

From: [Jefferson Braswell](#)
To: [Comments](#)
Subject: [REDACTED] August 22, 2024 Financial Data Transparency Act Joint Data Standards; Comment Request (RIN 3064-AF96)
Date: Thursday, October 17, 2024 8:56:27 PM
Attachments: [ACTUS Financial Research Foundation response to the FDTA consultation.pdf](#)

[REDACTED]

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Dear Sir/Madam,

The ACTUS Financial Research Foundation is pleased to have the opportunity to submit comments to the FDIC on the August 22, 2024 consultation on the FDTA Joint Data Standards proposal.

The ACTUS Financial Research Foundation is very interested to continue our dialogue with the FDIC on the topic of financial data standards as it applies to the needs and responsibilities of the FDIC to collect timely information from FDIC member institutions. ACTUS is a royalty-free and open standard (not proprietary) that can greatly improve the ability of the FDIC to oversee and manage the individual and systemic risks of depository institutions in the U.S.

ACTUS was in fact one of the 11 finalists in the Rapid Phased Prototyping competition that the FDIC staged with the goal of seeking improvements and alternatives to the quarterly call report and ways to establish an “early warning system” for risks to the health of the FDIC network of depository institutions.

We do believe that there would be significant merit in following up on the benefits and improvements for the FDIC that the prototype which we delivered clearly demonstrated. We would like to invite interested parties at the FDIC for a brief meeting in which we could summarize those benefits, so please feel free to forward this email and response to appropriate parties at the FDIC.

Please feel free to reach out with any questions about the attached response to the FDTA consultation.

Thanks again, and best regards,

Jefferson Braswell
Chair, ACTUS Financial Research Foundation Board
[REDACTED]



Comments on Proposed Rules Implementing the FDTA

Introduction

The ACTUS Financial Research Foundation (ACTUS FRF) is the not-for-profit developer of the royalty-free ACTUS Financial Contract Standard and the associated open-source ACTUS software. ACTUS FRF welcomes the opportunity to comment on the proposed standardization of regulatory data. The objective of ACTUS FRF is to make a transformative contribution to financial transparency and analytics. ACTUS models financial contracts using the data contained in the contracts themselves and the implied algorithms of the natural language financial contracts. The algorithms and the contract terms together precisely provide the obligations of a contract's counterparties to exchange payments.¹

The passage and implementation of the Financial Data Transparency Act is an important step forward in establishing a common understanding by financial regulators and the industries they regulate of data collected for regulatory purposes. This common understanding should ultimately not only enable a better understanding of the types of information currently collected, but also lead to new ways of representing data that enable critically needed regulatory analytics and insights, especially analytics that are also useful in the internal management of financial institutions. From this perspective, what is important is not only standardization per se but also the nature and structure of the standard or standards chosen and what they enable.

¹ www.ACTUSfrf.org

Pertinent to this objective is the statement by Senator Chris Dodd when introducing the Senate version of legislation that became the Dodd-Frank Act (DFA):

“...in addition to looking in the rear-view mirror, we must look through the windshield. There will be shocks to our system in the future for certain. And we need an early warning system so that the next time it occurs our system is prepared to deal with it.”

This objective of the Dodd-Frank Act has yet to be fully realized, as can be seen from the unexpected and rapid collapse of Silicon Valley Bank (SVB) 13 years after the passage of DFA. This large bank failure occurred only a few months after its regulator, the Federal Reserve, awarded SVB its highest rating for capital quality and quantity.

How to achieve the DFA objective was identified by Senator Jack Reed, the father of the Office of Financial Research:

“Regulators need to know who owes what to whom, (and when) ...this data collection effort requires data in a standard that supports forward-looking analysis...(which) begins by mapping the cash flows on a contract-by-contract basis (into the standard).”²

ACTUS – the standard we propose here – fulfills this condition. It can fully do so when used along with other standards, such as the LEI.

The “Common Rule” criteria

The Common Rule lays out excellent criteria for any standards that might be adopted under the proposed FDIA regulation:

- Reliance on international standards when available
- Reporting data in a format that is fully searchable and machine readable
- Reliance on high quality schemas and documents that clearly define semantic meaning
- Ensuring that a data element or data asset that exists to satisfy an underlying regulatory information collection requirement be consistently identified as such in associated machine-readable metadata
- Being nonproprietary or available under an open license.

These criteria are inherent in ACTUS:

- ACTUS is an open standard and available (royalty-free) to any user
- The ACTUS Foundation is a Liaison A member of ISO TC68 (Financial Services) and is preparing to submit ACTUS to ISO as a proposed ISO standard

² <https://www.youtube.com/watch?v=p2-HuTYLG4g>

- ACTUS incorporates existing ISO standards wherever possible, such as:
 - Dates - ISO 8601
 - Currencies - ISO 4217
 - Time Periods - ISO 8601
 - And other places where applicable
- ACTUS is a standard that is recognized by the Office of Financial Research (OFR) and is included in the OFR's Financial Instrument Reference Database (FIRD) required by DFA
- ACTUS is working currently on Proofs of Concept (PoCs) with the European Central Bank and the OCC
- ACTUS represents financial contracts as algorithms that are machine executable and data terms that are:
 - Machine readable
 - Searchable
 - Documented

FDTA and Common Data Standards: Necessary, But Not Sufficient

The importance of establishing data standards for the consistent reporting of financial data by the private sector and the consolidation, sharing and analysis of those data by the public sector agencies is well recognized and supported.

The Common Rule proposal contemplates meeting this important objective by combining:

- A small number of specific, individual data element standards, on the one hand, with
- A very general, and unspecific, mention of the need to establish or incorporate relevant, yet undetermined, financial data models (“ontologies, taxonomies, schemas”), on the other.

The fact that the FDTA Common Rule proposal calls for the use of semantic models and standards to further “financial data transparency” without any further guidelines is an implicit request to propose specific models and standards that can meet these needs.

However, as necessary as data standards are to fulfill the objectives of the Financial Data Transparency Act, by themselves data standards are not sufficient to ultimately realize the objectives of the FDTA. Data that is just a static snapshot of financial positions at a single point in time does not provide the forward-looking insight that is essential for analysts and examiners at regulatory agencies to be able to understand, anticipate and measure financial system risk.

Fortunately, by its very design, the ACTUS Algorithmic Contract Type Standard provides the capability to generate forward-looking cash flows when financial contract data is collected in the ACTUS Standard.

Enabling Forward-Looking Analysis

As mentioned above, the ACTUS Standard addresses the need of all prudential regulators to analyze and understand value, income, sensitivity, risk, and other financial metrics by utilizing forward-looking cash flow analysis.

The collapse of Silicon Valley Bank (SVB) in 2023 clearly demonstrated the need for additional analytical tools to better anticipate how the condition of regulated entities changes when the state of the world changes. This fact was recognized by the Federal Reserve in the Barr report. On Page 6 it states that as late as November 2022 the regulators judged SVB's capital as " 'Broadly Meets Expectations (BME),' which is the highest rating in the LFI³ rating system." As the Federal Reserve concluded in their post-mortem analysis, the net market value of SVB was about a negative \$17 billion while the value reported to the Fed in November 2022 was a positive \$14 billion.

An earlier and more direct focus on cash flows and potential difficulties arising from the structure of their balance sheet would have been of great help. The value of such an approach goes beyond addressing only the specific weaknesses revealed by the collapse of SVB. For example, a proposal currently being discussed would require all banking institutions to recognize unrealized gains and losses on securities. Such a proposal is a targeted response to the specific circumstances that led to the unforeseen collapse of Silicon Valley Bank. However, as is often the case with new regulations, it is designed to fix the weaknesses revealed yesterday. Enabling regulatory access to timely cash flow information would provide the analytics to see and address new threats to stability as they arise, as well as providing a fix for the specific weaknesses revealed by the SVB collapse. At the same time, this would be a "win/win" for financial institutions enabling them to better understand and manage their own risks and exposures.

In the following we will first provide an intuitive introduction to the ACTUS Standard. Then we will discuss the benefits that prudential regulators can realize by using the standard for the information collected from regulated financial institutions. Finally, we will discuss the steps needed to map granular transactions and position data into the ACTUS Standard.

The conceptual basis of ACTUS

The ACTUS Standard is based on the core business of financial institutions, namely creating, bundling, servicing, trading, and analyzing financial contracts. These contracts include many different types, such as car loans, mortgages, leasing contracts, swaps, futures, options of any form, and various kinds of deposits. All such financial contracts are pure exchanges of payment obligations which follow a small number of patterns.

³ Large Financial Institution

Payments or cash-flows are central to finance. They are important when a deal is contractually established, and they occur in various ways over time until the contractual maturity date or default. Furthermore, they are continuously analyzed over their lifetimes. Virtually all financial analytics share the same starting point: the contractual payment obligations and their associated cash flows. These are the cash-flows Senator Reed spoke about.

These sequences of payment obligations created by financial contracts are most precisely represented by algorithms. The algorithms are a collection of simple calculation formulas which define such things as the way interest is calculated, principal is paid, or an option pay-off is determined.⁴

The model we are describing is graphically represented in Figure 1 below:

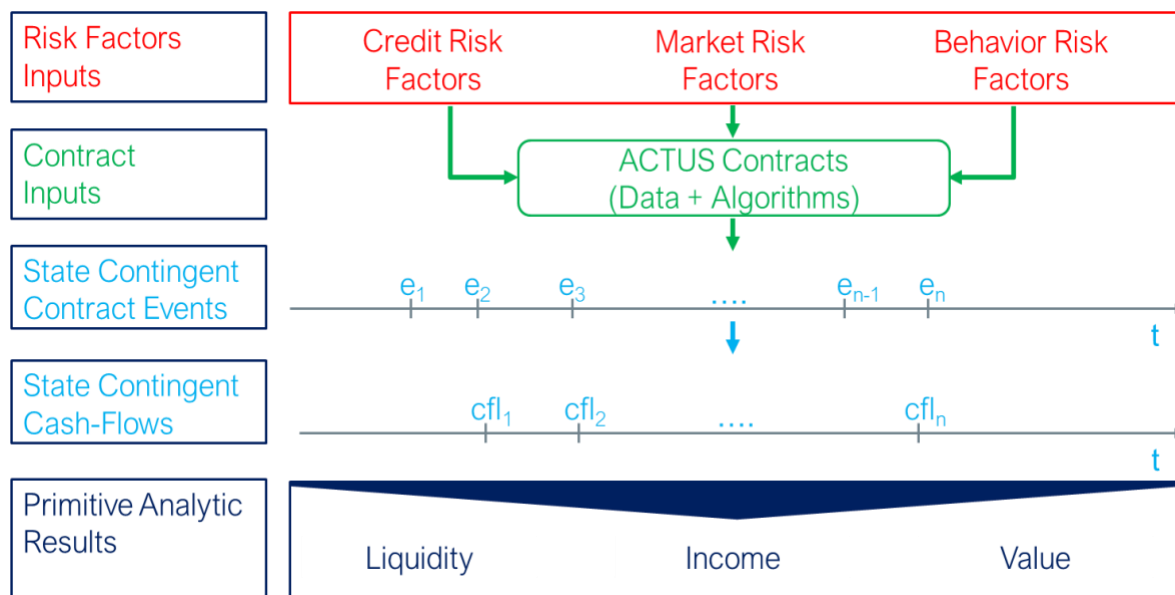


Figure 1: Financial contracts, risk factors and financial analysis

At the top of the graphic, we have the risk factors which influence the performance of all financial contracts. They are grouped into the categories of market, credit, and behavioral risk factors. Market risk factors are interest rates (yield curves), foreign exchange rates, and stock market prices, etc. Credit risk factors describe the likelihood of adherence to the payment promises in financial contracts. Behavioral risk factors describe items such as withdrawal behavior of saving accounts, prepayments of mortgages, refinancing during the term of a loan contract, etc. They are called “risk factors,” due to their stochastic, non-deterministic nature.

⁴ In fact, given the volume of financial transactions, operating a bank would be impossible without the use of computers and such algorithms. However, banks do not use a common standard for these algorithms.

As mentioned above, financial contracts – the second row in Figure 1 – can range from mortgages or other kinds of loans, deposits, bonds, swaps, futures, options, CDOs, etc. What they all share is:

- They are all pure exchanges of payments or cash flows over time;
- The payments or cash flow obligations are unambiguously defined by the financial contracts themselves;
- The most precise representation of these payment obligations is in mathematical form as computational algorithms;
- These payment obligations are deterministic irrespective of whether they are described in natural language or symbolically; and
- The number of relevant cash-flow exchange patterns used in financial contracts is quite small (we will discuss more about this below).

Financial contracts relate to external risk factors (shown on the top row of Figure 1, above) in multiple ways. Risk factors can be part of the financial agreements themselves. For example, in a swap or a variable rate bond, or an option pay-off. While the contract defines the exact or deterministic rule (which index to use and when to access it when calculating payment obligations), the final value of, for example, the interest payment in a variable rate bond will only be known on the day of the rate reset. The rule therefore is deterministic, whereas the resulting value must be considered stochastic until the point when it is executed.

External risk factors also play a pivotal role in valuation. Discount rates, for example, are derived at any point in time from observed yield curves. Market-determined foreign exchange rates are used to convert values from one currency to another, etc.

The third row in Figure 1 describes the financial contract events. Contract events are the execution of the rules defined within the contract, such as an interest or a principal payment, a fixing of an interest rate, etc.⁵ Given a certain state of the risk factors – such as observed on any given date or an assumed forecasted date – the calculation of the “state contingent contract events” becomes a deterministic exercise.

From these events, observed or forecasted, it is possible to extract the state contingent cash-flows, the fourth line in the graphic. These cash-flows are the necessary ingredients for any financial analysis from simple to complex accounting, and from simple to rocket science risk management. Anything of interest in finance is derived from these cash flows.

“State contingent cash-flows” means that the expected cash-flows are calculated for alternative states of the world. The lack of certainty about future states of the world is the reason it is not desirable nor appropriate for regulators to only collect pre-calculated cash-flows from banks. Regulators need the ability to re-analyze the contract cash flows under different scenarios. An adequate understanding of risk requires that the contract terms in association with their specific algorithms be provided in a standardized form. Recalculation by regulators is necessary for monitoring systemic risks as forecasts about the state of risk factors evolve.

⁵ In wealth management these events are often called “corporate actions.”

The notion “primitive analytic results,” on the fifth row of Figure 1, refers to the results which can be directly retrieved by simple summation from the state contingent cash-flows which constitute funding liquidity (cash-flows grouped in time buckets), nominal income, and nominal value. Financial analysis, however, goes much further. Many different valuation methods (such as fair value, amortized cost, etc.) have been developed over time, depending on perceived needs or usefulness. There are also many different risk management techniques, such as Value at Risk, expected shortfall, risk adjusted valuation, sensitivity analysis, stress testing and balance sheet forecasting using what-if, or Monte Carlo scenarios. These analyses require in many cases different assumptions or sources of information about the expected evolution of the risk factors and/or different views of the results.

Although this description represents finance accurately, reality imposes some obstacles, the reason being that financial contracts – the second row in figure 1– are written by lawyers and bankers in natural language using a special, generally non-mathematical terminology developed over centuries. The algorithms are hidden behind words, only understandable in given contexts and, therefore, difficult to recognize.

This obstacle can be overcome using the standardized algorithms of the open-source algorithmic financial standard ACTUS (Algorithmic Contract Type Unified Standard). The ACTUS Standard is comprised of the following major components:

- Taxonomy: A full taxonomy of all relevant financial contracts expressed as algorithms which embody the financial contracts cash-flow exchange patterns which we call ContractTypes.⁶
- Data Dictionary: a formal semantic definition, or Data Model, which defines and describes the full set of Contract Terms necessary and applicable for all defined ContractTypes.⁷
- Open-Source Reference Implementation (code): The algorithms that make up the ContractTypes are coded and
 - Defined and documented in a formal specification⁸
 - The code is available on GitHub
 - There is a sandbox where the code can be demonstrated and tested⁹
 - An open source “community edition” of a sample ACTUS cash-flow forecasting service is available for downloading and independent use on local desktop systems.

⁶ ACTUS currently defines 32 distinct patterns which, with limited exceptions, cover every type of contract used by all but the largest banks. Smaller banks may use products that are represented by as few as half a dozen ContractTypes. See <https://www.actusfrf.org/taxonomy>

⁷ <https://www.actusfrf.org/dictionary>

⁸ https://www.actusfrf.org/files/ugd/3df5e2_11de48b7dff47758c729f21e9d5219a.pdf

⁹ <https://demo.actusfrf.org/>

ACTUS taxonomy

As mentioned above, the number of cash-flow exchange patterns used in financial contracts is quite small. In fact, the number of algorithms - which we call ContractTypes – that are needed to represent the cash-flow obligations of financial contracts extant in financial markets is typically less than three dozen.¹⁰

Figure 2 gives an overview of the ContractTypes in the ACTUS Standard.

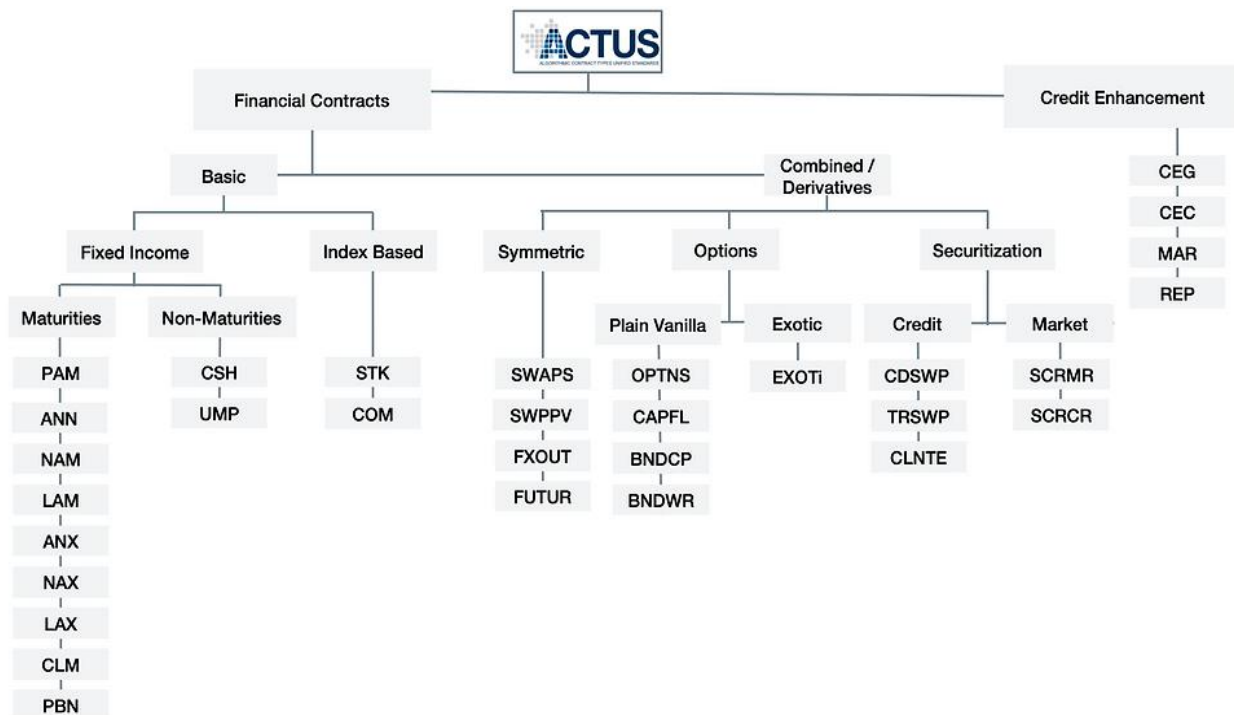


Figure 2: ACTUS taxonomy

The meanings of the short-hand names of the ContractTypes are defined on the ACTUS website: <https://www.actusfrf.org/taxonomy>. In order to see the definitions you need to scroll down through the landing page.

- Each ContractType is an algorithm made up of a set of well-defined computational functions which compute the payment obligations to which the counterparties to a financial contract have agreed.

¹⁰ All financial contracts in general use are covered by the ACTUS Standard. Most retail banks operate with financial contracts that are represented by only a handful of ContractTypes. However, some large financial institutions may have highly specialized trading operations that create exotic bespoke instruments that might not be precisely represented by any of the ACTUS ContractTypes. Nevertheless, such instruments can still be represented by non-standardized algorithms.

ACTUS Benefits

Using the ACTUS Standard can benefit all parties.

- *Financial institutions* will be able to reduce reconciliation problems and costs in general, produce higher quality analytics, and more easily apply their own stress tests and scenarios, and perform them more frequently.
- Using ACTUS to convey payment obligations can increase financial transparency and improve financial literacy for *consumers*.
- For *regulators*, gaining access to granular financial contract information in the ACTUS Standard places regulators on an equal footing with the risk managers of well managed financial institutions. Regulators would have the same data and could have the same analytical power to carry out their regulatory mandates, including the ability to perform more frequent stress tests and scenarios.
- By using such a standard, regulators can understand the condition of each regulated institution on an ongoing, and if necessary, very timely basis. They will not have to depend on the regulated institution's internal systems and will not be limited to backward-looking time-consuming manual reviews of on-site, randomly selected samples of financial accounts or contracts.
- Since the financial structures and actions modeled by ACTUS provide direct support to carry out examiner responsibilities, it will become easier and more efficient for prudential regulators to train examiners and for examiners to carry out their tasks.
- The ACTUS Standard enables comprehensive systemic risk analysis.

The Barr Report on the collapse of SVB makes a strong case as to why this is important. When the size of SVB's balance sheet rapidly grew from \$50 billion to more than \$200 billion, its status changed from an RBO (Regional Banking Organization) to an LFBO (Large and Foreign Banking Organization). This change in status required the assignment of SVB to a new Fed supervisory team. The Barr Report has a lengthy discussion about the time it took for the new regulatory team to get acquainted with the SVB internals. This difficulty arises because the data situation in each bank is different. It takes a long time to understand the condition of the bank in terms of valuation, sensitivity, and other standard risk metrics. This problem would not arise if regulators collected granular financial contract data in the ACTUS Standard on an ongoing basis. The supervisors would have clearly seen the problems at SVB long before its insolvency.

Another example of the benefit of ongoing access to granular balance sheet data in the ACTUS Standard is related to the FDIC's responsibility to resolve insolvent insured depository institutions. It would become much easier to identify and value assets and liabilities and their relationship to one another and, therefore, to sell off assets or merge failed banks.

Furthermore, it will not be possible to understand and oversee the financial system as a system rather than a collection of individual institutions without the adoption of data and algorithmic

standards. ACTUS standardizes and directly models the contractual cash flow obligations between institutions in the financial system. Macro-prudential regulators must be able to directly see the network of cash flow obligations between financial institutions. For regulators with responsibility to safeguard the entire system, this is essential.

Cost of Mapping Contract Data to the ACTUS Standard

Lastly, a word on the cost or burden of mapping the financial contracts of a financial institution to the ACTUS standard.

While it is difficult to make a general statement regarding the cost to map contracts from production systems of record for any given financial institution to ACTUS, there are several factors that make this exercise much more straightforward and practical than might otherwise be imagined.

- **One-to-one, financial product/financial contract mapping**
 - The definitions of the data elements referenced by the various algorithmic financial Contract Types in the ACTUS Standard are all contained and defined in a single, manageable “flat” data dictionary of approximately 150 data elements. Each ACTUS Contract Type references the elements in the ACTUS Data Dictionary that are applicable to the ACTUS Contract Type algorithm.
 - Most production systems that perform the daily operations of financial institutions are themselves implemented in a manner that allows the origination, updating and processing of very large numbers of financial product contracts in batches that also utilize “flat” record structures containing the specific terms of each financial contract.
 - The main product lines of a commercial bank typically utilize the bank’s own internal application contract type logic for the financial products of each product line (e.g., deposits, residential mortgages, commercial loans, time deposits, credit cards, etc.), and the ACTUS taxonomy of defined Financial Contract Types was itself derived and developed by simply understanding and embodying the logic of existing financial contract products..
 - The net result of this is that the process of mapping from the internal, contract type flat format and terms of the production systems of a bank’s different product types into the equivalent terms of the (flat) ACTUS Data Dictionary and Contract Type for those systems is straight forward.
- **Non-invasive, read-only, repeatable extraction from settled systems-of-record**
 - The financial data that is mapped into ACTUS is extracted and mapped in a read-only manner from systems of record that reflect settled positions. There is no need to modify or disrupt any of the core processing of an institution, nor modify

any of its transactional messaging or workflow that constitutes the ongoing operations of a financial institution.

- Once established, the read-only mapping and extraction process can be scheduled and automated.
- Snapshots of the contractual obligations and commitments of an institution can be obtained from systems of record in this fashion. This information can not be obtained using balance-only information in general ledger accounting systems.

- **Working with financial services core processors will result in economies of scale**

- The very large majority of financial institutions outsource their core banking operations to core processors that utilize a common data platform to operate a single data processing set of applications.
- A single mapping exercise of a core processor's financial contract systems of record to the ACTUS format would result in effectively mapping all the banks that use that core processor to ACTUS.

- **Prior experience**

The amount of time and resources required to map a bank's balance sheet into ACTUS depends on:

- the size, complexity, and quality of the available data contained in the balance sheet;
- the availability of required staff at an institution who are qualified to provide information regarding the source format;
- the nature and capabilities of the mapping tools and previous mapping knowledge that are brought to the project.

Apart from the very large, global, systematically important banks (G-SIBs) or other very large, multinational financial institutions, satisfactory results with typical commercial banks have required as little as 3 months and 3-4 qualified staff to initially map an institution's basic product lines (i.e., mortgages, deposits, commercial loans, time deposits, etc.). Additionally, incremental follow-up after initial mapping has been performed as needed to resolve data quality issues or mapping exceptions.

This is similar to the degree of effort involved to initially map legacy data for use by a new, third-party application that is introduced for use at an institution, but without the time and effort involved in training staff, modifying operations, or altering workflow needed to incorporate the application at a bank. This effort is also significantly less than the effort that is typically expended in data warehouse projects that often take years of development and ongoing maintenance to support. Furthermore, the economies of

scale obtained when the mapping to ACTUS is performed at core processors or vendors that service many hundreds of banks effectively reduce the degree of effort for each bank by several orders of magnitude.

Recommendation to Adopt the ACTUS Financial Contract Standard

The fact that the FDTA Common Rule proposal contemplates the use of semantic standards models (e.g., ontologies, taxonomies, schemas) to further “financial data transparency” without any further guidelines is an implicit request to propose appropriate models and standards to meet these needs and objectives.

The mission and focus of the ACTUS Foundation is the development and promotion of the ACTUS Standard as the best practice standard for the representation, transmission, collection, and forward-looking analysis of financial contracts for both financial institution and systemic regulators.

ACTUS enables:

- Standardized representation of each financial contract in a bank
- Forward-looking projection of cash flows and contract events
 - Based on current contract state
 - Under any number of user-defined scenarios
- Analysis of cash flow results of individual contracts
 - Consistent aggregation up to any desired level
 - Drill-down from aggregated results to individual source contracts
- Consolidation of financial contract data across business units and products, and for single institutions as well as systemwide
- Integration with third-party tools and apps

Collaboration and Cooperation of Financial Standards Initiatives

There is tremendous breadth and depth of all the operations, relationships, technologies, resources, assets and liabilities, customers, vendors, commitments, policies, plans, risks, and regulations that form the interactions of actors in the private and public sectors in the real economy. Not surprisingly, there is no single scheme or model that comprehensively and completely models all aspects of the real economy.

Rather, several cooperating models, each of which addresses an appropriately scoped subdomain of the real world, need to be integrated with standards that allow the models to interoperate via their natural interfaces.

A similar approach involving complementary models and standards that address different major aspects of the financial system and which interoperate and complement each other is also needed.

The ACTUS Standard itself does not know “who owes whom”, and therefore needs to incorporate a standard to uniquely identify counterparties of financial contracts. The Legal Entity Identifier (LEI) was established for this very reason. ACTUS can utilize the LEI as the identifier of counterparties as part of the contractual terms of ACTUS contracts. Not only is that important for financial institutions to understand their own enterprise credit risks, but also necessary for regulators to be able to assess and manage systemic risk.

The ACTUS Foundation liaises and cooperates with other standards organizations and initiatives that are working to develop standards in business and technology domains that are complementary to ACTUS. For example:

- ISO 20022
- ISO TC68 (Financial Services)
- ISO TC307 (Distributed Ledger Technology / Blockchain)
- ISO/IEC 11179 (Metadata Registry)
- ASC-X9 (Industry Forum For Financial Data Harmonization)
- Office of Financial Research (OFR) (Financial Instrument Reference Database)
- CPMI/IOSCO (Critical Data Elements Harmonization)
- EDM Council (Data Management, Industry Models)
- G-20 FSB Regulatory Oversight Committee (ROC)
 - ANNA Derivatives Service Bureau (DSB) ISIN, UPI
 - Global LEI Foundation (GLEIF) LEI
- Object Management Group (OMG) FIBO, FIGI
- BIAN (Banking Industry Architecture Network)
- xBRL (Financial Accounting)

Respectfully submitted, on behalf of the ACTUS Financial Research Foundation, by:

Jefferson Braswell -- Chair, ACTUS Financial Research Foundation Board ¹¹

The Honorable Allan I. Mendelowitz, Ph.D., President, ACTUS Financial Research Foundation ¹²

Willi Brammertz, Dr. Oec, Chair, ACTUS Users Association Board ¹³

Joseph Langsam, Ph.D, Director, ACTUS Financial Research Foundation Board ¹⁴

Professor Henriette Elise Breyman, Dr. Phys, Director, ACTUS Financial Research Foundation Board ¹⁵

Bob Mark, Ph.D -- Director, ACTUS Financial Research Foundation Board ¹⁶

¹¹ Founding Partner and CEO, Tahoe Blue Ltd; Former Chair: Technology, Operations and Standards Committee of the Board of Directors, Global LEI Foundation; Former President of Risk Management Technologies (RMT) Berkeley.

¹² Former Chairman of the Federal Housing Finance Board; Co-Leader of the Committee to Establish the National Institute of Finance; former Executive Director, Congressional Trade Deficit Review Commission; Executive Vice President, U.S. Export-Import Bank; Managing Director - International Trade and Finance, U.S. GAO; Brookings Institution, Economic Policy Fellow.

¹³ Founder and CEO of Ariadne Business Analytics; Author of the book “Unified Financial Analysis – the missing links of finance” (Wiley, 2009) that provides the concept on which ACTUS builds.

¹⁴ Former Morgan Stanley Managing Director responsible for Fixed Income Analytic Modeling; 2 years as senior lecturer, Sloan School, MIT, 6 years member Board on Mathematical Sciences and Analytics for the National Academy of Sciences, and 6 years as Policy Fellow, Smith School, University of Maryland; Founding member of Committee to Establish the National Institute of Finance; Co-Editor, Handbook on Systemic Risk.

¹⁵ Professor at Zurich University of Applied Sciences; Secretary of ACTUS Financial Research Foundation and ACTUS Users Association.

¹⁶ Managing Partner of Black Diamond Risk Enterprises, founding Executive Director of the MFE Program at the UCLA Anderson School of Management, Co-Founder of PRMIA; awarded as the Financial Risk Manager of the Year by GARP; Formerly Chief Risk Officer at several tier 1 banks as well as co-author of three Risk Management books.