UCL Financial Mathematics Practitioners Seminar

Game of Benchmarks: LIBOR and IRON thrones

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Questions!

In mathematics, the art of posing a question is more important than the art of solving one.

Georg Cantor, 1867

Game of Benchmarks

Margins

Why benchmarks

To save time!

Reference interest rate set by the market and used to establish the rate on loans, bonds, or derivatives.

Interest rate benchmarks: based on term rates or overnight rates.

LIBOR

London InterBank Offered Rate.

> *At what rate could you borrow funds, were you to do so by asking for and then accepting interbank offers in a reasonable market size just prior to 11 am London time?*

Created on 1 January 1986.

Published for GBP, USD, CHF and JPY; EURIBOR for EUR.

Term rate: typically 3 and 6 months

LIBOR

BIS statistics: IR derivatives notional outstanding:
USD 415,000,000,000,000
Cleared at LCH SwapClear in 2017: USD 760 trillions.
S&P 500 market capitalisation: USD 23 trillions.

THE WALL STREET JOURNAL.

Libor: A Eulogy for the World's Most Important Number

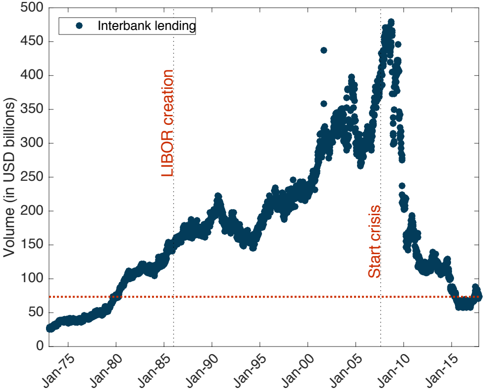
The benchmark for loans world-wide became an unworkable symbol of a more anarchic era

LIBOR - panels

BANK/CCY	USD	GBP	EUR	CHF	JPY
Lloyds Bank plc	○	○	○	○	○
Bank of Tokyo-Mitsubishi UFJ Ltd	○	○	○	○	○
Barclays Bank plc	○	○	○	○	○
Mizuho Bank, Ltd.		○	○		○
Citibank N.A. (London Branch)	○	○	○	○	
Cooperatieve Rabobank U.A.	○	○	○		
Credit Suisse AG (London Branch)	○		○	○	
Royal Bank of Canada	○	○	○		
HSBC Bank plc	○	○	○	○	○
Santander UK Plc		○	○		
Bank of America N.A. (London Branch)	○				
BNP Paribas SA, London Branch		○			
Crédit Agricole Corporate & Investment Bank	○	○			○
Deutsche Bank AG (London Branch)	○	○	○	○	○
JPMorgan Chase Bank, N.A. London Branch	○	○	○	○	○
Société Générale (London Branch)	○	○	○	○	○
Sumitomo Mitsui Banking Corporation Europe Limited	○				○
The Norinchukin Bank	○				○
The Royal Bank of Scotland plc	○	○	○	○	○
UBS AG	○	○	○	○	○

LIBOR – decrease of importance

Unsecured lending has decreased a lot since the crisis.



Source: US Federal Reserve – All Commercial Banks in the United States – Interbank loans

LIBOR – decrease of importance

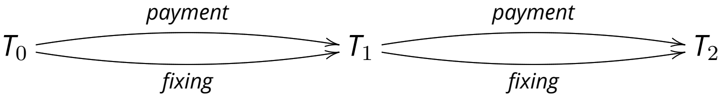
Regulators have put the future of LIBOR existence in doubt: speech by Andrew Bailey (FCA) in July 2017 titled "The future of LIBOR".

Panel bank support to sustain LIBOR until end-2021.

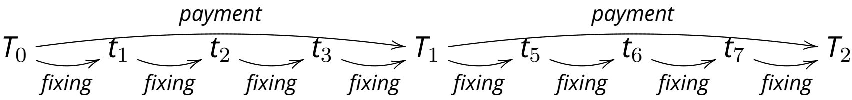
Alternatives: USD, CHF, GBP

IR Derivatives: main types

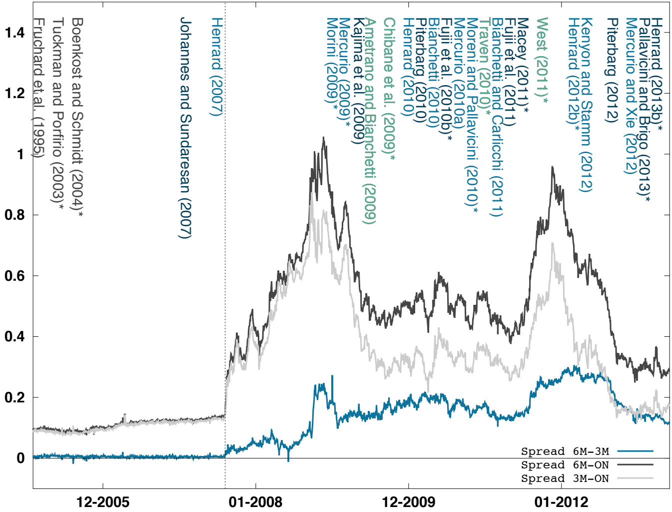
IRS Exchange on a regular schedule a fixed rate against the LIBOR rate on its natural period, typically 3 months or 6 months.



OIS Exchange on a regular schedule a fixed rate against the ON rate compounded over a term, typically 6 months or 1 year.



IR Derivatives: spreads – multi-curve



Margins

New benchmarks

LIBOR rates are based on unsecured lending. The importance of unsecured lending has decreased significantly. Some new benchmarks are based on secured lending, treasury repo in particular.

LIBOR rates are based on term lending, with the most popular being 3-month and 6-month. More inter-bank lending is now done on an overnight basis. The new benchmarks pushed by regulator are often overnight based (SONIA, SOFR, SARON).

New benchmarks: users

What are the requirements from the end-users?
ALM financials: borrowing (savings) v lending (mortgages).
Pension funds: long term investments v liabilities (inflation?)
Corporate: borrowing
Term to overnight: time consuming! Original reason for benchmark is to save time.

Proposals for new benchmarks have been done in several currencies, but there are still major questions. Already answers, still looking at posing right the questions!

Fallback

Even if LIBOR is not published anymore, transactions referencing it will still exists. Those transactions can be very long term (up to 50 years).

What will happen to those transaction? Fallback clause exists in contract but are not designed for long term discontinuation of a benchmark.

Fall-back proposal from ISDA is to replace LIBOR by a term OIS rate plus a deterministic term spread to be computed on discontinuation. The details of this deterministic spread need to be worked out. Even ignoring manipulation potential, simply computing the (forward) spreads already requires modelling.

Game – Spot the mistakes

LIBOR – EURIBOR – SONIA – EONIA – POLONIA – SONET – RIR – SOFR – IDIOT – TONAR – SONAR – SMART – PAIRS – PRISMA – TRIPLET – PIBOR – TARGET – SARON – ARRC – MARC – BBSW – RFR – TIBOR – FSB – BCBS – SAURON – MUTAN – CDOR – MIFOR – WIBOR – IRON – JIBAR – HICP – NZIONA – HONIX – POLONIUM – CORRA – EFFR – AONIA – BBA – ICE – FIRE – RONIA – TOIS – SIOR – WMBA – ECB – IOSCO – EMIR –

Game – Spot the mistakes

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Margins

Pricing with multi-curve and collateral

2007 - Multi-curve framework
Description of existing curves. Interpolation mechanism are far from trivial (see spread for fallback).
Design a good mathematical model with realistic dynamic: curve shape, spreads, curves order, etc.
Impact of the change fallback clause on the existing trades?
How to extract the fondamental components?

2010 - Collateral framework – VM mandated by EMIR regulation since March 2017.
Value of the trade is paid in collateral. Interest is paid on the collateral at a benchmark rate. Theoretical impact of those payment are relatively well understood.
How to change benchmark in practice? What are the best procedure to decrease the impact on the market?

Replacement of LIBOR

USD 415 trillions question!

How to design a good benchmark; pricing should be clear in theory and easy in practice.

What is a good fall-back procedure? From financial mathematics to lawmaking, instead of the inverse.

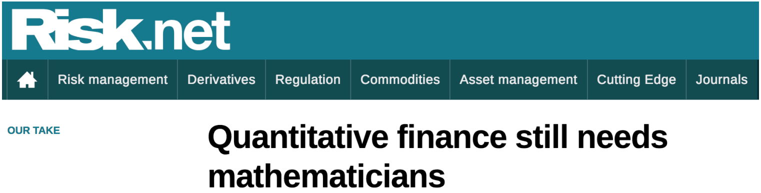
Long-term IRS based on short term OIS or long-term OIS. Same valuation formula at the start, very different pay-off process.

Conclusion

Crisis induced changes in the market and require a review of the existing benchmarks.

Regulatory induced changes in the market infrastructure have increase the importance of IR benchmarks.

Mathematical finance models have to be adapted. There is still a lot of opportunities for research and development.



Margins

Regulation

FCA The future of LIBOR: `https://www.fca.org.uk/news/speeches/the-future-of-libor`

EMIR European Market Infrastructure Regulation – Regulation (EU) No 648/2012 of the European Parliament and of the Council of 4 July 2012 on OTC derivatives, central counterparties and trade repositories.

FSB Reforming Major Interest RateBenchmarks

Magazine and blogs

Multi-curve blog	Game of benchmarks
Mathematicians	Quantitative finance still needs mathematicians
Fallback	The fraught search for a Libor fallback
Libor transition	Pimco calls for urgency on Libor transition
Repo	Libor's sunset sees US repo market cast a longer shadow

Website

Libor `https://www.theice.com/iba/libor`

Libor-Wikipedia `https://en.wikipedia.org/wiki/Libor`

Thank you!

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