Can eCash & Virtual Currency Compete with Other Electronic Payments?

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Presented at the Accredited Standards Committee (ASC) X9
All Committees Meetings

Federal Reserve Bank of Minneapolis

October 22, 2014

The views expressed in this presentation are those of the presenter and do not necessarily represent the views of the Federal Reserve Bank of Boston or the Federal Reserve System.
Outline of my talk

1. Data on use of “traditional” electronic payment instruments.
2. Why is there so much interest in e-cash, virtual currency, and faster payments?
3. Economics of medium of exchange, commodity money, fiat money, and cash.
4. The differences between e-cash and virtual currency.
5. E-cash cards.
7. Faster payments service and account-to-account transfers.
Transformation of U.S. noncash payments: From paper to (traditional) electronics (volume)

Number of US payments by all sectors (household, business, government)

- Checks: $1,420 billion
- Debit: $39 billion
- ACH: $2,186 billion
- Credit: $95 billion
- Prepaid: $24 billion

Source: Federal Reserve Payment Study (FRPS); (indicate average payment value in 2012).
Transformation of U.S. noncash payments: From paper to (traditional) electronics (shares of vol.)

Share of US payments by all sectors (household, business, government)

Percentage share of annual payments

- Checks ($1,420)
- Credit ($95)
- Debit ($39)
- ACH ($2,186)
- Prepaid ($24)
- Checks + Debit + ACH ($873)

Source: Federal Reserve Payment Study (FRPS); (indicate average payment value in 2012)
U.S. consumers have more payment instruments to choose from:
Why is there so much interest in e-cash and virtual currency?

- Most alternatives to notes and coins are costly (interchange fees on debit and credit cards; usage fees on prepaid cards).
- Notes and coins have unique characteristics that consumers desire (anonymity, accessibility, no direct transaction fees, immediate settlement, no debt): Are there virtual or portable electronic devices that also have these properties?
- Internet access, reliability, and speeds are rising; encryption improvements.
- The explosion of mobile devices with significant processing power.
- Bailout (or non-bailout) of failing banks during crises (March 2013 Cyprus crisis).

![Bitcoin Price and Volume 2013-2014 graph]
What is cash?

Cash may have several characteristics such as:

- Physical aspect (notes and coins versus digital)
- Liability and backing:
  Sovereign government (outside money) versus private money (inside money, e.g. BerkShares)
- Asset value

Purposes and functions of cash (the commonly-used textbook explanations):

- Medium of exchange (our primary focus today)
- Store of value
- Unit of account
Medium of exchange

- Trading parties must agree on a common medium of exchange
- An increase in a medium’s popularity is referred to as “network effects”
- Radford (*Economica*, 1945) describes how cigarettes (commodity money) served as a medium of exchange in a POW camp during WW2
- Radford noted that even after the Red Cross distributed dollars, cigarettes (commodity money) remained the dominating medium of exchange
- So, how would you like to trade today?

With  Or  ?

[Image of a hand holding money and a magazine cover with a sailor and cigarettes]
Why do people hold a particular (or any) Fiat currency? (the most difficult question in monetary economics)

Why is it such a difficult question?

- In 1971, President Richard Nixon officially took the U.S. off the gold standard:
  $1 today can buy only 1/6 of the gold it could buy in 1971

- We use fiat (“it shall be” in Latin) money

- “Legal tender” does not guarantee that a currency can maintain its value relative to goods, services, or other currencies (may even not guarantee trade)

Four (out of many) common incomplete explanations include:

- Governments accept tax payments only in that country’s fiat currency
  For example: Form 1040 must be filed in $ (not Euro and not Bitcoin)

- Implicit or explicit (legal tender) social norm (but could be unstable), i.e., both parties accept it

- Hedge against other currencies (exchange-rate fluctuations)

- Hedge against alternative payment options not being accepted / available
Elaborating on: “Alternative Payment Options Not Acceptable” (We re-entered an era of “barter” with so many instruments!)

Economic theory suggests that the introduction of *fiat* money could be welfare improving because it solves the “double coincidence of wants” problem (avoid missing trading opportunities because the parties *cannot agree* on a common medium of exchange).
Will e-cash and virtual cash replace physical cash? (It’s partly a chicken and egg question)

- To replace physical cash, would-be alternatives must replicate (ideally, improve on) the features that make it attractive to users, including, particularly, its ubiquity.

- Ubiquity is the result of what economists call “network effects”; here are a few formal definitions:
  - Technologies are said to be compatible if they can “work together,” in which case we say that they adhere to the same standard.
  - Network effects are the benefits users derive from an increase in the number of other consumers and/or merchants who adopt the same (or a compatible) standard.

- Of course, this begs the question of what gives rise to positive network effects and a successful alternative to cash...
Two types of digital money: **E-cash vs. virtual currency**

<table>
<thead>
<tr>
<th>E-cash</th>
<th>Virtual currencies (VC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denominated in fiat currency</td>
<td>Denominated in their own unit of account</td>
</tr>
<tr>
<td>Fully exchangeable for fiat currency on 1:1 basis</td>
<td>May or may not be exchangeable to fiat currency; if exchangeable, typically at variable exchange rates</td>
</tr>
<tr>
<td>Examples: Mondex-Visa, MintChip</td>
<td>Examples: Bitcoin, Facebook Credits, Linden Dollars, Amazon Coins</td>
</tr>
</tbody>
</table>

**Summary of money types:**

<table>
<thead>
<tr>
<th></th>
<th>Physical (notes &amp; coins)</th>
<th>Digital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not government backed</td>
<td>Private money</td>
<td>Virtual currency</td>
</tr>
<tr>
<td>Government backed</td>
<td>Cash</td>
<td>E-cash</td>
</tr>
</tbody>
</table>

*Note: There is no agreement on how to define “e-cash” and “virtual currency”; these classifications are mine and for this presentation*
E-cash: the Mondex and Visa Cash experiments in the 1990s

- In the late 1990s developers envisioned anonymous e-cash
- Chase and Citi distributed the cards with a loading capacity of up to $500 at ATMs
- 675 merchants received free terminals, 96,000 cards were issued (Upper W. Side)
- Some foreign cities participated. Swindon, UK was chosen as “typical” city
- The experiment ended because of below-expectation adoption rates
Incomplete sample of worldwide adoptions of e-cash cards (multiple standards).

Netherlands

Germany

Belgium

Hong Kong

US military (closed loop)
E-cash and government initiatives: the Royal Canadian Mint Project

- MintChip was initiated in 2012 by the Royal Canadian Mint
- The private sector was invited to develop all forms of apps
- The MintChip could be attached SD cards and other mobile formats
- The balance (dollars) is on the card (therefore, “true” e-cash)
- The card contains a private key signed by the Mint
- E-cash properties: theft-proof (but not loss-proof, just like notes and coins)
- Next, to be auctioned to the private sector
Virtual Currency:

- “Open source” money: Anyone (governments included) can copy and use the software to create her/his own virtual currency (since 2009)
- Security is also open source and openly discussed
- The value used to fluctuate sharply probably because of the low trading volume
- “Mining” designed to reward individuals for connecting high-performance servers
- International as the Internet (like a social network)
- Long-term cap on the money supply: 21 million bitcoins
- Currently, about 14 million “in circulation”
- Divisible to the 8th digit (for small transactions)
- 2013/11: First ATM (Canada)
More on virtual currencies (VC)

- There are at least 150 virtual currencies, not backed by any government, including, for example, social networks (Facebook credit), games (Linden dollars in Second Life), Shopping (Amazon Coins)
- Some are exchangeable to dollars (one- or two-way), some are not
- FinCEN may require registration as a Money Service Business (MSB) for convertible VC (in addition to state-by-state money transmitter registration)
- ECB concluded that VC will not impact price stability (still too small)
- Less regulation in Europe and the UK than in the US
Assessing the likelihood of positive network effects: a few considerations

How well do the e-cash and virtual currency options replicate / improve on some of cash’s attributes?

- **Anonymity:**
  - Bitcoin designed to be decentralized and anonymous
  - E-cash options can be designed without reference to central account

- **Confidence in maintenance of value (credit risk):**
  - Bitcoin designed to limit supply
  - Other models depend on creditworthiness of issuer

- **Ease of use / acceptance:**
  - May depend on convertibility to fiat currency, as well as technology that must be deployed by users
  - Typically better than cash for digital transactions
  - Regulation / taxation (or lack of clarity about regulation / taxation) can affect acceptance (warning issued by the CFPB about Bitcoin)
Faster payment service (FPS): Account-to-account (A2A)

- US consumers are not used to A2A transfers to other bank accounts (under different account ownership)
- People are not eager to exchange their bank account numbers (although people tend to write checks to anyone)
- This is not the case in countries with Giro tradition (no checkbooks)
- Most US banks either don’t allow it, or charge high fees
- In 2005, the Office of Fair Trading (UK) “asked” banks to shorten the float period of payments
- In 2008, the UK FPS started operating by 12 banks. Timeline:

```
OFT announces a new service | Contract for central infrastructure awarded to Vocalink | Operation begins: All 12 major banks connected
```
Faster payment service: Protocol: 1-2 seconds

- Simon (bank A) sends £1, or £10,000, or £100,000 (limits vary)
- Mike (bank B) is credited within 1-2 seconds (15s maximum or sender is notified to redo it)
- Sending bank checks for “good funds” and accepts/rejects
- FPS infrastructure checks the validity of the “sort” code
- Receiving bank confirms recipient's account and credits Mike’s account
Faster payments service: Method

- Settlement (3 times daily, via Bank of England) was separated from clearing (immediate)
- Banks provide instantaneous credit to fund recipients
- Mobile applications (Paym) began in 2014. ISO 20022 compatible
- So far, not used very much at the point-of-sale. Free for users, so no revenues are made as of now (5 years)
- In the US: Sept. 2013, the Fed published a consultation paper asking for comments on how to reform the US payment system, see http://fedpaymentsimprovement.org/
The UK FPS: How it is used

Faster Payments volumes

<table>
<thead>
<tr>
<th>Year</th>
<th>Transactions (millions)</th>
</tr>
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<tbody>
<tr>
<td>2008</td>
<td>82m</td>
</tr>
<tr>
<td>2009</td>
<td>294m</td>
</tr>
<tr>
<td>2010</td>
<td>425m</td>
</tr>
<tr>
<td>2011</td>
<td>525m</td>
</tr>
<tr>
<td>2012</td>
<td>811m</td>
</tr>
<tr>
<td>2013</td>
<td>970m</td>
</tr>
</tbody>
</table>
The UK FPS: How it is used (number of transactions)

Note: Debit card volume continued to climb
The UK FPS: How it is used (avg. transaction value)

Note: FPS average transaction value has increased sharply
The UK FPS: Some additional (anecdotal) benefits

• Renters who are late paying rent
• Taxpayers missing a deadline
• Parties to a one-time transaction (unlikely to meet again and need an immediate confirmation)
• **Small business**: A car mechanic needs a new carburetor today! Supplier won’t ship the part until payment is received
• **Small business**: Paying workers for overtime on the same day
• **Government**: Weekly unemployment compensation to part time workers who can report how much time they actually worked only at the end of the week
• **Individuals**: Person-to-person in 2 seconds

Thanks for listening !!!
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