Blockchain & Money

Class 13

October 30, 2018
Class 13 Overview

• Act 3: Financial Sector Use Cases
• Readings and Study Questions
• Payment Systems, Ledgers and Credit Cards
• Technologies Affecting Payments
• Mobile Payments
• Global and U.S. Payment Statistics
• Bitcoin and Blockchain Technology
• Conclusions
Blockchain and Money – Act 3: Financial Sector Use Cases

• Class 13 & 14 (10/30 & 11/1): Payments
• Class 15 & 16 (11/6 & 8): Central Banks & Commercial Banking
• Class 17 (11/13): Secondary Markets & Crypto-Exchanges
• Class 18 (11/15): A New Approach to Crypto-Exchanges & Payments
• Class 19 (11/20): Primary Markets, ICOs & Venture Capital
• Class 20 (11/27): Primary Markets, ICOs & Venture Capital
• Class 21 (11/29): Post Trade Clearing, Settlement & Processing
• Class 22 (12/4): Trade Finance & Supply Chain
• Class 23 (12/6): Digital ID
Class 13 (10/30): Readings

- ‘The Federal Reserve Payment Study:2017 Annual Supplement’ Federal Reserve
- ‘Global Payments Report’ Worldpay
- ‘The Best Mobile Apps of 2018’ PC World
- ‘Why China’s Payment Apps Give U.S. Bankers Nightmares’ Bloomberg
- ‘M-Pesa: how Kenya revolutionized mobile payments’ N26 Magazine
- ‘Cross-border Retail Payments’ (pages 6 -15, 39) BIS
Class 13 (10/30): Study Questions

• What are the major trends – mobile apps, digital wallets, open banking, and enhanced methods of bank transfers & authentication - in payment systems today?

• What lessons can be drawn from non-blockchain payment innovations, such as Alipay, WeChat Pay, M-Pesa, India’s IMPS, and U.S. mobile payment apps?

• What are the challenges and opportunities in the current cross-border payment system architecture?
Guest – Alin Dragos

• Heads strategic partnerships for the Digital Currency Initiative, and leads product management for the DCI's efforts on Layer 2 solutions.

• Before MIT, he was a vice president at First Data Corporation, a leading payment system provider – he was responsible for a $200M P&L and an organization of ~200 employees.

• Previously, he spent 3 years in the startup world, raising seed funds, scaling up businesses and managing a post-acquisition integration.
Payment System

A Method to Amend and Record Entries on Ledgers for Money Authorizing, Clearing and Recording Final Settlement

Personal Check
Thomas Jefferson
1809

Western Union
Telegram
1873

Telex
1950s – 1970s

Check and telegram are in the public domain.
Financial Ledgers

Record Economic Activity and Financial Relationships

Record Transactions and Accounts

Proto Cuneiform
Uruk, ca 3000 B.C

Personal Ledger
George Washington
1747

IBM 360
1961

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Credit Cards

Charge Plates & Credit Coins
Late 1880s – 1960s

First Bank Card
Charge-It
First National Bank
Brooklyn, 1946

Merchant Credit Cards
Late 1920s – 2000s

Term ‘Credit Card’
Edward Bellamy’s
Science Fiction
‘Looking Backward’
1887

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Credit Cards

First General Merchant Card
Diners’ Club
1949

American Express
First Plastic Card
1959

Bank of America
First General Purpose Credit Card
1966
Credit Card Processing

Slide Card Imprinter
1950s

Visa Imprinter
1979

Payment Terminal
2018

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Modern Payment Systems

Digital wallets:
- Apple Pay
- Android Pay
- Amazon Pay
- Facebook Payments
- Visa Checkout
- MasterPass
- PayPal
- Venmo
- Samsung Pay
- AliPay
- Chase Pay
- Other Pay [...]

Access method
- Phone
- POS
- Web | e-commerce Gateway

Consumer 1
- Issuing Bank
  - Financial instrument
    - Bank account
    - Debit Card
    - Credit Card
    - Prepaid Card
    - Others
  - Networks & PSPs
    - Visa/Mastercard/etc.
    - First Data/Stripe/etc.
    - ACH
    - Other

Merchant
- Merchant Bank
- Acquirer
- Merchant 2

Cryptocurrency (Bitcoin)
Transaction Breakdown

In Typical $100 Purchase

<table>
<thead>
<tr>
<th>$97.25</th>
<th>$2.20</th>
<th>23¢</th>
<th>19¢</th>
<th>13¢</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goes to the merchant</td>
<td>Issuing bank</td>
<td>Payment processor</td>
<td>Acquiring bank</td>
<td>Card network</td>
</tr>
</tbody>
</table>

Source: ‘Why China’s Payment Apps Give U.S. Bankers Nightmares’
Cross Border Payments – Front End

Source: BIS Cross Border Payment Report

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Cross Border Payments – Front End

Front end country A

Back end

Front end country B

Back end arrangements
- Correspondent banking
- Interlinking of payment and market infrastructures
- Closed-loop
- Peer-to-peer

Back end providers
- Transaction banks
- Aggregators / hub providers
- Payment and market infrastructure operators
- Foreign exchange agents
- Telecommunication network providers

Back end processes
- Messaging
- Clearing
- Settlement
- Foreign exchange management
- Liquidity management

Source: BIS Cross Border Payment Report
Public Policy Framework

• Guarding Against Illicit Activity

• Financial Stability

• Protecting the Investing Public
Technologies of our Time Affecting Finance

AI & ML
Blockchain
Cloud
Open API

Biometrics
Chatbots
Mobile
RPA

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Early Cryptographic Digital Currencies ... All Failed

• DigiCash (David Chaum) – 1989
• Mondex (National Westminster Bank) - 1993
• CyberCash (Lynch, Melton, Crocker & Wilson) – 1994
• E-gold (Gold & Silver Reserve) – 1996
• Hashcash (Adam Back) – 1997
• Bit Gold (Nick Szabo) – 1998
• B-Money (Wei Dai) - 1998
• Lucre (Ben Laurie) – 1999
Digital & Mobile Payments

1998
1999
2003
2007

1911
2011
2013
2014
# Global Payments Methods

<table>
<thead>
<tr>
<th>Method</th>
<th>2016</th>
<th>2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credit Card</td>
<td>29%</td>
<td>15%</td>
</tr>
<tr>
<td>eWallet</td>
<td>18%</td>
<td>46%</td>
</tr>
<tr>
<td>Bank Transfer</td>
<td>17%</td>
<td>16%</td>
</tr>
<tr>
<td>Debit Card</td>
<td>13%</td>
<td>8%</td>
</tr>
<tr>
<td>Cash on Delivery</td>
<td>9%</td>
<td>7%</td>
</tr>
<tr>
<td>Charge &amp; Deferred Debit Card</td>
<td>6%</td>
<td>3%</td>
</tr>
<tr>
<td>Pre-Paid</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td>PostPay</td>
<td>2%</td>
<td>1%</td>
</tr>
<tr>
<td>PrePay</td>
<td>2%</td>
<td>1%</td>
</tr>
<tr>
<td>Other</td>
<td>1%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Source: Worldpay Report

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<table>
<thead>
<tr>
<th>Type of Payment</th>
<th>Number</th>
<th>Value</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Card payments</td>
<td>103.5</td>
<td>5.65</td>
<td>55</td>
</tr>
<tr>
<td>Debit cards</td>
<td>69.6</td>
<td>2.56</td>
<td>37</td>
</tr>
<tr>
<td>Non-prepaid</td>
<td>59.0</td>
<td>2.27</td>
<td>38</td>
</tr>
<tr>
<td>In person</td>
<td>49.5</td>
<td>1.58</td>
<td>32</td>
</tr>
<tr>
<td>Remote</td>
<td>9.5</td>
<td>0.69</td>
<td>73</td>
</tr>
<tr>
<td>Prepaid</td>
<td>10.6</td>
<td>0.30</td>
<td>28</td>
</tr>
<tr>
<td>General purpose</td>
<td>4.3</td>
<td>0.15</td>
<td>35</td>
</tr>
<tr>
<td>In person</td>
<td>3.6</td>
<td>0.10</td>
<td>29</td>
</tr>
<tr>
<td>Remote</td>
<td>0.8</td>
<td>0.05</td>
<td>63</td>
</tr>
<tr>
<td>Private label</td>
<td>3.6</td>
<td>0.07</td>
<td>20</td>
</tr>
<tr>
<td>Electronic benefits transfers (EBT)</td>
<td>2.6</td>
<td>0.08</td>
<td>29</td>
</tr>
<tr>
<td>Credit cards</td>
<td>33.9</td>
<td>3.08</td>
<td>91</td>
</tr>
<tr>
<td>General purpose</td>
<td>31.0</td>
<td>2.80</td>
<td>90</td>
</tr>
<tr>
<td>In person</td>
<td>21.7</td>
<td>1.30</td>
<td>60</td>
</tr>
<tr>
<td>Remote</td>
<td>9.3</td>
<td>1.50</td>
<td>161</td>
</tr>
<tr>
<td>Private label</td>
<td>2.8</td>
<td>0.28</td>
<td>98</td>
</tr>
<tr>
<td>Network automated clearinghouse payments</td>
<td>19.3</td>
<td>41.64</td>
<td>2,159</td>
</tr>
<tr>
<td>Credit transfers</td>
<td>8.0</td>
<td>26.78</td>
<td>3,333</td>
</tr>
<tr>
<td>Debit transfers</td>
<td>11.3</td>
<td>14.86</td>
<td>1,321</td>
</tr>
<tr>
<td>Check payments</td>
<td>17.9</td>
<td>28.97</td>
<td>1,614</td>
</tr>
<tr>
<td>U.S. Treasury checks</td>
<td>0.1</td>
<td>0.14</td>
<td>2,413</td>
</tr>
<tr>
<td>Postal money orders</td>
<td>0.1</td>
<td>0.02</td>
<td>226</td>
</tr>
<tr>
<td>Commercial checks¹</td>
<td>17.8</td>
<td>28.80</td>
<td>1,618</td>
</tr>
<tr>
<td>Interbank¹</td>
<td>13.3</td>
<td>20.92</td>
<td>1,573</td>
</tr>
<tr>
<td>On-us¹</td>
<td>4.5</td>
<td>7.88</td>
<td>1,751</td>
</tr>
</tbody>
</table>

Courtesy of the Federal Reserve and is in the public domain.
“I've been working on a new electronic cash system that's fully peer-to-peer, with no trusted third party.”
Use Cases: Assessing Costs & Benefits

• **Benefits of blockchain technology?**
  • What problem or ‘pain point’ is being solved for stakeholders? For a company?
  • What value is being created or captured?
  • What are competitors doing to address similar ‘pain points’?
  • Why is blockchain technology the best solution?

• **What are the specifics of the blockchain use case?**
  • Which costs of verification or networking can be reduced?
  • Which transactions need recording?
  • Which stakeholders need write and read access to ledgers?
  • What is the customer interface and how is it better than current interface?
Use Cases: Assessing Costs & Benefits

• Costs of technical challenges and transition?
  • What tradeoffs of scalability, performance, privacy & coordination are necessary?
  • Can Permissioned blockchain adequately address use case?
  • How can broad adoption be realized?

• Are net benefits sufficient?
Why use a Blockchain vs. Traditional Database?

### Access

- **Client Server**
- **Multiple Permissioned**
- **Open Permissionless**

### Traditional Databases
- Trusted Party Hosts Data
- Trusted Party can Create, Read, Update, & Delete (CRUD)
- Client Server Architecture

### Private Blockchain
- Known Participants
- Private Write Capability
- Append Only Timestamped Log
- Publicly Verifiable
- No Native Currency

### Public Blockchain
- Unknown Participants
- No Central Intermediaries
- Public Write Capability
- Peer to Peer Transactions
- Token Economics
Class 14 (11/1): Study Questions

• What lessons can be drawn from the challenges for blockchain related payment applications? Might Layer 2 solutions, such as Lightening, resolve these challenges?

• What are the opportunities in cross-border payments? In domestic P2P or P2B payments?

• What are tradeoffs of utilizing permissioned vs. permissionless payment applications?
Class 14 (11/1): Readings

• ‘How Blockchain Can Finally Fulfill its Promise in global Payments’ CoinDesk

• ‘Extending the World of Payments to Blockchain’ ACI Worldwide

• ‘The Payment Industry is About to be Struck by Lightning: Expert Take’ Coin Telegraph

• ‘Why Stripe Gave up on Bitcoin and Blockchain Payments’ Fortune

• ‘How XRP Fits into Ripple’s Payment Products Explained’ CoinDesk
Conclusions

• Payment Systems Amend and Record Ledgers for Money

• Technology is Rapidly Changing Payment Systems around the Globe

• Payment Systems cost 0.5 % – 1.0 % of Global GDP

• Blockchain Technology may Provide a new P2P Method to Make Payments

• In Assessing Potential Use Cases, though, the Devil is in the Details