Observations on the Digital Revolution
Financial Innovation and FinTech

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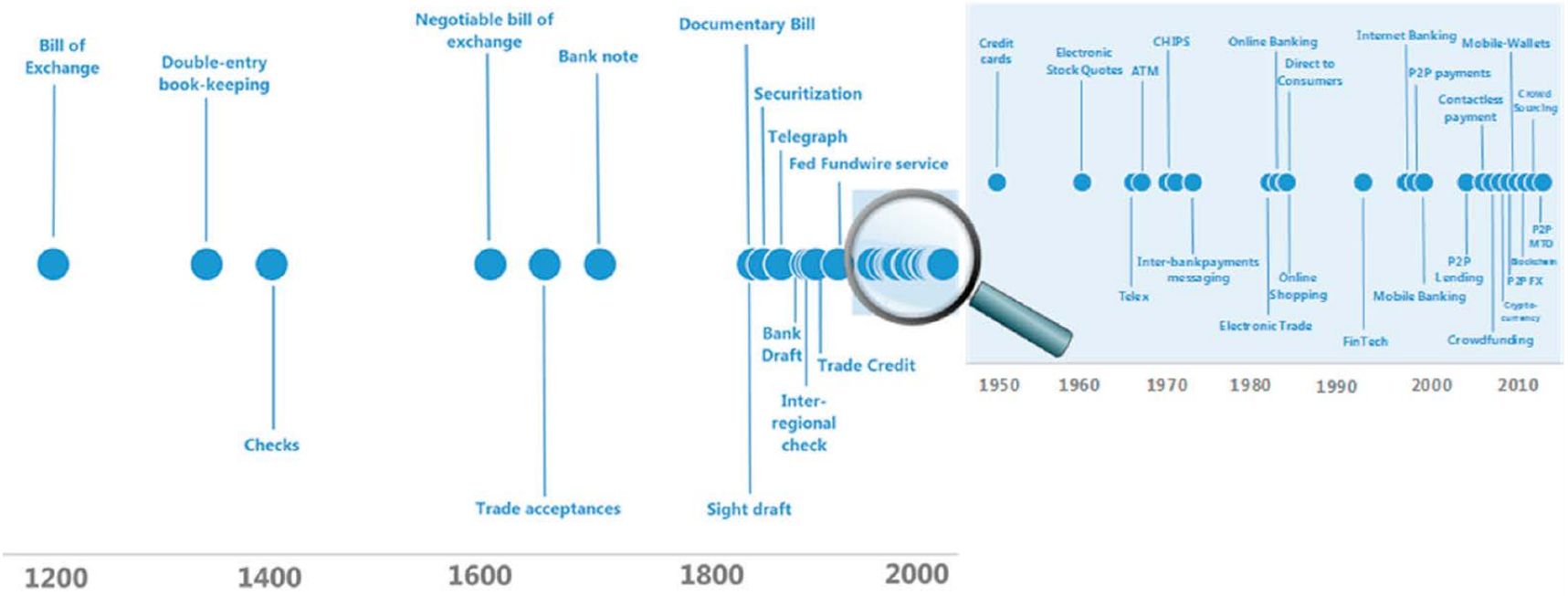
Overview of remarks

- Digitalization of financial services, “FinTech”, offers enormous global opportunities for new and improved services and substantially lower costs, with disproportional improvements accruing to those who are underserved by current standards.
- Successful realization of these opportunities faces material challenges and there will definitely be financial service industry “winners” and “losers” from its successful implementation.
- FinTech innovations will create disruptive challenges for users, providers, advisors and regulators of financial services but also create potentially significant opportunities for them as well.
- Will today’s technology disruptions to current practice of existing financial-service providers lead to their displacement or will it create enhanced opportunities for them?
- Four challenges to be addressed for the successful and wide-scope adoption of FinTech:
  - *Trust* -- fundamental to financial services; technology by itself is not sufficient to create it
  - *Credit risk* – what’s worse than being uninsured? Believing you are insured when you’re not
  - *Innovation risk* – implementation of innovation mismatched to the infrastructure to support it
  - *Regulation* – supports trust; government is ultimately responsible for system failures.
- Appendix: FinTech is “not new” but is important-- financial innovation wave of the 1970s
- Appendix: Risks of FinTech implementation isn’t new either --- financial crisis of 2008-9

Accelerating Pace of Technological Progress in Financial Services



Sources: Arner, Barberis, and Buckley (forthcoming); Quinn and Roberds (2008); World Economic Forum (2015).

A FinTech Challenge: Trust is Fundamental to Financial Services

- Technology by itself is not sufficient to create trust. Transparency or verification is a substitute for trust.
- FinTech will succeed most easily in areas of financial services involving calculations, processing and record-keeping where performance can be readily tested and verified, and in any activity in which transparency can be adequately substituted for opaqueness. Truly transparent services do not require trust.
- FinTech with technology alone will be challenged in disrupting services and products that are "inherently opaque [i.e., cannot be made transparent] such as financial advice, solutions and many integrated financial products. The only means of providing those services and products is through trust. Technology by itself is not a substitute for trust.
- FinTech requires a model and the data to populate it. The model selected will depend on the objectives of the selector. Models require abstractions from complex reality and the selection of the abstractions involves judgment—the "art of the science". The quality of the data used in the model is critical. These judgments are opaque, extremely difficult to verify, and thus, inherently require trust by users.

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Verification: How Long Does It Take to Verify Superior Advice? How Much Outperformance or Underperformance is Required?

- Historical average return = 15% and standard deviation = 20%
- 95% confidence level of outperformance or underperformance [t-statistic = 2.0]
- What future realized sample returns would be needed to achieve significance?

PERIOD OF PAST HISTORY = 10 YEARS

Future Observation Period	Required Outcome
5 years	< - 12% or > 42%
10 years	< - 7% or > 37%
20 years	< - 5% or > 35%

PERIOD OF PAST HISTORY = 30 YEARS

Future Observation Period	Required Outcome
5 years	< - 9% or > 39%
10 years	< - 3% or > 33%
20 years	< 0% or > 30%

Practical conclusion: performance cannot be verified based on return series alone

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Trust is Essential for FinTech to Succeed and Fintech's Success Will Enhance the Value of Trust

- Trust requires two components: 1. trustworthy 2. competence.
- FinTech increases time efficiency and lowers cost by substituting "black box" technology for human efforts of both advisors and providers but in doing so it also increases "opacity", which in turn makes trust an even more important and valuable asset. FinTech's success will thus drive increasing value for the trusted advisor, provider, consultant and overseer.
- Technological advances will likely leverage providers who have the "trust asset" to enhance their expansion instead of taking business away from them. Technology to succeed will have to partner with entities that can provide the trust asset, since it cannot create trust by itself. The trusted provider must assess the risk of lost of its valuable asset by supporting a Fintech that fails. How will the value jointly created be shared between the technology and the trust assets?
- Consumers of financial services lost trust in their providers and their regulators in the 2008-9 crisis. Financial advisors and institutions with business strategies based on restoring trust by minimizing conflicts of interest, such as fee-only independent advisors, will disrupt traditional product-based wealth-management models with captive distribution broker and adviser systems. Will established institutions that are trusted and adopt Fintech have an advantage over new FinTech entrants into financial services? Will the industry become more fragmented or more concentrated?

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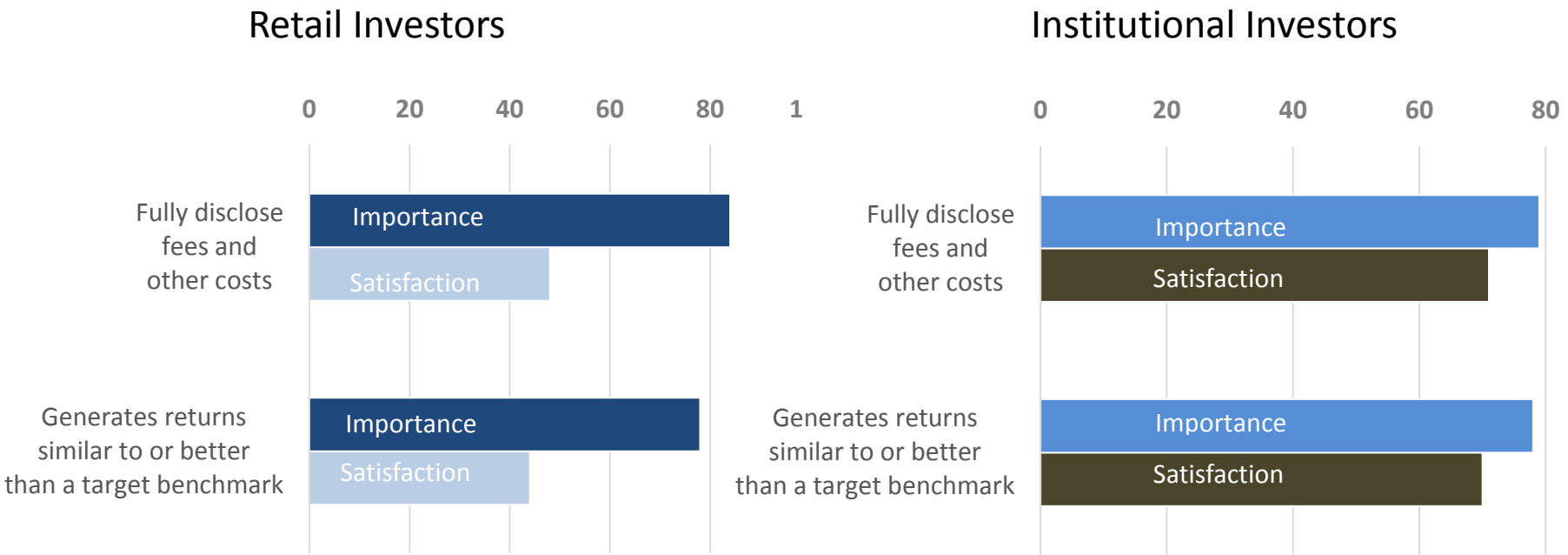
Missing Trust: Retail Investors Register Low Satisfaction with Cost Disclosures and Performance from Active Portfolio Managers

Satisfaction and Importance ratings by investors (%)



Source: CFA Institute
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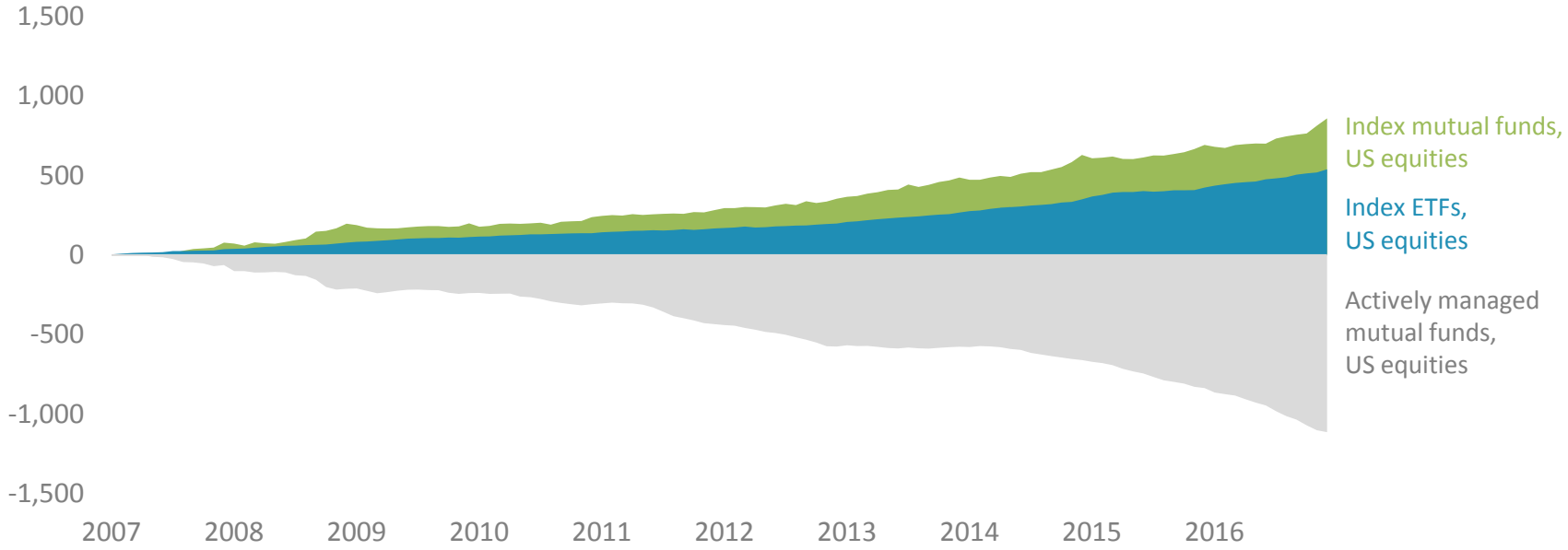
Growth of Index Funds and ETFs vs. Actively Managed Funds Industry Impact of a Loss of Retail Investor Trust 2008-9 and a Continuing Flight to Transparency as a Second-Best Strategy?



Source: 2017 ICI Factbook. http://www.icifactbook.org/ch2/17_fb_ch2

Cumulative flows to and net share issuance of index mutual funds (US equities) and index ETFs (US equities), billions of dollars; monthly, January 2007–December 2016. Prior to October 2009, index equity Index ETF (US equities) data include a small number of actively managed domestic equity ETFs. Note: Equity mutual fund data include net new cash flow and reinvested dividends. Data exclude funds that invest primarily in other funds. Copyright © 2017 by the Investment Company Institute. All rights reserved. The charts is for illustrative purposes only and are not indicative of any investment.

Improving Regulatory Innovation to Create and Restore Trust

- Cultivate the “Trust Triangle: consumer-provider; consumer-regulator; regulator-provider – FinTech regulation much more important for B-to-C than for B-B
- Fiduciary duty responsibility for financial advisors strengthened to promote creation of trust but with significant clarity on the meaning of “client’s best interests”, to provide balance to protect the advisor from too much litigation risk.
- Encourage transparency and avoidance of conflict of interests
- Mandated disclosures matched to the user of the information. E.g., disclosures to customers should contain only information deemed “meaningful” to the customer, to avoid inducing frustration or poor decisions
- Risk definitions and measures consistent with the purpose or goal of the product or advice offered. E.g., risk of retirement-income-goal product or portfolio measured in terms of volatility of its retirement income and not the volatility of its value.
- Disclosures of expenses to permit meaningful comparisons among similar alternatives. Expenses disclosed for a product or service could include the total embedded fees of the product [computed like VAT] as well as the marginal contribution to expense from service or product provider.
- Regulations should be routinely reviewed for their “unintended” consequences

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Block-Chain Technology with Great Potential Impact on Industry
The Essential Role of Trust in Its Successful Implementation

- Determining ownership – clearing and settling transactions—is a fundamental function in both finance and real estate—Block Chain offers transformational potential for a non-centralized, efficient, low-cost and highly reliable method for clearing & settling.
- Block Chain cannot succeed unless it is accepted and therefore trusted.
- How do the users determine the motivation of the creator of the system?
- How do the users determine the quality of the specific block-chain model in the system?
- How do the users determine the quality and completeness of the data used in the model?
- How do the users determine the degree of security for the data and the model?
- How do the users determine the reliability of who is responsible if system fails?

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Trust in Digital Currencies is Supported by Intrinsic Value
Fiat Digital Currencies are Not All the Same: Legal Tender vs Not

- Legal-tender fiat currencies have intrinsic value because they can always be used to settle government obligations of taxes and fees ($4.8 trillion annually in US) and all legal-tender-denominated private-sector financial obligations.
- Fiat digital currencies that are not legal-tender do not have such intrinsic value.
- The viability of any currency depends on collective trust by its users and lack of any material intrinsic value is a prime sources of its instability.
- Because governments hold the ultimate responsibility for failures in their payment systems, it is difficult to imagine their accepting as legal tender any currency that was not under their control including controlling unobservable flows into and out of their jurisdictions by criminals and terrorists.
- Governments have the power to effectively ban the holding of any legal-tender currency surrogate [e.g., ban on US citizens ownership of gold prior to 1971]. Such a ban is a risk for all non-legal-tender currencies and another important source of instability.
- Prediction: only government-controlled digital currencies will be legal tender.

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A FinTech Challenge: Credit Risk

- Credit risk is the risk that an issuer/provider will not fulfill the promised future payments or other deliverables such as repairs on its products and services.
- Customers vs investors: *customers* do not want and don't expect the payouts on the products or service purchased to depend on the fortunes of the issuer/provider. *Investors* expect the payout on the securities, products, or services purchased to depend on the fortunes of the issuer/provider. The same entity can be a customer for some products and an investor for other products. Lending to customers, loans, is not a credit-sensitive business. Borrowing from customers, deposits, is a credit-sensitive business.
- The efficiency and effectiveness of customer products is diminished by issuer/provider credit risk. The efficiency and effectiveness of investor products is not diminished by credit risk.
- FinTech provider can appear to be lower cost when it is not, if its credit risk in not properly taken into account.
- FinTech provider often must convince its credit-risk-sensitive customers that it is not risky.

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Very Excited About FinTech But Concerned About Innovation Risk

- Successful innovations always run ahead of the necessary infrastructure to support them and therefore the mismatch between the two is a structural risk of innovation
- Limit the speed until reach balanced equilibrium—managing the tradeoff between efficient implementation with stability vs. stifling innovation is a major challenge
- Damage by those who do not heed this balance is not limited to them but also impacts others who use the same system….it destroys trust and hinders subsequent innovation for all…financial system is particularly vulnerable because enormous common-carrier structure 2008-9 financial crisis
- Ponzi's scheme started out as a legitimate arbitrage opportunity across geopolitical borders but then in the frenzy of get-rich-quick…free-lunch beliefs degenerated into a pyramid scheme with no connection to the original arbitrage [aka purpose] or sustainability.
- When it happens, fools and knaves are attracted…dot-bomb era 1999-2000 and again in 2008-9, legitimate and valuable financial innovations went amuck to help create a financial crisis

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Managing the Risk of Innovation: 5 Rules of Thumb

- Recognize that all decisions about how to implement and use an innovation depend on models, whether formal or intuitive, and the data used to apply the model
- Acknowledge the model's limitations—all models are incomplete descriptions of complex reality and therefore will fail under certain conditions
- Expect the unexpected– every innovation requires a process to manage its failure, even if the cause of failure is unknown.
- Understand the application and user of the model –make sure they are well matched to the model employed
- Check the infrastructure—the benefits and risks of an innovation are not only determined by the choices about how to use it but also by the infrastructure into which it is introduced.

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A FinTech Challenge: Regulation

- Effective regulation can improve trust and reduce credit-risk exposure for customers
- Regulation can improve trust in markets and intermediaries for both customers and investors.
- Government guarantees such as deposit insurance can eliminate credit risk of providers to their customers, who do not want it
- Every system is built on models. Models are incomplete description of reality and so all models can fail. Therefore every viable system must have a process for handling failure.
- Government is held accountable for addressing systemic or system-wide failure and therefore needs to impose regulations to manage the risk and cost of such failures.
- If FinTech alternatives for services are lower cost as the result of not having to comply with regulations of traditional intermediaries, so called “regulatory arbitrage”, they will lose that advantage once the regulatory process catches up. If regulations were flawed or unnecessary, they will be driven to change for traditional as well as the alternatives.

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Appendix: FinTech is "Not New"
Major Financial and Economic Crisis 1970s:
Risk Explosion and Stagflation in USA

- Multi-dimensional explosion of volatilities in the western financial systems
- Fall of Bretton Woods currency system
- First oil crisis in 1973-4 and a second one in 1979
- Double-digit inflation in the US, highest since Civil War
- Double-digit interest rates, highest since Civil War
- No mortgage money: Regulation Q -5% deposit interest cap
- High unemployment ~9%
- "Stagflation" unknown, and still unsolved, economic disease
- Stock market fell 50% in real terms mid 1973 – 1974
- 1973-1975 recession was really a 1970s recession because its effects extended into the 1980s

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1970s Risk Explosion Drives an Explosion of Financial Innovation in USA--Later Adopted Throughout the World--Finance Science and Technology Became Inexorably Linked to Innovation of the Financial System—FinTech is "Not New"

- Option exchange: financial value insurance
- Financial futures for currencies, interest rates, stocks
- NASDAQ , first electronic stock market
- Money market funds, high-yield and floating rate bonds
- Index funds Stage Coach Fund 1970 & Vanguard 1975
- TIAA-CREF international diversification in stocks 1972 – global diversification of asset management
- ERISA 1974 modern employer-funded pension system in US
- May Day 1975 negotiated commissions which sparked the institutionalization of stock trading
- Debt securitization and creation of a national mortgage market
- Interest-rate swap contract eliminated forever the largest risk in banks –maturity-mismatch
- Reform destructive regulations: elimination of deposit rate ceilings
- Finance science & computers: quantitative models and data bases were essential for these innovations
- Fee-rates reduced but not fee revenue because of wider and deeper financial services provided

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Speaker Profile

Robert C. Merton is the School of Management Distinguished Professor of Finance at the MIT Sloan School of Management and the John and Natty McArthur University Professor Emeritus at Harvard University. He was the George Fisher Baker Professor of Business Administration (1988–98) and the John and Natty McArthur University Professor (1998–2010) at Harvard Business School. After receiving a PhD in Economics from MIT in 1970, Merton served on the finance faculty of MIT's Sloan School of Management until 1988 at which time he was J.C. Penney Professor of Management. He is currently Resident Scientist at Dimensional Holdings, Inc., where he is the creator of Target Retirement Solution, a global integrated retirement-funding solution system.

Merton received the Alfred Nobel Memorial Prize in Economic Sciences in 1997 for a new method to determine the value of derivatives. He is past president of the American Finance Association, a member of the National Academy of Sciences, and a Fellow of the American Academy of Arts and Sciences.

Merton has also been recognized for translating finance science into practice. He received the inaugural Financial Engineer of the Year Award from the International Association for Quantitative Finance (formerly International Association of Financial Engineers), which also elected him a Senior Fellow. He received the 2011 CME Group Melamed-Arditti Innovation Award and the 2013 WFE Award for Excellence from World Federation of Exchanges. A Distinguished Fellow of the Institute for Quantitative Research in Finance ('Q Group') and a Fellow of the Financial Management Association, Merton received the Nicholas Molodovsky Award from the CFA Institute. He is a member of the Halls of Fame of the Fixed Income Analyst Society, Risk, and Derivative Strategy magazines. Merton received Risk's Lifetime Achievement Award for contributions to the field of risk management and the 2014 Lifetime Achievement Award from the Financial Intermediation Research Society. He received the 2017 Finance Diamond Prize from Fundación de Investigación , IMEF

Merton's research focuses on finance theory, including lifecycle and retirement finance, optimal portfolio selection, capital asset pricing, pricing of derivative securities, credit risk, loan guarantees, financial innovation, the dynamics of institutional change, and improving the methods of measuring and managing macro-financial risk. Merton received a BS in Engineering Mathematics from Columbia University, a MS in Applied Mathematics from California Institute of Technology, and a PhD in Economics from Massachusetts Institute of Technology and honorary degrees from eighteen universities. http://robertcmerton.com/