

SOFR STUDY TO ASSESS OBSERVATION PERIOD SHIFT MTM IMPACT

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Abstract

- The purpose of the work is to study the different compounding conventions that have been used in the USD SOFR market, including lookback and backward period shifts. Compounding/averaging determines whether the SOFR daily unpaid interest rates are compounded. Lookback and backward period shift both shift the effective SOFR interest rate period by a predetermined number of days. But backward period shift also shifts the rate weights according to the new observation period.
- We explore the variations of SOFR conventions by creating a few sample trades and analyzing the MTM impact between each scenario. The variations of SOFR convention essentially impacts the periodic rates and the daily weighting to the rates across the days that are observed.
- We then further explore in the second part is the impact on realized cashflows is larger than the forward projected cashflows. You could argue that projected forward rates are smoother due to algorithms that smooth the forward rates and that realized cashflows would have a larger impact as the variation of the daily one-day forward rate would be less smooth.
- We observe that both for realized as well as projected cashflows the difference in value and DV01 is very small and less than $\frac{1}{4}$ bp.
- The study is only done on a single as of date so it's possible that 'special' date constellations have larger impacts.

Agenda

Part I - Observation period shift MTM Impact

- Introduction
- Results

Part II - MTM Impact taking consideration projected vs actual realized flows

- Introduction
- Results
- Appendix with All Cashflows in Excel

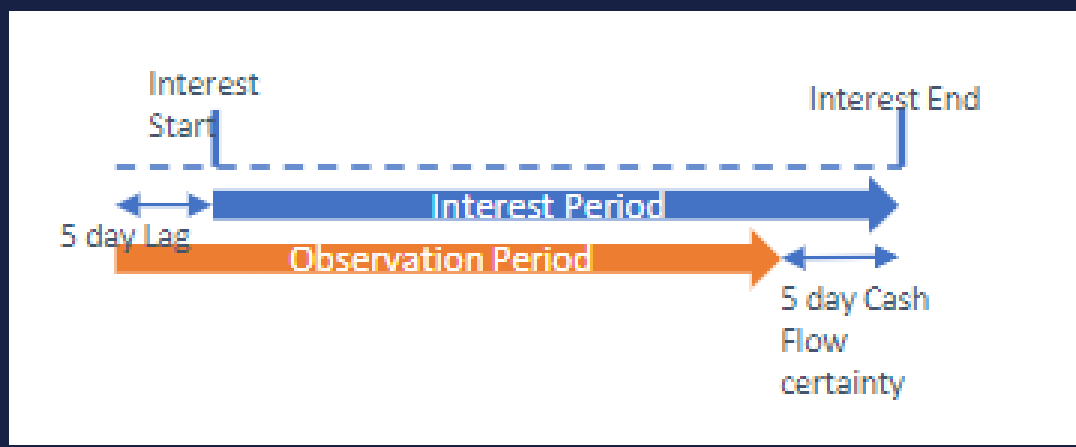
PART I - OBSERVATION PERIOD SHIFT MTM IMPACT

Part I - Introduction

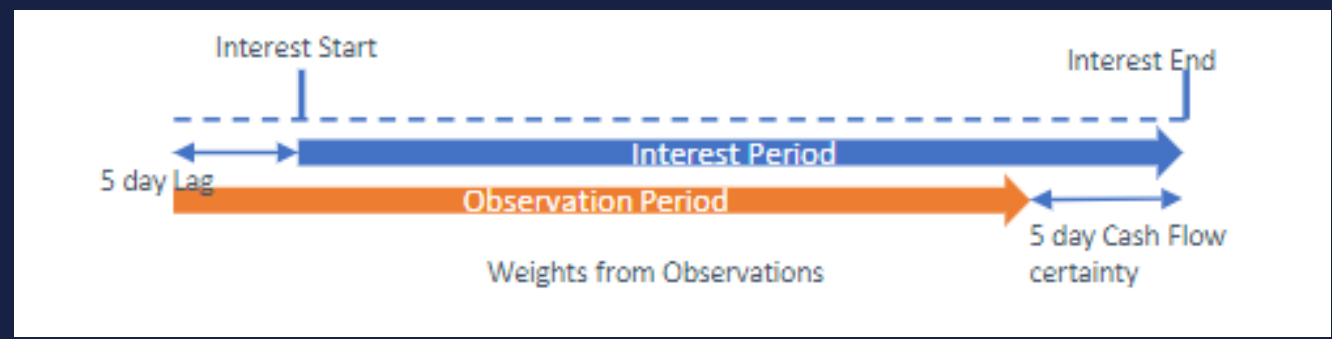
- This POC aims to study the different compounding conventions that have been used in the USD SOFR market, including lookback and backward period shifts. Compounding/averaging determines whether the SOFR daily unpaid interest rates are compounded. Lookback and backward period shift both shift the effective SOFR interest rate period by a predetermined number of days. But backward period shift also shifts the rate weights according to the new observation period.
- We explore the variations of SOFR conventions by creating a few sample trades and analyzing the MTM impact between each scenario. The variations of SOFR convention essentially impacts the periodic rates and the daily weighting to the rates across the days that are observed.
- These features were calculated by Finastra's Summit application, where all the following screenshots are taken. The actual exercise was performed in Finastra's GSC demo system where the actual trades can be seen, studied and demoed.
- Valuations are done as of 8/1/2019 to take into account September spike of the rate. We did not explore in detail if the spike has a specific impact or not or defined the dates in a specific way to give higher weight to the spike.

LOOKBACK VS BACKWARD period shift

- Lookback (Lag)



- Backward Period Shift (Observation period shift)



Summary

All deals are Fixed vs 1DSOFR with different conventions
Notional 100M, Maturity 10Y

	Base Case	Variation 1	Variation 2	Variation 3	Variation 4	Variation 5
Trade ID	23203S	23204S	23205S	23206S	23218S	23219S
Payment Freq	Annual	Monthly	Monthly	Monthly	Monthly	Monthly
Compounding	Compounded	Compounded	Compounded	Average	Compounded	Average
Lookback	-	-	-2D	-2D	-2D	-2D
Backward Period Shift	-	-	-	-	-2D	-2D
Fixed Rate	1.5534	1.5534	1.5534	1.5534	1.5534	1.5534
DV01	90,889.91	90,294.20	90,294.20	90,294.20	90,294.20	90,294.20
MTM	0	-101,730.67	-95,671.45	-104,692.39	-98,885.06	-107,887.56

Base scenario: Vanilla SOFR SWAP

- Price a vanilla SOFR swap as the base case scenario
 - Simple vanilla SOFR swap with OIS discounting
 - Swap rate = 1.5534

Compounded non-lookback by default

Average

Type **O** Freq **D** Anniversary day NonBus Rate Conv Convert time

Lookback Gap **0D** Rule **MF** Cut off days **1** Cut off B/C **B** Cut off mthd **CARRY**

ID: 23203S Version: 1 State: Done 8/1/2019 SOFRQIS

Trade Diary: NO Pay: Disc OIS Receive: AVG Disc OIS FEDSOFR TradeCleared: NO...

Trade

Start 8/3/2019 End 8/3/2029

Pay **Pay** Receive **Receive**

Ccy USD Ntl 100,000,000.00 Ccy USD Ntl 100,000,000.00

Index FIXED Ntl exp Index SOFR Ntl exp

Term Rate **1.5534** Term 1D Rate

Basis A360 Spread Basis A360 Spread

Counterparty CITIBANK Broker

Product / Formula

[Product description] [Product description]

Company / Desk / Book / Folder

SUMMIT LONDON DEMO

Portfolio

Clearing house / Clearing member / Broker

More...

Schedule

	Freq	Day	Roll date	Cal		Freq	Day	Roll date	Cal
Pay	A	3	MF	NY	Pay	A	3	MF	NY
Reset					Reset	A	3	MF	NY

Valuation

Pay	-14,395,545.25	USD	Net	0.03	USD	Receive	14,395,545.28	USD
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Execution Facilities

Emerging markets

Base scenario: cash flow

Start	End	Fixing	IDays	Σ	Rate	Σ	Forward	Σ
8/3/2019	8/3/2020	7/31/2020		366	1.7715		1.7715	
8/3/2020	8/3/2021	8/2/2021		365	1.31701		1.31701	
8/3/2021	8/3/2022	8/2/2022		365	1.28255		1.28255	
8/3/2022	8/3/2023	8/2/2023		365	1.37126		1.37126	
8/3/2023	8/3/2024	8/2/2024		366	1.40727		1.40727	
8/3/2024	8/3/2025	8/1/2025		365	1.51982		1.51982	
8/3/2025	8/3/2026	7/31/2026		365	1.55051		1.55051	
8/3/2026	8/3/2027	8/2/2027		365	1.72811		1.72811	
8/3/2027	8/3/2028	8/2/2028		366	1.78796		1.78796	
8/3/2028	8/3/2029	8/2/2029		365	1.87149		1.87149	

Bloomberg reconciliation

- Book the same trade in Bloomberg
- Swap rate = 1.5543

91) Actions		92) Products		93) Views		94) Info		95) Settings		Swap Manager	
Solver (Coupon)			Load			Save			Trade		
3) Main		4) Details		5) Curves		6) Cashflow		7) Resets		12) Matrix	
Deal		Fixed vs SOFR		Counterparty		SWAP CNTRPARTY		+ Ticker / SWAP		20) Properties	
Swap		Leg 1:Fixed		Leg 2:Float		Arrears		Valuation Settings			
Notional		100M		Notional		100M		Curve Date		08/01/2019	
Currency		USD		Currency		USD		Valuation		08/01/2019	
Effective		2D 08/03/2019		Effective		2D 08/03/2019		CSA Coll Ccy		N/A	
Maturity		10Y 08/03/2029		Maturity		10Y 08/03/2029		OIS DC Stripping			
Coupon		1.554321		Index		1D SOFRRATE					
Pay Freq		Annual		Spread		0.000 bp					
Day Count		ACT/360		Leverage		1.00000					
Calc Basis		Money Mkt		Latest Index		2.19000					
Market		↻		Reset Freq		Daily					
Leg 1: NPV		-2,271.84		Leg 2: NPV		2,271.84					
Accrued		0.00		Accrued		0.00					
Premium		-2.27		Premium		2.27					
DV01		93.16		DV01		-0.87					
Valuation Results						22) Calculators					
Par Cpn		1.554321		Premium		0.00000		PV01		92.28	
Principal		0.00		BP Value		0.00000		DV01		92.29	
Accrued		0.00		Gamma (1bp)		0.10					
NPV		0.00									

Variation 1: MONTHLY PAYMENTS

Set pay and receive frequency from Annual to Monthly

Compounded non-lookback unchanged

Average
 Type **D** Freq **D** Anniversary day NonBus Rate Conv Convert time
 Lookback Gap **0D** Rule **MF** Cut off days Cut off B/C **B** Cut off mthd **CARRY**

Base Case MTM	Variation 1 MTM
0	-101,730.67

ID: 23204S Version: 1 State: Done 8/1/2019 SOFRQIS

Trade Diary: NO Pay: Disc OIS Receive: AVG Disc OIS FEDSOFR TradeCleared: NO...

Trade
 Start 8/3/2019 End 8/3/2029

Pay Receive

Ccy USD Ntl 100,000,000.00 Ccy USD Ntl 100,000,000.00
 Index FIXED Ntl exp Index SOFR Ntl exp
 Term Rate 1.5534 Term 1D Rate
 Basis A360 Spread Basis A360 Spread
 Counterparty CITIBANK Broker

Product / Formula
 [Product description]

Company / Desk / Book / Folder
 SUMMIT LONDON DEMO

Portfolio
 Clearing house / Clearing member / Broker
 More...

Schedule

	Pay	Reset	Freq	Day	Roll date	Cal
	Pay	Reset	M	3	MF	NY
	Pay	Reset	M	3	MF	NY

Valuation
 Pay -14,516,166.85 USD Net -101,730.67 USD Receive 14,414,436.18 USD

Execution Facilities
 Emerging markets

Variation 1: cash flow

Start	End	Fixing	IDays	Σ	Rate	Σ	Forward	Σ
8/3/2019	9/3/2019	9/2/2019		31	2.192		2.192	
9/3/2019	10/3/2019	10/2/2019		30	2.12423		2.12423	
10/3/2019	11/3/2019	11/1/2019		31	1.98137		1.98137	
11/3/2019	12/3/2019	12/2/2019		30	1.8659		1.8659	
12/3/2019	1/3/2020	1/2/2020		31	1.802		1.802	
1/3/2020	2/3/2020	1/31/2020		31	1.75011		1.75011	
2/3/2020	3/3/2020	3/2/2020		29	1.67084		1.67084	
3/3/2020	4/3/2020	4/2/2020		31	1.62646		1.62646	
4/3/2020	5/3/2020	5/1/2020		30	1.58261		1.58261	

Variation 2: Compounded & 2d lookback/LAG

Compounded + 2D lookback

Average

Type **O** Freq **D** Anniversary day NonBus Rate Conv **Y** Convert time

Lookback **LAG** Gap **-2D** Rule **MF** Cut off days **1** Cut off B/C **B** Cut off mthd **CARRY**

ID: 23205S Version: 3 State: Pending Save 8/1/2019 SOFRQIS

Trade Diary: NO Pay: Disc OIS Receive: AVG Disc OIS FEDSOFR TradeCleared: NO...

Trade

Start 8/3/2019 End 8/3/2029

Pay

Ccy USD Ntl 100,000,000.00 Index FIXED Ntl exp Rate 7.5534

Receive

Ccy USD Ntl 100,000,000.00 Index SOFR Ntl exp Rate

Term Basis A360 Spread Counterparty CITIBANK Broker

Product / Formula

Company / Desk / Book / Folder

SUMMIT LONDON DEMO

Portfolio

Clearing house / Clearing member / Broker

More...

Schedule

	Freq	Day	Roll date	Cal
Pay	M	3	MF	NY
Reset	M	3	MF	NY

Valuation

Pay	-14,516,166.85	USD	Net	-95,671.45	USD	Receive	14,420,495.39	USD
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Execution Facilities

Emerging markets

Variation 1 MTM	Variation 2 MTM	MTM diff in % of ntl
-101,730.67	-95,671.45	0.006%

Variation 2: cash flow

Start	End	Fixing	IDays	Σ	Rate	Σ	Forward	Σ	AllInRate	Σ	Notional	Σ	Date	Flows	Σ
8/3/2019	9/3/2019	9/2/2019	31		2.21523		2.21523		2.21523		100,000,000.00		9/5/2019		190,755.71
9/3/2019	10/3/2019	10/2/2019	30		2.13558		2.13558		2.13558		100,000,000.00		10/7/2019		177,964.76
10/3/2019	11/3/2019	11/1/2019	31		1.9921		1.9921		1.9921		100,000,000.00		11/6/2019		171,541.98
11/3/2019	12/3/2019	12/2/2019	30		1.87687		1.87687		1.87687		100,000,000.00		12/5/2019		156,405.70
12/3/2019	1/3/2020	1/2/2020	31		1.80646		1.80646		1.80646		100,000,000.00		1/7/2020		155,556.63
1/3/2020	2/3/2020	1/31/2020	31		1.75779		1.75779		1.75779		100,000,000.00		2/5/2020		151,365.46
2/3/2020	3/3/2020	3/2/2020	29		1.67846		1.67846		1.67846		100,000,000.00		3/5/2020		135,209.52
3/3/2020	4/3/2020	4/2/2020	31		1.62956		1.62956		1.62956		100,000,000.00		4/7/2020		140,322.86
4/3/2020	5/3/2020	5/1/2020	30		1.58876		1.58876		1.58876		100,000,000.00		5/6/2020		132,396.74

Variation 3: non-Compounded & 2d lookback

Non-Compounded + 2D lookback

Average

Type **W** Freq **D** Anniversary day NonBus Rate Conv **Y** Convert time

Lookback **LAG** Gap **-2D** Rule **MF** Cut off days **1** Cut off B/C **B** Cut off mthd **CARRY**

ID: 23206S Version: 3 State: Pending Save 8/1/2019 SOFRQIS

Trade Diary: NO Pay: Disc OIS Receive: AVG Disc OIS FEDSOFR TradeCleared: NO...

Trade

Start 8/3/2019 End 8/3/2029

Pay **Pay** Receive

Ccy USD Ntl 100,000,000.00 Ccy USD Ntl 100,000,000.00

Index FIXED Ntl exp Index SOFR Ntl exp

Term Rate 7.5534 Term 1D Rate

Basis A360 Spread Basis A360 Spread

Counterparty CITIBANK Broker

Product / Formula

Company / Desk / Book / Folder

SUMMIT LONDON DEMO

Portfolio

Clearing house / Clearing member / Broker

More...

Schedule

	Freq	Day	Roll date	Cal	Freq	Day	Roll date	Cal	
Pay	M	3	MF	NY	Pay	M	3	MF	NY
Reset	M	3	MF	NY	Reset	M	3	MF	NY

Valuation

Pay	-14,516,166.85	USD	Net	-104,692.39	USD	Receive	14,411,474.46	USD
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Execution Facilities

Emerging markets

Variation 1 MTM	Variation 2 MTM	Variation 3 MTM
-101,730.67	-95,671.45	-104,692.39

Variation 3: cash flow

Start	End	Fixing	IDays	Σ	Rate	Σ	Forward	Σ	AllInRate	Σ	Notional	Σ	Date	Flows	Σ
8/3/2019	9/3/2019	9/2/2019	31		2.21324		2.21324		2.21324		100,000,000.00		9/5/2019		190,584.81
9/3/2019	10/3/2019	10/2/2019	30		2.13379		2.13379		2.13379		100,000,000.00		10/7/2019		177,816.09
10/3/2019	11/3/2019	11/1/2019	31		1.9905		1.9905		1.9905		100,000,000.00		11/6/2019		171,403.75
11/3/2019	12/3/2019	12/2/2019	30		1.87549		1.87549		1.87549		100,000,000.00		12/5/2019		156,290.81
12/3/2019	1/3/2020	1/2/2020	31		1.80515		1.80515		1.80515		100,000,000.00		1/7/2020		155,443.18
1/3/2020	2/3/2020	1/31/2020	31		1.75655		1.75655		1.75655		100,000,000.00		2/5/2020		151,258.28
2/3/2020	3/3/2020	3/2/2020	29		1.6774		1.6774		1.6774		100,000,000.00		3/5/2020		135,123.94
3/3/2020	4/3/2020	4/2/2020	31		1.62848		1.62848		1.62848		100,000,000.00		4/7/2020		140,230.13
4/3/2020	5/3/2020	5/1/2020	30		1.58778		1.58778		1.58778		100,000,000.00		5/6/2020		132,314.63

Lookback vs non-lookback

Non-lookback

Avg Details - [23204S] : STANDARD

Window Help
App Config

ResetDate	Quot Rate Σ	Eqv Rate Σ	Spread Σ	Rate Σ	Days Σ
8/3/2019	2.19013	2.19013		2.19013	2
8/5/2019	2.19	2.19		2.19	1
8/6/2019	2.19	2.19		2.19	1
8/7/2019	2.19	2.19		2.19	1
8/8/2019	2.19	2.19		2.19	1
8/9/2019	2.19013	2.19013		2.19013	3
8/12/2019	2.19	2.19		2.19	1
8/13/2019	2.19	2.19		2.19	1
8/14/2019	2.19	2.19		2.19	1
8/15/2019	2.19	2.19		2.19	1
8/16/2019	2.19013	2.19013		2.19013	3
8/19/2019	2.19	2.19		2.19	1
8/20/2019	2.19	2.19		2.19	1
8/21/2019	2.19	2.19		2.19	1
8/22/2019	2.19	2.19		2.19	1
8/23/2019	2.19013	2.19013		2.19013	3
8/26/2019	2.19	2.19		2.19	1

Lookback

Avg Details - [23205S] : STANDARD

Window Help
App Config

ResetDate	Gapped Date	Quot Rate Σ	Eqv Rate Σ	Spread Σ	Rate Σ	Days Σ
8/3/2019	8/1/2019	2.55	2.55		2.55	2
8/5/2019	8/1/2019	2.19	2.19		2.19	1
8/6/2019	8/2/2019	2.19013	2.19013		2.19013	1
8/7/2019	8/5/2019	2.19	2.19		2.19	1
8/8/2019	8/6/2019	2.19	2.19		2.19	1
8/9/2019	8/7/2019	2.19	2.19		2.19	3
8/12/2019	8/8/2019	2.19	2.19		2.19	1
8/13/2019	8/9/2019	2.19013	2.19013		2.19013	1
8/14/2019	8/12/2019	2.19	2.19		2.19	1
8/15/2019	8/13/2019	2.19	2.19		2.19	1
8/16/2019	8/14/2019	2.19	2.19		2.19	3
8/19/2019	8/15/2019	2.19	2.19		2.19	1
8/20/2019	8/16/2019	2.19013	2.19013		2.19013	1
8/21/2019	8/19/2019	2.19	2.19		2.19	1
8/22/2019	8/20/2019	2.19	2.19		2.19	1
8/23/2019	8/21/2019	2.19	2.19		2.19	3
8/26/2019	8/22/2019	2.19	2.19		2.19	1
8/27/2019	8/23/2019	2.19013	2.19013		2.19013	1

Variation 4: Compounded & 2d backward period shift

Compounded + 2D Backward period shift

Average
 Type **O** Freq **D** Anniversary day NonBus Rate Conv **Y** Convert time
 Lookback **OBSPERS** Gap **-2D** Rule **MF** Cut off days Cut off B/C **B** Cut off mthd **CARRY**

ID: 23218S Version: 1 State: Done 8/1/2019 SOFRQIS

Trade Diary: NO Pay: Disc OIS Receive: AVG Disc OIS FEDSOFR TradeCleared: NO...

Trade
 Start 8/3/2019 End 8/3/2029
 Pay Receive
 Ccy USD Ntl 100,000,000.00 Ccy USD Ntl 100,000,000.00
 Index FIXED Ntl exp Index SOFR Ntl exp
 Term Rate 1.5534 Term 1D Rate
 Basis A360 Spread Basis A360 Spread
 Counterparty CITIBANK Broker

Product / Formula
 Company / Desk / Book / Folder
 SUMMIT LONDON DEMO

Portfolio
 Clearing house / Clearing member / Broker
 More...

Schedule

	Freq	Day	Roll date	Cal		Freq	Day	Roll date	Cal
Pay	M	3	MF	NY	Pay	M	3	MF	NY
Reset					Reset	M	3	MF	NY

Valuation
 Pay -14,516,166.85 USD Net -98,885.06 USD Receive 14,417,281.78 USD

Execution Facilities
 Emerging markets

Variation 1 MTM	Variation 4 MTM	MTM diff in % of ntl
-101,730.67	-98,885.06	0.0028%

Variation 4: cash flow

Start	End	Fixing	IDays	Σ	Rate	Σ	Forward	Σ
8/3/2019	9/3/2019	9/2/2019	31		2.19187		2.19187	
9/3/2019	10/3/2019	10/2/2019	30		2.13783		2.13783	
10/3/2019	11/3/2019	11/1/2019	31		1.99092		1.99092	
11/3/2019	12/3/2019	12/2/2019	30		1.87899		1.87899	
12/3/2019	1/3/2020	1/2/2020	31		1.80452		1.80452	
1/3/2020	2/3/2020	1/31/2020	31		1.75931		1.75931	
2/3/2020	3/3/2020	3/2/2020	29		1.6814		1.6814	
3/3/2020	4/3/2020	4/2/2020	31		1.62849		1.62849	
4/3/2020	5/3/2020	5/1/2020	30		1.58803		1.58803	

AllInRate	Σ	Notional	Σ	Date	Flows	Σ
2.19187		100,000,000.00		9/5/2019	188,744.03	
2.13783		100,000,000.00		10/7/2019	178,152.62	
1.99092		100,000,000.00		11/6/2019	171,439.94	
1.87899		100,000,000.00		12/5/2019	156,582.82	
1.80452		100,000,000.00		1/7/2020	155,388.97	
1.75931		100,000,000.00		2/5/2020	151,496.01	
1.6814		100,000,000.00		3/5/2020	135,445.87	
1.62849		100,000,000.00		4/7/2020	140,231.01	
1.58803		100,000,000.00		5/6/2020	132,335.78	

Variation 5: NON-Compounded & 2d backward period shift

Non-Compounded + 2D Backward period shift

Average
 Type **W** Freq **D** Anniversary day NonBus Rate Conv **Y** Convert time
 Lookback **OBSPERS** Gap **-2D** Rule **MF** Cut off days **1** Cut off B/C **B** Cut off mthd **CARRY**

Variation 1 MTM	Variation 4 MTM	Variation 5 MTM
-101,730.67	-98,885.06	-107,887.56

ID: 23219S Version: 1 State: Done 8/1/2019 SOFRQIS

Trade Diary: NO Pay: Disc OIS Receive: AVG Disc OIS FEDSOFR TradeCleared: NO...

Trade

Start 8/3/2019 End 8/3/2029

Pay **Pay** Receive

Ccy USD Ntl 100,000,000.00 Ccy USD Ntl 100,000,000.00

Index FIXED Ntl exp Index SOFR Ntl exp

Tem Rate 7.5534 Tem 1D Rate

Basis A360 Spread Basis A360 Spread

Counterparty CITIBANK Broker

Product / Formula

Company / Desk / Book / Folder

SUMMIT LONDON DEMO

Portfolio

Clearing house / Clearing member / Broker

More...

Schedule

	Freq	Day	Roll date	Cal		Freq	Day	Roll date	Cal
Pay	M	3	MF	NY	Pay	M	3	MF	NY
Reset	M	3	MF	NY	Reset	M	3	MF	NY

Valuation

Pay -14,516,166.85 USD Net -107,887.56 USD Receive 14,408,279.29 USD

Execution Facilities

Emerging markets

Variation 5: cash flow

Start	End	Fixing	IDays	Σ	Rate	Σ	Forward	Σ
8/3/2019	9/3/2019	9/2/2019	31	2.19006	2.19006		2.19006	
9/3/2019	10/3/2019	10/2/2019	30	2.13593	2.13593		2.13593	
10/3/2019	11/3/2019	11/1/2019	31	1.98936	1.98936		1.98936	
11/3/2019	12/3/2019	12/2/2019	30	1.87766	1.87766		1.87766	
12/3/2019	1/3/2020	1/2/2020	31	1.80316	1.80316		1.80316	
1/3/2020	2/3/2020	1/31/2020	31	1.7581	1.7581		1.7581	
2/3/2020	3/3/2020	3/2/2020	29	1.68033	1.68033		1.68033	
3/3/2020	4/3/2020	4/2/2020	31	1.62734	1.62734		1.62734	
4/3/2020	5/3/2020	5/1/2020	30	1.58708	1.58708		1.58708	

AllInRate	Σ	Notional	Σ	Date	Flows	Σ
2.19006		100,000,000.00		9/5/2019	188,588.08	
2.13593		100,000,000.00		10/7/2019	177,993.83	
1.98936		100,000,000.00		11/6/2019	171,306.40	
1.87766		100,000,000.00		12/5/2019	156,471.92	
1.80316		100,000,000.00		1/7/2020	155,272.25	
1.7581		100,000,000.00		2/5/2020	151,391.98	
1.68033		100,000,000.00		3/5/2020	135,360.01	
1.62734		100,000,000.00		4/7/2020	140,132.49	
1.58708		100,000,000.00		5/6/2020	132,256.54	

Backward shift vs non-backward shift

Non-Shift

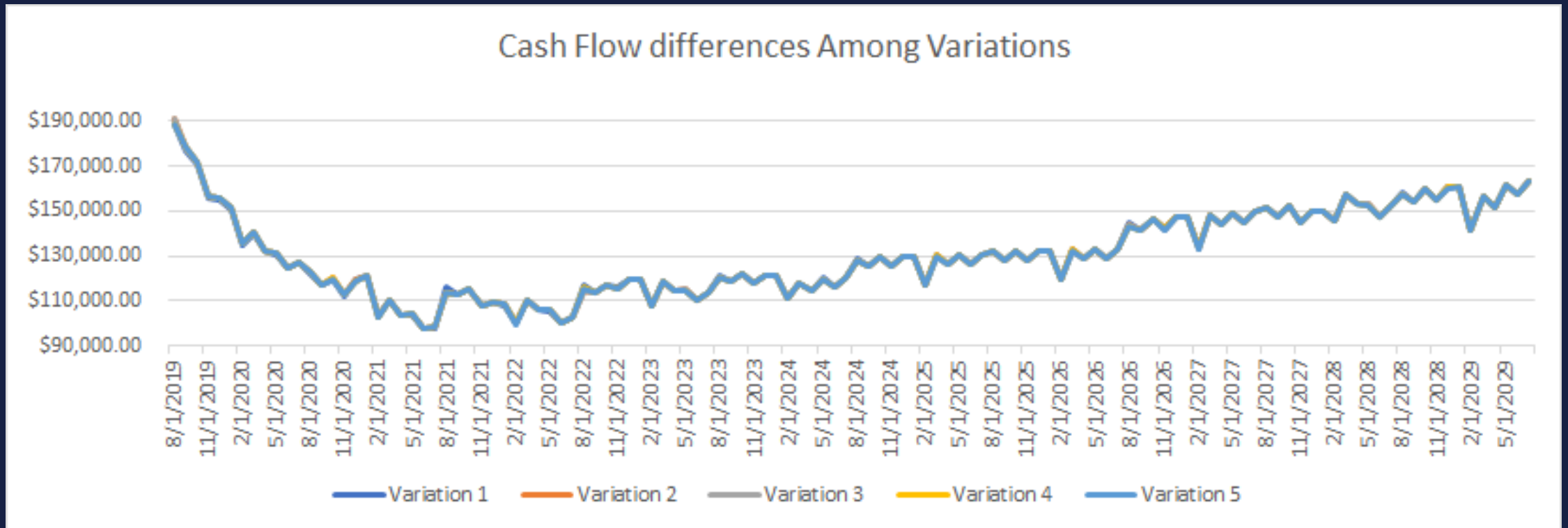
ResetDate	Quot Rate Σ	Eqv Rate Σ	Spread Σ	Rate Σ	Days Σ
8/3/2019	2.19013	2.19013		2.19013	2
8/5/2019	2.19	2.19		2.19	1
8/6/2019	2.19	2.19		2.19	1
8/7/2019	2.19	2.19		2.19	1
8/8/2019	2.19	2.19		2.19	1
8/9/2019	2.19013	2.19013		2.19013	3
8/12/2019	2.19	2.19		2.19	1
8/13/2019	2.19	2.19		2.19	1
8/14/2019	2.19	2.19		2.19	1
8/15/2019	2.19	2.19		2.19	1
8/16/2019	2.19013	2.19013		2.19013	3
8/19/2019	2.19	2.19		2.19	1
8/20/2019	2.19	2.19		2.19	1
8/21/2019	2.19	2.19		2.19	1
8/22/2019	2.19	2.19		2.19	1
8/23/2019	2.19013	2.19013		2.19013	3
8/26/2019	2.19	2.19		2.19	1

Shifted

ResetDate	Gapped Date	Quot Rate Σ	Eqv Rate Σ	Spread Σ	Rate Σ	Days Σ
8/3/2019	8/1/2019	2.55	2.55		2.55	0
8/5/2019	8/1/2019	2.19	2.19		2.19	1
8/6/2019	8/2/2019	2.19013	2.19013		2.19013	3
8/7/2019	8/5/2019	2.19	2.19		2.19	1
8/8/2019	8/6/2019	2.19	2.19		2.19	1
8/9/2019	8/7/2019	2.19	2.19		2.19	1
8/12/2019	8/8/2019	2.19	2.19		2.19	1
8/13/2019	8/9/2019	2.19013	2.19013		2.19013	3
8/14/2019	8/12/2019	2.19	2.19		2.19	1
8/15/2019	8/13/2019	2.19	2.19		2.19	1
8/16/2019	8/14/2019	2.19	2.19		2.19	1
8/19/2019	8/15/2019	2.19	2.19		2.19	1
8/20/2019	8/16/2019	2.19013	2.19013		2.19013	3
8/21/2019	8/19/2019	2.19	2.19		2.19	1
8/22/2019	8/20/2019	2.19	2.19		2.19	1
8/23/2019	8/21/2019	2.19	2.19		2.19	1

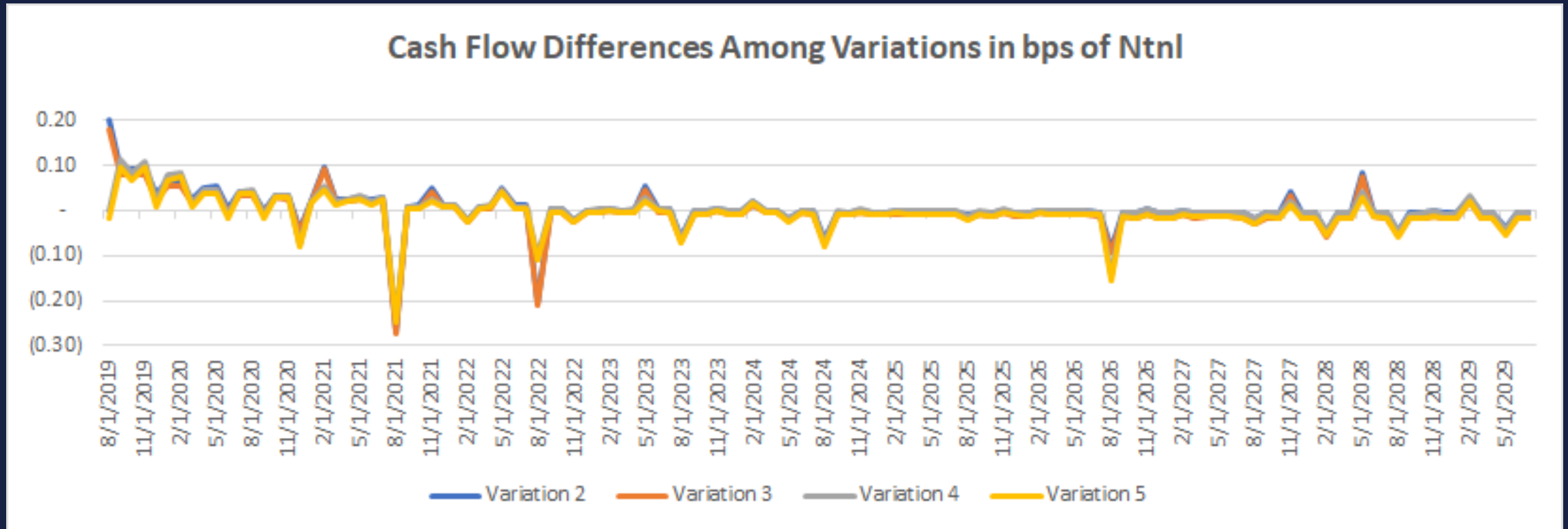
CASH FLOW COMPARISON - 1

Base case cash flows are excluded due to fewer cash flow dates



CASH FLOW COMPARISON - 2

Relative differences to variation 1 in bps of Notional



PART II - MTM IMPACT TAKING INTO CONSIDERATION PROJECTED VS ACTUAL REALIZED FLOWS

Part II - Introduction

The second topic studies the MTM impact of SOFR trades given past SOFR resets. We compare the MTM difference of one SOFR trade with projected cash flows and another one with realized cash flows. Both trades are booked as of 6/5/2018, when earliest SOFR curve was available on Bloomberg.

We began by creating a historical SOFR deal and priced it using historical curve data from Bloomberg. The first time we project the cashflows without resets, and the second time, we load resets from Bloomberg to price the same trade. This process is repeated for five variations of SOFR index conventions mentioned in the first topic. We summarized the MTM impact results in the next slide.

This study shows that when using historical resets, the realized SOFR trades are priced significantly different from the projected SOFR trades. However, between each variations, the MTM impact is small as a percentage of notional regardless of projected or realized trades.

Summary

All deals are Fixed vs 1DSOFR with different conventions as of 6/5/2018
Notional 100M, Maturity 10Y

	Variation 1	Variation 2	Variation 3	Variation 4	Variation 5
Trade ID	23307S	23310S	23311S	23323S	23325S
Payment Freq	Monthly	Monthly	Monthly	Monthly	Monthly
Compounding	Compounded	Compounded	Average	Compounded	Average
Lookback	-	-2D	-2D	-2D	-2D
Backward Period Shift	-	-	-	-2D	-2D
Fixed Rate	2.94687	2.94687	2.94687	2.94687	2.94687
DV01	88,445.10	88,445.10	88,445.10	88,445.10	88,445.10
Projected MTM	-0.38	-12,317.05	-44,128.67	-8,249.88	-40,030.86
Realized MTM	-532,427.83	-531,088.80	-562,090.05	-529,546.82	-560,510.81

VARIATION 1 WITH PROJECTED CASH FLOWS

Plain vanilla SOFR trade priced as of 6/5/2018

ID: 23307S Version: 1 State: Done 6/5/2018 SOFRQIS

Trade Diary: NO Pay: STUBS Receive: AVG STUBS FEDSOFR TradeCleared: NONE

Trade

Start: 6/7/2018 End: 6/7/2028

Pay: Receive:

Ccy: USD Ntl: 100,000,000.00 Ccy: USD Ntl: 100,000,000.00

Index: FIXED Ntl exp: Index: SOFR Ntl exp:

Term: Rate: 2.94687 Term: 1D Rate:

Basis: A360 Spread: Basis: A360 Spread:

Counterparty: CITIBANK Broker:

Product / Formula

Company / Desk / Book / Folder

SUMMIT LONDON DEMO

Portfolio

Clearing house / Clearing member / Broker

More...

Schedule

	Freq	Day	Roll date	Cal		Freq	Day	Roll date	Cal
Pay	M	3	MF	NY	Pay	M	3	MF	NY
Reset	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	Reset	M	3	MF	NY

Valuation

Pay	-26,056,585.47	USD	Net	-0.38	USD	Receive	26,056,585.09	USD
-----	----------------	-----	-----	-------	-----	---------	---------------	-----

Execution Facilities

Emerging markets

VARIATION 1 WITH REALIZED CASH FLOWS

Swap rate is kept unchanged but used past resets to get SOFR leg cash flows
Fixed leg remained unchanged

ID: 23307S Version: 1 State: Done 6/5/2018 SOFRQIS

Trade Diary: NO Pay: STUBS Receive: AVG STUBS FEDSOFR TradeCleared: NONE

Trade

Start 6/7/2018 End 6/7/2028

Pay Receive

Ccy USD Ntl 100,000,000.00 Ccy USD Ntl 100,000,000.00

Index FIXED Ntl exp Index SOFR Ntl exp

Term Rate 2.94687 Term 1D Rate

Basis A360 Spread Basis A360 Spread

Counterparty CITIBANK Broker

Product / Formula

Company / Desk / Book / Folder

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Portfolio

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More...

Schedule

	Freq	Day	Roll date	Cal		Freq	Day	Roll date	Cal
Pay	M	3	MF	NY	Pay	M	3	MF	NY
Reset					Reset	M	3	MF	NY

Valuation

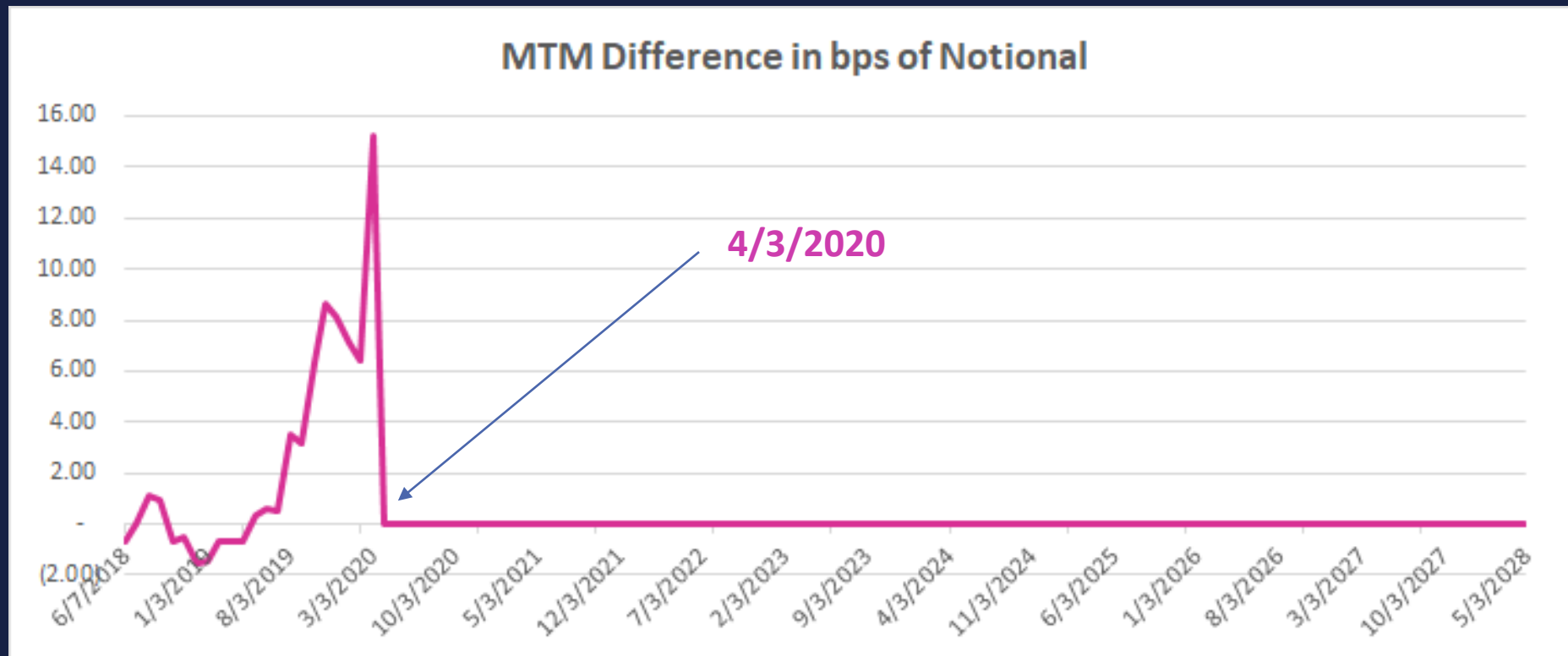
Pay	-26,056,585.47	USD	Net	-532,427.83	USD	Receive	25,524,157.64	USD
-----	----------------	-----	-----	-------------	-----	---------	---------------	-----

Execution Facilities

Emerging markets

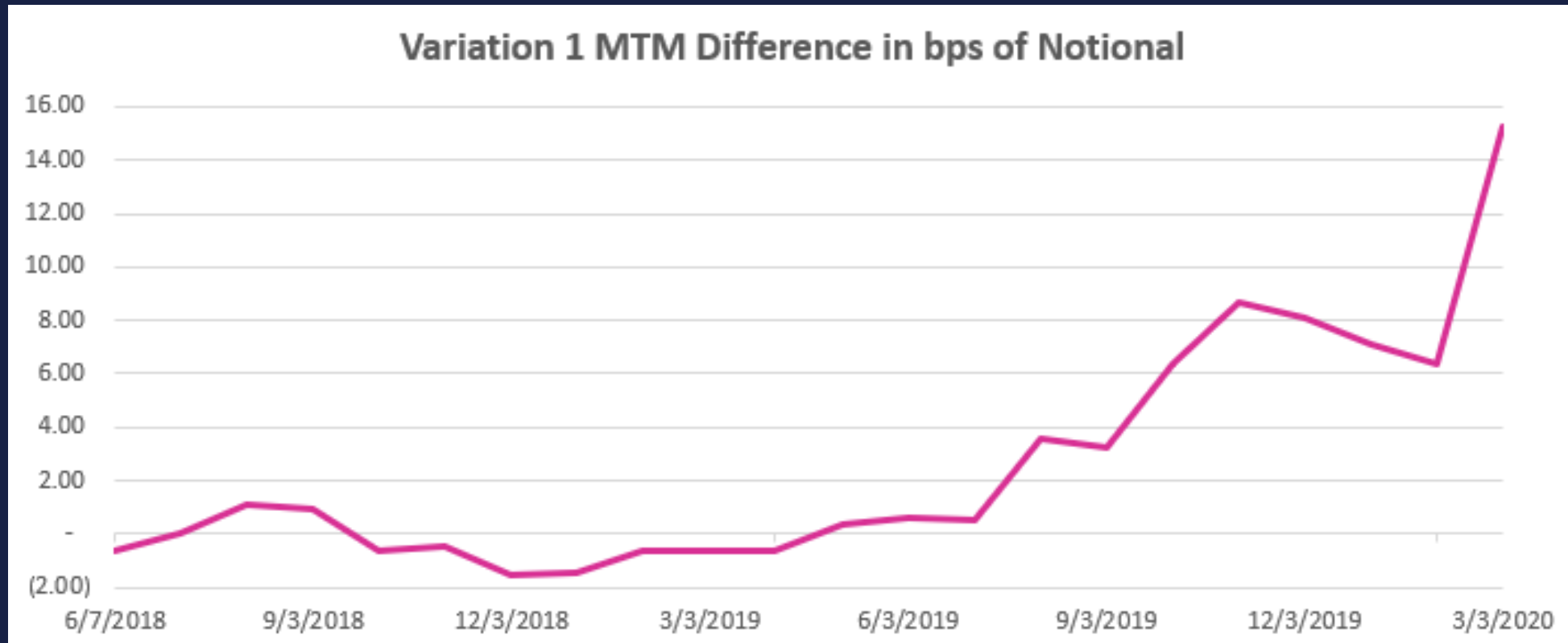
Cash flow difference - 1

Projected vs Actual cashflows forward in time



Cash flow difference – Closer look

Projected vs Actual cashflows forward in time



VARIATION 2 PROJECTED VS REALIZED

COMPOUNDED & 2D LOOKBACK/LAG

Projected

ID: TB01_0002 Version: State: 6/5/2018 SOFRQIS

Trade Diary: NO Pay: STUBS Receive: AVG STUBS FEDSOFR TradeCleared: NONE

Trade

Start 6/7/2018 End 6/7/2028

Pay Receive

Ccy USD Ntl 100,000,000.00 Ccy USD Ntl 100,000,000.00

Index FIXED Ntl exp Index SOFR Ntl exp

Term Rate 2.94687 Term 1D Rate

Basis A360 Spread Basis A360 Spread

Counterparty Broker Do!

Product / Formula

Company / Desk / Book / Folder

SUMMIT LONDON DEMO

Portfolio

Clearing house / Clearing member / Broker

More...

Schedule

	Freq	Day	Roll date	Cal		Freq	Day	Roll date	Cal
Pay	M	3	MF	NY	Pay	M	3	MF	NY
Reset					Reset	M	3	MF	NY

Valuation

Pay	-26,056,585.47	USD	Net	-12,317.05	USD	Receive	26,044,268.42	USD
-----	----------------	-----	-----	------------	-----	---------	---------------	-----

Execution Facilities

Emerging markets

Realized

ID: 23310S Version: 1 State: Done 6/5/2018 SOFRQIS

Trade Diary: NO Pay: STUBS Receive: AVG STUBS FEDSOFR TradeCleared: NONE

Trade

Start 6/7/2018 End 6/7/2028

Pay Receive

Ccy USD Ntl 100,000,000.00 Ccy USD Ntl 100,000,000.00

Index FIXED Ntl exp Index SOFR Ntl exp

Term Rate 2.94687 Term 1D Rate

Basis A360 Spread Basis A360 Spread

Counterparty CITIBANK Broker

Product / Formula

Company / Desk / Book / Folder

SUMMIT LONDON DEMO

Portfolio

Clearing house / Clearing member / Broker

More...

Schedule

	Freq	Day	Roll date	Cal		Freq	Day	Roll date	Cal
Pay	M	3	MF	NY	Pay	M	3	MF	NY
Reset					Reset	M	3	MF	NY

Valuation

Pay	-26,056,585.47	USD	Net	-531,088.80	USD	Receive	25,525,496.67	USD
-----	----------------	-----	-----	-------------	-----	---------	---------------	-----

Execution Facilities

Emerging markets

VARIATION 3 PROJECTED VS REALIZED

NON-COMPOUNDED & 2D LOOKBACK

Projected

ID: 23311S Version: 2 State: **Verified** 6/5/2018 SOFRQIS

Trade Diary: NO Pay: STUBS Receive: AVG STUBS FEDSOFR TradeCleared: NONE

Trade

Start 6/7/2018 End 6/7/2028

Pay Receive

Ccy USD Ntl 100,000,000.00 Ccy USD Ntl 100,000,000.00

Index FIXED Ntl exp Index SOFR Ntl exp

Term Rate 2.94687 Term 1D Rate

Basis A360 Spread Basis A360 Spread

Counterparty CITIBANK Broker

Product / Formula

Company / Desk / Book / Folder

SUMMIT LONDON DEMO

Portfolio

Clearing house / Clearing member / Broker

More...

Schedule

Pay	Freq	Day	Roll date	Cal	Pay	Freq	Day	Roll date	Cal
Pay	M	3	MF	NY	Pay	M	3	MF	NY
Reset					Reset	M	3	MF	NY

Valuation

Pay	-26,056,585.47	USD	Net	-44,128.67	USD	Receive	26,012,456.80	USD
-----	----------------	-----	-----	------------	-----	---------	---------------	-----

Execution Facilities

Emerging markets

Realized

ID: 23311S Version: 2 State: **Verified** 6/5/2018 SOFRQIS

Trade Diary: NO Pay: STUBS Receive: AVG STUBS FEDSOFR TradeCleared: NONE

Trade

Start 6/7/2018 End 6/7/2028

Pay Receive

Ccy USD Ntl 100,000,000.00 Ccy USD Ntl 100,000,000.00

Index FIXED Ntl exp Index SOFR Ntl exp

Term Rate 2.94687 Term 1D Rate

Basis A360 Spread Basis A360 Spread

Counterparty CITIBANK Broker

Product / Formula

Company / Desk / Book / Folder

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Portfolio

Clearing house / Clearing member / Broker

More...

Schedule

Pay	Freq	Day	Roll date	Cal	Pay	Freq	Day	Roll date	Cal
Pay	M	3	MF	NY	Pay	M	3	MF	NY
Reset					Reset	M	3	MF	NY

Valuation

Pay	-26,056,585.47	USD	Net	-562,090.05	USD	Receive	25,494,495.42	USD
-----	----------------	-----	-----	-------------	-----	---------	---------------	-----

Execution Facilities

Emerging markets

VARIATION 4 PROJECTED VS REALIZED

COMPOUNDED & 2D BACKWARD PERIOD SHIFT

Projected

ID: 23323S Version: 1 State: Done 6/5/2018 SOFRQIS

Trade Diary: NO Pay: STUBS Receive: AVG STUBS FEDSOFR TradeCleared: NONE

Trade

Start 6/7/2018 End 6/7/2028

Pay Receive

Ccy USD Ntl 100,000,000.00 Ccy USD Ntl 100,000,000.00

Index FIXED Ntl exp Index SOFR Ntl exp

Term Rate 2.94687 Term 1D Rate

Basis A360 Spread Basis A360 Spread

Counterparty CITIBANK Broker

Product / Formula

Company / Desk / Book / Folder

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Portfolio

Clearing house / Clearing member / Broker

More...

Schedule

	Freq	Day	Roll date	Cal		Freq	Day	Roll date	Cal
Pay	M	3	MF	NY	Pay	M	3	MF	NY
Reset	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	Reset	M	3	MF	NY

Valuation

Pay	-26,056,585.47	USD	Net	-8,249.88	USD	Receive	26,048,335.59	USD
-----	----------------	-----	-----	-----------	-----	---------	---------------	-----

Execution Facilities

Execution Facility Execution State:

Emerging markets

Realized

ID: 23323S Version: 2 State: Verified 6/5/2018 SOFRQIS

Trade Diary: NO Pay: STUBS Receive: AVG STUBS FEDSOFR TradeCleared: NONE

Trade

Start 6/7/2018 End 6/7/2028

Pay Receive

Ccy USD Ntl 100,000,000.00 Ccy USD Ntl 100,000,000.00

Index FIXED Ntl exp Index SOFR Ntl exp

Term Rate 2.94687 Term 1D Rate

Basis A360 Spread Basis A360 Spread

Counterparty CITIBANK Broker

Product / Formula

Company / Desk / Book / Folder

SUMMIT LONDON DEMO

Portfolio

Clearing house / Clearing member / Broker

More...

Schedule

	Freq	Day	Roll date	Cal		Freq	Day	Roll date	Cal
Pay	M	3	MF	NY	Pay	M	3	MF	NY
Reset	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	Reset	M	3	MF	NY

Valuation

Pay	-26,056,585.47	USD	Net	-529,546.82	USD	Receive	25,527,038.65	USD
-----	----------------	-----	-----	-------------	-----	---------	---------------	-----

Execution Facilities

Emerging markets

VARIATION 5 PROJECTED VS REALIZED

NON-COMPOUNDED & 2D BACKWARD PERIOD SHIFT

Projected

ID: 23325S Version: 2 State: **Verified** 6/5/2018 SOFRQIS

Trade Diary: NO Pay: STUBS Receive: AVG STUBS FEDSOFR TradeCleared: NONE

Trade

Start 6/7/2018 End 6/7/2028

Pay Receive

Ccy USD Ntl 100,000,000.00 Ccy USD Ntl 100,000,000.00

Index FIXED Ntl exp Index SOFR Ntl exp

Term Rate 2.94687 Term 1D Rate

Basis A360 Spread Basis A360 Spread

Counterparty CITIBANK Broker

Product / Formula

Company / Desk / Book / Folder

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Portfolio

Clearing house / Clearing member / Broker

More...

Schedule

Pay	Freq	Day	Roll date	Cal	Pay	Freq	Day	Roll date	Cal
Pay	M	3	MF	NY	Pay	M	3	MF	NY
Reset					Reset	M	3	MF	NY

Valuation

Pay	-26,056,585.47	USD	Net	-40,030.86	USD	Receive	26,016,554.61	USD
-----	----------------	-----	-----	------------	-----	---------	---------------	-----

Execution Facilities

Emerging markets

Realized

ID: 23325S Version: 1 State: **Done** 6/5/2018 SOFRQIS

Trade Diary: NO Pay: STUBS Receive: AVG STUBS FEDSOFR TradeCleared: NONE

Trade

Start 6/7/2018 End 6/7/2028

Pay Receive

Ccy USD Ntl 100,000,000.00 Ccy USD Ntl 100,000,000.00

Index FIXED Ntl exp Index SOFR Ntl exp

Term Rate 2.94687 Term 1D Rate

Basis A360 Spread Basis A360 Spread

Counterparty CITIBANK Broker

Product / Formula

Company / Desk / Book / Folder

SUMMIT LONDON DEMO

Portfolio

Clearing house / Clearing member / Broker

More...

Schedule

Pay	Freq	Day	Roll date	Cal	Pay	Freq	Day	Roll date	Cal
Pay	M	3	MF	NY	Pay	M	3	MF	NY
Reset					Reset	M	3	MF	NY

Valuation

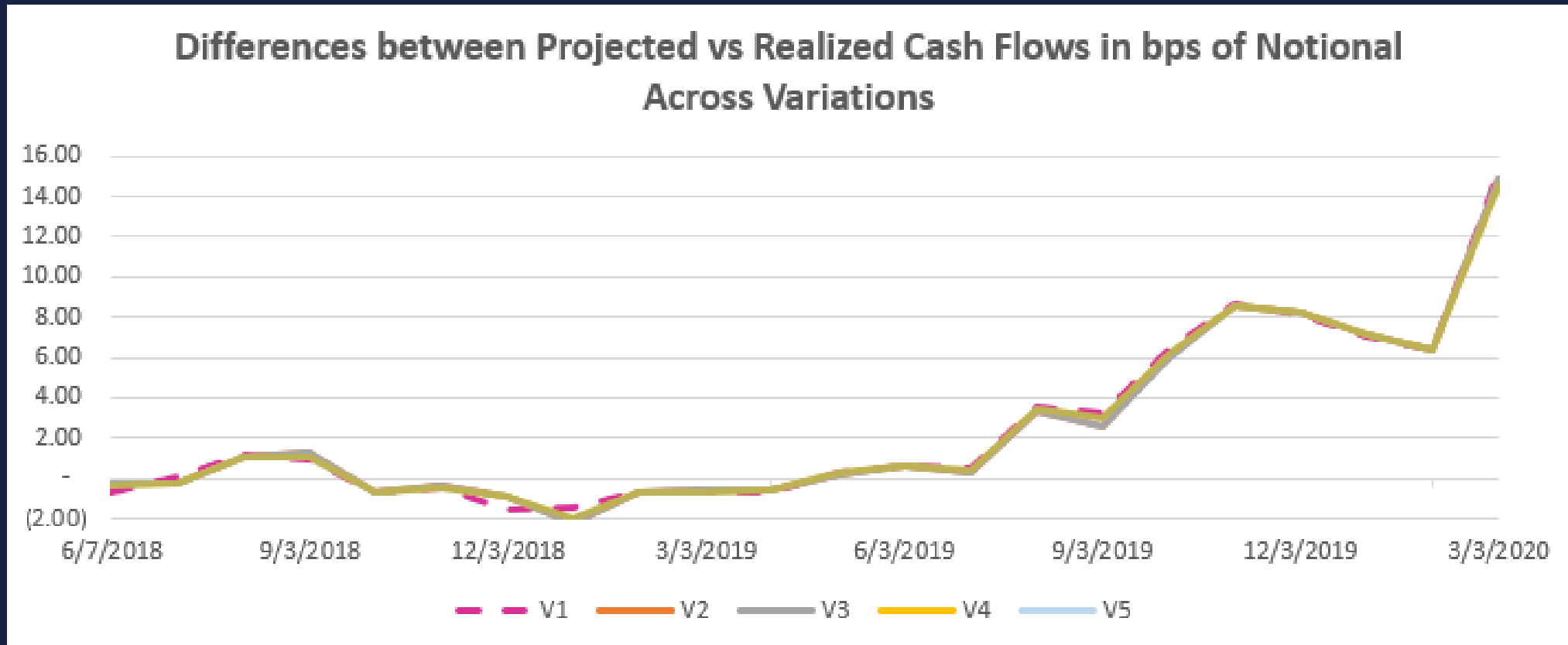
Pay	-26,056,585.47	USD	Net	-560,510.81	USD	Receive	25,496,074.65	USD
-----	----------------	-----	-----	-------------	-----	---------	---------------	-----

Execution Facilities

Emerging markets

Projected vs realized cash flows differences

From 6/7/2018 to 3/3/2020, when the latest reset was provided in the system



Further research

- This research will be extended to deepen the understanding.
- Find specific cases where observation Period shift has a larger impact
 - Sep 2019 spike of 1D SOFR
 - End of Year Rate Spike

Investigate why cash flow differences increased so much starting 2019

Thank you

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 @FinastraFS

 Finastra LinkedIn

 Finastra YouTube

Appendix

Full cash flow table

The attached file included the following information for 6 swaps:

1. Fixed leg cash flows
2. Float leg cash flows
3. Float leg average details



Microsoft Excel
Worksheet