Payments – yesterday, today, tomorrow

Presented By:
Julius Weyman

Not to be used, copied, or distributed without consent
Agenda

- Yesterday
- Today
- Tomorrow
Agenda

- Yesterday
- Today
- Tomorrow
The frame - retail payment instruments in the US

cash

check

credit, debit & prepaid cards

emerging
CASH - Yesterday
Cash - Short history and an upshot or two...

The first banknotes issued by commercial banks appeared in Europe in the mid-to-late 17th century. The also appeared in the American colonies at that time.

paper IOUs, paper checks, paper currency - have common origins
Cash was enmeshed in systemic crises in the US prior to the introduction of deposit insurance in 1933. Cash has been involved in systemic crises elsewhere in the world since, particularly in cases of hyperinflation.
See them at the FRBA money museum - The largest denomination of currency ever printed by the Bureau of Engraving and Printing (BEP), the $100,000 Series 1934 Gold Certificate featuring the portrait of President Wilson. These notes were printed from December 18, 1934 through January 9, 1935 and were issued by the Treasurer of the United States to Federal Reserve Banks only against an equal amount of gold bullion held by the Treasury Department. The notes were used only for official transactions between Federal Reserve Banks and were not circulated among the general public.
The Fed’s presence in cash - 2001 or so
The value of US currency in circulation rose reliably thru 2012.
Short history on the Paper Check

Paper IOUs ancestors of the paper check (akin to letters-of-credit) were first used extensively by Italian city/states in the 15\textsuperscript{th} & 16\textsuperscript{th} centuries to facilitate spice & other trade between the middle east & Europe.

Paper checks drawn on actual commercial banks became common in business-to-business transactions in Sweden, the Netherlands & England in the 18\textsuperscript{th} century.
The Fed had 45 check processing offices
As recently as 2004
Check does not appear to have played a role in any US financial crises in the 19th or 20 centuries.

In the week after the 9/11 attacks, the inability fly checks overnight around the US caused the Fed to extend $47 billion in credit to the banking system.
Check clearing in the US, before 2004

1. Consumer
2. Retailer
3. Bank of First Deposit
4. Clearing Intermediary
5. Paying Bank
6. Consumer
US consumers & businesses have historically relied more heavily on check than in other countries.

US check usage per-capita declined rapidly in this window but remained sizable.

Blue, red, and green represent the years 1990, 2000, and 2009.
Automated Clearinghouse (ACH EFT) Yesterday

ACH was the first fully-formed electronic payments system in the US, with operations beginning in 1974. Early implementations made extensive use of computer punch cards and tape storage. Until the late 1980s, the US had a number of regional ACH operations, including 11 in the Fed & one at the NY Clearing House.
Short history on the Automated Clearinghouse (ACH)

ACH was the first fully-formed electronic payments system in the US, with operations beginning in 1974. Early implementations made extensive use of computer punch cards and tape storage. A surprising number of paper registers were also printed and distributed that were used for posting to accounts for many years.

Until the late-1990s, the US had a number of regional ACH operations, including 11 in the Fed & one at the NY Clearing House.
The Fed had 45 check ACH processing offices once too, more or less...
ACH processing - how does it work?
ACH Network Volumes

ACH grew rapidly from 2002-2007 then decelerated

Billions of transactions, annual
Cards - Yesterday
A really short history of card

Frank X McNamara, 1950
An inventor of first general purpose credit card

John Shepherd-Barron, 1967
An inventor of the first ATM/cash dispenser & ATM card
Fed was/is not involved in processing debit & credit card transactions

We share supervisory authority with other federal regulators & our ACH, Fedwire & Net Settlement services facilitate interbank settlement

<table>
<thead>
<tr>
<th>networks</th>
<th>processors</th>
<th>issuing banks</th>
</tr>
</thead>
<tbody>
<tr>
<td>MasterCard</td>
<td>First Data</td>
<td>Bank of America</td>
</tr>
<tr>
<td>DISCOVER</td>
<td>Heartland Payment Systems</td>
<td>JPMorganChase</td>
</tr>
<tr>
<td>AMERICAN EXPRESS</td>
<td>Fiserv</td>
<td>us bank</td>
</tr>
<tr>
<td>VISA</td>
<td>FIS</td>
<td>citibank</td>
</tr>
<tr>
<td>VANTIV</td>
<td>Worldpay</td>
<td>WELLS FARGO</td>
</tr>
<tr>
<td>VANTIV</td>
<td>CARDINAL COMMERCE</td>
<td>Capital One Bank</td>
</tr>
<tr>
<td>VANTIV</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Agenda

- Yesterday
- Today
CASH – Today
One view of some noteworthy developments in cash

Smart Safes

Custodial inventories

Currency Depots and Coin Terminals

Recyclers
The Fed’s presence in cash 2001 or so – effectively, 38 full service operations.
The Fed's presence in cash
28 full-service operations & 10 contractor-run depots nationwide
The value of US currency in circulation rose reliably thru 2012.
U.S. currency in circulation continues to grow

As of January 2019, U.S. currency in circulation reached 1.7 trillion Worldwide

6.4% Increase YOY
How cash is used and circulates in society may be evolving

Annual Payment and Receipts Volume
My explanation of what we see in cash numbers and trends
A federal law in 2003 made something other than the original check its legal equivalent.

Check Clearing for the 21st Century Act, or Check-21.
Which changed how checks were cleared
several large image-clearing intermediaries
Check clearing in the US, before 2004, so what's changed?

1. Consumer
2. Retailer
3. Bank of First Deposit
4. Clearing Intermediary
5. Paying Bank
6. Consumer
US check clearing - what has changed?
The Fed had 45 check processing offices
As recently as 2004
The Fed’s operating presence in check - 2019
Check business management, network core, central image archive
Check processing transformation in the US
Number of checks being written in the US is falling, & electronic clearing is near 100%

Check-21 volume trends in the Fed, daily average in millions
Automated Clearinghouse (ACH EFT) Yesterday

ACH was the first fully-formed electronic payments system in the US, with operations beginning in 1974. Early implementations made extensive use of computer punch cards and tape storage. Until the late-1980s, the US had a number of regional ACH operations, including 11 in the Fed & one at the NY Clearing House.
Automated Clearinghouse (ACH) Today
The Fed had 45 check ACH processing offices once too, more or less...
The Fed's operating presence and the full landscape for ACH - 2019
ACH processing – how does it work – well it’s the same, just no more trucks, tapes or registers...
ACH in the US - recent developments - Checks could be converted into ACH debits since the year 2000. (And not to forget, Same Day!)
Cards – Today
Card growth robust 2016–17

Number of noncash payments. Source: Federal Reserve Payments Study.
Card payments growth, 2016–17

Debit growth fastest by number

Growth rate (%), number

- Prepaid debit cards: 10.5
- Non-prepaid debit cards: 10.4
- Credit cards: 9.4

Credit growth fastest by value

Growth rate (%), value

- Credit cards: 10.0
- Non-prepaid debit cards: 7.0
- Prepaid debit cards: 3.0

Annual growth rates (%) by number and value, 2016-17.
Source: Federal Reserve Payments Study.
Remote card payments grew rapidly

Faster than in-person payments by both number and value, 2016–17

Number and value of general-purpose card payments, 2012-17.
Source: Federal Reserve Payments Study.
Chip payments continue ascent

By value, more than half of in-person general-purpose card payments

Percentage shares of in-person chip and no-chip general-purpose card payments, 2012-17.

Source: Federal Reserve Payments Study.
Some context (in many ways, the story is card, there is all this other stuff... - first, ACH. Growth accelerated)

<table>
<thead>
<tr>
<th>Credit transfers</th>
<th>Debit transfers</th>
<th>Credit transfers</th>
<th>Debit transfers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number</strong></td>
<td></td>
<td><strong>Value</strong></td>
<td></td>
</tr>
<tr>
<td>2012-15</td>
<td>5.0, 5.2, 6.0</td>
<td>2015-16</td>
<td>4.8, 5.3, 5.5</td>
</tr>
<tr>
<td>2016-17</td>
<td>5.7, 5.5</td>
<td>2016-17</td>
<td>7.5, 5.1, 5.2</td>
</tr>
<tr>
<td>2017</td>
<td>1.4</td>
<td></td>
<td>5.9</td>
</tr>
</tbody>
</table>

Annual growth rates (%) of network ACH credit and debit transfers, by number and value, 2012-17. Source: Federal Reserve Payments Study.
By number, check decline sped up but at the current pace and decades long trends now, we still won't see an end to check soon

Annual growth rates (%) of large-institution check payments, by number and value, 2012-17.
Source: Federal Reserve Payments Study.
Distribution of Noncash Payments by Type

<table>
<thead>
<tr>
<th>Type</th>
<th>Number (in billions)</th>
<th>Dollar value (in trillions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Debit cards</td>
<td>69.5</td>
<td></td>
</tr>
<tr>
<td>Credit cards</td>
<td>33.8</td>
<td></td>
</tr>
<tr>
<td>Checks</td>
<td>17.3</td>
<td></td>
</tr>
<tr>
<td>ACH debit transfers</td>
<td>13.6</td>
<td></td>
</tr>
<tr>
<td>ACH credit transfers</td>
<td>9.9</td>
<td></td>
</tr>
<tr>
<td>ACH debit transfers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ACH credit transfers</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Debit card: Includes non-prepaid debit, general-purpose prepaid, private-label prepaid, and electronic benefit transfers. (source – most recent triennial FRS Payment Study)
Cash is the most **used** payment instrument

- Credit card use grew between 2016 and 2017
- Cash showed slight decline, but use still remains substantial
- Year over year changes show that usage patterns are persistent
Cash is used predominantly in low value payments

...but debit may be cutting in

---

*2017 Diary of Consumer Payment Choice: Preliminary Findings and not for quotation*
The on-line revolution may be overstated...

Consumers continue to make more than \( \frac{3}{4} \) of payments in person.

2017 Diary of Consumer Payment Choice: Preliminary Findings and not for quotation
Every generation *uses* cash

...including younger individuals (millennials and younger)

2017 Payment Instrument Usage by Age

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Average Transactions per Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age Under 25</td>
<td>24</td>
</tr>
<tr>
<td>Age 25 to 34</td>
<td>35</td>
</tr>
<tr>
<td>Age 35 to 44</td>
<td>42</td>
</tr>
<tr>
<td>Age 45 to 54</td>
<td>43</td>
</tr>
<tr>
<td>Age 55 to 64</td>
<td>45</td>
</tr>
<tr>
<td>Age 65 and Older</td>
<td>45</td>
</tr>
</tbody>
</table>

2017 Percent Payment Instrument Usage by Age

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Cash</th>
<th>Check</th>
<th>Credit</th>
<th>Debit</th>
<th>PrePaid</th>
<th>Electronic</th>
<th>Mobile</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age Under 25</td>
<td>48%</td>
<td>32%</td>
<td>8%</td>
<td>4%</td>
<td>25%</td>
<td>25%</td>
<td>21%</td>
<td>16%</td>
</tr>
<tr>
<td>Age 25 to 34</td>
<td>31%</td>
<td>19%</td>
<td>25%</td>
<td>25%</td>
<td>23%</td>
<td>34%</td>
<td>34%</td>
<td>34%</td>
</tr>
<tr>
<td>Age 35 to 44</td>
<td>31%</td>
<td>28%</td>
<td>23%</td>
<td>23%</td>
<td>18%</td>
<td>18%</td>
<td>19%</td>
<td>19%</td>
</tr>
<tr>
<td>Age 45 to 54</td>
<td>34%</td>
<td>34%</td>
<td>23%</td>
<td>23%</td>
<td>16%</td>
<td>34%</td>
<td>34%</td>
<td>34%</td>
</tr>
<tr>
<td>Age 55 to 64</td>
<td>34%</td>
<td>34%</td>
<td>34%</td>
<td>34%</td>
<td>34%</td>
<td>34%</td>
<td>34%</td>
<td>34%</td>
</tr>
<tr>
<td>Age 65 and Older</td>
<td>34%</td>
<td>34%</td>
<td>34%</td>
<td>34%</td>
<td>34%</td>
<td>34%</td>
<td>34%</td>
<td>34%</td>
</tr>
</tbody>
</table>

*2017 Diary of Consumer Payment Choice: Preliminary Findings and not for quotation*
....and everyone continues to **hold** cash

**Average Daily Holdings by Age**

<table>
<thead>
<tr>
<th>Age</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age Under 25</td>
<td>$29</td>
<td>$30</td>
<td>$31</td>
</tr>
<tr>
<td>Age 25 to 34</td>
<td>$30</td>
<td>$35</td>
<td>$35</td>
</tr>
<tr>
<td>Age 35 to 44</td>
<td>$45</td>
<td>$48</td>
<td>$48</td>
</tr>
<tr>
<td>Age 45 to 54</td>
<td>$46</td>
<td>$54</td>
<td>$54</td>
</tr>
<tr>
<td>Age 55 to 64</td>
<td>$66</td>
<td>$74</td>
<td>$74</td>
</tr>
<tr>
<td>Age 65 and Older</td>
<td>$93</td>
<td>$101</td>
<td>$101</td>
</tr>
<tr>
<td>Average</td>
<td>$55</td>
<td>$58</td>
<td>$61</td>
</tr>
</tbody>
</table>

**Average Daily Holdings by Household Income**

<table>
<thead>
<tr>
<th>Income Range</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than $25,000</td>
<td>$33</td>
<td>$38</td>
<td>$39</td>
</tr>
<tr>
<td>$25,000 – $49,999</td>
<td>$39</td>
<td>$51</td>
<td>$51</td>
</tr>
<tr>
<td>$50,000 – $74,999</td>
<td>$55</td>
<td>$56</td>
<td>$56</td>
</tr>
<tr>
<td>$75,000 – $99,999</td>
<td>$59</td>
<td>$64</td>
<td>$65</td>
</tr>
<tr>
<td>$100,000 – $124,999</td>
<td>$66</td>
<td>$72</td>
<td>$72</td>
</tr>
<tr>
<td>Greater than $125,000</td>
<td>$84</td>
<td>$89</td>
<td>$89</td>
</tr>
<tr>
<td>Average</td>
<td>$53</td>
<td>$53</td>
<td>$53</td>
</tr>
</tbody>
</table>

*2017 Diary of Consumer Payment Choice: Preliminary Findings and not for quotation*
Cash is the Contingency Plan in Disasters...

... and the Fed is the Contingency Plan for the Cash Supply Chain:

Hurricane Harvey’s and Irma’s peak order volume for 2 days was 5 times greater than prior 30 day average

Hurricane Maria’s peak order volume lasted nearly three weeks and was as much as 7 times greater than the prior 30 day average

Federal Reserve Cash Product Office
...But Cash is Facing Increasing Competition
Agenda

• Yesterday

• Today

• Tomorrow
OLD HABITS DIE HARD

We continue to use paper
We “home” on favorite methods
We act on preferences
Consumers have more choices

1939: Cash, check, money order, travelers’ check, prepaid paper (closed loop)

1950: Charge card

1960: Credit card

1972: Debit card

1974: Bank account number

1974: Bank account number

1983: Prepaid card (closed loop)

1996: Prepaid card (open loop)

1997: Online banking Mobile text

2004: Virtual currency (closed loop)

2004: Virtual currency (closed loop)
Consumers adopt new ways to pay—and keep the old

Percentage of U.S. consumers adopting payment instruments

- **Cash**
- Checking account
- **Debit card**
- Credit card
- Prepaid card
- **OBBP**
- **BANP**
- Money order
- Deduction from income
- Travelers' checks
- **Virtual currency, 0.7% 2017**

Source: Survey of Consumer Finances. – SCPC.
More than 70% of consumers adopt the big 4 payment instruments

Percentage of U.S. consumers adopting payment instruments

Cash
Checking account
Debit
Paper checks
Credit
BANP
Prepaid
OBBP
Money order
Deduction from income
Travelers’ checks
Virtual currency

Source: SCPC.
Beginning in 2016, consumers more likely to have **debit cards** than **paper checks**

Percentage of U.S. consumers adopting payment instruments

- Cash
- Checking account
- **Debit, 81% 2017**
- **Paper check, 78% 2017**
- Credit
- BANP
- Prepaid
- OBBP
- Money order
- Deduction from income
- Travelers’ checks
- Virtual currency

Source: SCPC.
More than 60% pay at billers’ websites
Half use online banking bill pay

Percentage of U.S. consumers adopting payment instruments

- Cash
- Checking account
- Debit
- Paper check
- Credit
- Bank account number
- Prepaid
- Online banking bill
- Money order
- Deduction from income
- Travelers’ checks
- Virtual currency

Source: SCPC.
Consumers make most payments with debit, cash, credit

Percentage of consumer transactions by payment instrument

Debit, 32% 2017
Cash, 27%
Credit, 23%

Source: SCPC.
Together, **cards** make up almost 60% of consumer payments in 2017.
Fewer than 80% of those with *checks* on hand report using them.
Is consumer behavior changing?

Adoption of 21st c. methods
Consumers with a nonbank payment account

2017

% of consumers adopting Venmo

<table>
<thead>
<tr>
<th>Year</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>1.3%</td>
</tr>
<tr>
<td>2016</td>
<td>2.8%</td>
</tr>
<tr>
<td>2017</td>
<td>5.7%</td>
</tr>
</tbody>
</table>

Payment use in 2017

- 1/3 of consumers made a mobile payment—compared to 1/4 in 2015
- 12% of consumers did not make a payment with cash—even once

Source: SCPC.
Demographics are important. **Income** matters most.

- Income
- Age
- Gender
- Race
- Ethnicity
- Household size
- Employment status
Income matters for payment choice

- **Low income** consumers use cash most
- **High income** choose credit

### Percentage of consumer transactions by payment instrument

<table>
<thead>
<tr>
<th>Payment Instrument</th>
<th>Income Category</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash</td>
<td>&lt; $25,000</td>
<td>44%</td>
</tr>
<tr>
<td>Credit card</td>
<td>&lt; $25,000</td>
<td>21%</td>
</tr>
<tr>
<td>Credit card</td>
<td>&gt; $100,000</td>
<td>30%</td>
</tr>
</tbody>
</table>

Source: Connolly and Stavins, table 5C.
Income matters for payment choice

- **Low income** use electronic means less

- **High income** choose methods linked to a bank account more

Source: Connolly and Stavins, table 5C.
Millennials, aged 23-37 in 2017, use cash and, on average, hold $35 to $50

Share of payments in cash by age 2017

Source: DCPC.
Payment instrument ratings make a difference for adoption and use

- Cost
- Security
- Convenience
Consumers say **credit cards** are most secure. **Cash** rates poorly for security.

<table>
<thead>
<tr>
<th>Consumer rankings 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>7</td>
</tr>
<tr>
<td>8</td>
</tr>
</tbody>
</table>

Source: SCPC.
When perceived **security** changes, consumer response is tepid

Economic **model** using SCPC

- + security
- small + change in card use

In the wake of the **Target** breach

**Immediate**
- PII security ratings for cards **fall**

**Long term**
- **No evidence** of behavior change

Source: Schuh and Stavins.

Source: Greene and Stavins.
Characteristics of the transaction are related to payment instrument choice

Value

Payee

Location
Online purchases creep up
In-person purchases still dominate

![Graph showing percentage of monthly purchases over time between in-person and online goods and services.](chart)

Source: SCPC.
For in-person payments less than $10, 2/3 of consumers prefer cash.

Percentage of consumers preferring, 2017

Source: DCPC.
Cash used for $\frac{3}{4}$ of P2P payments; New methods take share from checks

Shares of P2P payments by number

- **2015**
  - Cash: 72
  - Check: 18
  - Table: 1
  - PayPal: 0
  - Account-to-account transfer: 0
  - Other: 0

- **2016**
  - Cash: 74
  - Check: 14
  - Table: 1
  - PayPal: 0
  - Account-to-account transfer: 0
  - Other: 0

- **2017**
  - Cash: 75
  - Check: 10
  - Table: 1
  - PayPal: 0
  - Account-to-account transfer: 0
  - Other: 0

Source: DCPC.
For **bills**, most consumers prefer a payment method linked to **bank account**

Percentage of consumers preferring 2017

- **Debit**: 42%
- **Credit**: 29%
- **Cash**: 24%

- **OBBP**: 26%
- **BANP**: 10%
- **Debit**: 25%
- **Check**: 14%
- **Credit**: 12%
- **Cash**: 9%

Linked to a bank account, 75%

Source: DCPC.
By value, most bills paid electronically.
Bank account number is used most.

Bill payments by dollar value 2017

- Electronic 59%
  - Bank account number
  - Online banking bill pay
  - PayPal
  - A2A
  - Income deduction
  - Mobile
- Cards 13%
  - Debit, credit, prepaid
- Paper 27%
  - Cash, check, money order

Source: DCPC.
“PEOPLE AREN’T DUMB. THE WORLD IS HARD.”

Richard Thayler
Freakonomics Radio, September 16, 2018
Characteristics of [most] retail payments innovation – 2
Innovation is a bloody business, with successes, failures & missteps

Most innovations will not make it to maturity, and those that do are at “risk” of being co-opted by traditional providers
We do not want to stifle innovation in payments
And as a payments system operator, we want to engage in innovation, in pursuit of both business & public policy goals

“Og discovered fire, and Thorak invented the wheel. There’s nothing left for us.”
Retail Payments Risk Forum

- We serve as a catalyst for collaboration in the consumer and commercial payments risk management arena. We:
  - Conduct research and provide analysis
  - Convene and share with interested parties
  - Promote actions to mitigate risk

Take On Payments weekly blog

- [http://takeonpayments.frbatlanta.org](http://takeonpayments.frbatlanta.org)

Retail Payments Risk Forum webpage

- [https://www.frbatlanta.org/rprf](https://www.frbatlanta.org/rprf)
References & Resources

References


(Big thanks to Cash Product Office in San Francisco for development and use of numerous slides, information and insight).

Fed consumer surveys

• Survey of Consumer Payment Choice
• Diary of Consumer Payment Choice
• Survey of Consumer Finances
• Survey of Household Economics and Decisionmaking
• Survey of Consumer Expectations
• Consumers & Mobile Financial Services
• Federal Reserve Payments Study
Federal Reserve Payments Study


frpaymentsstudy@frb.gov