Seeding the Technology S-Curve? The Role of Early Adopters in Technology Diffusion

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Boston University Questrom School of Business
Why Should You Care?

The trust machine
How the technology behind bitcoin could change the world
The Blockchain

1st Block

Transaction 1
Transaction 2
Transaction 3

2nd Block

1st Block Hash
Transaction 4
Transaction 5

Transaction 6?
Transaction 7?
...

Mining the next block
The Blockchain

Computer Science

Economics and Market Design

Law
Agenda

• Why should you care?

• The MIT Digital Currency Experiment

• Seeding the technology S-curve? The role of early adopters in technology diffusion
MIT is about to become the world’s first Bitcoin economy


MIT conducts world’s largest Bitcoin experiment

A pot of $500,000 will be used to hand out free Bitcoins to every undergraduate at MIT later this year, in the hope of spurring research, innovation and entrepreneurialism around digital currencies among students

MIT Is Giving Each of Its Undergrads $100-Worth of Bitcoin

This fall, Dan Elitzer will give every MIT undergraduate $100.

There are a few catches. Elitzer, MBA ’15, will distribute the money through the MIT Bitcoin Project, which has raised $540,000 from donors, mostly MIT alumni. And the no-strings-attached payments won’t be in U.S. dollars. They will be in Bitcoins.
Key Challenges

• Uncertainty (risks for students, regulation, foreign, security)

• IRB application… + MIT OGC, IRS, Treasury, FED

• Students’ objectives versus research objectives (e.g., ability to randomize, Stanford experiment): can we learn anything even if everyone cashes out the next morning?

• Tech complexity, no compelling use case, seeding only one side of the market

• Questions over the LATE: what can we learn from MIT?
• ~4,500 undergraduate students eligible

• Educational content on digital currencies, risks and challenges, different types of wallets, privacy and security, securing digital assets

• Survey on Bitcoin, entrepreneurship, digital payments, social network

• Students had to select a wallet and generate their own wallet address

• PGP and encryption

• Overall process: **15 to 45 minutes**

• Launched on October 28th

• **5 days** to get on the waiting list
Main Randomizations

- Timing of the distribution
- Public commitment
- Wallet choice
- Incentive in exchange for social network
- Privacy prompt
5 Days to Get on the Waiting List

MIT Students can now get $100 in BTC for free!
(submitmit.mit.edu)
submitted 2 days ago by v4o
162 comments share

Wow, hurry and sign up you only have 5 days!?!?

- Yeah, I had the impression each student was going to be handed bitcoin (or emailed or whatever). This is a far more limited way to do it that will probably only reach a limited number of students.

- It's MIT. I bet they get 90% participation.

- Finally! I've been looking forward to see what comes out of this experiment and project. At least now, it's really started. I hope they report their findings during this school year, also, and don't just wait to release everything they learned at once once the school year is over.

- That it's only for a few days to claim it and that they don't even mention the free $100 in the email they sent.
First 12 hours

One MIT undergraduate student tries to hack us…

…and fails!
Familiarity with Bitcoin

- 12% none
- 29% moderate
- 53% slightly familiar
- 6% very or extremely familiar

(13.5% has a wallet)
What Draws You to Bitcoin?

- 35% I want to buy them as an investment
- 21% easier to use than cash
- 20% easier to conduct online transactions
- 17% independence from government currencies
- 16% lower transaction fees than traditional banking
- 12% benefits when traveling internationally and sending money overseas
- 9% more secure than other payment methods
- 8% transactions are not tracked by governments
- 7% faster funds transfers

BTC to USD

$693

$600

$500

$400

$300

$200

$100

$350

$300

$200

$200
Selection into the study

Participate

70% (3108)

Ignore
30% (1358)

Abandonment

Active
14.5% - 20.3%
(452 to 631)

Hold
47.9%
(1,490)

Cash out
39.5%
(1,226)
Active (14.5%)
Agenda

• Why should you care?
• The MIT Digital Currency Experiment
• Seeding the technology S-curve? The role of early adopters in technology diffusion
Research Question

What happens when the natural order of adoption is perturbed?

In Strategy…
A Process to be Managed

Early Market
- Innovators: 2.5%
- Early Adopters: 13.5%
  - Minimum Feature Set

Mainstream Market
- Early Majority: 34%
- Late Majority: 34%
- Laggards: 16%
  - Whole Product Solution

People Who Want Newest Things
- Enthusiasts
- Visionaries

People Who Want Complete Solutions and Convenience
- Pragmatists
- Conservatives
- Skeptics
Focus is on Technology Abandonment

- Who gave up on the technology?
- Measured by cashing out, i.e. converting bitcoin back to USD
- Unusual feature: abandonment here had an upside, not a sunk cost
- Fine-grained activity data (blockchain, wallet providers)
Tracking Transactions versus Trusting the Survey

No systematic bias on early adopters
How Do We Identify Early Adopters?

- First to join our waiting list! (robust to survey measures)
- Analogy in process to the people who signed up first for things like Google Glass etc.
Top 25% of the Waiting List versus Others

(a) Top Coder versus Not
(b) Released iOS or Android App
(c) Used Bitcoin Before

(d) Uses Venmo on a Daily or Weekly Basis
(e) Uses PayPal or SquareCash on a Daily or Weekly Basis
(f) Uses Mobile Payments on a Daily or Weekly Basis

(g) High Trust in Tech Firm or Startup for Financial Services
(h) No Trust at All in Government, Well-Known Retailer or Carrier
(i) Financial Independent versus Not Financial Independent
How Do We Identify Perturbations to the Natural Adoption Order?

• 50% of the subjects was randomly delayed by 2 weeks (initial aim was to identify network effects)

• No one was told when they would receive bitcoin, nor explanation was given for why some people received it and others did not

• Some of our natural early adopters (top of the waiting list) were not allowed to be first to adopt
Main Results (I)
Delaying Early Adopters Increases Their Cash Out Rate
Main Results (II)
Delaying Early Adopters
Impacts the Abandonment Curve

% Adoption

Days After Distribution

NEA in Dorm w/BM Share Delayed EA
NEA in Dorm w/AM Share Delayed EA
Agenda

• Why should you care?

• The MIT Digital Currency Experiment

• Seeding the technology S-curve? The role of early adopters in technology diffusion
  
  - Understanding the mechanism
  
  - Spillovers
It is Not About Being Financially Constrained
It is **Not** About Better Information & Expectations
It is **Not** About Investment Preferences and Risk Aversion
Effect is Coming from Dorms
Large versus Small Dorms

The graph illustrates the mean of immediate cash out in dorms for different waiting lists. The x-axis represents the dorm size categories: Rest of Waiting List (Above Median Dorm Size), Top 25% Waiting List (Above Median Dorm Size), Rest of Waiting List (Below Median Dorm Size), and Top 25% Waiting List (Below Median Dorm Size). The y-axis represents the mean of immediate cash out in dorms. The data is differentiated into two groups: Not Delayed (gray bars) and Delayed (orange bars).
<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>(1) ICO</th>
<th>(2) ICO</th>
<th>(3) ICO</th>
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<th>(5) ICO Dorms</th>
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<td>Top 25% Waiting List</td>
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<td>810</td>
<td>2,298</td>
<td>1,766</td>
<td>532</td>
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Robust Std. Errors in Parentheses

*** p<0.01, ** p<0.05, * p<0.1
Density of Computer Science Students

Mean of Immediate Cash Out in Dorms

1. BM CS Students
   - Rest of Waiting List
   - Top 25% Waiting List

2. AM CS Students
   - Rest of Waiting List
   - Top 25% Waiting List

1. Not Delayed
2. Delayed
Above and Below the Median Density of Tech Talent, Early Bitcoin Users, and Early Adopters

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>(1) ICO in Dorms Top Coders</th>
<th>(2) ICO in Dorms Other Students</th>
<th>(3) ICO in Dorms BM BTC Adopters</th>
<th>(4) ICO in Dorms AM BTC Adopters</th>
<th>(5) ICO in Dorms BM CS Students</th>
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<th>(7) ICO in Dorms BM Early Adopters</th>
<th>(8) ICO in Dorms AM Early Adopters</th>
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<tr>
<td>Top 25% Waiting List</td>
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<td>Delayed</td>
<td>0.4522** (0.1829)</td>
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<td>All Delayed</td>
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<td>0.4294** (0.1685)</td>
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<tr>
<td>Observations</td>
<td>697</td>
<td>1,601</td>
<td>1,018</td>
<td>1,280</td>
<td>993</td>
<td>1,305</td>
<td>1,021</td>
<td>1,277</td>
</tr>
</tbody>
</table>

Robust Std. Errors in Parentheses

*** p<0.01, ** p<0.05, * p<0.1
All Delayed versus None Delayed

[Bar chart showing the mean percentage of ICO in dorms for 'All Delayed' and 'None Delayed' groups. The 'All Delayed' group has a significantly higher mean compared to the 'None Delayed' group, with error bars indicating variability. The x-axis represents the waiting list categories, and the y-axis represents the mean percentage of ICO in dorms.]
Agenda

• Why should you care?

• The MIT Digital Currency Experiment

• Seeding the technology S-curve? The role of early adopters in technology diffusion
  - Understanding the mechanism
  - Spillovers
Financially Independent vs Not

Top Coders versus Not

Dorms versus Off Campus

AM/BM Density of CS Students
Delayed versus Not and Early Adopters

% Adoption vs. Days After Distribution

- Delayed EA
- Not Delayed EA
- Delayed Other
- Not Delayed Other
Spillovers within Dorms (NEA)

Above versus Below Median Share of Delayed Early Adopters
Spillovers and Microgeography

Floors: Above versus Below Median Share of Delayed Early Adopters (NEA Only)
Spillovers and Microgeography

Small Dorms: Above versus Below Median Share of Delayed Early Adopters (NEA Only)
Spillovers and the S-Curve

Dorms: Above versus Below Median Share of Delayed Early Adopters (NEA Only)
Key Limitations

• We are studying the very beginning of an S-curve. Not clear how this translates to the “majority”

• The delay was only 2 weeks, and no variation in length of delay

• It is MIT so LATE is strange (but perhaps most of the bias may go in the opposite direction)

• Abandonment is slightly unusual as you get a reward in cash
Summary

- Delaying early adopters increases technology abandonment
- There appear to be spillovers from this effect on peers
- Role of reputation and “identity” as technology gatekeepers?
- Overall, it is difficult to speed up technology adoption
- Partly because there is a natural order to it, and it backfires to disturb it
Thank You!
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