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FINANCE BEYOND CRISIS
Impact, Disruption, and Innovation

Thursday, April 25, 2019 / Convene, 117 West 46th Street / New York, NY

#MITSloanFinance
Welcome Remarks

David Schmittlein, John C Head III Dean, MIT Sloan School of Management
Opening Session

Leonid Kogan, PhD ’99, Nippon Telegraph & Telephone Professor of Management
Faculty Head, Finance Group, MIT Sloan School of Management
Finance at MIT

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pushing boundaries
solving problems
improve the world
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The financial crisis tested industries, governments, and academia. Some failed. Finance at MIT scored high by tackling issues head on.
The crisis strengthened our resolve

...principled finance is an essential leadership skill

...the language of finance is a passport to engaging in the world
our common ground
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It’s the people taking finance education, thought and invention to new levels

It’s the vast capabilities, resources and potential of the global MIT Finance Ecosystem

It’s where ingenuity drives results
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16 affiliated faculty
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Built on rigor and action

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- Undergraduate programs
- MicroMasters in Finance
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“The modern intellectual history of finance begins with Paul A. Samuelson, who started his lifelong career at MIT in 1940.”
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Investor behavior
Systemic risk
Funding models
Financing retirement
Technological innovation
Industry Partnerships
Engaging global business

New business models
Broader access
Data driven insights
Improved security

Finance at MIT
Academic Programs
Faculty and Advisors
Innovations and Tools
Students and Graduates
Centers and Labs
Research and Insights
Alumni Network
Forums and Events
Alumni Network
Making global impact

24,000 MIT Sloan alumni
136,000 MIT alumni
95 MIT clubs
90 countries
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Presenting thought leaders

- MIT FinTech Conference
- MIT Sloan Investment Conference
- MIT Venture Capital & Innovation Conference
- MIT ETA Summit
Solve complex problems and fuel progress in the world through the ingenuity and reach of the MIT Finance Ecosystem.
Solve complex problems
fuel progress in the world
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MIT SLOAN IDEA EXCHANGE

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Thursday, April 25, 2019 / Convene, 117 West 46th Street / New York, NY
SeLFIES—a globally applicable bond innovation to improve retirement funding, support infrastructure development, and lower government financing cost and risk

Robert C. Merton, PhD ’70, School of Management Distinguished Professor of Finance, MIT Sloan School of Management
Global Challenges of Funding Retirement
Why current retirement funding systems may not be sustainable

- Sources of potential non-sustainability of current retirement funding systems
  - Shifting demographics: populations aging rapidly
  - Increasing longevity: population living longer
  - Economy shift from rural agriculture toward city industrial
  - Difficult budget positions of governments running deficits
  - Legacy of large unfunded liabilities of define-benefit and pay-as-you-go ("PAYGO") pension plans from inadequate contributions and overly optimistic return-earning
  - PAYGO systems’ sustainable contribution rates are very sensitive to demographics, longevity and growth rate of the economy
  - Contribution and balance sheet risks too great for plan sponsors causes the subsequent exit from defined-benefit plans ("DB")
  - Traditional role of defined-contribution plans ("DC") was supplemental and not for core retirement funding, and so current practice is not a suitable solution for core retirement
Korea: Challenges of Funding Retirement

Why current retirement funding systems may not be adequate or sustainable

• National Pension Service (NPS) fund may be on unsustainable long-term path
  – Buffer fund is expected to diminish from 2040 and could be depleted by 2060
  – Increasing the contribution rate from current 9% to correct this may be difficult
  – Cutting benefits may also be difficult and at a 40% maximum replacement ratio which is already inadequate to provide a full retirement funding, may not work
  – Increasing general tax rates to provide government subsidy is not a long-run fix
  – Trying to increase return by taking more investment risk, requires a “safety net” funding plan in case the risk is realized

• About 51% of population is in NPS, which means that 49% is not covered

• Private pensions: 17% of population have a retirement pension and 24% have a personal voluntary one. However those so covered have large overlap with NPS and so a material part of population is uncovered by either a public or private plan

• Conclusion: more of the population will become responsible for funding a larger proportion of their retirement through personal saving and Defined-Contribution plans

• SeLFIES is a proposed innovation to enable people to do so and improve retirement outcomes
What is a Goal for a “Good” Retirement?

“An inflation-protected income for life that allows you to sustain the standard of living you enjoyed in the latter part of your working life.”

Standard of living is measured by income, and not by wealth. Standard-of-living risk is measured by income risk and not wealth risk.

*Reality everywhere*: Individuals will have to take greater responsibility for funding their own retirement in the future than in the past.

SeLFIES is a bond innovation to address this challenge.
What are SeLFIES?
Standard-of-Living indexed, Forward-starting, Income-only Securities

• SeLFIES payouts are designed to create a pension-like payout pattern desired by individuals for retirement
• There is a deferred start of payouts until a specified future date (anticipated retirement date) and from that date on there are annual level payouts with indexing, until a specified ending date (a bit longer than life expectancy at retirement)
• SeLFIES would be issued as a series in small denominations with different annual starting dates
• The payouts are indexed to aggregate per capita consumption, so that the holder is hedged against both consumption inflation and standard of living change risks
• Robust design to work in any country.
E.G. SeLFIES – Standard-of-Living indexed, Forward-starting, Income-only Securities

26-Year Old Planning to Retire at Age 65 (2058) with Goal of $50,000 Retirement Income

• Each 2058 SeLFIES has the following:
  – Starts paying periodic level-payouts of $10/year in 2058 for a fixed period of 20 years, with no principal or “balloon” payout at its maturity in 2078
  – Payouts indexed to per-capita consumption
  – Protects the holder against inflation and standard-of-living changes

• Super simple to figure out what you need to own to meet your goal
  Goal = $50,000/$10 = need to own 5,000 bonds

• Super simple to figure out how close you are to your goal
  Where am I? Own 3,000 bonds = $30,000. You are 60% to your goal

• Addresses the challenge of a lack of financial literacy for savers to take responsibility for their own retirement outcomes
Why Do SeLFIES Have a Payout Time Pattern Different from Traditional Bonds with Periodic Coupon Payments and a Principal “Balloon” Payment at Maturity?

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Why Index Cash Payouts to Consumption Per Capita Instead of Just to Inflation (CPI) ?

Goal for retirement is referenced to sustaining the standard of living experienced in the *latter* part of work life just before retirement –

Average Compound Growth Rates: Korea

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Consumption per Capita*</th>
<th>Inflation (CPI)**</th>
<th>Standard of Living (SoL)</th>
<th>Goal Short-Fall CPI Only / (CPI &amp; SoL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007-2017</td>
<td>3.7%</td>
<td>2.3%</td>
<td>1.4%</td>
<td>0.87 10 Years</td>
</tr>
<tr>
<td>1997-2017</td>
<td>5.0%</td>
<td>2.2%</td>
<td>2.7%</td>
<td>0.64 20 years</td>
</tr>
<tr>
<td>1987-2017</td>
<td>8.4%</td>
<td>3.9%</td>
<td>4.3%</td>
<td>0.28 30 years</td>
</tr>
<tr>
<td>1965-2017</td>
<td>13.6%</td>
<td>7.4%</td>
<td>5.8%</td>
<td>0.04 53 years</td>
</tr>
</tbody>
</table>

*Covers both inflation (CPI) and standard of living (SoL)  
**Covers inflation (CPI) only

Source: Statistics Korea, Bank of Korea Economic Statistics System
Standard of Living Growth in Korea 1965-2017
Annual Inflation-adjusted per Capita Consumption
Who Will be the Users of SeLFIES?
Individual Retail and Institutional Investors

- Individuals who are uncovered by any public or private pension plan and must accumulate assets for retirement through personal saving
- Individuals who are covered by a pension plan but the plan benefits are inadequate to provide for a good retirement and they must accumulate additional assets for retirement through personal saving
- Individuals who are covered by a pension plan but at least part of the plan requires their personal decision-making and responsibility as to what to invest the plan assets in, as in a defined-contribution (DC) plan
- Institutional investors such as pension funds and insurance companies who have pension and annuity benefit liabilities, and want to hedge them effectively and at low cost
- General institutional and retail investors who would want an efficient and low-cost core “best-diversified” portfolio, according to finance theory [Consumption Capital Asset Pricing Model, Breeden 1979]
Why Government Should be the Issuer of SeLFIES?

• SeLFIES will have no credit risk and so made very simple for buyers because do not worry about risk of default and all the associated disclosures

• Reliable supplier—to be successful most be prepared to issue bonds in good and bad times and have the capacity to provide large volume on regular basis

• Governments with VAT are “natural” issuers because the bond payments can be hedged by VAT revenues, since VAT is a tax on consumption

• Issuing SeLFIES ensures more domestic holding of government debt, a material benefit, especially for emerging market countries

• A security issued by government to improve financial market “completion” similar to 2007 issuing of JGB 40-year “ultra longs” or 1997 issuing of US Treasury inflation-indexed bonds “TIPS,” could also reduce debt funding cost

• Governments doing infrastructure financing improve maturity-matching of funding for infrastructure investments which reduces re-financing risk and issuing costs; can also be used to management government tax-revenue risk
Addressing Multiple Market Needs and Policy Objectives with a Single Bond Innovation: Retirement Income, Funding Infrastructure, and Improving Investors’ Core Diversification… all by Issuing SelFIES

- Principle: match the “best” issuers with the “best” holders and improve to maximize scale and minimize cost
- Retirement funding improvements for individuals and institutions; improve maturity-matching of funding for infrastructure investments to reduce re-financing risk and issuing costs; control government tax-revenue risk
- Pattern of delayed payouts for many years and then level payouts match infrastructure cash inflow pattern and provides a precise match to cash flow needs of retirees, so no further transactions are needed by either issuer or buyer
- Finance science predicts that an asset which is perfectly correlated with aggregate consumption would be an ideal diversification asset for all investors
Appendix

- Survey of professional interest in SeLFIES—South Africa

- Scientific papers underlying SeLFIES

- Public interest in SeLFIES—op-ed and news articles
Survey of Interest in SeLFIES - What feature(s) of SeLFIES appeal to you?

A. Forward Starting / Deferred payment
B. The in-force payment pattern
C. The indexing feature
D. Some or all of the above
E. None of the above

Voted: 136
Survey of Interest in SeLFIES:
Assuming it was possible, would you take retirement SeLFIES?

A. Definitely interested – Assuming the economics makes sense

B. Slight interest – Can’t really see the investment merit here

C. No Interest

Voted: 136

Actuarial Society of South Africa Conference 2018
Scientific Papers Underlying SeLFIES Concept


Interest In SeLFIES: OP-ED & Articles

- South Africa: Survey Actuarial Society of South Africa
- USA/Europe: Op-ED Pensions & Investments Europe & PLANSPOsor
- UK: The Economist Will SeLFIES Stick?
- France: OP-ED Le Monde
- Japan: Nikkei
- Australia: Investment Magazine
- India: Times of India
- Turkey: RÖPORTAJ
To address the looming retirement crisis, many governments are introducing new pension programmes tied to employment for uncovered workers (NEST in the UK and Secure Choice in some US states). These attempts to improve access to pensions, and continue a trend of transferring responsibility for retirement security from governments and employers (via defined benefit [DB] plans) to the individual (via defined contribution [DC] plans), as neither governments nor companies are willing to bear the liabilities associated with pension obligations. This shift requires new thinking about how portfolios are managed and which instruments are available to investors. Our proposed SelfIES (Standard of Living indexed, Forward-starting, Income-only Securities) make individuals self-reliant and are also advantageous for governments.

For optimal portfolio management, members of DC plans should focus on maximising funded status or retirement income (not wealth, as in traditional investment approaches). Further, unlike multi-generational DB plans, DC plans must achieve their objectives in a single lifetime, and it is hard to pool risks because these plans are inherently flexible: (a) participation is often voluntary; (b) participants may require liquidity; (c) retirement ambitions, risk tolerance and life expectancy vary; and (d) employment patterns change over time (ie, the gig economy does not tether an individual to a single company). A new financial instrument is needed to enable financial security for retirees in the current environment.

DC investors seek to ensure a guaranteed, real income, ideally from retirement to death. It is also reasonable to assume they would want to lead a lifestyle comparable to pre-retirement. Investing in existing assets (stocks, bonds, or REITs) is risky because these do not provide a simple cash flow hedge against desired retirement income. For example, viewed through the retirement income lens, a portfolio of traditional, 'safe' government securities, unless heavily financially engineered, would be risky because of the cash flow (and potential maturity) mismatch between traditional bonds and the desired income stream.

There is thus a need for governments to issue a new 'safe' bond instrument, which we call SelfIES. These will ensure retirement security and the government is a natural issuer.

The innovative SelfIES design
A default-free bond offers certainty about two characteristics critical for DC retirement portfolios: (i) a commitment to pay over a particular time horizon (how/when one is paid); and (ii) a specific cash flow (what is paid). DC investors require a guaranteed cash flow that protects their real purchasing power in retirement. Two simple innovations could create the 'perfect' instrument.

The first innovation addresses (i) 'how/when one is paid' by creating forward-starting, income-only bonds. These would start paying investors upon retirement, paying coupons only for a period equal to the average life expectancy.
SeLFIES a good look for Australian retirement

By Robert C. Staunton and Avan S. Mundifish | 06.05.2018

The Treasury Department has issued a report seeking comment on ways to improve retirement income security in Australia. (Retirement Income Covenant Position Paper: Stage one of the Retirement Income Framework, May 2018).
SeLFIES For India

These long-term bonds can fund India's infrastructure needs and improve retirement security

Robert C. Norton and Anu M. Mahatma

The Indian government unveiled its Budget and recognition that the infrastructure sector needs investments of Rs 80 lakh crore (equivalent to USD 13.4 trillion as a primary step). Simultaneously, certain provisions in the Budget seek to improve the lives of retirees, and finance minister Arun Jaitley specifically noted that “a life with dignity is a right of every individual. In general, more so for the senior citizens.”

Once the major challenges that India will face is ensuring the income security of its senior citizens, especially in a country where financial literacy is relatively low. The government has committed fund infrastructure, especially since it has given permission to the National Highways Authority of India (NHAI) and other institutions to issue bonds, and to have an immediate impact on the retirement challenge by issuing a new type of long-term bond, one we call SeLFIES – Standalone Life Insurance, Forwarded, Interest Only Securities.

SeLFIES addresses many of the challenges raised in the Budget and can also be advantageous to the ministry of finance, especially in light of the recent implementation of a Goods and Services Tax (GST).

“Life with dignity” would ideally include guaranteed, real income, from retirement through death, and the ability to lead a lifestyle compatible to pre-retirement. The Indian government and documentation because they are largely financial illiterate.

The complexity of retirement planning leaves many confused about what constitutes adequate savings for retirement. Individuals are overwhelmed by the information provided and the absence of a robust and uniform method to make these calculations. Moreover, there is uncertainty over what to invest in and how best to destructure. Most adults can hardly answer questions about compound interest, the effects of inflation or the benefits of diversification. Investing in assets is risky relative to the retirement objective, because the assets fail to provide a stable or secure cash flow.

SeLFIES are designed to pay people when they need it and how they need it. Even the most financially illiterate individual can be self-reliant with respect to retirement planning.

The equity markets are not sufficiently deep or developed. More importantly many insights into key missions because they can be complex, expensive, and illiquid. Investors figure and being able to smooth down their wealth and maintain a steady income through their retirement years.

The Indian government's natural hedge of revenues against the bonds, through GST.

In this way, even the most financially illiterate individual can be self-reliant with respect to retirement planning. For example, if someone wants to guarantee Ro 100,000 annually, risk-free for 15 years, to maintain their current standard of living, they would invest only 4% in SeLFIES. 20%, Ro 20000 divided by Ro 90,000, over their working life.

The complete details of how much to save, how to invest, and how to draw down are simply folded into an easy calculation of how many bonds to buy. SeLFIES do not address all issues, including longevity risk, but can bring many toward improving retirement security.

These securities are a good deal for governments, too. In fact, governments, are the biggest beneficiaries. SeLFIES not only improve retirement outcomes for all citizens saving for retirement, but also have spill over benefits.

First, collections from SeLFIES reflect increase in cash flows for infrastructure spending, thereby, large cash flows for capital expenditures, followed by delayed, inflation-indexed revenues, some projects are national. Their implementation has been a challenge for the current government, especially given the current budget.

SeLFIES gives the Indian government a natural hedge of revenues against the bonds, through GST.
老後保障向け金融商品
退職後支払いの新型国債を
個人の資産運用負担軽減

経済教室
SeLFIES - Turkey

MIT PROFESÖRÜ NOBEL ÖDÜLLÜ ROBERT MERTON VE GEORGETOWN UNIVERSITY EMELKİLİR ARAŞTıRıMALARı MERKEZİ

DR. ARUN MURALĐHAR, "Emelkilik için Basit ve Ethan Bir Çocuğun Önerisi: SeLFIES"

“ÖMERDİRİMİ ZEVİK, ABO AĞUSTALVA, JAPONYA VE HİNDİSTAN'DA OLDUĞU GİRİŞ TÜRKİYE'DE DE EMELKİLİR: SİSTEMİNİ HİLESTRİP, MIYONACA KATLAMACI, DOĞAL MALAYCH, KOLAY VE GÖZÜM'DE EMELKİLİR: YOĞU AÇABILİR.”

Büyük ve küçüklerle birlikte, 2020 baharında benim de o kadar güzel bir rehberin, bu dönenin 20. yılına kadar, SeLFIES'in anahtar gizemini, Emelkilik'in en şık ve reyonal şekillerini, en şık ve reyonal şekillerini, en şık ve reyonal şekillerini, en şık ve reyonal şekillerini, en şık ve reyonal şekillerini, en şık ve reyonal şekillerini, en şık ve reyonal şekillerini, en şık ve reyonal şekillerini, en şık ve reyonal şekillerini, en şık ve reyonal şekillerini, en şık ve reyonal şekillerini, en şık ve reyonal şekillerini, en şık ve reyonal şekillerini, en şık ve reyonal şekillerini, en şık ve reyonal şekillerini, en şık ve reyonal şekillerini, en şık ve reyonal şekillerini, en şık ve reyonal şekillerini, en şık ve reyonal şekillerini, en şık ve reyonal şekillerini, en şık ve reyonal şekillerini, en şık ve reyonal şekillerini, en şık ve reyonal şekillerini, en şık ve reyonal şekillerini, en şık ve reyonal şekillerini, en şık ve reyonal şekillerini, en şık ve reyonal şekillerini, en şık ve 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Q&A

How to submit your questions

WEB

Scan the QR Code or visit POLLEV.COM/MITSLOAN
Enter your name and class year (Example: Sally, MBA 99)
Enter your question during any Q&A Session

TEXT

Text MITSLOAN to 22333
Text in your questions during any Q&A Session
The Role of Housing and Mortgage Markets in the Financial Crisis

Antoinette Schoar, Michael M. Koerner (1949) Professor of Entrepreneurship; Professor Finance, MIT Sloan School of Management
NEW CONSENSUS OF THE HOUSING CRISIS

- Housing markets were subject to a classic asset bubble
  - Rising house prices and over-optimistic expectations played a key role in the increase in mortgage debt and defaults
  - Households increased demand for housing and mortgage debt across all income groups, especially middle-class borrowers
  - Banks lent against increasing collateral values and underestimate the risk of defaults

- Not a “subprime crisis” but a middle-class crisis!
  - Financial sector acted as an amplification mechanism for changes in expectations by lending into the bubble
  - No unilateral shift of credit allocation towards marginal or sub-prime borrowers, Adelino, Schoar, Severino (2015, 2016)
THE FACTS

- The Run-up: Credit expanded across the income distribution, not just poor or low FICO borrowers
  - Middle/high income households had a much larger contribution to mortgage debt before the crisis than poor/low FICO borrowers
  - Debt-to-income levels (DTI) went up for all income groups
  - Loan-to-Value distribution stayed constant before the crisis
  - Faster churning of houses leading up to the crisis
  - Ownership rates went down for subprime and low income households before the crisis

- The Aftermath: Sharp increase in delinquENCIES for middle class and prime borrowers after 2007
  - Middle class and high FICO borrowers made up much larger share of defaults, especially in areas with high house price growth
MORTGAGE ORIGINATION ACROSS INCOME GROUPS STAYED STABLE

Fraction of mortgage dollars originated per year by income quintile (HMDA)
MORTGAGE DEBT EXPANDED PROPORTIONALLY

Data from SCF, own calculations
COMBINED LOAN TO VALUE DISTRIBUTION AT ORIGINATION

Corelogic, own calculations
INCREASED SPEED OF HOME SALES

Share of owners moving in last 12 months, ACS data

![Graph showing share of owners moving in last 12 months across different quintiles from 2001 to 2015. The graph includes lines for Quintile 1 (lowest), Q2, Q3, Q4, and Quintile 5, with values ranging from 0 to 0.1.]
SUBPRIME TAKES ROLE OF FHA/VA

Share of FHA/SubPrime Mortgages in 2000 versus 2005
THE AFTERMATH …
SHARE OF DELINQUENT MORTGAGES (3 YRS OUT)

<table>
<thead>
<tr>
<th>Year</th>
<th>FICO &lt; 660</th>
<th>660 ≤ FICO &lt; 720</th>
<th>FICO ≥ 720</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>71</td>
<td>20</td>
<td>9</td>
</tr>
<tr>
<td>2004</td>
<td>63</td>
<td>25</td>
<td>12</td>
</tr>
<tr>
<td>2005</td>
<td>47</td>
<td>34</td>
<td>18</td>
</tr>
<tr>
<td>2006</td>
<td>39</td>
<td>38</td>
<td>23</td>
</tr>
</tbody>
</table>
SHARE OF DELINQUENT MORTGAGES BY FICO AND HOUSE PRICE GROWTH

2003 Cohort

- Low HP Growth 02-06: 26 (FICO < 660), 8 (FICO > 660)
- Q2: 15 (FICO < 660), 7 (FICO > 660)
- Q3: 13 (FICO < 660), 7 (FICO > 660)
- High HP Growth 02-06: 17 (FICO < 660), 4 (FICO > 660)

2006 Cohort

- Low HP Growth 02-06: 6 (FICO < 660), 7 (FICO > 660)
- Q2: 6 (FICO < 660), 6 (FICO > 660)
- Q3: 7 (FICO < 660), 14 (FICO > 660)
- High HP Growth 02-06: 37 (FICO < 660), 20 (FICO > 660)
DROP IN HOMEOWNERSHIP FOR LOW INCOME HOUSEHOLDS

Data from ACS, own calculations
AND IF YOU WANT TO BE SCARED …

Share FHA and VA loans

Data from Corelogic, own calculations
IMPORTANT POLICY IMPLICATIONS

• (Optimistic) house price expectations played a major role in the expansion of credit and delinquencies

• Important focus on macro-prudential implications
  o Systemic build up of risk can lead to losses across the financial system, e.g. strategic responses to house price drops
  o Protect functioning of financial system when crisis occurs
  o How to build provisions against losses across financial institutions once a crisis occurs

• After the crisis the risk of housing debt has shifted to the government (FHA, VA and the GSEs)
  • Next housing downturn will be born by US tax payers
Q&A

How to submit your questions

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Scan the QR Code or visit POLLEV.COM/MITSLOAN
Enter your name and class year (Example: Sally, MBA 99)
Enter your question during any Q&A Session

TEXT

Text MITSLOAN to 22333
Text in your questions during any Q&A Session
Break

Program will resume at 11:00 a.m.

Please help yourself to refreshments at the three Nourish stations throughout the venue.
Is Equity Market Exchange Structure Anti-Competitive?

Chester Spatt, Golub Distinguished Visiting Professor of Finance, MIT Sloan School of Management; Distinguished Senior Fellow, MIT Golub Center for Finance and Policy Pamela R. and Kenneth B. Dunn Professor of Finance, Tepper School of Business, Carnegie Mellon University
Post “NMS” Stock Trading & Exchange

• Access fee pilot & market data
• Affiliate families vs. competition
• Cross-subsidization
• Analogy: Pricing tiers: The design of airline frequent flyer programs and competition
• Rebate pricing tiers: Customized, intricate, price discrimination & agency conflict
• Interaction: Pricing tiers, data & co-location
• Profit-max pricing tactics by exchanges
• Link to “Best Execution”
“Maker-taker” vs. “Taker-maker”

• “Maker-taker”
  — Subsidize “maker” (limit order)—rebate
  — Charge fees to “taker” (market order)
  — Encourage liquidity provision: Exchange competition

• “Taker-maker” (“inverted model”)
  — Subsidize “taker” (market order)—rebate
  — Charge fees to “maker” (limit order)
  — Enhance attractiveness for market orders
  — Similarities to “payment for order flow” model

• Neutrality vs. Agency
Agency Problem

- Distortion in the routing decision due to distinct buckets for routing fees & rebates vs. execution—sets up “agency” conflicts
- Evidence in the form of routing to platforms that offer rebates, poor/slow execution (both empirically, theoretically)
- Battalio, Corwin and Jennings (JF, 2016) documents agency problems & identifies some problematic brokers
- Enhanced disclosures on routing practices or execution costs would be very useful
  — Ban on fees/rebates or side pocket
Access Pilot Proposal

• SEC unanimously adopted (Dec. 2018) a pilot to study tightening the fee caps and whether it should ban rebates

• Control and three treatment groups
  — Reduce fee cap to 15 mils from 30 mils
  — Reduce fee cap to 5 mils from 30 mils
  — Eliminate rebates and let fees adjust

• Exchanges filed suit vs. SEC
  — Agency vs. neutrality revisited
  — Partial stay by SEC, pending resolution
Recent SEC Action on Market Data

- SEC (10/16/2018) declared that it would not approve proposed exchange price increases, unless satisfying Exchange Act
- Fair and reasonable; not unduly discriminatory; promote competition
- Public roundtable (10/25-26/2018) highlighted calls for the exchanges to be more transparent to facilitate analysis of compliance with Exchange Act**
- Exchanges vs. buy-side & brokers
Exchanges and Affiliates

• Three main exchange families (95% share) and a total of 13 exchanges
  — NYSE
  — Nasdaq
  — BATS/CBOE (BATS and Direct Edge merger)
  — IEX (no rebates)—new entrant, no price tiering and data charges
• Joint staffing, potential pricing coordination within a parent company/family
Nature of Competition

• Tension between competition for individual orders (better pricing for customers) vs. competition among platforms (innovation)
  — Issue in selling assets (e.g., house brokers)
• Central limit order book (“CLOB”) and the importance of liquidity externality vs. fragmentation
• Affiliate families limit the competition among platforms in pricing exchange activities without concentrating liquidity & enhancing the competition facing orders
Rebates and Fees

• Fees are capped at 30 mils/shares (Reg NMS)
• Baseline rebates at about 20 mils/share
• Many alternatives to get somewhat larger rebates, sometimes larger than 30 mils
• Given that costly to operate a trading platform, fees should exceed rebates, at least without cross-subsidization
  — Otherwise, access fees are a loss leader
Cross Subsidization of Trading

• In a number of situations the highest rebates being offered can exceed the maximum fee (30 mils) under Reg NMS
  • Nasdaq: 30.5
  • Direct Edge: 32
  • BATS: 32
  • ARCA: 31 (NYSE: 27.5 mils)
• NYSE American with Electronic DMM: 45 mils to add displayed liquidity (and charge only two mils to take liquidity!)
Frequent Flyer Programs

• Major airlines (American, United, Delta) use four award levels and two main paths to get to each:
  — Each airline has 8 pricing tiers & more options
  — Limited options to buy miles or status—opaque—customization—surplus extraction
• All paths involve qualifying dollar spending & either qualifying miles or segments
• American and United use identical thresholds; Delta mostly uses similar ones
More on Frequent Flyer Status

• Many paths facilitate price discrimination & surplus extraction (Qualifying dollars, miles or segments can bind)
• Average reward increases with flights
• Entry barrier vs. entrants whose rewards & benefits essentially proportional:
  — JetBlue, Southwest
• Status based on cumulative performance
  — Marginal value uncertain early in the period
  — Marginal value high (or low) late in the period
Large Numbers of Pricing Tiers

- Per Royal Bank of Canada (RBC) Capital Market, 1,023 pricing tiers across platforms (839 two years ago)
- The pricing tiers determined by at least 3,762 pricing variables
- Of these, 381 consist of rebates
Pricing Tiers and Complexity

• Odd (“weird”) features to some pricing tiers together with the number of them suggests that many selected by a single participant or designed for one—extraction and price discrimination; customization
• Many tiers with complex conditions—some very odd—as if customized for some clients (and to exclude others): RBC, 2018
• Relatively continuous rebates—differ only by about .5 mils, but increasing with activity
# Table 1 (Nasdaq)
Rebate to Add Displayed Liquidity

<table>
<thead>
<tr>
<th>Conditions: All US Equities</th>
<th>Rebate for Per Share Executed</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Executed at or above $1.00 per share)</td>
<td></td>
</tr>
<tr>
<td>Greater than <strong>1.25%</strong> add</td>
<td><strong>$0.00305</strong></td>
</tr>
<tr>
<td>Greater than <strong>0.60%</strong> added</td>
<td><strong>$0.0029</strong></td>
</tr>
<tr>
<td>Greater than <strong>0.30%</strong> added</td>
<td><strong>$0.0027</strong></td>
</tr>
<tr>
<td>Greater than <strong>0.10%</strong> added</td>
<td><strong>$0.0025</strong></td>
</tr>
<tr>
<td>Minimum of 250,000 shares added per day in Tape A or Tape B securities (combined)</td>
<td><strong>$0.0020</strong></td>
</tr>
<tr>
<td>Minimum of 10,000 shares executed via QDRK</td>
<td><strong>$0.0020</strong></td>
</tr>
<tr>
<td>All other firms</td>
<td><strong>$0.0020</strong> for Tape A &amp; B Securities <strong>$0.0015</strong> for Tape C Securities</td>
</tr>
</tbody>
</table>
## Table 2 (Nasdaq)
### Rebate to Add Displayed Liquidity

<table>
<thead>
<tr>
<th>Conditions: All US Equities (Executed at or above $1.00 per share)</th>
<th>Rebate for Per Share Executed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Add greater than 0.60% TCV; and</td>
<td></td>
</tr>
<tr>
<td>2. Add NOM Market Maker liquidity in Penny Pilot Options and/or Non-Penny Pilot Options of 0.10% or more of total industry ADV in the customer clearing range for Equity and ETF option contracts per day in a month on NOM; and</td>
<td>$0.00305</td>
</tr>
<tr>
<td>3. Add Customer, Professional, Firm, Non-NOM Market Maker and/or Broker-Dealer liquidity in Penny Pilot Options and/or Non-Penny Pilot Options of 1.50% or more of total industry ADV in the customer clearing range for Equity and ETF option contracts per day in a month on NOM</td>
<td></td>
</tr>
<tr>
<td>1. Add greater than 0.12% TCV; and</td>
<td></td>
</tr>
<tr>
<td>2. Add Customer, Professional, Firm, Non-NOM Market Maker and/or Broker-Dealer liquidity in Penny Pilot Options and/or Non-Penny Pilot Options of 1.15% or more of total industry ADV in the customer clearing range for Equity and ETF option contracts per day in a month on NOM</td>
<td>$0.0030</td>
</tr>
<tr>
<td>1. Add greater than 0.10% TCV; and</td>
<td></td>
</tr>
<tr>
<td>2. Add Customer, Professional, Firm, Non-NOM Market Maker and/or Broker-Dealer liquidity in Non-Penny Pilot Options of 0.40% or more of total industry ADV in the customer clearing range for Equity and ETF option contracts per day in a month on NOM</td>
<td>$0.0027</td>
</tr>
</tbody>
</table>
Table 4 (Nasdaq)

Rebate to Add Displayed Liquidity

<table>
<thead>
<tr>
<th>Conditions: All US Equities (Executed at or above $1.00 per share)</th>
<th>Rebate for Per Share Executed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greater than 0.60% added</td>
<td>$0.0029</td>
</tr>
<tr>
<td>Greater than 0.40% added of which 0.10% are Tape B securities</td>
<td>$0.0029</td>
</tr>
<tr>
<td>Greater than 0.15% added and total contracts per day (added and removed) of 0.9% or more of total industry ADV in the customer clearing range for Equity and ETF option contracts per day in a month on NOM</td>
<td>$0.0029</td>
</tr>
<tr>
<td>Add greater than 0.50% TCV and Remove greater than 0.70% TCV</td>
<td>$0.0029</td>
</tr>
<tr>
<td>Add Customer, Professional, Firm, Non-NOM Market Maker and/or Broker-Dealer liquidity in Penny Pilot Options and/or Non-Penny Pilot Options of 1.15% or more of total industry ADV in the customer clearing range for Equity and ETF option contracts per day in a month on NOM</td>
<td>$0.0029</td>
</tr>
</tbody>
</table>
Monthly Tiers

• Tier price applies to the current month, but only known at the end of the month
• This prevents the broker from immediately rebating back the rebate to his client or even disclosing it contemporaneously, which would have been natural solutions.
• Customers recognize the inability to rebate or disclose contemporaneously
Monthly Tiers, Agency Conflicts

• Lack of knowledge of incentive by buy-side client prevents neutralizing
• Exchange interest served by agency conflict as it maximizes the broker’s incentive—otherwise no ability to price discriminate or serve as entry barrier
• Constant tiers would mitigate some of the agency conflict as rebate would be known
• Exchange’s client is the broker-dealer; exchange doesn’t know investor identity
Partial Remedies

• Public disclosure of pricing tiers by exchanges under SEC’s “fair access requirements”
• However, no public disclosure of which pricing tier a particular broker received
• Even no disclosure of numbers of brokers receiving a particular tier
• Enhance disclosure environment
• Favor banning non-constant rebates, if rebates retained
Why “Cross Subsidize”?

• Over time relatively more of the revenue of the NYSE and Nasdaq comes from selling data and relatively less from trading.

• A reasonable assumption is that the value of data is proportional to overall trading activity, so subsidizing trading can be profitable.
More on Cross Subsidization

• Ordinarily, cross subsidization is fine when there are two-sided markets (platform theory). However:
• Agency theory—potentially important distortions in trading and order routing
• Exchange Act pricing
  — Fair and reasonable; not unduly discriminatory; promote competition
  — IEX recently did its own cost study to argue costs are about 5% of data/connectivity fees
Data as a Product

• Potential costs (technology) now quite low
• Whose data (intellectual property?) is it?
  — Zuckerberg say data not owned by Facebook!
• Basic quotes and trade data are utility, SIP
• Exchanges offer a range of prop data (e.g., order books) & co-location services
• Of course, some potential purchasers of proprietary data would find the value much greater than others (e.g., high vol.; HFT)
• Data, co-location fees fixed, so does not discourage activity—not traditional price discrimination
Rebates and Trading Incentives

• Rebate tiering and marginal incentives increases activity on an exchange and value of its proprietary data

• Higher (marginal) rebates imply that the value of being at the front of the queue is greater
  — Hence greater incentive to achieve this and hence willingness to purchase fast technology and co-location to become as fast as possible
  — Akin to the dynamic between trading and data
  — Strong interaction effects
Profit Max by Exchanges

• Attract activity by fixed fees for proprietary and co-location (costs, but no variable charges); reinforced by volume discounts for orders adding liquidity (tiered rebates)
• Facilitates price discrimination to individual brokers due to diminishing marginal value
• Price discrimination reinforced across volume states by using relative volumes
• By attracting more orders, exchanges charge more for prop data & co-location
• Large liquidity providers: Neg all-in pricing
More on Best Execution

• If proprietary data is required for Best Execution, then the Exchanges would charge relatively higher prices for data as they are a monopoly supplier. Monopoly data would arise due to the business need for the data (even w/o formal “Best Ex”).

• While investors can execute anywhere--so little monopoly power in stock prices, each exchange has monopoly control over data!
  ― So more important to regulate data pricing than stock prices; Opp. of prior SEC (& NMS)
Best Execution

• U.S. Treasury “Capital Markets” report suggests not “requiring” data for “Best Execution,” except for the basic data through the “SIP” for “Best Execution”
• Purchase of proprietary data viewed as a regulatory cost & source of market power
• SEC not explicit about what data needed for “Best Ex”—perhaps because of faster markets, evolving algos
Conclusions

- Price discrimination and marginal reward
- Customization and surplus extraction
- Relative volume—entry barrier for exchange and brokerage customers
- Agency maximizes routing incentive
- Tiering prevents neutralizing agency
- Tiering enhances value of data, colocation
- Declining unit costs of liquidity providers
- Policy: Constant rebates, strong disclosure
Q&A

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Lunch

Program will resume at 1:15 p.m., seating is available in the Gallery, Living Room, and Hub One.
MIT SLOAN IDEA EXCHANGE

FINANCE BEYOND CRISIS
Impact, Disruption, and Innovation

Thursday, April 25, 2019 / Convene, 117 West 46th Street / New York, NY

#MITSloanFinance
MFin Ten Years and Counting

Moderator: Heidi V. Pickett, Assistant Dean, Master of Finance Program, MIT Sloan School of Management

Kapil Dilwali, SB ’09, MFin ’10, Vice President, Investment Banking - Corporate Finance Advisory, J.P. Morgan
What if...

Government, industry and academia partnered to create a resilient global financial infrastructure?

Financial engineering could cure cancer, solve the energy crisis and stop global warming?
We could (re)design **finance tools** to address the increased longevity in populations and the decreased prevalence of pension plans?

**FinTech** brought access to the 2 billion people without a bank account driving better outcomes in education, healthcare, and more?
2008 MFin is launched!
2009 Welcomed 1st class
2010 Prof. Merton returns to MIT
2011 Added Ethics to curriculum
2012 New MFin Action Learning: Finance Research Practicum™
2013 Incorporated math courses
2014 1st annual Asia Study Tour
2015 Introduced 18M format
2016 STEM Classified
2017 Added financial engineering concentration
2018 Welcome 10th class
2019 Graduate 10th class
2020 MFin 10th year reunion
MFin Features

STEM Classified

12 & 18 month Options

Concentrations in:
- Financial Engineering
- Capital Markets
- Corporate Finance

Certificates in:
- Business Analytics
- Sustainability
- Healthcare

Rewarding Careers

Academic Excellence

World Renowned Faculty

Hands-On Action Learning

MIT Experience
MFin is a smart investment for high achievers

<table>
<thead>
<tr>
<th>Entering Class</th>
<th>2009</th>
<th>2012</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class size</td>
<td>26</td>
<td>122</td>
<td>116</td>
</tr>
<tr>
<td>International</td>
<td>52%</td>
<td>82%</td>
<td>91%</td>
</tr>
<tr>
<td># Countries</td>
<td>8</td>
<td>25</td>
<td>31</td>
</tr>
<tr>
<td>Women</td>
<td>30%</td>
<td>36%</td>
<td>36%</td>
</tr>
<tr>
<td>Avg. work exp. (months)</td>
<td>18</td>
<td>15</td>
<td>17</td>
</tr>
<tr>
<td>STEM undergrad</td>
<td>48%</td>
<td>48%</td>
<td>64%</td>
</tr>
<tr>
<td>Applicants per seat</td>
<td>7</td>
<td>12</td>
<td>14</td>
</tr>
</tbody>
</table>

1st MFin Class

Class increases to 2 cohorts

Focus on seating STEM undergrads
Master of Finance Degree Requirements

Required Core (Summer Term):
- Finance Theory
- Corporate Financial Accounting

Required Advanced Core:
- Analytics of Finance Engineering

Required Action Learning: (choose 1)
- Proseminar in CM/IM (F)
- Proseminar in CF/IB (F)

Restricted Electives: (min 4)
- Entrepreneurial Finance
- Investments
- Options & Futures Markets
- Mergers & Acquisitions
- Advanced Corporate Finance
- Valuation
- Business Analysis Financial Statements

General Electives: (min 3)
- Graduate level courses or Thesis
Required Core (Summer Term):
- Finance Theory
- Corporate Financial Accounting
- Financial Mathematics or
- Advanced Mathematical Methods for Financial Engineering

Required Advanced Core:
- Financial Markets (F)
- Corporate Finance (F)
- Analytics of Finance (S) or
- Advanced Analytics of Finance (S)

Required Action Learning: (choose 1)
- Proseminar in CM/IM (F)
- Proseminar in CF/IB (F)
- Finance Research Practicum (IAP & SH-1)

Required Professional & Technical Development
- Finance Ethics & Social Responsibility (FH-1)
- Programming Literacy Test

Restricted Electives: (min 4)
- Entrepreneurial Finance & VC
- Options & Futures Markets
- Fixed Income Securities & Derivatives
- Mergers, Acquisitions & PE
- International Finance – Capital Markets
- Advanced Corporate Finance
- Financial Engineering
- Functional & Strategic Finance
- Asset Management, Lifecycle Investing, & Retirement Finance
- Consumer Finance: Markets, Product Design and FinTech
- Financial Market Dynamics

General Electives: (min 0)
- Graduate level courses or Thesis
Expanding the finance ecosystem since 2008

- 50% increase in tenured track finance faculty
- 50% expansion of finance courses
- 63% new finance related clubs and competitions
MFin graduates represent over 70 countries
Global representation promotes diverse thinking
Rewarding Careers
MFin is an investment that will generate returns throughout your lifetime

Quantitative Finance consultant
- derivatives trader
- private wealth manager
- private equity
- credit strategy analyst
- Investment Banking risk manager
- Consulting fixed income research analyst
- M&A associate
- Corporate Finance Impact Investing
- quant trader
- quantitative investment analyst
- portfolio manager
- FinTech investment bank analyst
- proprietary trader
- Asset Management
Rewarding Careers

99% RECEIVED OFFER FULL-TIME EMPLOYMENT

100% CONDUCTED SUMMER INTERNSHIP

74% ACCEPTED SUMMER INTERNSHIP NORTH AMERICA
24% ACCEPTED SUMMER INTERNSHIP ASIA
2% ACCEPTED SUMMER INTERNSHIP EUROPE


65% NORTH AMERICA
24% ASIA
10% EUROPE

76% CONVERTED INTERNSHIP TO FULL-TIME OFFER
Developing the next Masters of Finance
Master of Finance – Impact, Disruption, and Innovation

Brian Liston and Edward Woodford
MFin ’15, Forbes 30 under 30, 1st licensed cryptocurrency exchange

Chinedu Azodoh
MFin ’15, Cofounder, Max. Max is on a mission to make moto-taxis safe, affordable and accessible across West Africa.

Joshua Kazdin
MFin Ten Years and Counting

Moderator: Heidi V. Pickett, Assistant Dean, Master of Finance Program, MIT Sloan School of Management

Kapil Dilwali, SB ’09, MFin ’10, Vice President, Investment Banking - Corporate Finance Advisory, J.P. Morgan
MIT SLOAN IDEA EXCHANGE

FINANCE BEYOND CRISIS
Impact, Disruption, and Innovation

Thursday, April 25, 2019 / Convene, 117 West 46th Street / New York, NY

#MITSloanFinance
Alumni Panel Discussion

Moderator: Matthew Rothman, Senior Lecturer, MIT Sloan School of Management
Managing Director, Goldman Sachs

Armen Avanessians, SB ’81, Chief Investment Officer, Quantitative Investment Strategies, Goldman Sachs
Asset Management
Cheryl M. Duckworth, CFA, SM ’94, Partner and Senior Managing Director; Director, Global Consultant
Relations, Wellington Management
Joseph Naggar, MBA ’96, Partner and Head of Structured Products, GoldenTree Asset Management
C.S. Venkatakrishnan, SB ’86, SM ’89, PhD ’91, Chief Risk Officer, Barclays

#MITSloanFinance
Q&A

How to submit your questions

WEB

Scan the QR Code or visit POLLEV.COM/MITSLOAN
Enter your name and class year (Example: Sally, MBA 99)
Enter your question during any Q&A Session

TEXT

Text MITSLOAN to 22333
Text in your questions during any Q&A Session
Break

Program will resume at 1:45 p.m.

Please help yourself to refreshments at the three Nourish stations throughout the venue.
MIT SLOAN IDEA EXCHANGE

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#MIT Sloan Finance
Technological Innovation and Creative Destruction of Human Capital

Lawrence D.W. Schmidt, Victor J. Menezes (1972) Career Development Professor of Finance; Assistant Professor, Finance, MIT Sloan School of Management
Technological Innovation and Creative Destruction of Human Capital

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Fintech Beyond Crisis

............

Gary Gensler, Senior Lecturer, MIT Sloan School of Management; Senior Advisor to the Director, MIT Media Lab; Co-Director of Fintech, CSAIL
MIT Sloan Idea Exchange
Finance Beyond Crisis

FinTech

Gary Gensler

April 25, 2019

FinTech @CSAIL
Overview

• Finance and Financial Technology
• AI, Machine Learning and Deep Learning
• Blockchain Technology
• Payments
• FinTech Actors
• Public Policy Frameworks
• Conclusions
Financial Sector

Moves, Allocates & Prices Money and Risk

Long has had Symbiotic Relationship with Technology
FinTech – the Early Years

Ledgers
- Proto Cuneiform
- George Washington’s Ledger
- IBM 360

Money
- Roman Gold Aureus
- Nigerian Cowrie Shells
- Yap Rai Stones
- U.S. Private Bank Note

Credit Cards
- Term ‘Credit Card’
- First Bank Card
- First Plastic Card
FinTech - Finance’s Fertile Ground

• Dematerialization of Money, Securities and Credit
• Vast and Expanding Amounts of Customer Data
• Rapid Expansion of Computational & Analytical Power
• Reliance on Multiple Systems of Ledgers
• Wide Public Acceptance of New Tech
• Legacy Customer Interface and Processing Systems
• Infrastructure Systems’ Costs and Counterparty Risks
• Economic Rents and Centralized Concentrated Risks
FinTech – Disruptive Potential

• Updated Customer User Interface and Robo Advice
• Greater Financial Inclusion
• Peer to Peer Services
• ‘Internet of Value’: Interoperable Movement of Value & Micro Payments
• AI for Managing Credit, Trading, Insurance & Underwriting Risks
• Greater Liquidity for Less Liquid Asset Classes
• Shorter Settlement Cycles and Lower Counterparty Risks
• Streamlined Accounting, Compliance & Processing Systems
• Revenue Models shifting to Data for Free Services
• Efficiencies & Tighter Margins => Financial Sector at a Lower GDP %
FinTech – Technologies of our Times

AI & ML

Blockchain

Cloud

Open API

Biometrics

Chatbots

Mobile

RPA
AI and Machine Learning

AI: Machines Capable of Imitating Intelligent Human Behavior

ML: Machines able to Adjust (‘Learn’) from Data

DL: Machine Learning using Deep Neural Networks

RL: Machines able to Infer Features & Learn from Data

Artificial Intelligence

Machine Learning

Representation Learning

Deep Learning
Deep Learning in One Slide

• What is it:
  Extract useful patterns from data.

• How:
  Neural network + optimization

• How (Practical):
  Python + TensorFlow & friends

• Hard Part:
  Good Questions + Good Data

• Why now:
  Data, hardware, community, tools, investment

• Where do we stand?
  Most big questions of intelligence have not been answered nor properly formulated
Ethics and Governance of AI

• Biases, Inclusion and Values
• Transparency, Auditability and Explaining Algorithms
• Privacy and Data Ownership
• Jobs
• ‘Singularity’
Blockchain Technology

timestamped append-only log

multiple party consensus protocol

decentralized auditable database

Secured via cryptography
- Hash functions for **integrity**
- Digital signatures for **consent**

Addresses ‘**cost of trust**’
(Byzantine Generals problem)
May use Native Token as incentive
- Permissioned

Tamper resistant record of
- Transfers of **value**
- Running of **computer code**
Blockchain Technology

• Provides Peer to Peer Alternative to Computing & Moving Value
• Can Lower Verification and Networking Costs
• Use Cases Must Address purpose vs. Traditional Data Bases?

• Incumbents Largely Looking at Private Permissioned Systems
• Crypto Finance Markets are Rive with Scams, Fraud and Manipulation
• Adoption rests on tackling Technical, Commercial and Policy Challenges

• Potential exists, though, to be a Catalyst for Change
Crypto Market - $175 Billion (4/24/19)
Crypto Token Sectors

- **Payment Tokens** ≈ $125 - 130B
  - Bitcoin ($97B), ...
- **Platform Tokens** ≈ $30 - 35B
  - Ethereum ($17B), ...
- **DApp Tokens** ≈ $12 - 17B
  - Binance Coin ($3.1B), ...
- **Stable Value Tokens** ≈ $4B
  - Tether ($2.7B), ...
- **Tokenized Securities and Assets**
Financial Sector Potential Use Cases

• **Venture Capital** - Crowdfunding through Initial Coin Offerings

• **Payment Systems** - Cross border, Large interbank, & Retail

• **Trade Finance & Loan Financing** - Digitizing paper-based processes

• **Clearing, Settlement and Processing** – Securities & Derivatives

• **Tokenized Fiat (Stable Value Coins), Securities & Assets**

• **Central Bank Initiatives**
FinTech - Digital & Mobile Payments

- PayPal: 1998
- Ericsson: 1999
- Telenor: 2003
- Alipay: 2007
- Mobile App: 2011
- Google Wallet: 2011
- WeChat Pay: 2013
- Apple Pay: 2014
Global Payments Methods

Global eCom payment methods

<table>
<thead>
<tr>
<th>Method</th>
<th>2018*</th>
<th>2022**</th>
</tr>
</thead>
<tbody>
<tr>
<td>eWallet</td>
<td>36%</td>
<td>47%</td>
</tr>
<tr>
<td>Credit Card</td>
<td>23%</td>
<td>17%</td>
</tr>
<tr>
<td>Debit Card</td>
<td>12%</td>
<td>11%</td>
</tr>
<tr>
<td>Bank Transfer</td>
<td>11%</td>
<td>11%</td>
</tr>
<tr>
<td>Charge &amp; Deferred Debit Card</td>
<td>8%</td>
<td>6%</td>
</tr>
<tr>
<td>Cash on Delivery</td>
<td>5%</td>
<td>3%</td>
</tr>
<tr>
<td>Pre-Paid Card</td>
<td>2%</td>
<td>1%</td>
</tr>
<tr>
<td>PostPay</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>eInvoices</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>PrePay</td>
<td>1%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Global POS payment methods

<table>
<thead>
<tr>
<th>Method</th>
<th>2018*</th>
<th>2022**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash</td>
<td>31%</td>
<td>17%</td>
</tr>
<tr>
<td>Debit Card</td>
<td>29%</td>
<td>30%</td>
</tr>
<tr>
<td>Credit Card</td>
<td>20%</td>
<td>22%</td>
</tr>
<tr>
<td>eWallet</td>
<td>16%</td>
<td>28%</td>
</tr>
<tr>
<td>Charge Card</td>
<td>2%</td>
<td>2%</td>
</tr>
<tr>
<td>Pre-Paid Card</td>
<td>1%</td>
<td>1%</td>
</tr>
</tbody>
</table>

Source: Worldpay 2018 Report
FinTech – The Actors

Big Finance

Ant Financial
Bank of America
CIBC
Citi
Fidelity
HSBC
Nasdaq
State Street

Startups

Affirm
Atom Bank
Avaloq
AVANT
Axio
BMO
Circle
Confluent
Credit Karma
Go euro
Gusto
Kabbage
Klarna
Lineworks
Monzo
N26
NU Bank
OakNorth
One97
Plaid
Policy Bazaar
Revolut
Robinhood
Stirpe
Tiger Brokers
TradeShift
TransferWise
Uneg

Big Tech

Alibaba
Baidu
Google
Facebook
Amazon
Apple
Microsoft
Tencent
FinTech – Startup ‘Unicorns’

• Payments
  avidxchange, BREX, Klarna, NuBank, One97, Plaid, Ripple, Stripe, Toast, Toss, Tradesshift, TransferWise

• Credit and Lending
  Affirm, Atom Bank, AVANT, Chime, Monzo, N26, OakNorth, Revolut, SoFi, SoFi, SoFi, SoFi, SoFi, SoFi

• Asset Management and Advisory
  Avaloq

• Trading and Capital Markets
  Binance, Circle, Coinbase, Robinhood, Tiger Brokers

• Insurance and Other
  Clover, Gusto, Oscar, PolicyBazaar, Zenefits

• Comprehensive
Public Policy Framework

• Protecting the Public

• Financial Stability

• Guarding Against Illicit Activity
FinTech - Policy Alternatives

• New Activities Come within Existing Frameworks & Laws
• Clarification where Application of Rules are Ambiguous

• Legal and Regulatory Requirements Adjusted:
  • For New Activities
  • For Existing Activities
• Regulatory Perimeters Moved

• Early Stage Activity Requirements Limited (e.g. Sandboxes)
FinTech – Disruptive Potential

• Updated Customer User Interface and Robo Advice
• Greater Financial Inclusion
• Peer to Peer Services
• ‘Internet of Value’: Interoperable Movement of Value & Micro Payments

• AI for Managing Credit, Trading, Insurance & Underwriting Risks
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• Streamlined Accounting, Compliance & Processing Systems

• Revenue Models shifting to Data for Free Services
• Efficiencies & Tighter Margins => Financial Sector at a Lower GDP %
Conclusions

• Finance has long had a Symbiotic Relationship with Technology
• We already Live in a Digital Financial Age
• The Pace of Technology Innovation and Adoption has Accelerated
• Financial Innovations present both Rewards & Risks
• Startups, Big Financial and Big Tech will all Play a Role
• Public Confidence and Growth is built upon Living within Public Policy Norms
• Development will Swing with much Hype Masquerading as Fact
• FinTech, though, will disrupt current Revenue and Margin Models
• The Potential of FinTech to Provide Better Services and Bring Change is Real
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Fireside Chat

David Schmittlein, John C Head III Dean, MIT Sloan School of Management

John A. Thain, SB ’77, Life Member, MIT Corporation; Former Chairman & Chief Executive Officer, CIT Group, Inc
Q&A

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Closing Remarks

Leonid Kogan, PhD ’99, Nippon Telegraph & Telephone Professor of Management Faculty Head, Finance Group, MIT Sloan School of Management
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