





EDM Webinar

From Granular Financial Contract Data to Risk Analytics and Smart Financial Contracts

A conversation with

Hon. Allan I. Mendelowitz, Ph.D.

President, ACTUS Financial Research Foundation

Willi Brammertz, Ph.D.

Founder
Ariadne Business Analytics

Mark Greenslade

Head of R&D
Casper Association

Francis Parr, Ph.D.

Standards Development
ACTUS Financial Research Foundation


ACTUS
ALGORITHMIC CONTRACT TYPES UNIFIED STANDARDS

EDM Council

Moderated by **Mike Meriton**
Co-Founder & COO, EDM Council

- Joined EDM Council full-time 2015 to lead Industry Engagement
- EDM Council Co-Founder & First Chairman (2005-2007)
- EDM Council Finance Board Chair (2007-2015)
- Former CEO GoldenSource (2002-2015)
- Former Executive for D&B Software and Oracle
- FinTech Innovation Lab – Executive Mentor (2011 – Present)

EDMCouncil

Today's panel

Hon. Allan I. Mendelowitz, Ph.D.
President,
ACTUS Financial Research Foundation

Willi Brammertz
Founder
Ariadne Business Analytics

Mark Greenslade
Head of Research & Development, Casper Association

Francis Parr, Ph.D.
Open Software
ACTUS FRF

From
Granular Financial Contract Data
to
Risk Analytics and Smart Financial Contracts

1. Introduction to ACTUS concepts	Allan I. Mendelowitz
2. What regulators could have seen at SVB	Willi Brammertz
3. ACTUS and Smart Financial Contracts	Mark Greenslade
4. Using Open Source ACTUS software	Francis Parr
5. Your questions – discussion – summary	

Introduction to ACTUS concepts

- **Data is valuable based on what you can do with it.**
- **The ACTUS Financial Research Foundation has created an open-source, royalty-free algorithmic financial contract standard that is transformative because it has multiple uses across finance and regulation**
- **This webinar will present the foundations of this innovation and provide a few examples of how it can be used.**

Core Activities in the Financial Sector

Issuance of financial contract

Life cycle management of financial contract

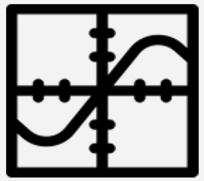
Trading and securitization of financial contracts

Analysis of financial contracts

Crucial Features of Financial Contracts

Pure exchange of sequences of cash-flows

Cash flows are units of account and can be represented by pure numbers



The sequence of cash-flows are determined by algorithms (with some external input in some cases)

The different sequence-patterns of algorithms are limited in number

Financial Contracts Today

Endre vullumsandio dion endipsummy nos dolobore vel ut alis amet autem dionseq uismodigna feumsan dionse dolor ullandre magna feuipsummy nullum ad tin ….

Bank shall pay the sum of 1000 USD on 2023.05.25 (date) to Mr. Smith (obligor). Obligor will pay an interest of 9 % on a semi-annual basis and repay the full amount in 10 years.

Date, Signature

These underlying insights are at the heart of the ACTUS Standard:

- Financial contracts are agreements to exchange promised payments.
- While financial contracts are written in natural language, the words of the contracts have to be converted into algorithms to compute the amounts and timing of the payment obligations.
- Despite the thousands of different financial products, there is a relatively small number of cash flow patterns . Most financial contracts' payment obligations can be represented by less than 3 dozen algorithms that compute the payment obligations of the natural language contracts.

The ACTUS Standard consists of:

- A set of such algorithms that we call Contract Types (CTs),
- A Data Dictionary of Contract terms (interest rates, payment cycles, day count method, etc.) and the CTs they are applied to in order to compute a specific contract's cash flow obligations,
- The technical specifications of each Contract Type, and
- A reference implementation in java that is downloadable from the ACTUS GitHub.

Why is this important?

Almost every activity in the financial world starts out with the payment obligations of financial contracts:

transaction processing, risk analytics, liquidity analysis, pre-trade analysis, forward business planning, better regulatory reporting, and even accounting records.

Despite a common starting point, existing financial data systems fail to take advantage of the potential efficiencies and other benefits available from using a validated standardized financial contract standard for all of these uses.

Why is this important?

Today we will provide a few examples of the use of the ACTUS Standard and the related benefits:

- The use of granular financial contract data in the ACTUS Standard for far better and less burdensome regulatory reporting and oversight – the case of Silicon Valley Bank
- The use of ACTUS as the computational core of smart financial contracts in the DeFi world
- Analysis of a real bank's balance sheet and how you can access the ACTUS standard and test it out for yourselves for similar analytics.

An Early Warning System
What regulators could have seen at SVB well before the fact

Willi Brammertz

Table of Content

Intention of the exercise

- Demonstrating the benefits of standardized data (ACTUS) for the analytic use case
- We use SVB as a demonstration case
- We reverse engineer the contractual data from the Call-Report

The intention of this exercise is not to generate an exact picture of SVB (not possible from the source) but to demonstrate the analytic insight any regulator could have on the spot if the data were directly delivered in the ACTUS standard.

Table of Content

What do we find in Call-Reports

Data is per End Of June 2022

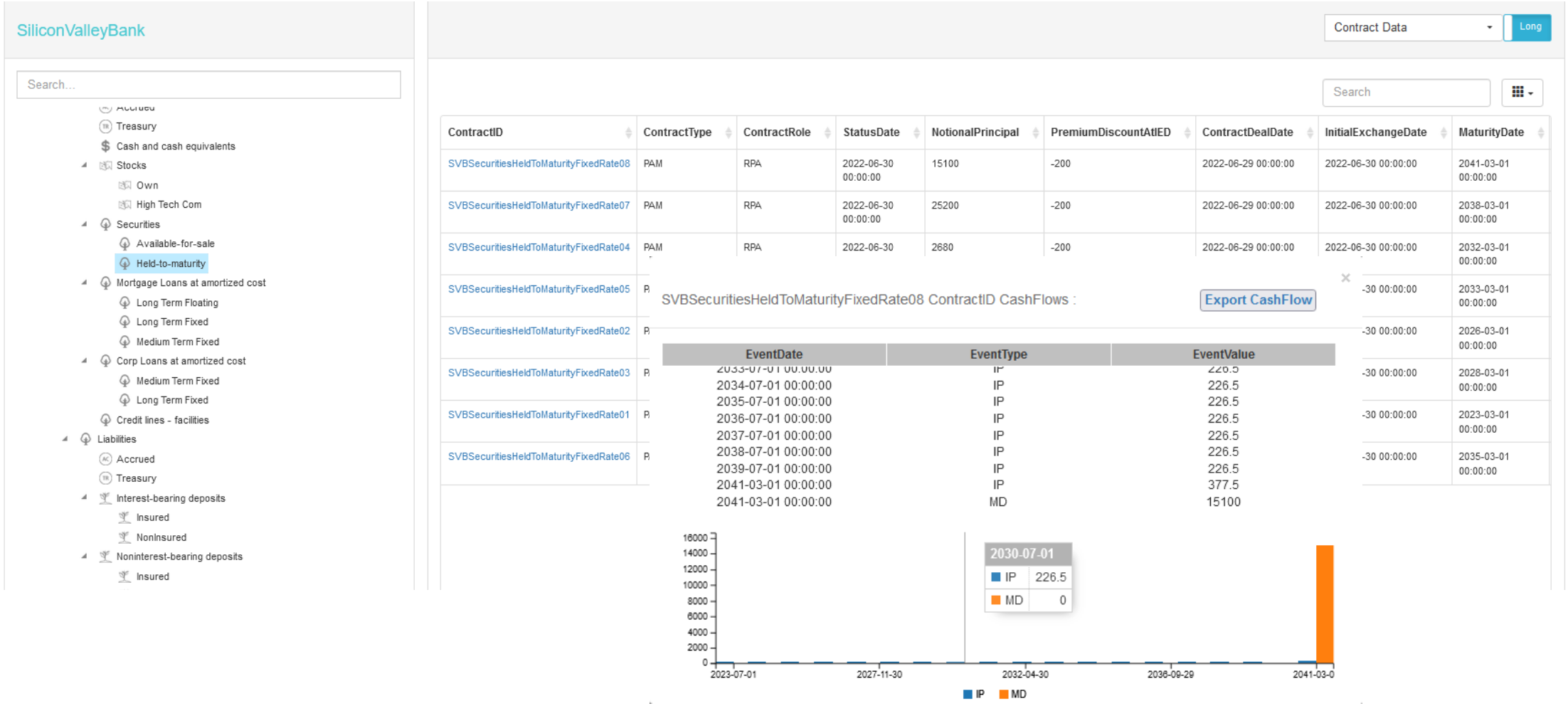
- Book and some market values
- Remaining maturity grouped in rough buckets
- Income from where rates can be somehow reengineered

The stable market conditions pre 2022 are also helpful for guessing rates.
However, rates are least precise of the three information sets

What we added

- Market data on treasury yield curves and rating: For valuation
- Counterparty information: This will let us demonstrate exposure analysis, especially large exposures.
- Swaps: This is based on press reports. We include swap data for demonstration purposes.

Data in the ACTUS Standard – and the algorithms



Conclusion

It is well possible that there is more data available from the call report if correctly scrutinized. For a demonstration purpose we consider the exploited information as sufficient.

Table of Content

June 30, 2022: End of Day Balance Sheets

Value | Liquidity | Liquidity Gap-CUM | Rate Reset Gap | Dur/Conv

Account	NominalValue	Fair Value	IFRS
SVB	20,059.00	5,241.99	24,597.23
Balance Sheet	20,059.00	5,241.99	24,597.23
Assets	217,795.00	202,215.79	222,403.23
Accrued	0.00	0.00	0.00
Treasury	0.00	0.00	0.00
Cash and cash equivalents	15,398.00	15,398.00	15,398.00
Stocks	0.00	6,600.00	6,600.00
Own	0.00	3,300.00	3,300.00
High Tech Com	0.00	3,300.00	3,300.00
Securities	122,347.00	101,682.54	120,165.23
Available-for-sale	26,223.00	23,961.23	23,961.23
Held-to-maturity	96,124.00	77,721.31	96,204.00
Mortgage Loans at amortized cost	42,050.00	41,344.95	42,140.00
Long Term Floating	10,000.00	10,136.05	10,030.00
Long Term Fixed	20,050.00	19,329.63	20,080.00
Medium Term Fixed	12,000.00	11,879.27	12,030.00
Corp Loans at amortized cost	38,000.00	37,190.30	38,100.00
Medium Term Fixed	8,000.00	7,873.36	8,050.00
Long Term Fixed	30,000.00	29,316.94	30,050.00
Credit lines - facilities	0.00	0.00	0.00
Liabilities	-197,736.00	-196,973.80	-197,806.00
Accrued	0.00	0.00	0.00
Treasury	0.00	0.00	0.00
Interest-bearing deposits	-73,976.00	-73,976.00	-73,976.00
Noninterest-bearing deposits	-113,969.00	-113,969.00	-113,969.00
Short-term borrowings	-3,703.00	-3,649.57	-3,733.00
Long-term debt	-3,367.00	-2,753.49	-3,397.00
Other liabilities	-2,721.00	-2,625.74	-2,731.00
Equity	20,059.00	18,165.03	37,520.27

June 30, 2022: Liquidity Gap, LCR

AccountName			NominalValue	After Haircuts	After Cups	Fair Value	After Haircuts		IFRS	After Haircuts		LGAAP	After Haircuts	023-06-30
LCR Classification														
Market Liquidity Level Type														
Level 1	Cash Marketable securities	41'621.00	41'621.00	41'621.00	41'621.00	39'359.23	39'359.23	39'359.23	39'359.23	39'359.23	39'359.23	41'621.00	41'621.00	
Level 2A (must not comprise more than 15% of the total stock of HQLA)	Marketable securities guaranteed by sovereigns, central	96'124.00	96'124.00	81'705.40	18'498.96	77'721.31	66'063.11	15'813.35	96'204.00	81'773.40	18'169.89	96'124.00	81'705.40	
Level-2B RMBS - Residential mortgage-backed securities (RMBS) (not issued by a financial institution or any of its affiliated entities)			0.00	0.00	0.00	0.00			0.00			0.00		
Level-2B Corp Debt Securities (not issued by a financial institution or any of its affiliated entities)			0.00	0.00	0.00	0.00			0.00			0.00		
Level-2B Common Equity (not issued by a financial institution or any of its affiliated entities)			0.00	0.00	0.00	6'600.00			6'600.00			14'640.00		
Illiquid			0.00	0.00	0.00	0.00			0.00			0.00		
SUM - Stock of HQLA			137'745.00	123'326.40	60'119.96	123'680.54	105'422.34	55'172.58	142'163.23	121'132.63		152'385.00	123'326.40	
Cash out flow Originator Type														
Stable Deposits			0.00			0.00			0.00			0.00		
Stable Deposits with Insurance Scheme	Insured: Interest-bearing deposits NonInterest-bearing deposits	-28'191.75	-28'191.75	-845.75	-845.75	-28'191.75	-845.75	-845.75	-28'191.75	-845.75	-845.75	-28'191.75	-845.75	
Less Stable Retail Deposits (deposits that are not fully covered by an effective deposit insurance scheme)	NonInsured: Interest-bearing deposits NonInterest-bearing deposits	-159'753.25	-159'753.25	-15'975.33	-15'975.33	-159'753.25	-15'975.33	-15'975.33	-159'753.25	-15'975.33	-15'975.33	-159'753.25	-15'975.33	
Operational Deposits gen by Clearing Custody and Cash Mgmt activities			0.00			0.00			0.00			0.00		
Other Deposits			0.00			0.00			0.00			0.00		
SUM - Total expected cash outflows			187'945.00	16'821.08	16'821.08	187'945.00	16'821.08	16'821.08	187'945.00	16'821.08		187'945.00	16'821.08	
Cash inflows														
Secured lending including reverse repos and securities borrowing			0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	
Committed facilities			0.00											
Retail and small business customer inflows			0.00											
Wholesale inflows			0.00											
Other cash inflows			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Total expected cash inflows			0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	
Total net cash outflows over the next 30 calendar days			187'944.70	16'820.78	16'820.78	187'944.70	16'820.78	16'820.78	187'944.70	16'820.78	0.00	187'944.70	16'820.78	
Total net cash outflows over the next 30 calendar days = Total expected cash outflows – Min {total expected cash inflows; 75% of total expected cash outflows}														
LCR Stock of HQLA / Total net cash outflows over the next 30 calendar days ≥ 100%			73%		357%	66%		328%		720%	#DIV/0!	81%	733%	

LCR calculations highly approximative

The problem was not the LCR but the unaccounted losses

June 30, 2022: Sensitivity (Duration)

Value | Liquidity | Liquidity Gap-CUM | Rate Reset Gap | Dur/Conv

Account	Fair Value	Duration	Convexity
SVB	18,165.03	57.78	553.95
Balance Sheet	5,241.99	286.66	3,435.67
Assets	202,215.79	7.55	89.91
Liabilities	-196,973.80	0.13	0.87
Equity	18,165.03	57.78	553.95
Off Balance Sheet	12,923.04	-35.06	-614.97

With Swap

Without Swap

June 30, 2022: Large Exposure

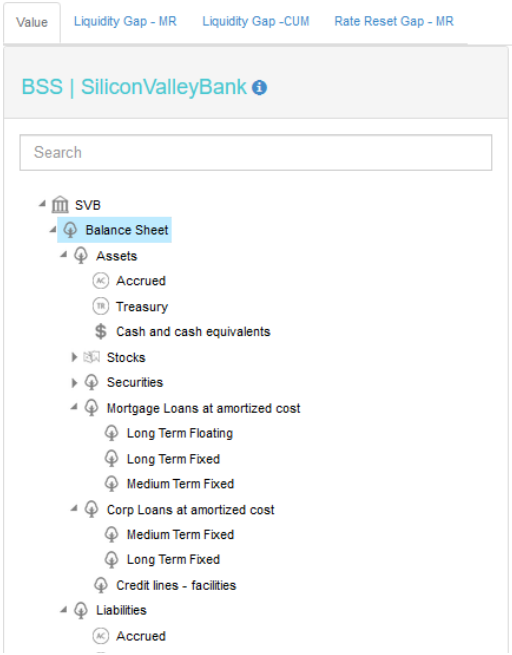
Note: This report is not based on any available data and for demonstration purpose only

CounterParty | Top Exposures | Table | $ - USD

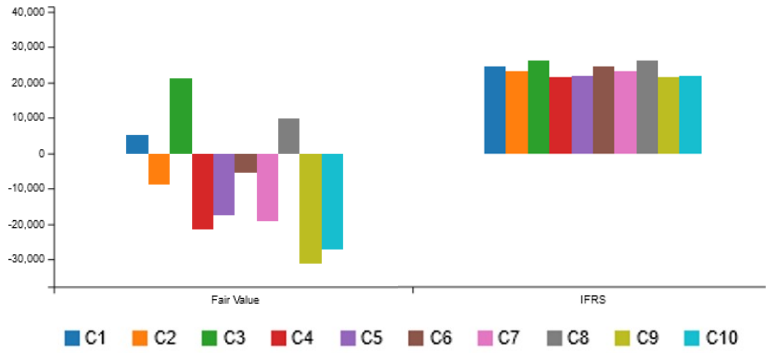
Account	Gross Exposure NV	Gross Exposure FV	Net Exposure NV	Net Exposure FV	LGD NV	LGD FV
SVBCPsExposures	270,447.00	247,170.44	152,205.05	129,235.72	7,195.08	-19,080.88
Counterparty Class	202,397.00	180,217.79	127,955.05	105,969.26	2,345.08	-12,964.81
US Agency	122,347.00	101,682.54	122,347.00	101,682.54	1,223.47	58.58
Retail CPs	42,050.00	41,344.95	-1,750.00	-2,341.24	-350.00	-7,300.83
Corporates CPs	38,000.00	37,190.30	7,358.05	6,627.96	1,471.61	-5,722.56
Industry	68,050.00	66,952.65	24,250.00	23,266.45	4,850.00	-6,116.07
Private Individuals	42,050.00	41,344.95	-1,750.00	-2,341.24	-350.00	-7,300.83
HighTechData	7,500.00	7,368.91	7,500.00	7,368.91	1,500.00	97.94
SmartTechnology	7,500.00	7,409.08	7,500.00	7,409.08	1,500.00	495.27
ElectricVehicles	7,800.00	7,690.95	7,800.00	7,690.95	1,560.00	355.86
StarUps	3,200.00	3,138.75	3,200.00	3,138.75	640.00	235.69

Table of Content

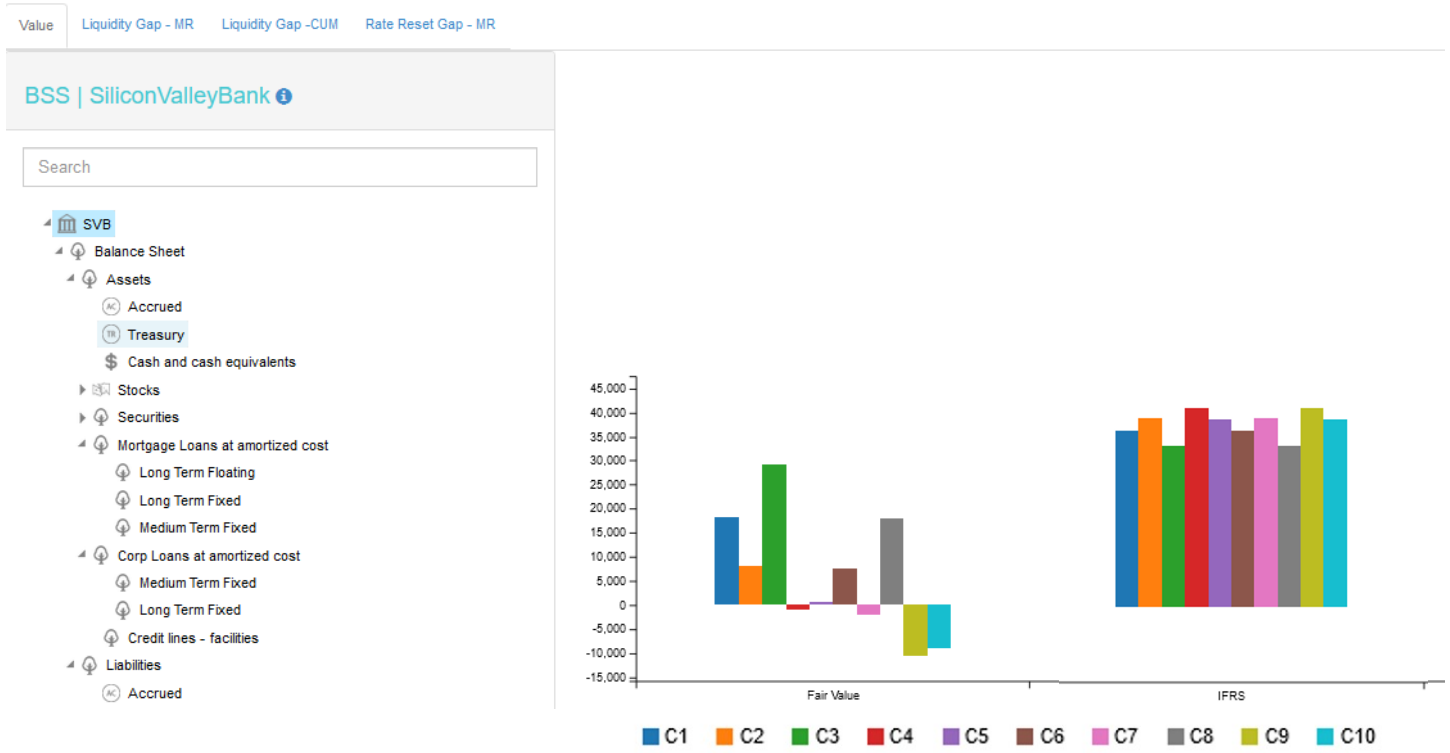
June 30, 2022: Market + Credit Stress No Swaps



ID	Market Scenario	Credit Scenario	Behavior Scenario
C1	Canonical	Canonical	Canonical
C2	100bp up	Canonical	Canonical
C3	100bp down	Canonical	Canonical
C4	200bp up	Canonical	Canonical
C5	Up and flatten	Canonical	Canonical
C6	Canonical	SVB Stress CPs	Canonical
C7	100bp up	SVB Stress CPs	Canonical



June 30, 2022: Market + Credit Stress With Swaps



ACTUS + DLT = SFC

Smart Financial Contracts

Mark Greenslade May ‘23

ACTUS + DLT = SFC

SFC Pillars

SFC Integrity

SFC Tokenisation

SFC Payments

ACTUS + DLT = SFC

ACTUS

(Counter Parties, Term Set, Algorithm, Cash Flow)

Cryptographic Proofs

(Attestations, Signatures, Fingerprints, ZK-Proofs)

DLT

(Smart Contract)

ACTUS + DLT = SFC

Minting

(Identifiers, Dimensions, Counter Parties, Balances, Metadata)

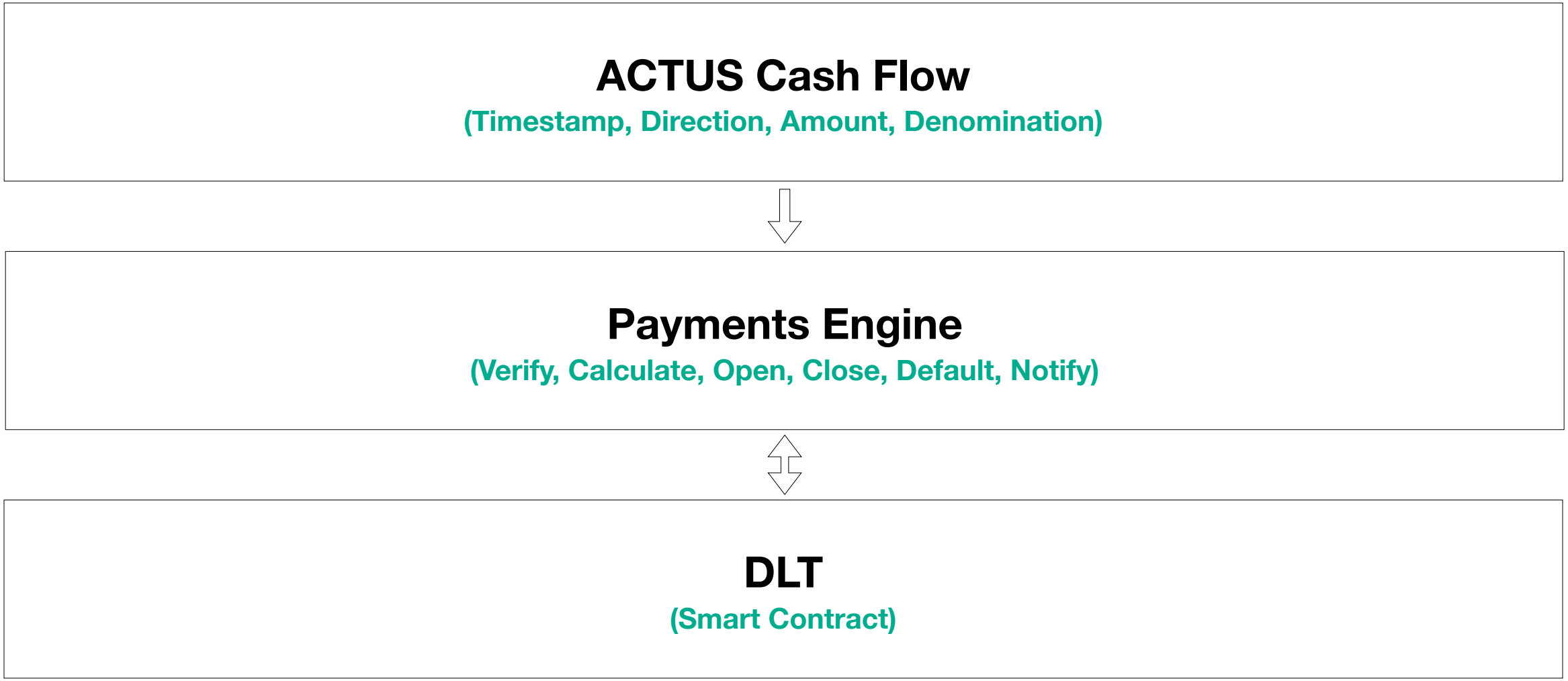
DLT

(Smart Contract)

Servicing

(Auditors, Rating, Regulators, Markets)

ACTUS + DLT = SFC



SFC Principles

- **Occams Razor**
  As Little As Possible, As Much As Necessary
- **Chain Agnostic**
  Standard Smart Contracts
- **Privacy Preserving**
  Who, What, When, Why
- **Trust But Verify**
  Cryptographic Proofs Everywhere

ACTUS + DLT = SFC

Smart Financial Contracts

Mark Greenslade May ‘23

Using the ACTUS open source (royalty-free) reference implementation software

For (1) bank analysis demo for the FDIC
(2) dockerized, risk factor enabled, portfolio analysis

Francis Parr - May 2023

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ALGORITHMIC CONTRACT TYPES UNIFIED STANDARDS

FDIC prototype: ACTUS technology with contract data from a working bank

- In 2020-21 the FDIC initiated competitive demonstrations of relevant future regulatory technology as a planning exercise.

- ACTUS FRF obtained contract level data for the holdings of a small US commercial bank

- The “demonstration delivered to the FDIC involved:
  - Converting spreadsheet data on the holdings into ACTUS contracts,
  - Simulating future cashflows for these contracts for up and down yield curve shifts using an actus server
  - Generating simple visual reports on expected future bank profits and liquidity for these scenarios

ACTUS
ALGORITHMIC CONTRACT TYPES UNIFIED STANDARDS

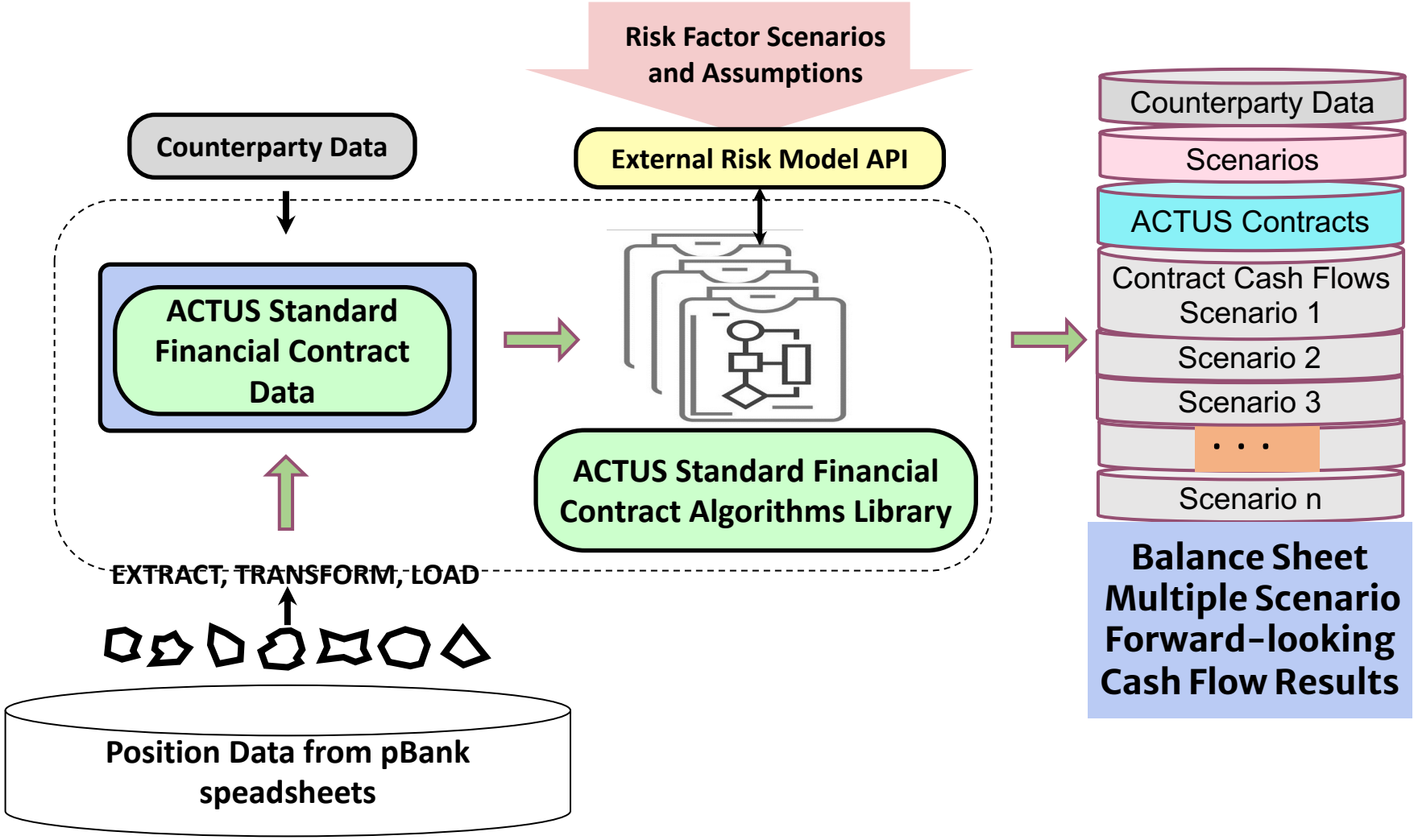
FDIC prototype: ACTUS technology with contract data from a working bank

- This work was done by a team of 6 – working part time for the 8 months of the FDIC project
- The ACTUS proposal successfully advanced to the third/final round of competition
- This establishes:
  - **=> The feasibility of mapping the holdings of a bank into an ACTUS contract portfolio**
  - **=> The value of having *fine grained contract level data* for forward looking risk**

ACTUS
ALGORITHMIC CONTRACT TYPES UNIFIED STANDARDS

ACTUS Solution For the FDIC Competition to Replace the Call Report

ACTUS Input Data + Contract Type Algorithms ➔ Output Events Process Flow



In a nutshell, to recap: ACTUS FDIC PoC -- from Core Systems of Record …

Loan Data

	LN-TYPE-CODE	LN-CURR-BAL	LN-INT-RATE	LN-MAT-DATE	LN-REPRICING-DATE	LN-BALLOON-DATE	LN-AMORT-CODE	LN-PMT-FREQ	LN-PMT-AMT	LN-PMT-DUI DT	LN-PMT-TYPE	LN-FORE-STATUS	LN-CEILING
1													
2	10	1116782.89	5.75	04052027	04052022	00000000	Y	01	7610.48	10052020	07	N	000000000000
3	15	148017.16	5.00	05312027	10012020	00000000	Y	01	2179.15	10102020	07	N	000000000000
4	15	-111012.80	4.00	05312027	10012020	00000000	Y	01	1.00	10102020	07	N	000000000000
5	15	3360571.44	5.00	06052045	10012020	00000000	Y	01	19742.28	10102020	07	N	000000000000
6	15	-2520428.58	4.00	06052045	10012020	00000000	Y	01	1.00	10102020	07	N	000000000000
7	15	1005681.77	5.00	06052045	10012020	00000000	Y	01	5908.06	10102020	07	N	000000000000
8	15	-754261.32	4.00	06052045	10012020	00000000	Y	01	1.00	10102020	07	N	000000000000
9	26	738467.00	1.00	05012022	00000000	00000000	Y	01	39191.75	05012021	07	N	000099000000
10	11	4635908.61	4.00	12112020	00000000	00000000	N	01	0.00	10122020	01	N	000000000000
11	11	1643940.04	4.25	12182020	00000000	00000000	N	01	0.00	10192020	01	N	000000000000
12	11	3588073.15	4.50	10082020	00000000	00000000	N	01	0.00	10082020	01	N	000000000000
13	10	1418693.35	6.40	11302037	05302025	00000000	Y	01	7734.51	09302020	07	N	000000000000
14	10	-425937.14	5.90	11302037	05302025	00000000	Y	01	1.00	10302020	07	N	000000000000
15	10	-425937.14	5.90	11302037	05302025	00000000	Y	01	1.00	10302020	07	N	000000000000
16	10	-283958.11	5.90	11302037	05302025	00000000	Y	01	1.00	10302020	07	N	000000000000
17	02	835649.36	5.85	03152024	00000000	03152024	Y	01	6209.18	10152020	07	N	000099000000
18	06	7246556.95	4.75	12082027	00000000	00000000	Y	01	42367.18	10082020	07	N	000099000000
19	11	1001750.37	3.00	10302020	00000000	00000000	N	01	0.00	10302020	01	N	000000000000
20	04	1548352.00	3.00	11062020	00000000	00000000	N	01	0.00	10062020	01	N	000018000000
21	04	1599233.75	4.50	11262020	00000000	00000000	N	01	0.00	11012020	01	N	000018000000
22	04	551177.00	4.25	05292021	00000000	00000000	N	01	0.00	09292020	01	N	000018000000
23	04	950000.00	4.75	10022020	00000000	00000000	N	01	0.00	10022020	01	N	000018000000
24	04	584921.42	3.75	12192020	00000000	00000000	N	01	0.00	10192020	01	N	000018000000
25	04	768083.23	4.75	01292021	00000000	00000000	N	01	0.00	10292020	01	N	000018000000
26	06	1135702.91	5.25	07102030	08102025	00000000	Y	01	9305.18	10102020	07	N	000000000000
27	12	1234278.16	4.95	10012024	00000000	00000000	Y	01	10292.90	11012020	07	N	000099000000
28	10	1120882.87	4.00	05132025	05132025	00000000	Y	01	6005.71	10132020	07	N	000000000000
29	10	359539.14	6.13	01302025	01302025	00000000	Y	01	2665.42	10152020	07	N	000000000000
30	12	1225072.58	5.50	02012022	00000000	00000000	Y	01	9508.16	10152020	07	N	000099000000
31	10	1097273.51	6.75	01212025	01212025	00000000	Y	01	8539.85	10212020	07	N	000000000000

Open source (royalty free) ACTUS as a Regulatory Data Strategy

- Dockerized ACTUS-webapp easily modified /extended to read data from small or midsized banks – and create an ACTUS contract view
- No change required on the existing systems or operating procedures of the banks
- Add-on software for this could be made available by regulator at no/low -cost
- Some “forward looking” cash flow analytics available to the using banks – bonus for the installation
- Regulator has access to ACTUS holdings data from the banks hence reliable systemic analysis – regulator seeing same holdings as bank executives

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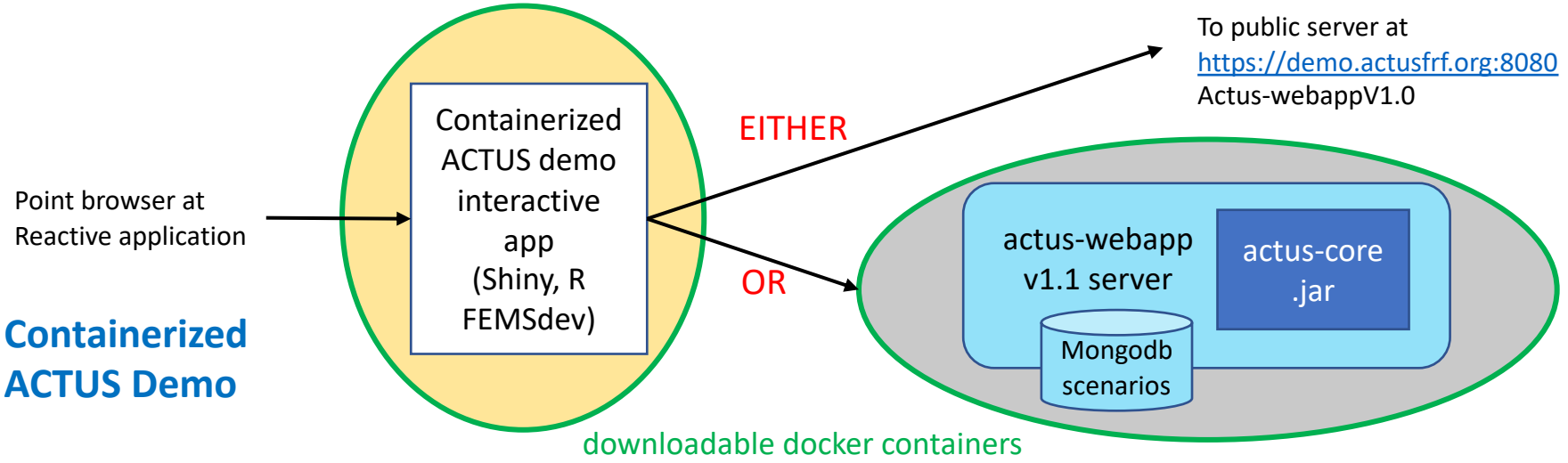
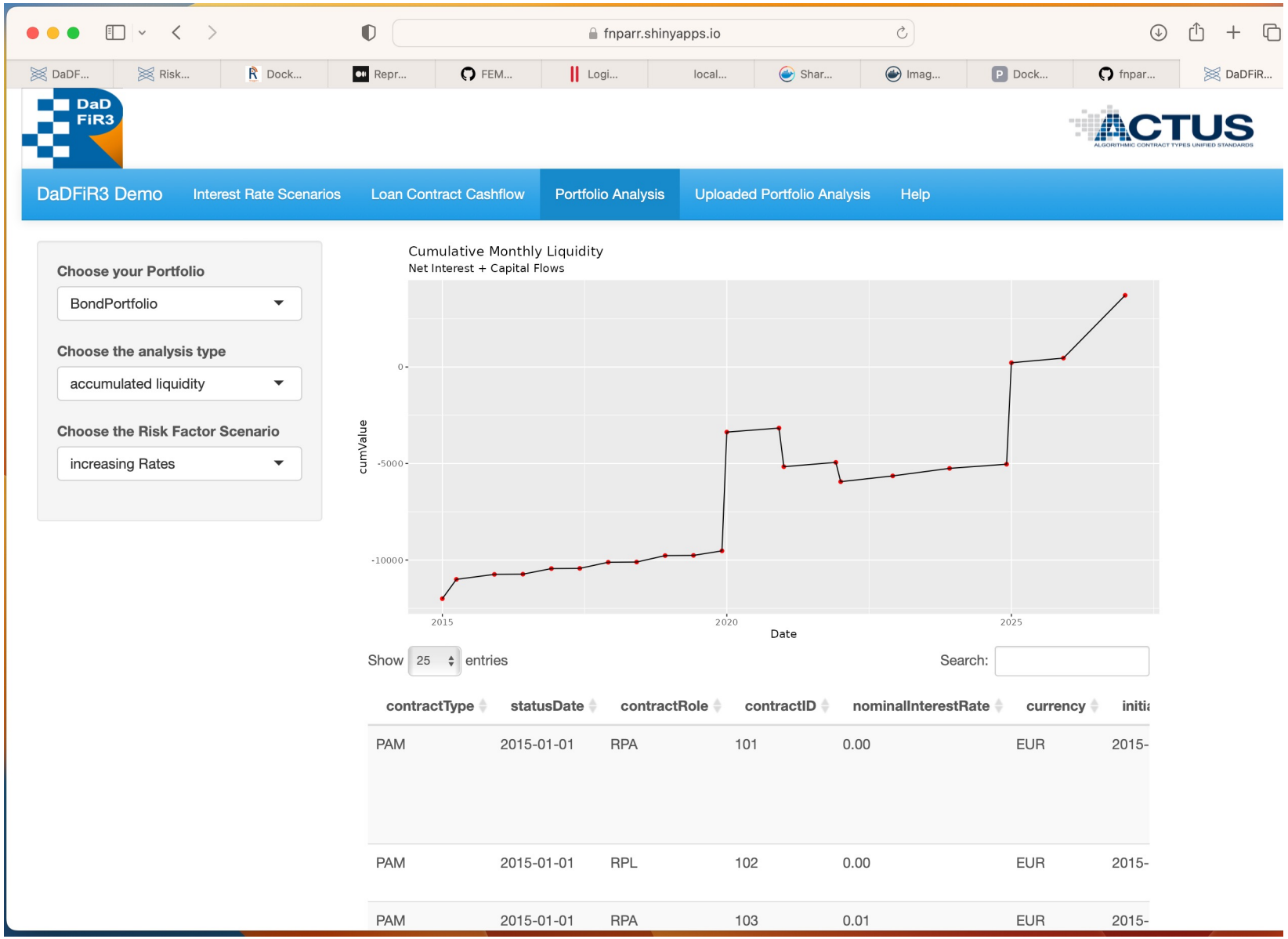
User exploration of ACTUS using docker container components

- ACTUS original demo: https://demo.actusfrf.org:8080
  - Illustrates ACTUS cashflow event timeline for each contract type
- Deployed shiny demo: https://dadfir3.shinyapps.io/DaDFiR3demo/
  - Simple profit and cashflow *portfolio reports* for *selected interest rate scenarios*
- Docker containers for R Shiny demo, and actus-webappV1.1: https://github.com/fnparr/docker-actus
  - Same demo as above – but componentized standalone desktop demo with risk factor API



An ACTUS cloud demo – https://dadfir3demo.rshiny.io



Summary

- **A containerized open source fine grained contract standard makes it significantly easier to add a forward-looking cash flow analysis to existing financial systems**

- **The breadth of contract types defined in ACTUS allows a complete forward- looking view across all asset types in complex institutions**

- **Because ACTUS is an open standard, with open source, royalty free reference implementations and risk APIs allows regulators and bank executives to have “the same” risk analysis tools**

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ALGORITHMIC CONTRACT TYPES UNIFIED STANDARDS

Questions?

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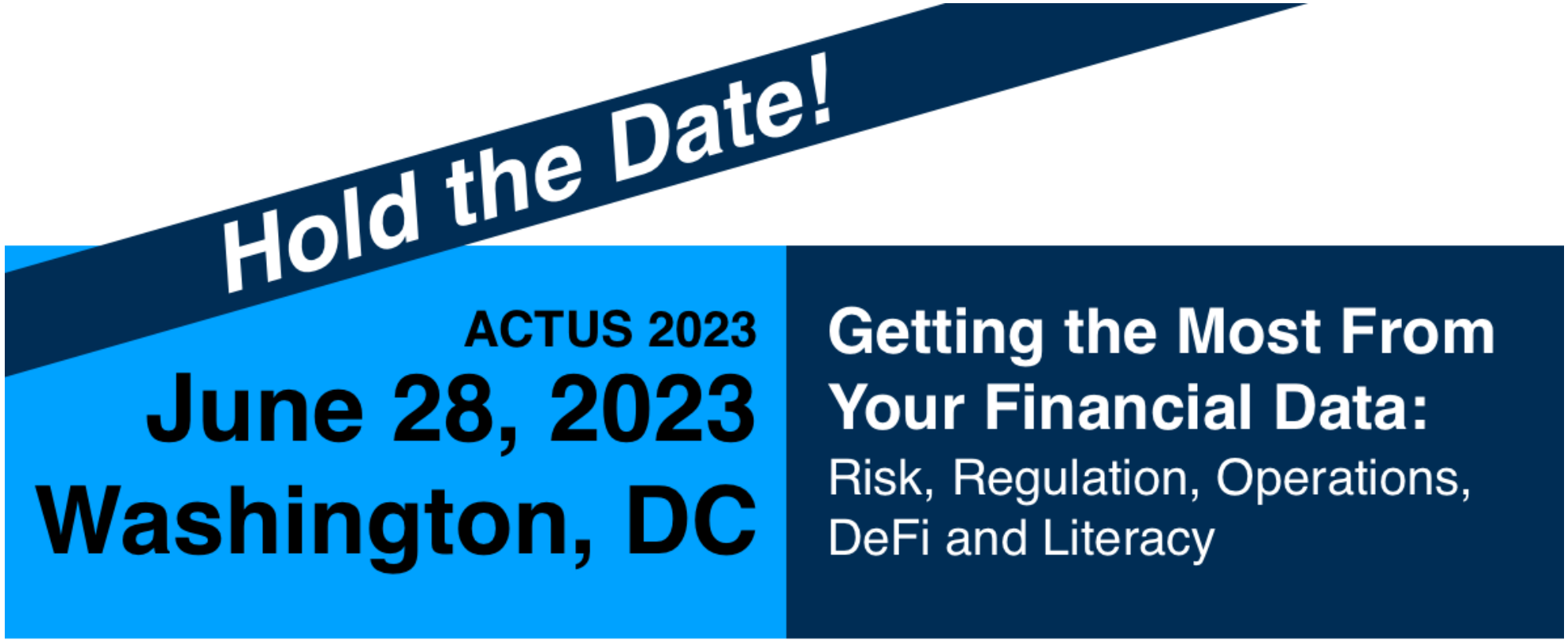

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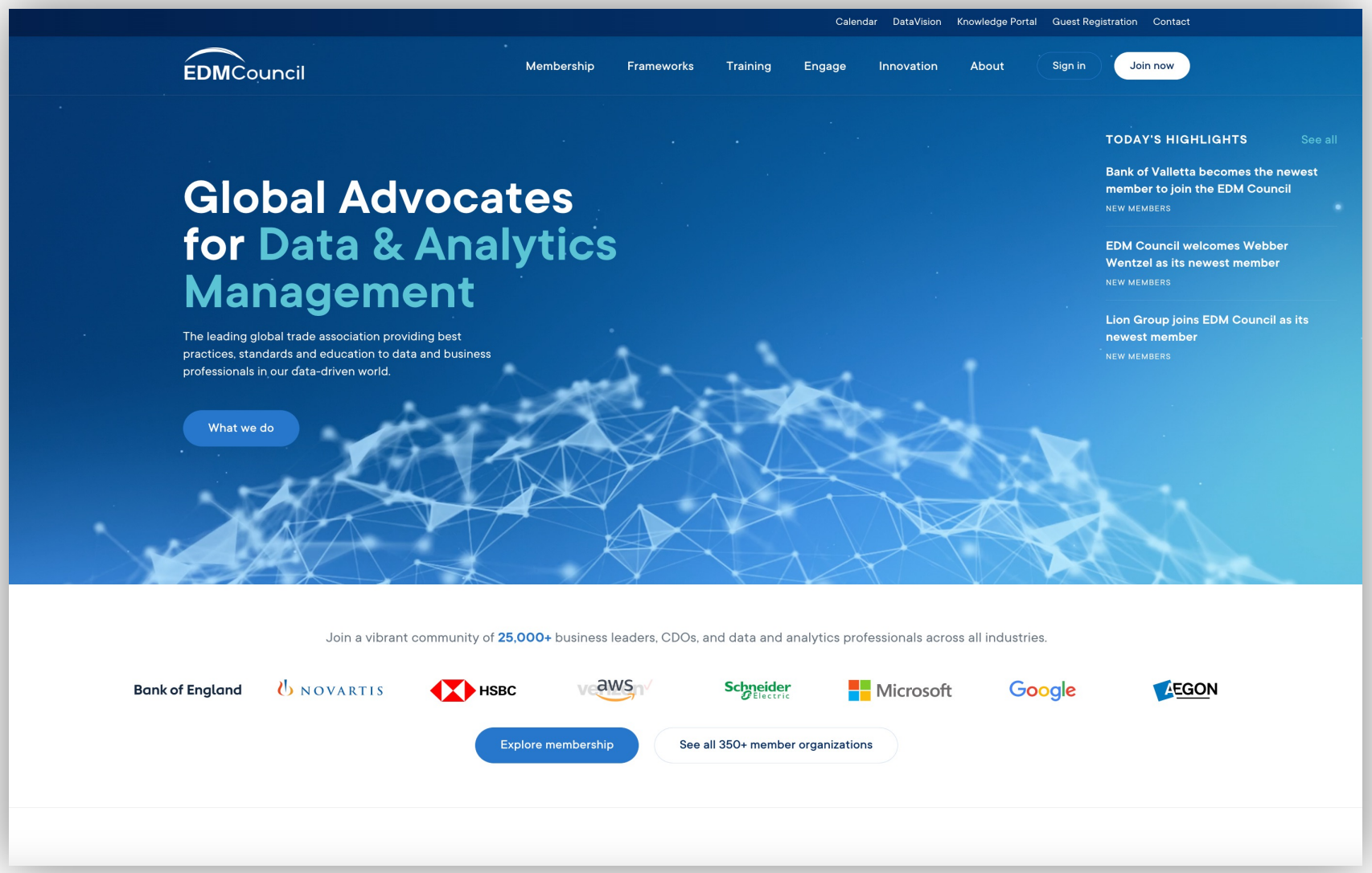

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Thank you!

FOR MORE INFORMATION:

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