protocol process.

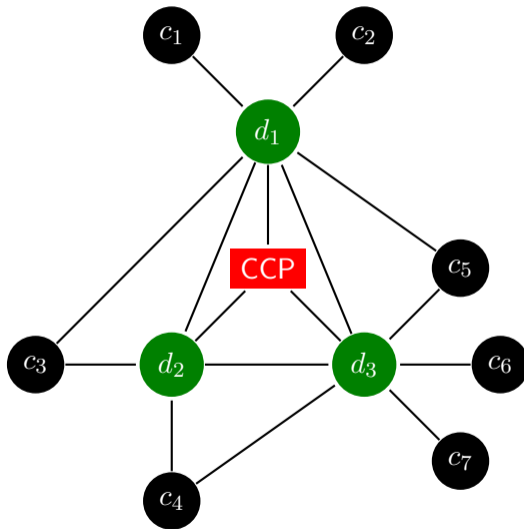


SOFR is estimated as BTFR (FRBNY), or $-2 \text{ bps} + 0.58 \text{ GCF tsy repo} + 0.42 \text{ BNYM tsy repo}$ ($R^2 = 0.99$).

Settlement of floating-rate coupons

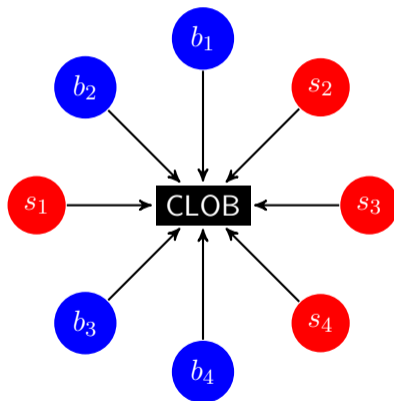
- ▶ For USD, the new benchmark will be the Secured Overnight Financing Rate (SOFR).
- ▶ For the settlement of floating-rate coupons at some tenor, say 3-months, one could in principle use the 3-month overnight index swap (OIS) rate S associated with SOFR.
- ▶ But there might not be enough depth in the 3-month OIS market to fix S robustly.
- ▶ An alternative is to compound daily SOFR during the quarter that ends with the coupon payment. This robust compounded daily rate may become known as “SAFR.”
- ▶ At the start of a quarter, the market value of receiving SAFR at the end of the quarter is equal to the market value of receiving the 3-month OIS rate S at the end of the quarter.
- ▶ I recommend converting LIBOR contracts to SAFR contracts. But the rest of this presentation does not depend on a particular new floating rate coupon settlement.

Step 1: An auction of centrally cleared derivatives

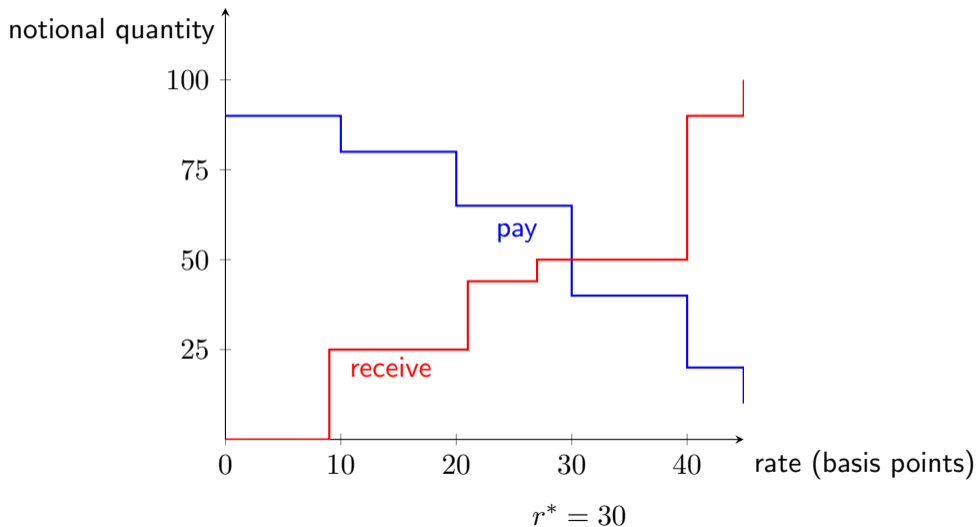


Double-auction design

Bids and offers of compensation rates for replacing LIBOR with the new floating rate



The market-clearing compensation rate



Example of basic auction terms for swaps of a given maturity

- ▶ Seller s_1 , with legacy swaps that receive LIBOR, was willing to convert up to $q = \$19$ billion notional if compensated at a rate of at least $r = 21$ bps running. She will be awarded all \$19 billion and be compensated at the auction clearing rate $r^* = 30$ bps.
- ▶ Buyer b_1 , with legacy swaps that pay LIBOR, was willing to convert up to $q = \$15$ billion notional if required to pay in compensation no more than $r = 20$ basis points running. (None of this bid was executed, because $20 \text{ bps} < r^*$.)
- ▶ An auction participant can place as many different such (q, r) limit orders as desired.
- ▶ Extremely preliminary: An auction participant is permitted to place both buy and sell orders, subject to not expanding that bidder's total absolute amount of LIBOR swaps.

Step 2: Conversion by voluntary protocol

- ▶ A swap protocol (e.g. ISDA) by which, for each maturity, those pairs of swap counterparties that sign the protocol agree in advance to convert their bilateral positions at the auction clearing rate r^* , interpolated to their maturity according to an agreed formula.
- ▶ The protocol also covers positions that are unilaterally submitted for conversion to a CCP, with pro-rata rationing on the heavy side, as in a dark pool.

Example: A total of \$1.6 trillion of payers are submitted to a given CCP for protocol conversion. A total of \$2.4 trillion of receivers are submitted to the same CCP. All \$1.6 trillion of submitted payers are converted, and $2/3$ of all submitted receivers are converted, pro rata to quantities submitted.

- ▶ A CCP could apply compression algorithms, subject to clearing-member risk tolerances, so as to maximize the total duration-weighted notional amount of swaps that is converted. (More on that later ...)

Protocol fees

- ▶ For positions that could have been converted in an auction, conversion by protocol may be subjected to a small fee.
- ▶ A protocol fee would discourage free-riding on auction price-discovery. The overall auction-and-protocol design should provide an incentive to bid actively and naturally in the auction so as to get close to an efficient-market clearing rate r^* .
- ▶ The aggregate fees paid in the protocol are awarded to winning bidders in the auction, so as to further encourage active bidding.
- ▶ Very preliminary: A fee might also discourage manipulative bidding strategies that are designed to incur a loss in the auction and make a larger gain when converting a big notional amount in the protocol.
- ▶ The design of an appropriately small fee and the method for sharing aggregate fees would require a careful analysis.

Converting other LIBOR-linked instruments by protocol

- ▶ A similar process could be used to convert LIBOR futures.
- ▶ Auction-based compensation rates could be applied in bilateral agreements to convert floating-rate notes and commercial bank loans.
- ▶ Retail loans (e.g. mortgages) could in principle be converted at the same auction-based compensation rates through unilateral action by lenders, subject to the terms of existing retail contracts, potential legislation, and regulatory checks.
- ▶ So far, there are no compelling proposals for how to convert LIBOR-based options, such as caps, floors, Eurodollar options, and swaptions.

Timing

- ▶ The conversion process could begin well before the end of 2021, but after market participants have achieved some familiarity with the new reference rate and its related derivatives.
- ▶ A regular market for long-term derivatives on the new reference rate (or basis swaps) may not be sufficiently active in time for reliance on that market to set the compensation rates to be used in conversion protocols. It would be risky to rely on a thin new-rate market to convert a large volume of legacy LIBOR derivatives.
- ▶ An auction-and-protocol process could be run several times over the next few years, in order to successively reduce the outstanding stock of legacy LIBOR derivatives.

A preliminary concept for compression-conversion auctions

- ▶ A CCP could use a cross-maturity compression algorithm to obtain significant increases in conversion volumes.
- ▶ A hypothetical example of a limit order for a buyer:

I am willing to pay a duration-weighted compensation rate of up to 24 basis points for conversion of up to \$50 billion total notional of the legacy pay-LIBOR swaps listed on my bid form (which have actual maturities between 9 and 11 years).

The post-conversion swaps may have final maturities that differ from those of the legacy swaps, subject to compensation for any change in effective portfolio duration of at least 2.5 basis points per year per unit notional converted.

The post-conversion duration of my portfolio (legacy and new) must remain within 0.25 years of the pre-conversion duration.

- ▶ One could in principle allow a bid to include specified minimum compensation for changes in convexity, with limits on changes in convexity.

Optimal compression conversion

- ▶ Swaps at the same CCP that are to be converted by protocol could be included in the compression step, subject to risk tolerances specified in protocol submissions. This further increases conversion efficiency.
- ▶ The CCP solves a convex optimization problem to choose the conversion compensation rates r_1, \dots, r_k at respective standard maturities t_1, \dots, t_k , and an allocation of LIBOR and new-rate swaps to bidders, so as to maximize the total notional volume converted, subject to (i) compatibility with respect to bids, (ii) market clearing, and (iii) budget balancing.
- ▶ The illustrated form of compression-conversion auction is speculative and incomplete. Compression experts should get involved here.

Appendix:

Supplementary content available for discussion

Table: Sample mean differences (bps) in various three-month rates (2012 Q4-2017 Q3)

	LIBOR	OIS	Compounded FF	SAFR
LIBOR	0	19.24	19.61	23.02
OIS	-19.24	0	0.37	3.77
Compounded FF	-19.61	-0.37	0	3.41
SAFR	-23.02	-3.77	-3.41	0

Notes:

SOFR is estimated as BTFR (FRBNY) when available, and otherwise by regression as $-2 \text{ bps} + 0.58 \text{ GCF treasury repo rate} + 0.42 \text{ BNYM tri-party treasury repo rate}$ ($R^2 = 0.99$).

Estimates of SAFR are obtained by compounding the estimated SOFR, daily for 3 months.

Compounded FF is the federal funds rate, compounded daily for 3 months.

Table: Sample standard deviations of differences in various three-month rates (2012 Q4-2017 Q3)

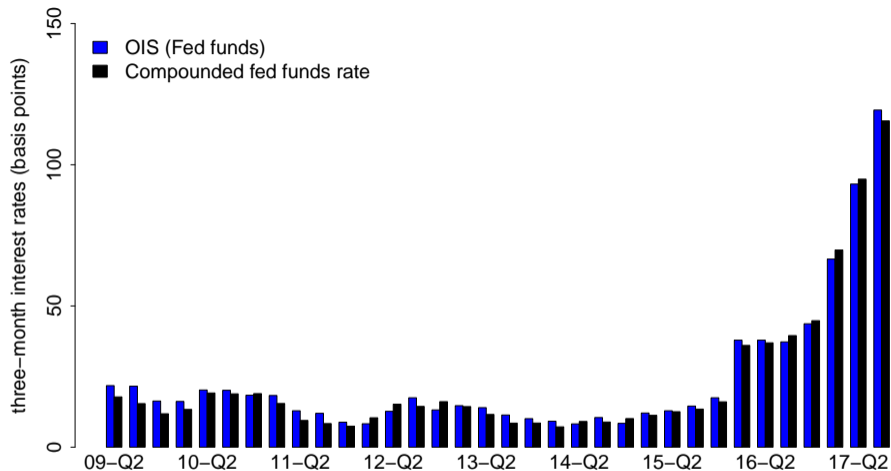
	LIBOR	OIS	Compounded FF	SAFR
LIBOR	0	7.75	6.83	8.96
OIS	7.75	0	1.99	4.89
Compounded FF	6.83	1.99	0	4.29
SAFR	8.96	4.89	4.29	0

Notes:

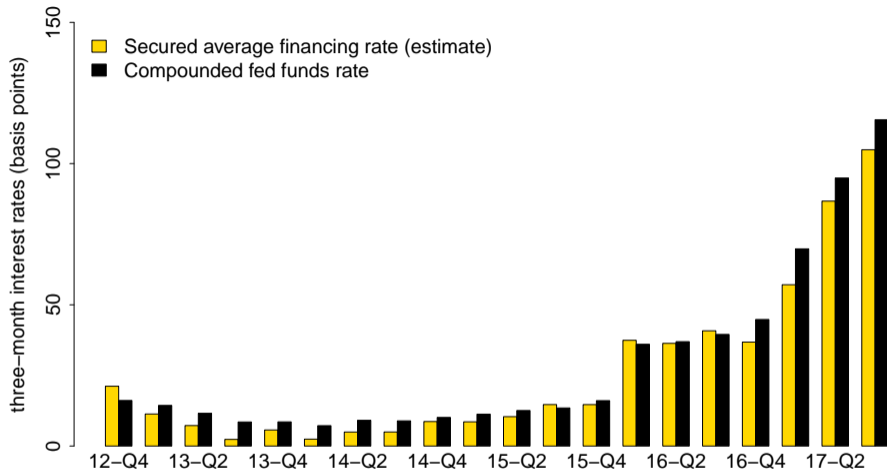
SOFR is estimated as BTFR (FRBNY) when available, and otherwise by regression as $-2 \text{ bps} + 0.58 \text{ GCF treasury repo rate} + 0.42 \text{ BNYM tri-party treasury repo rate}$ ($R^2 = 0.99$).

Estimates of SAFR are obtained by compounding the estimated SOFR, daily for 3 months.

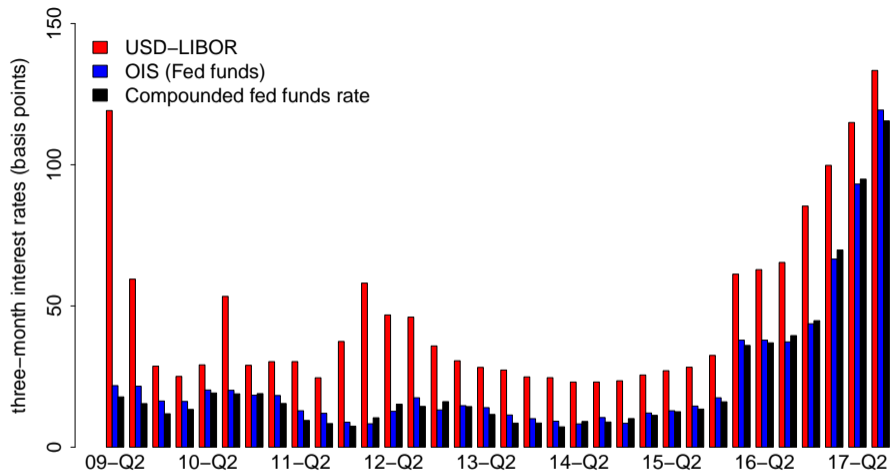
Compounded FF is the federal funds rate, compounded daily for 3 months.



Data: Bloomberg



SOFR is estimated as BTFR (FRBNY), or $-2 \text{ bps} + 0.58 \text{ GCF tsy repo} + 0.42 \text{ BNYM tsy repo}$ ($R^2 = 0.99$).



Data: Bloomberg

Warning in a KraftHeinz Floating Rate Note Prospectus

KHC Float 08/10/22 Corp.

“... on July 27, 2017, the U.K. Financial Conduct Authority announced that it intends to stop persuading or compelling banks to submit LIBOR rates after 2021. Furthermore, in the United States, efforts to identify a set of alternative U.S. dollar reference interest rates include proposals by the Alternative Reference Rates Committee of the Federal Reserve Board and the Federal Reserve Bank of New York. At this time, it is not possible to predict the effect of any such changes, any establishment of alternative reference rates or any other reforms to LIBOR that may be enacted in the United Kingdom, in the United States or elsewhere.

Uncertainty as to the nature of such potential changes, alternative reference rates or other reforms may adversely affect the trading market for LIBOR-based securities, including the Notes. Reform of, or the replacement or disappearance of, LIBOR and proposed regulation of LIBOR and other benchmarks may adversely affect the value of and return on the Notes.”