# Back to bank:
# Digital payments, deposits' substitution & credit

**L. Spadavecchia**
Princeton & Bocconi

J. Apaa
Bank of Uganda

S. Musoke
Bank of Uganda

QCGBF annual conference

July 1, 2024

“Big picture” question of my agenda:

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What specific frictions and constraints prevent the development of financial markets in LMICs?

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Can policy affect these, if so how?

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$ 3.5 billion daily

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Local Markets

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DOUGH RISING

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## Research Question

# Do digital currencies disintermediate banks?

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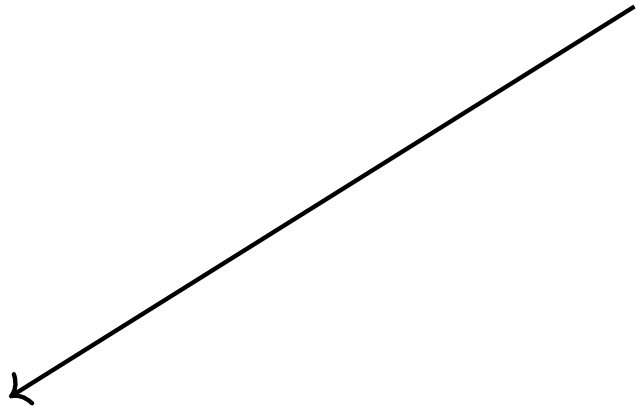

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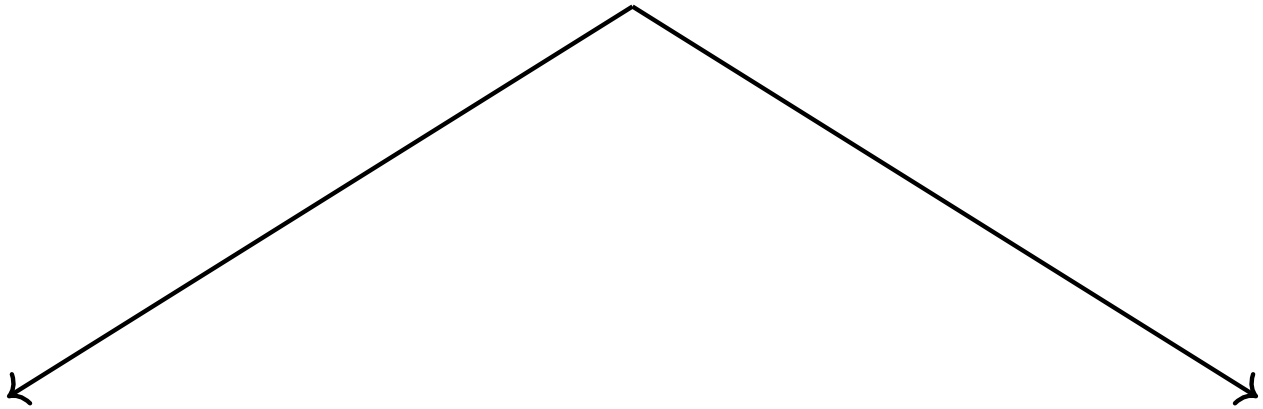

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# Mobile Money, Banks & Cash - simplify Ugandan market

User

Banks

Cash

Mobile Money

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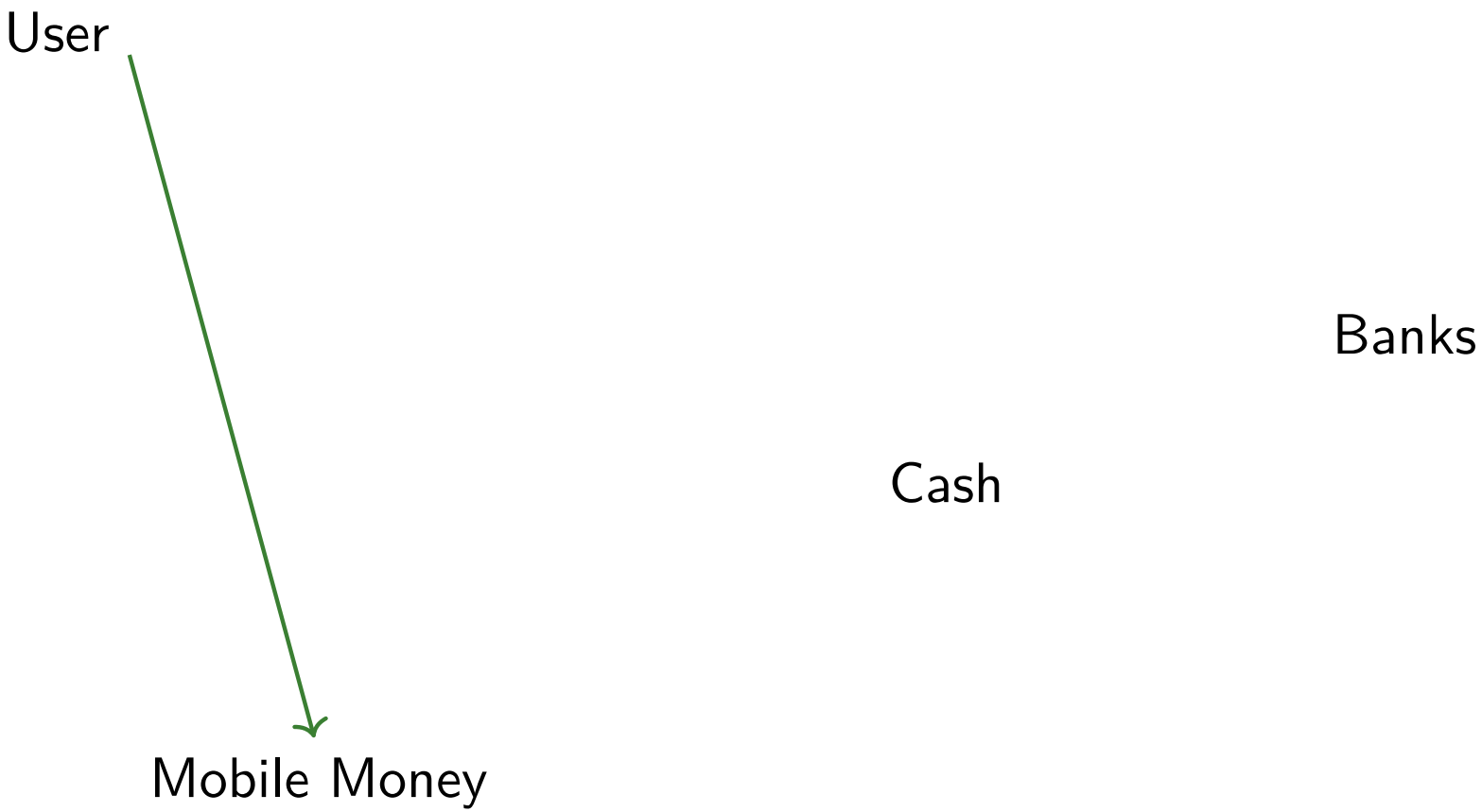

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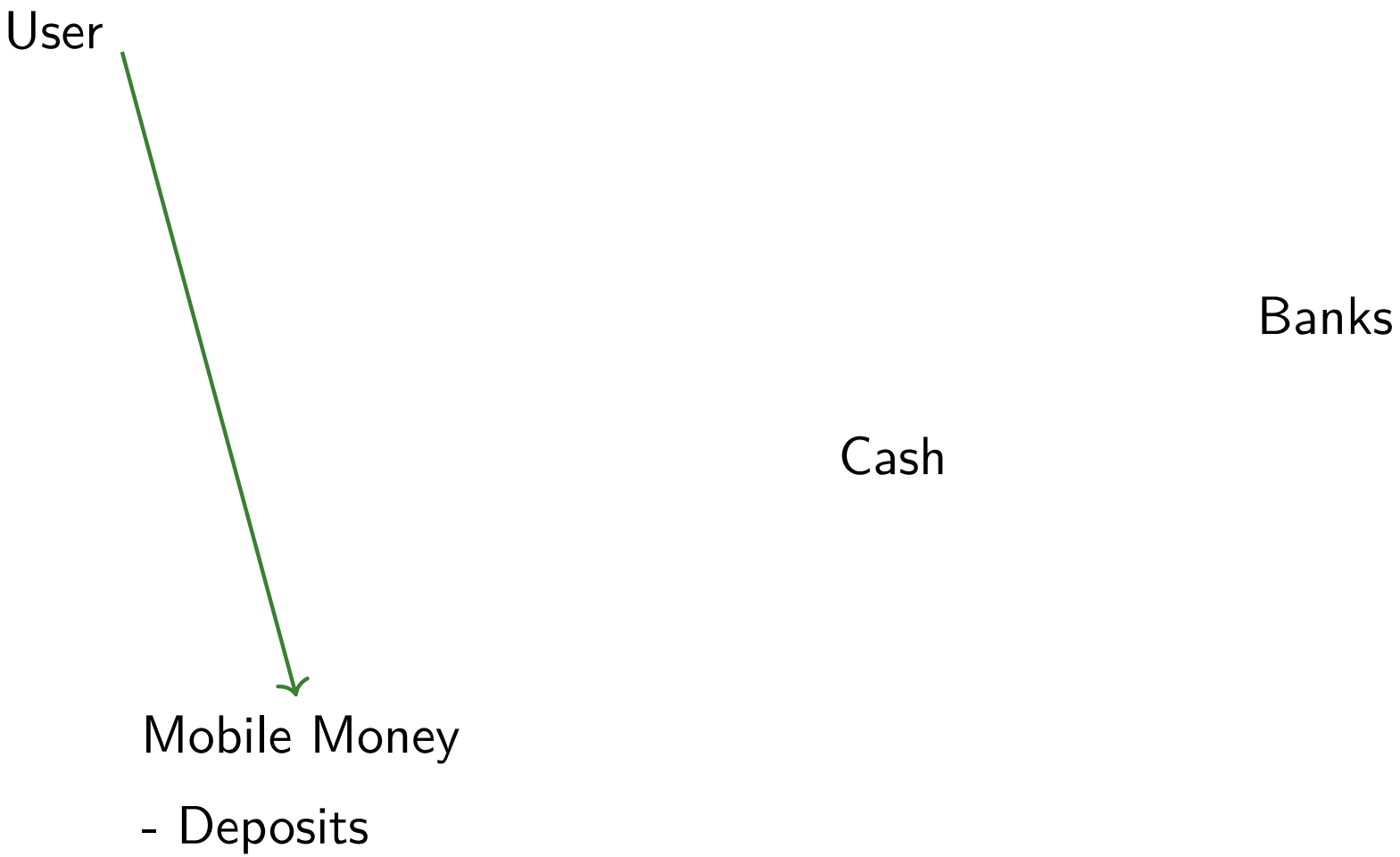

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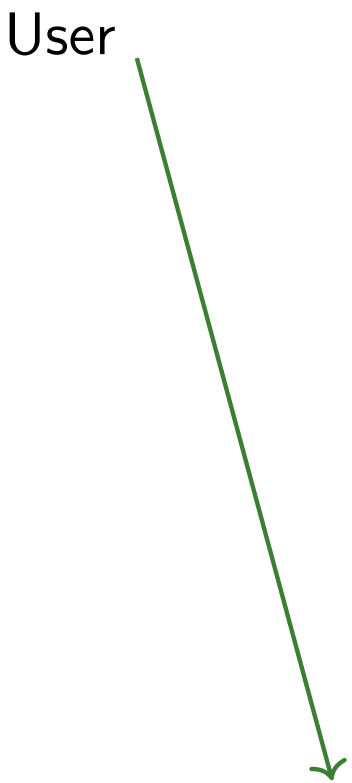


Banks

Cash

Mobile Money

- Deposits
- Payments

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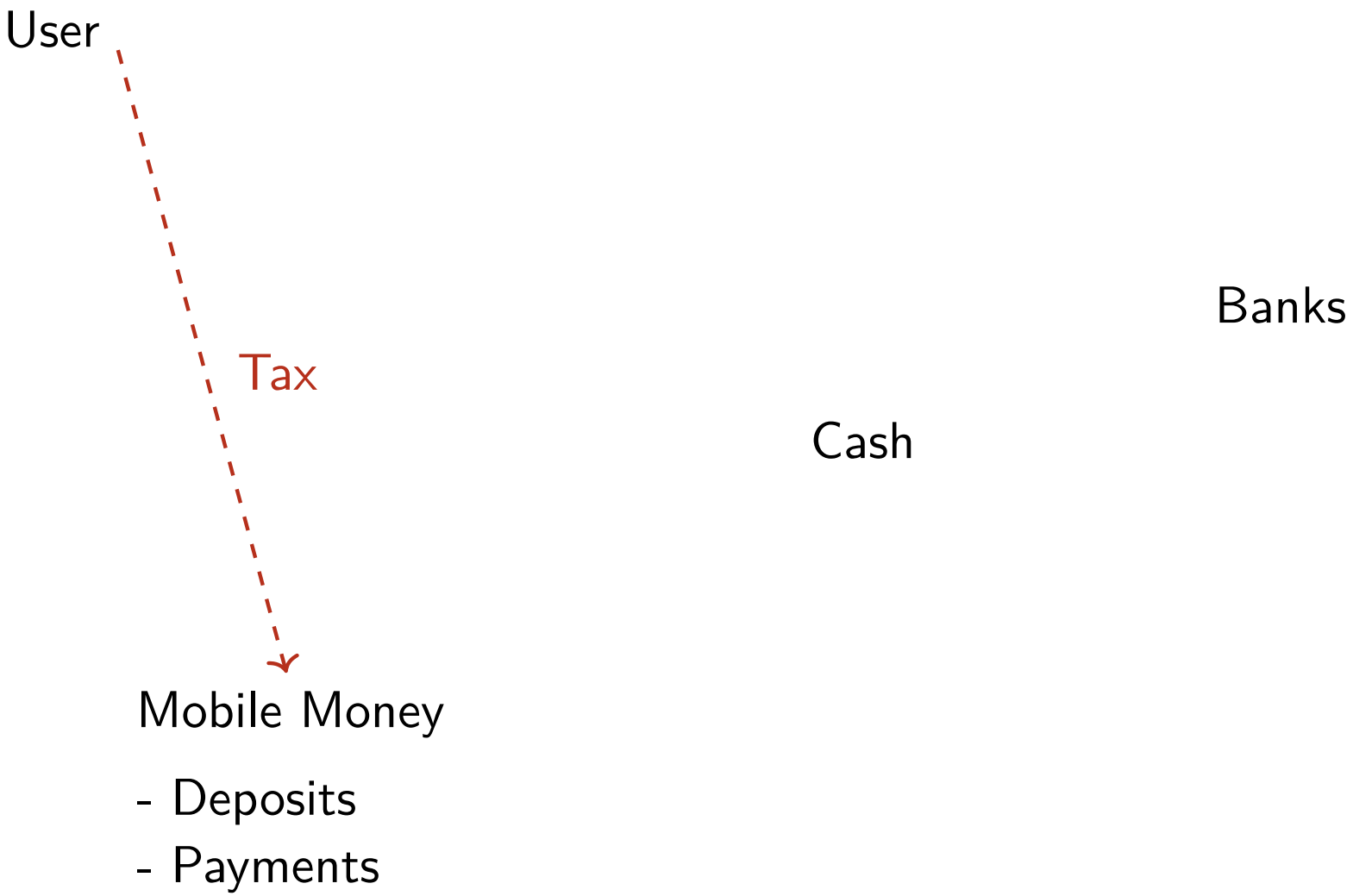

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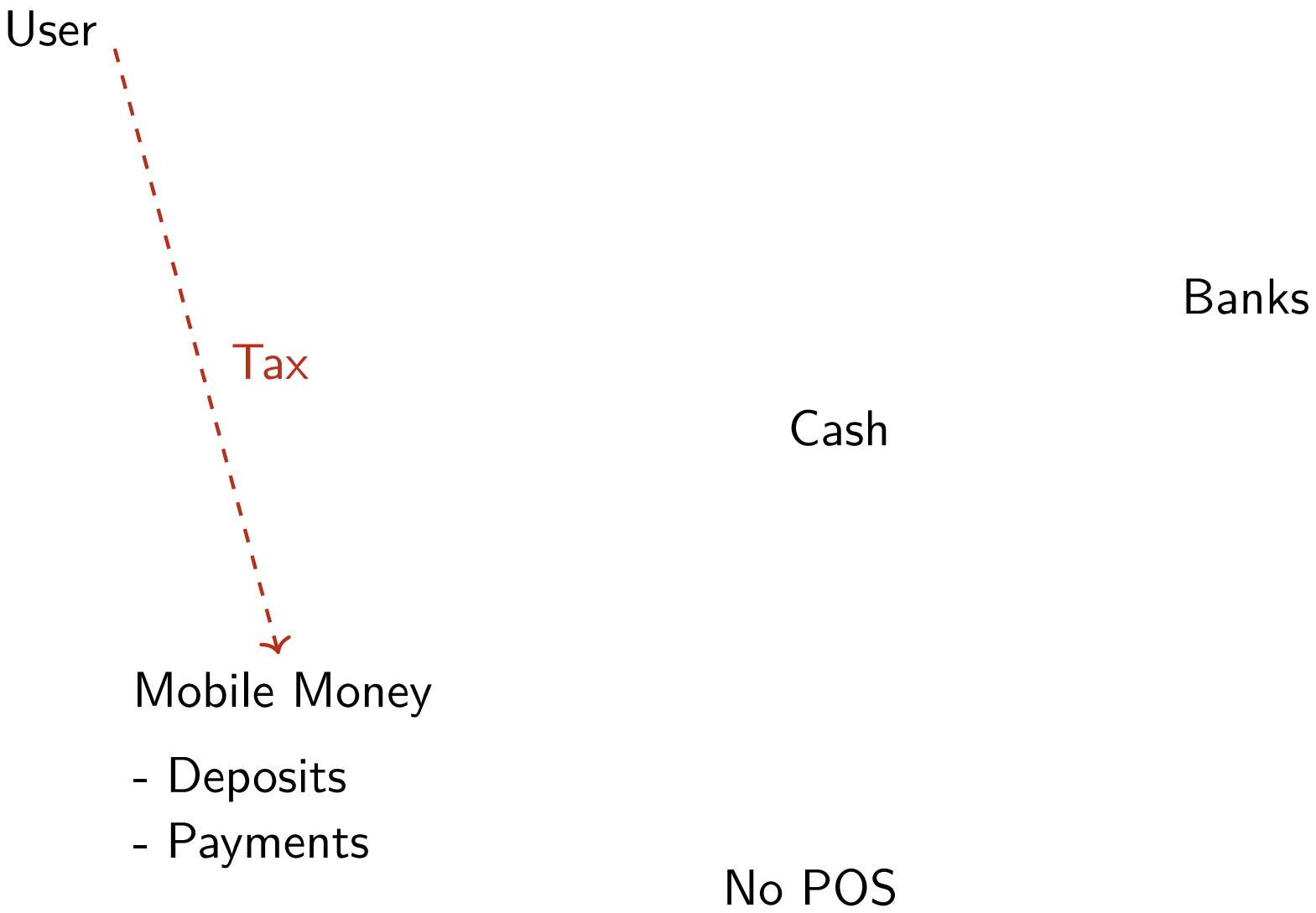

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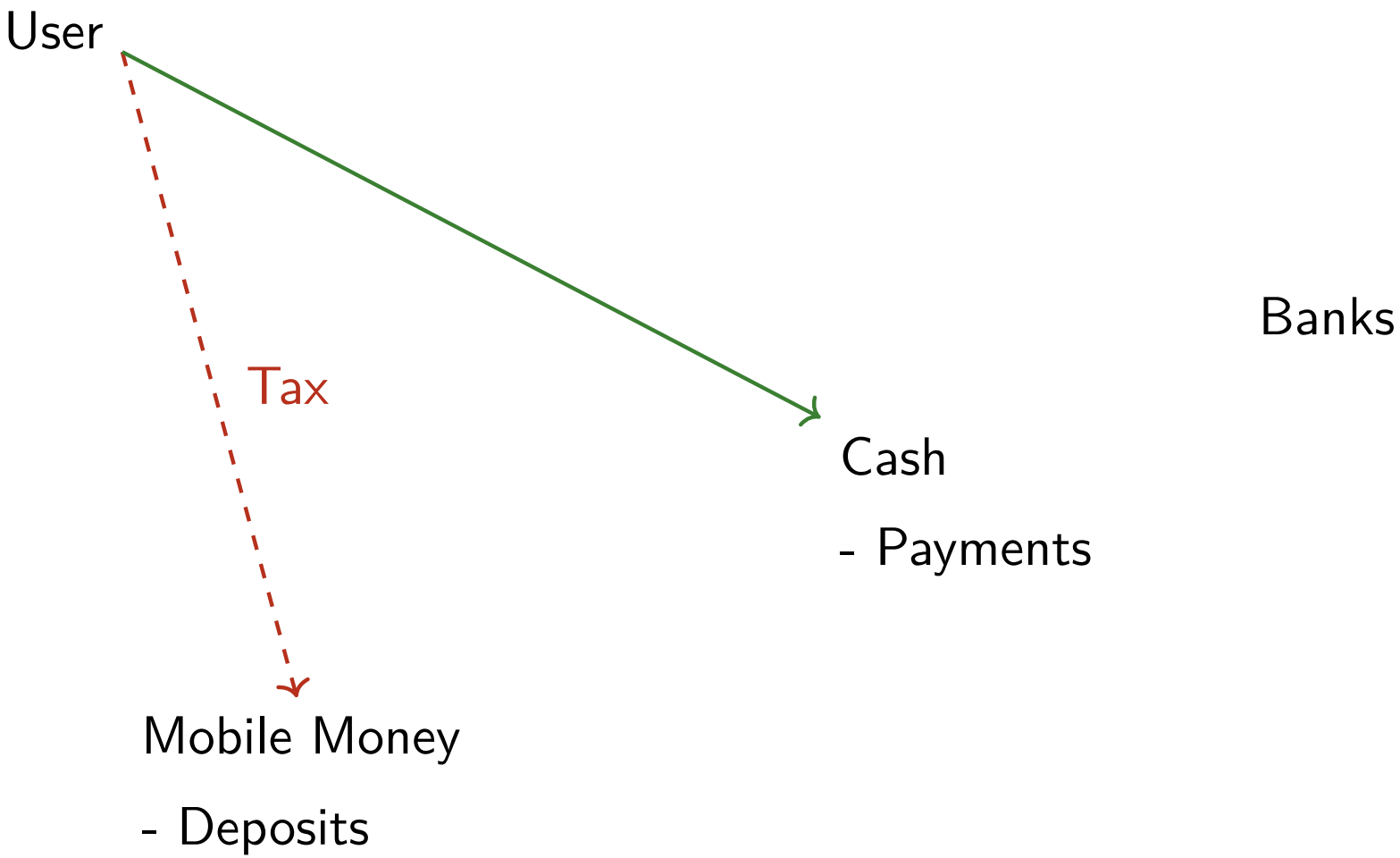

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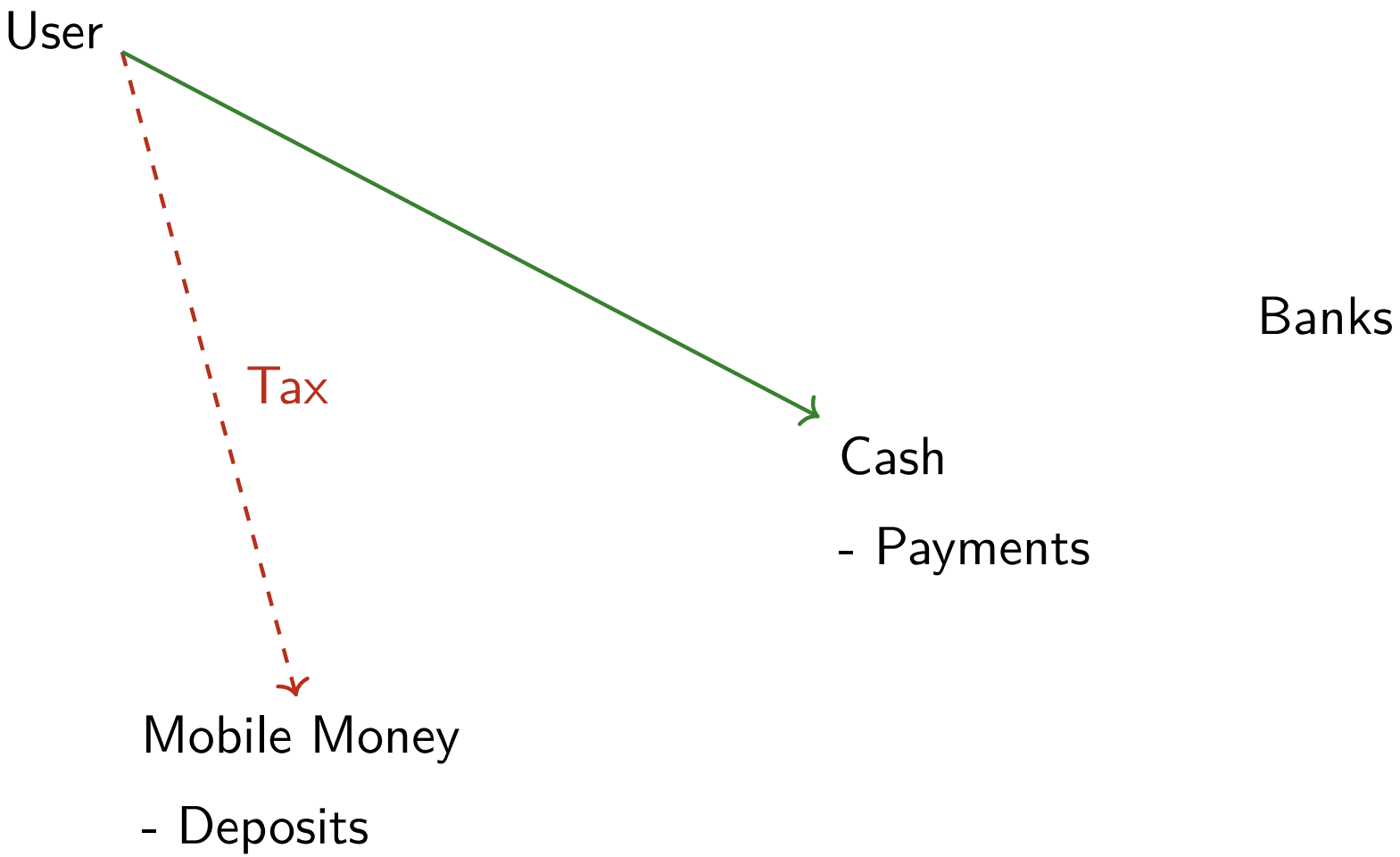


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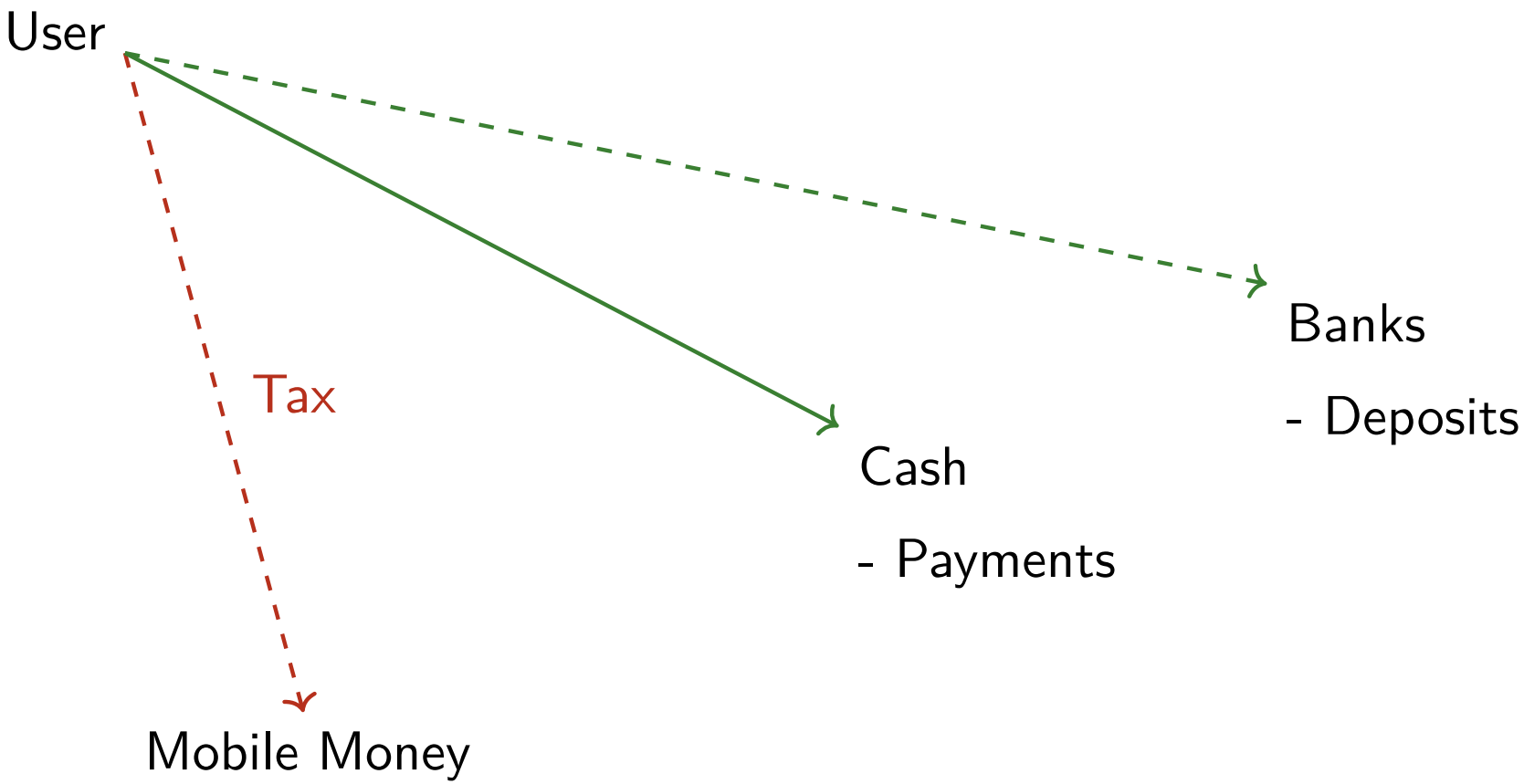


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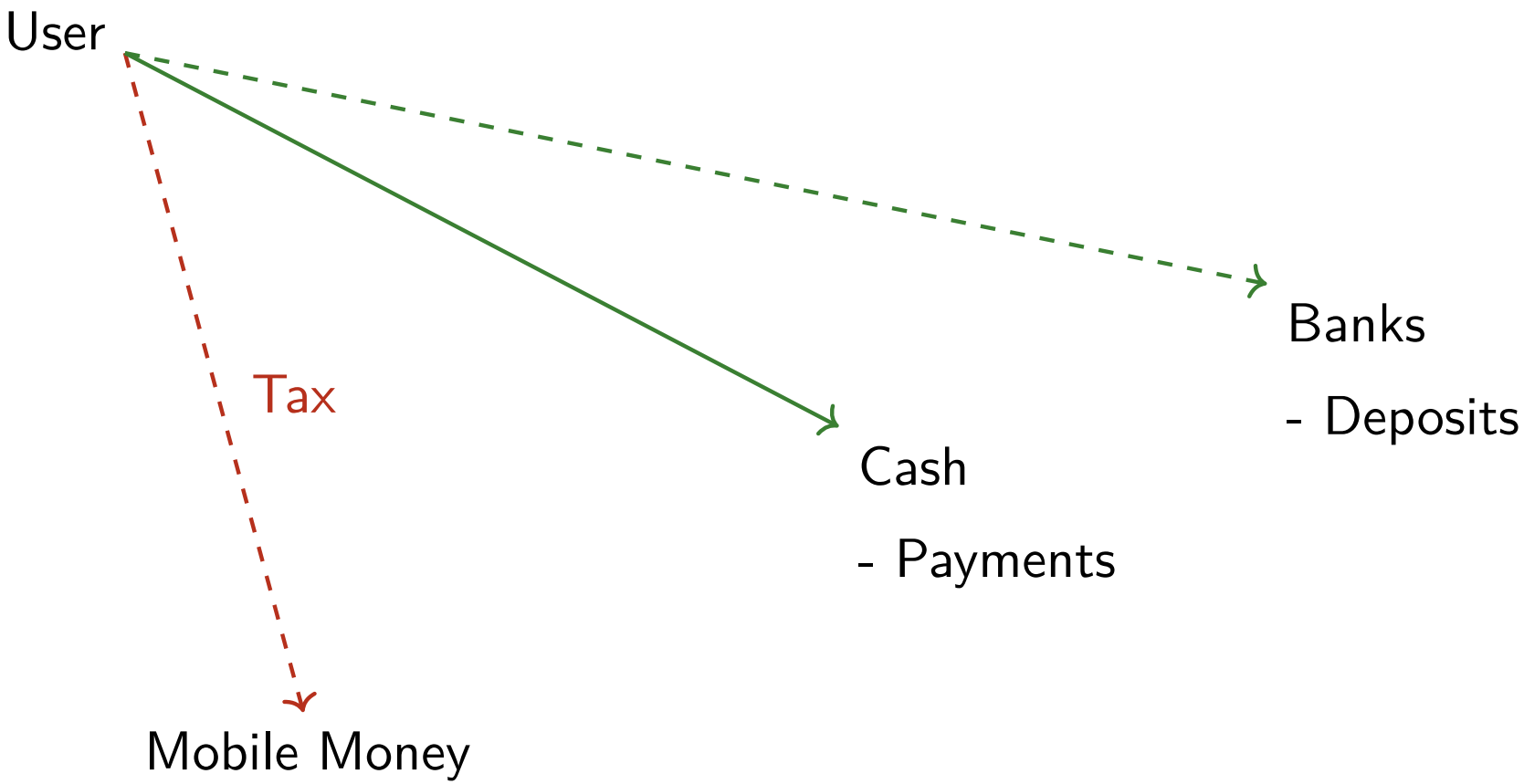


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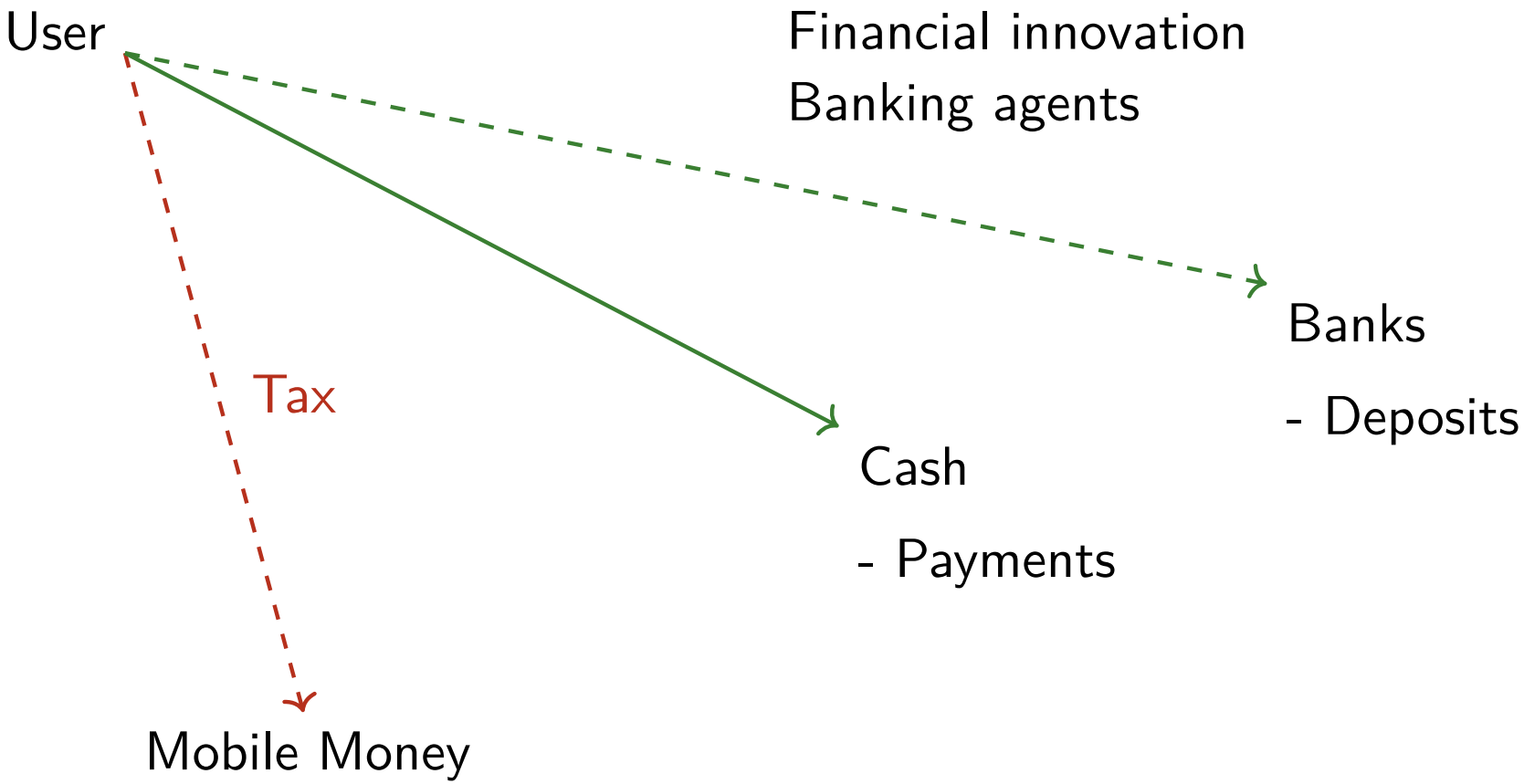


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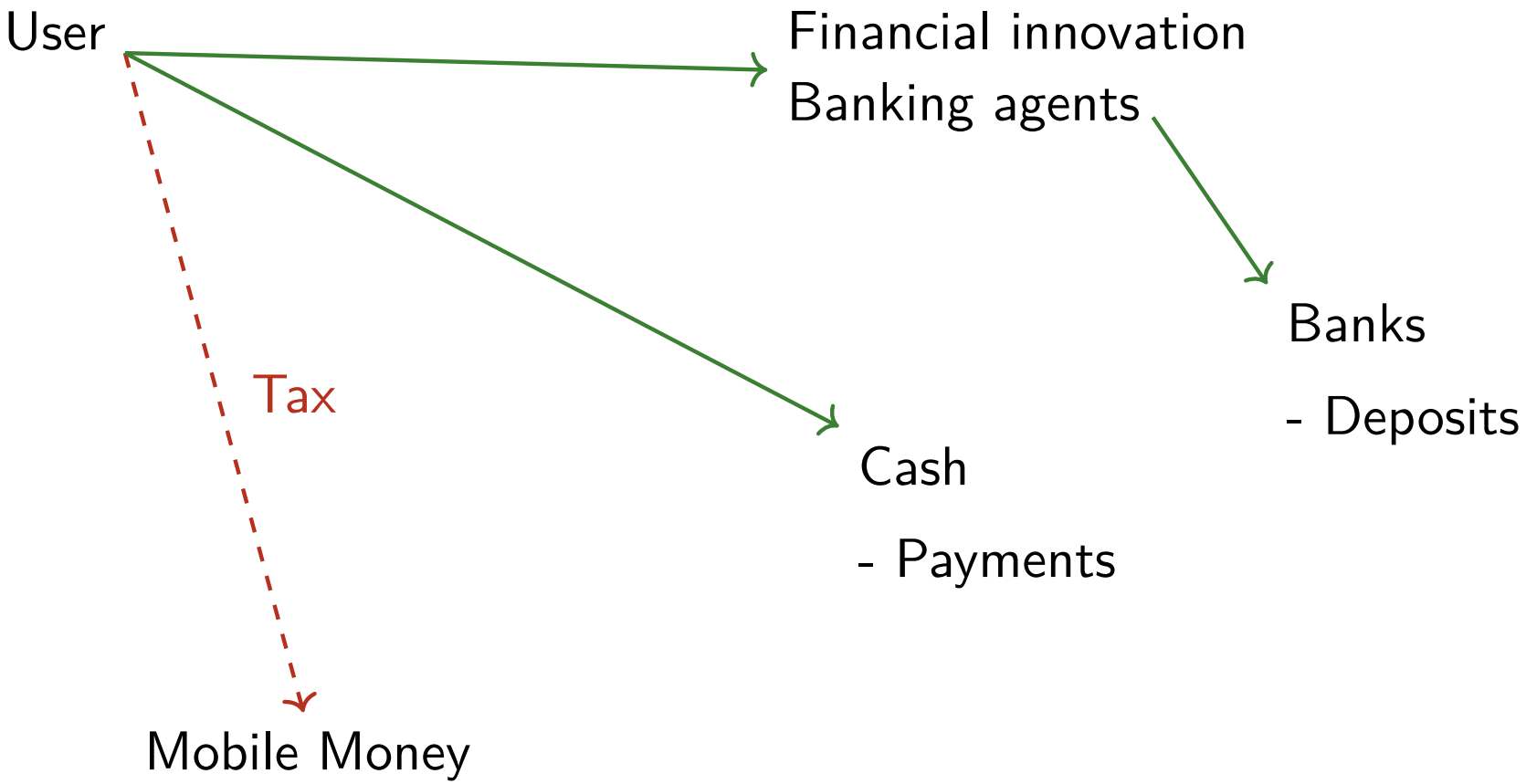


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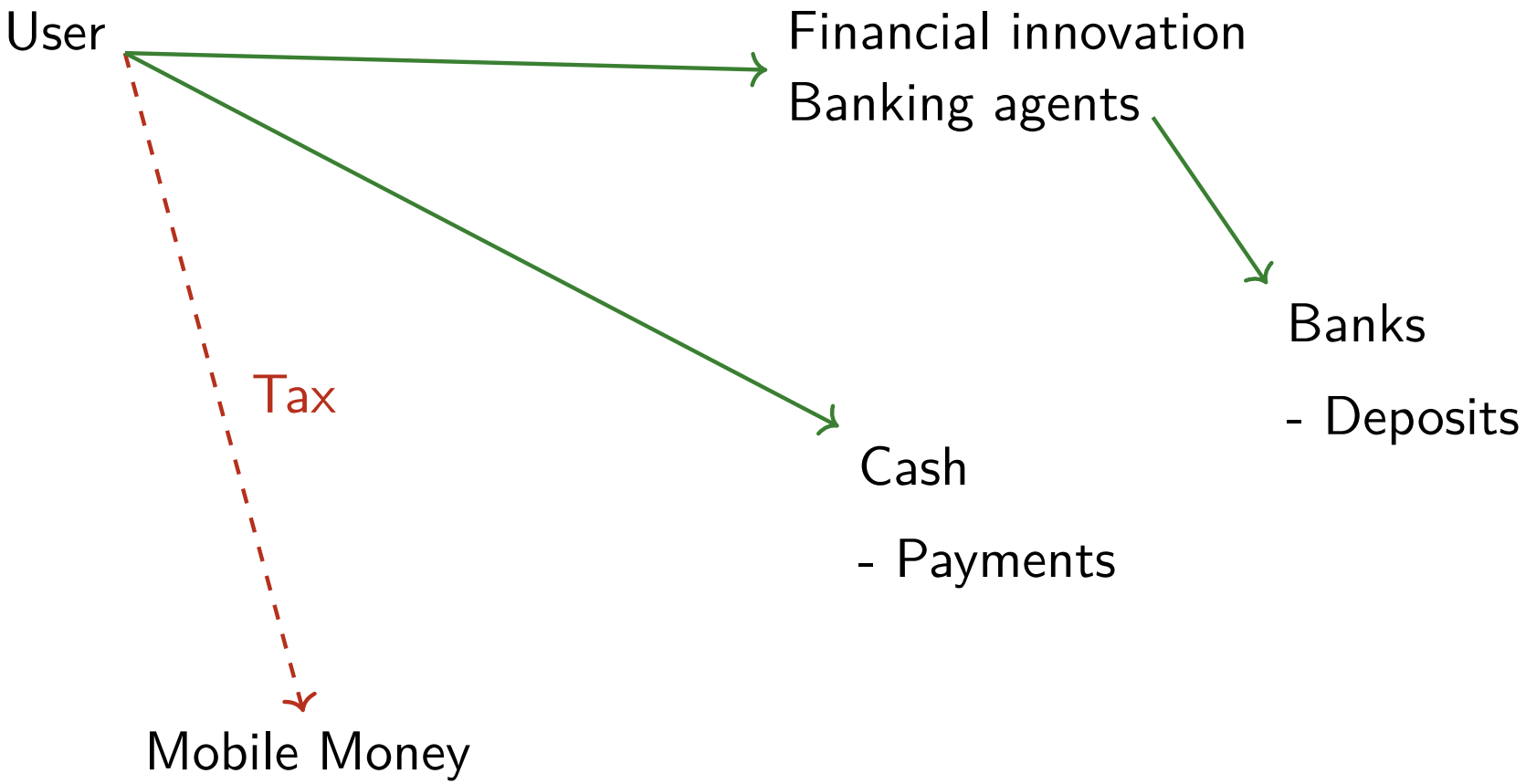


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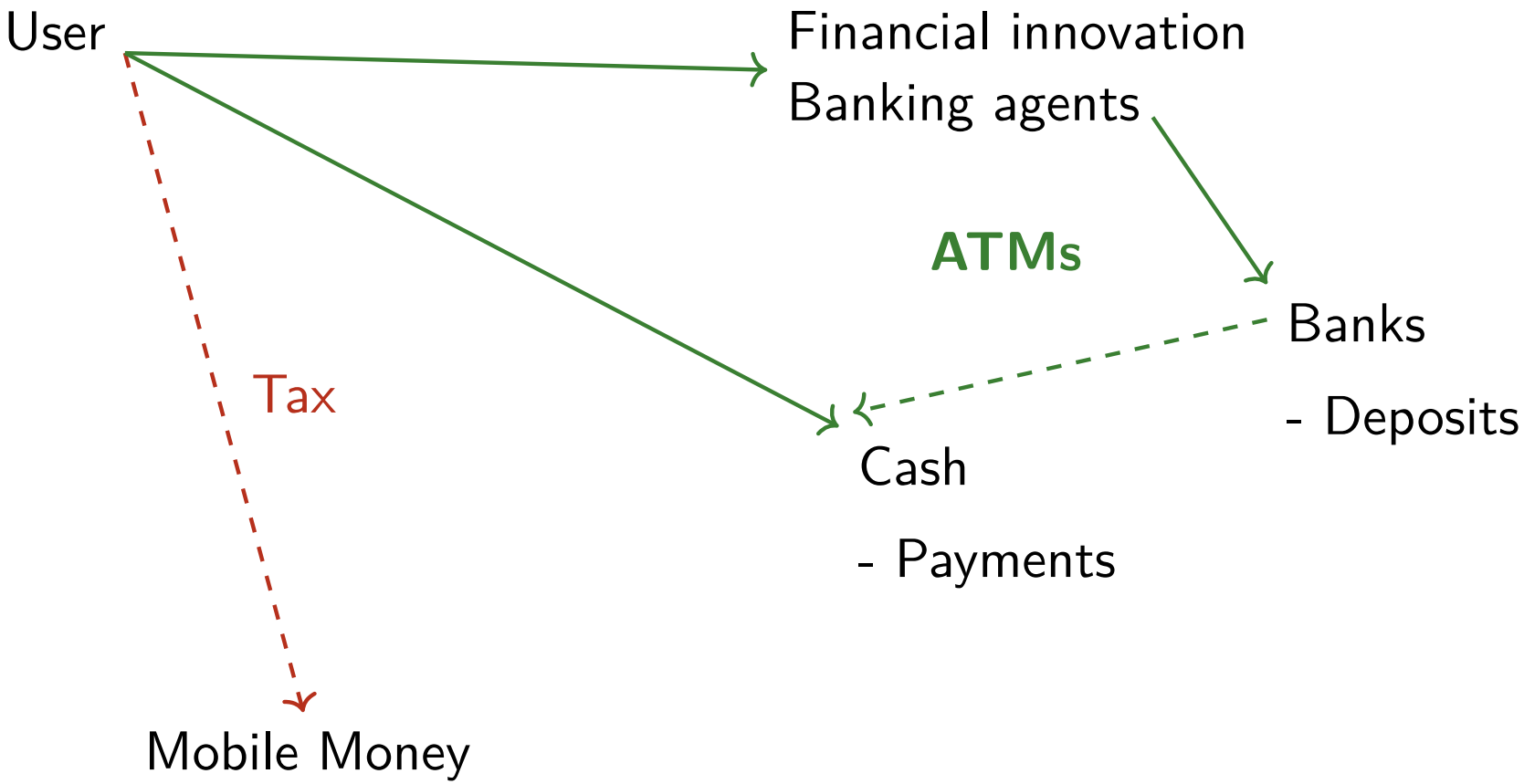


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# Paper in 1 picture

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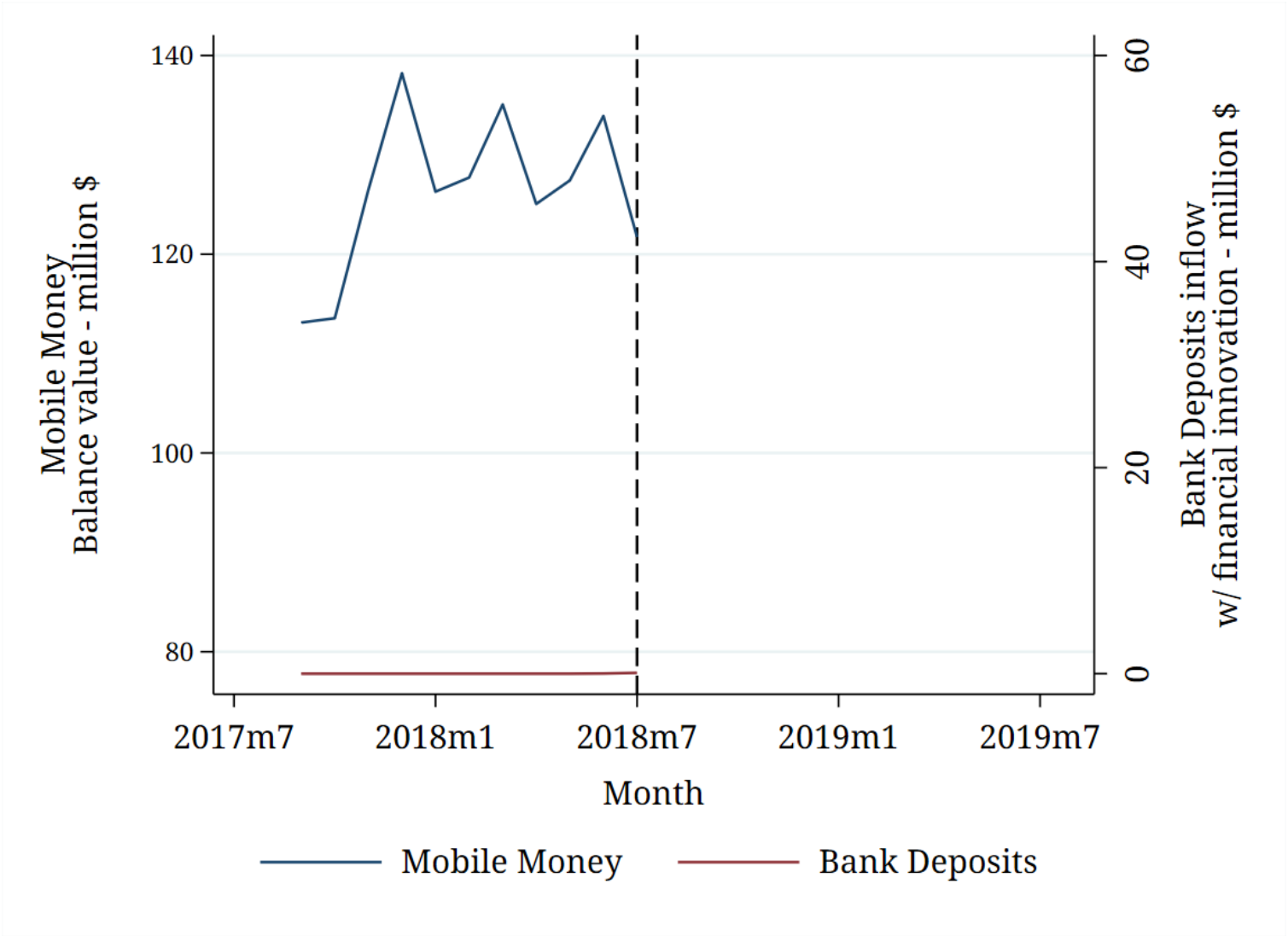

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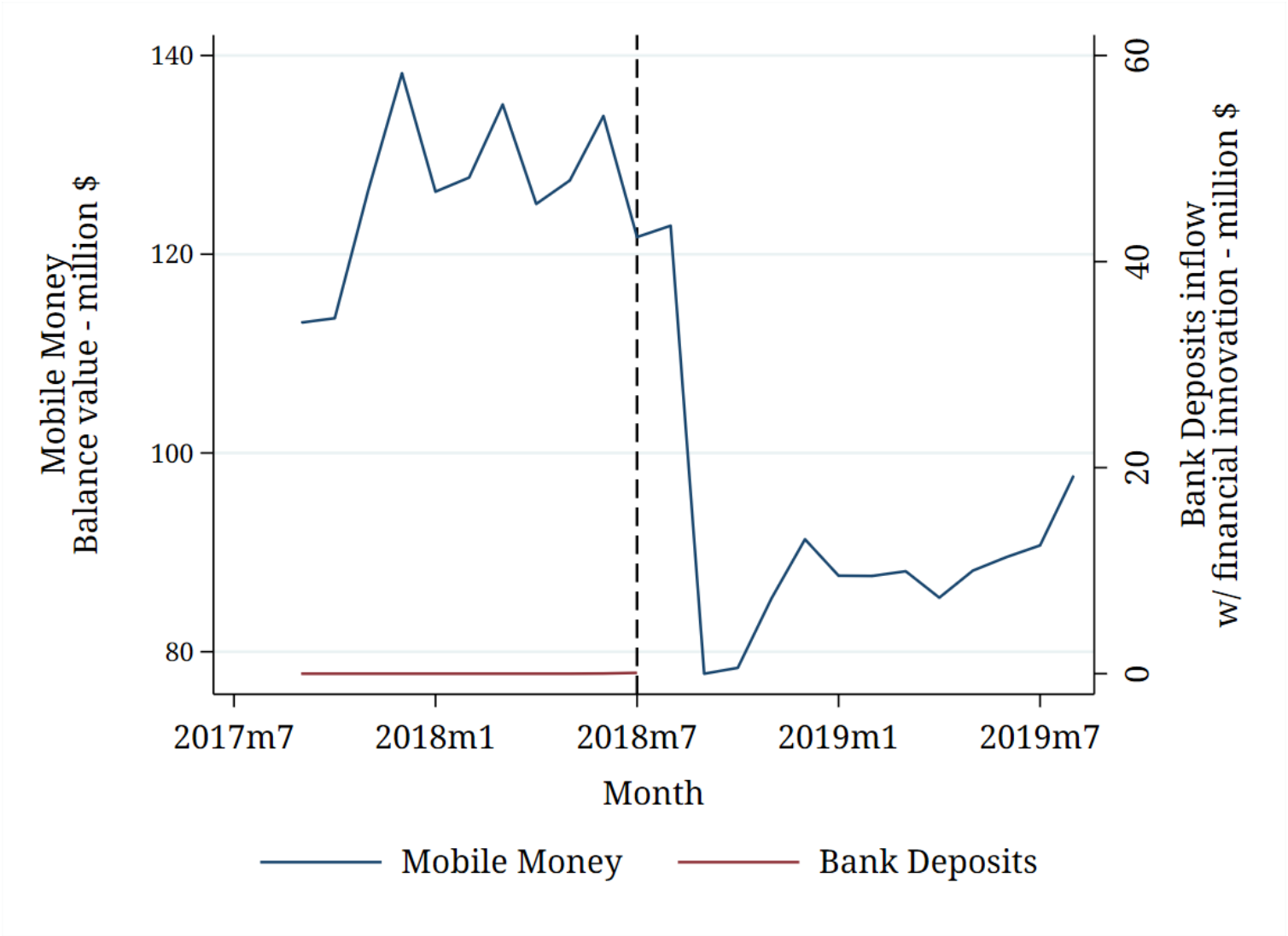

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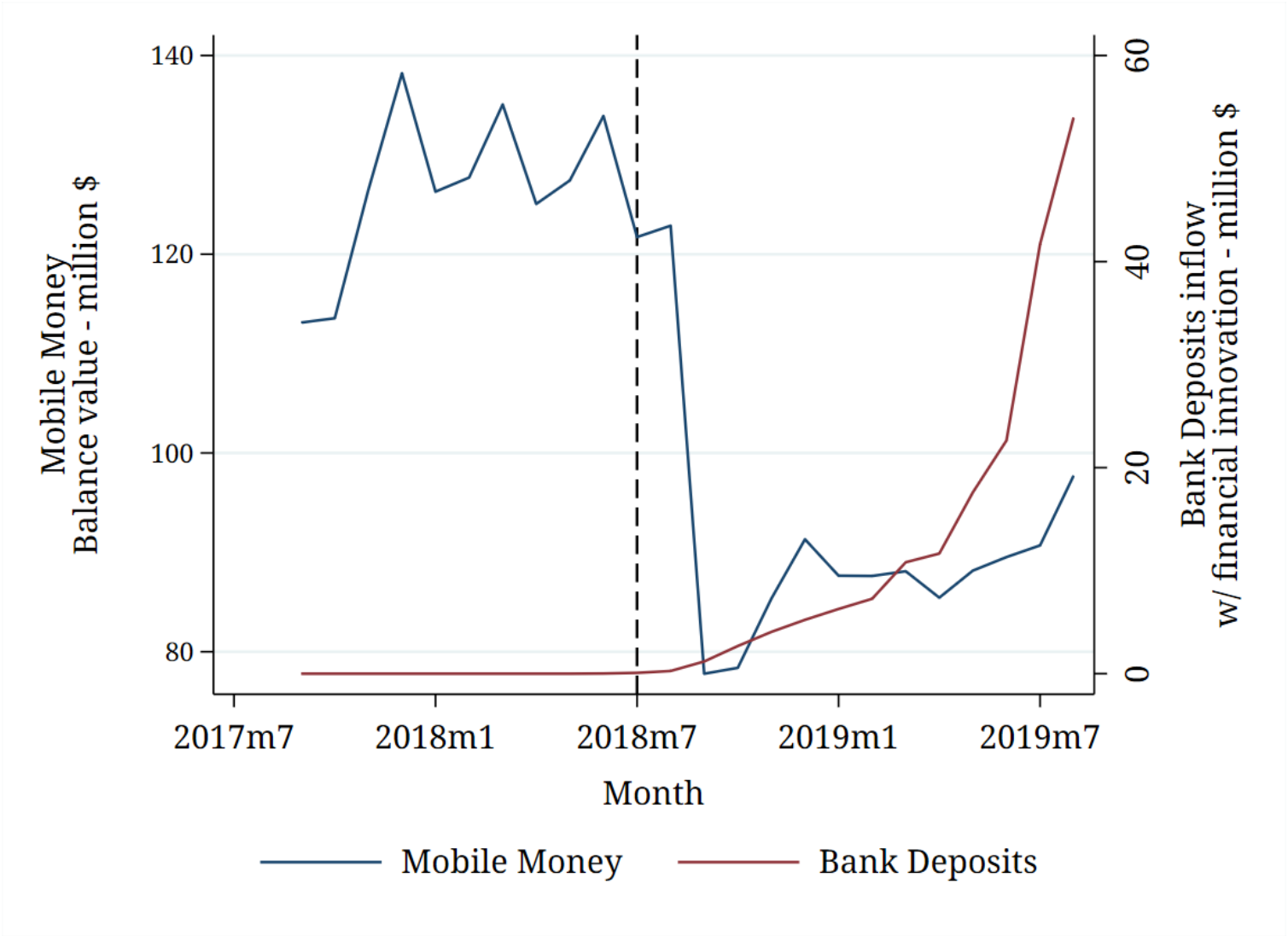

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Mixed theoretical effects of digital currency (CBDC) on banks' intermediation

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# A Roadmap

1. Data & Identification

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# Data & Identification

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## Mobile Money Transactions

- 2 billion transactions in 2018
- 20 million users $\Longrightarrow$

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**Credit registry** - monthly

- 2 million loans
- borrower: location, demographics, credit history

Statistics

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- Borrower level

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Event study specification + DiD

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$\mathbf{I}\left[\text{High ATM}\right]_i$
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- Banks: top quartile of ATM market share

# Empirical specification

Event study specification + DiD

$$\log Y_{it} = \alpha_i + \alpha_t + \sum_{\tau=1,\tau\neq5}^{T} \beta_\tau \text{Month}_\tau \times \mathbf{I}\left[\text{High ATM density}\right]_i + \epsilon_{it}$$

$$\log Y_{it} = \alpha_i + \alpha_t + \beta \text{Post Tax}_t \times \mathbf{I}\left[\text{High ATM}\right]_i + \epsilon_{it}$$

$i$ unit of analysis: individual, household, district, bank

Unit $\alpha_i$ & time $\alpha_t$ FEs.

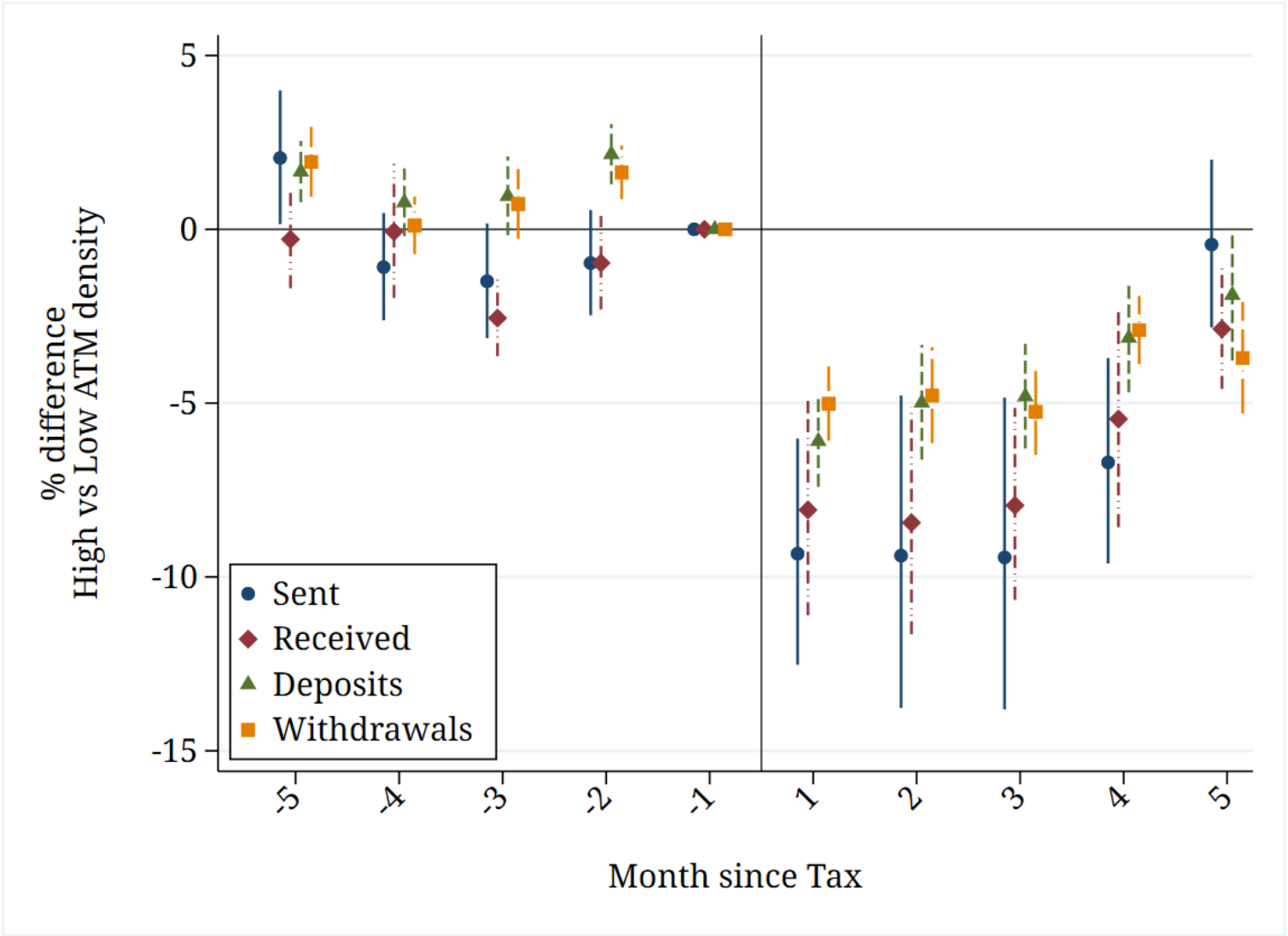
$\mathbf{I}\left[\text{High ATM}\right]_i$
- Individuals, districts: top quartile of ATM density
- Banks: top quartile of ATM market share

Robustness: include Post $\text{Tax}_t \times \mathbf{X}_i$ to rule out concurrent mechanisms

Mobile Money ↓

# Mobile Money usage: individual level

Figure 1: Effect of Tax on Mobile Money usage



# Mobile Money usage: individual level

Table 1: Mobile Money usage: (log) value

| | Sent | Received | Deposits | Withdrawals |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Post tax dummy | -0.103*** | -0.117*** | -0.040*** | -0.060*** |
| $\times$ High ATM density$_d$ | (0.017) | (0.014) | (0.008) | (0.005) |
| User FE | Yes | Yes | Yes | Yes |
| Time FE | Yes | Yes | Yes | Yes |
| Users | 285044 | 450730 | 1171380 | 1382856 |
| Adj. R sq. | 0.438 | 0.349 | 0.407 | 0.448 |

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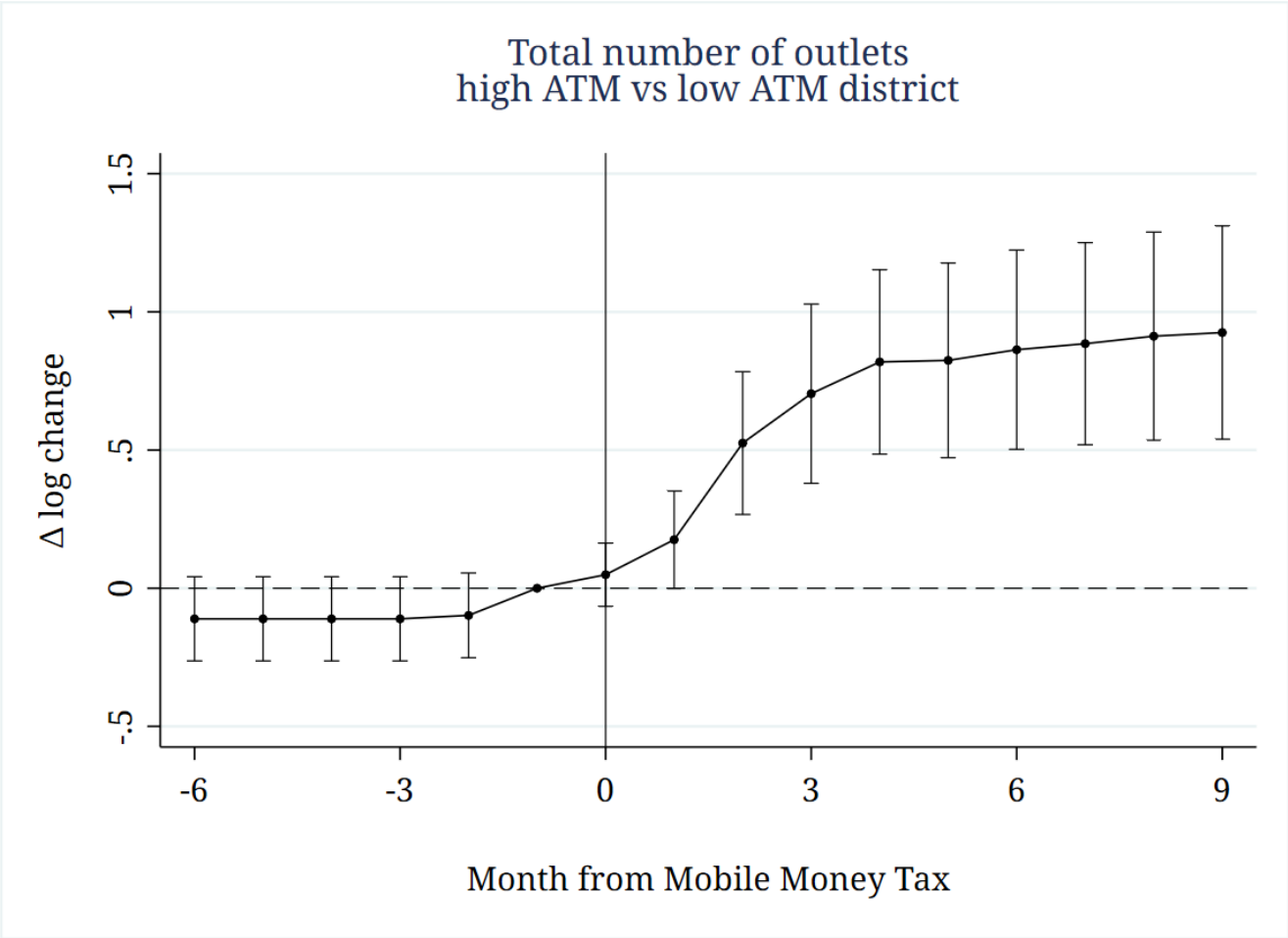
Similar results: using Rasul & Bassi (2017, AEJ:AE) on survey data

Adoption of bank-related technology ↑

# New bank-related technology: district level

Figure 2: Technology adoption: number of banking agents

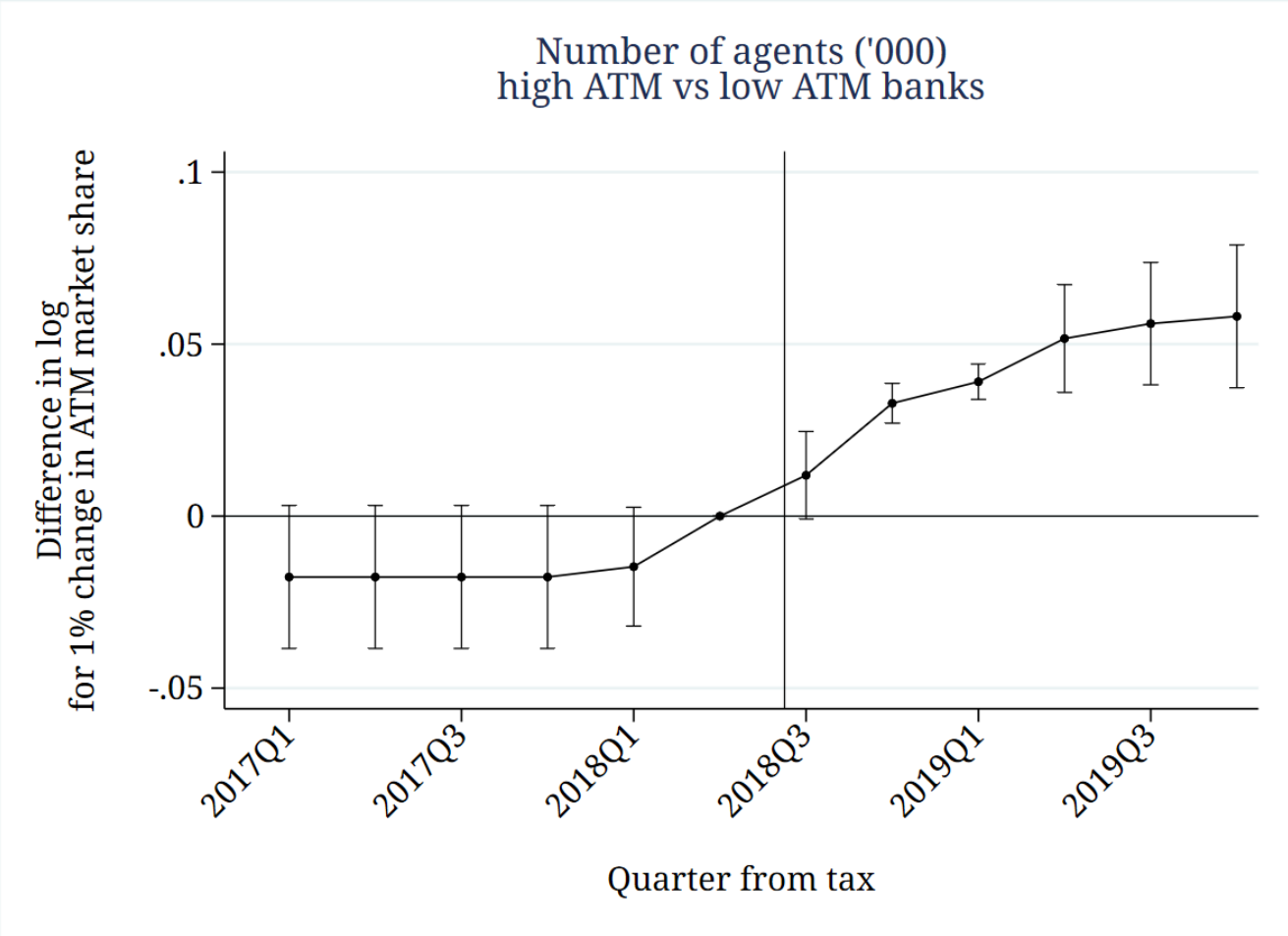



High ATM districts: on avg from 2 to 120 agents

Low ATM districts: on avg from 0.1 to 8 agents

# New bank-related technology: bank level

Figure 3: Technology adoption: number of banking agents




High ATM banks: on avg from 2 to 2200 agents

Low ATM banks: on avg from 0.5 to 75 agents

Deposits ↑

# Deposits: district level

Table 2: Inflow of deposits through new technology

| | Volume | | Value | |
|---|---|---|---|---|
| | $\Delta$ Log | $\Delta$ Pr $>$ median | $\Delta$ Log | $\Delta$ Pr $>$ median |
| | (1) | (2) | (3) | (4) |
| Tax dummy$_t$ $\times$ High ATM density$_c$ | 2.327*** | 0.412*** | 7.866*** | 0.396*** |
| | (0.391) | (0.068) | (1.307) | (0.069) |
| Time FE | Yes | Yes | Yes | Yes |
| District FE | Yes | Yes | Yes | Yes |
| Obs. | 1840 | 1840 | 1840 | 1840 |
| Adj. R sq. | 0.637 | 0.509 | 0.621 | 0.507 |
| Mean Dep. Var. | 0.892 | 0.131 | 3.951 | 0.143 |

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Robustness: why different measures? See Chen & Roth (2024, QJE)

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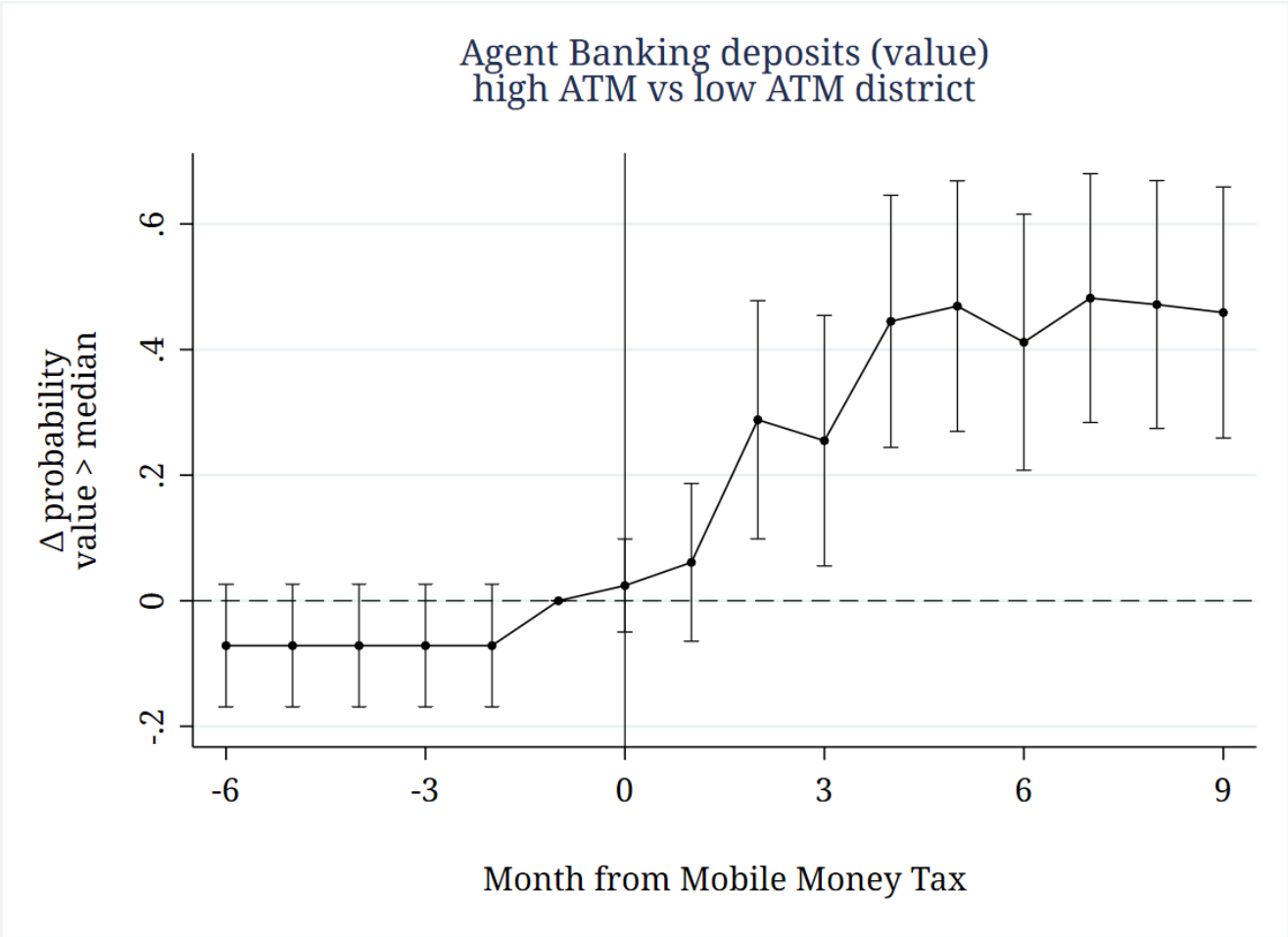
Technology shift & Network effects: results in line with Crouzet et al. (2023, QJE)

# Deposits: district level

Figure 4: Inflow of bank deposits




High ATM: on avg from 571$ to 1.1 million$

Low ATM: on avg from 8$ to 34'000$

Volume of transactions

# Deposits: bank level

Table: Bank deposits stock (log)

| | Bank owned deposits | Time deposits | Savings deposits | Demand deposits | Cash stored |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| Post Tax × **I**[ATM Market share] | -0.039 | -0.109 | 0.104 | | |
| | (0.199) | (0.155) | (0.068) | | |
| Bank FE | Yes | Yes | Yes | | |
| Time FE | Yes | Yes | Yes | | |
| Obs. | 831 | 831 | 831 | | |
| Adj. R sq. | 0.442 | 0.949 | 0.997 | | |
| Mean Dep. Var. | 1.848 | 31.439 | 30.504 | | |

# Deposits: bank level

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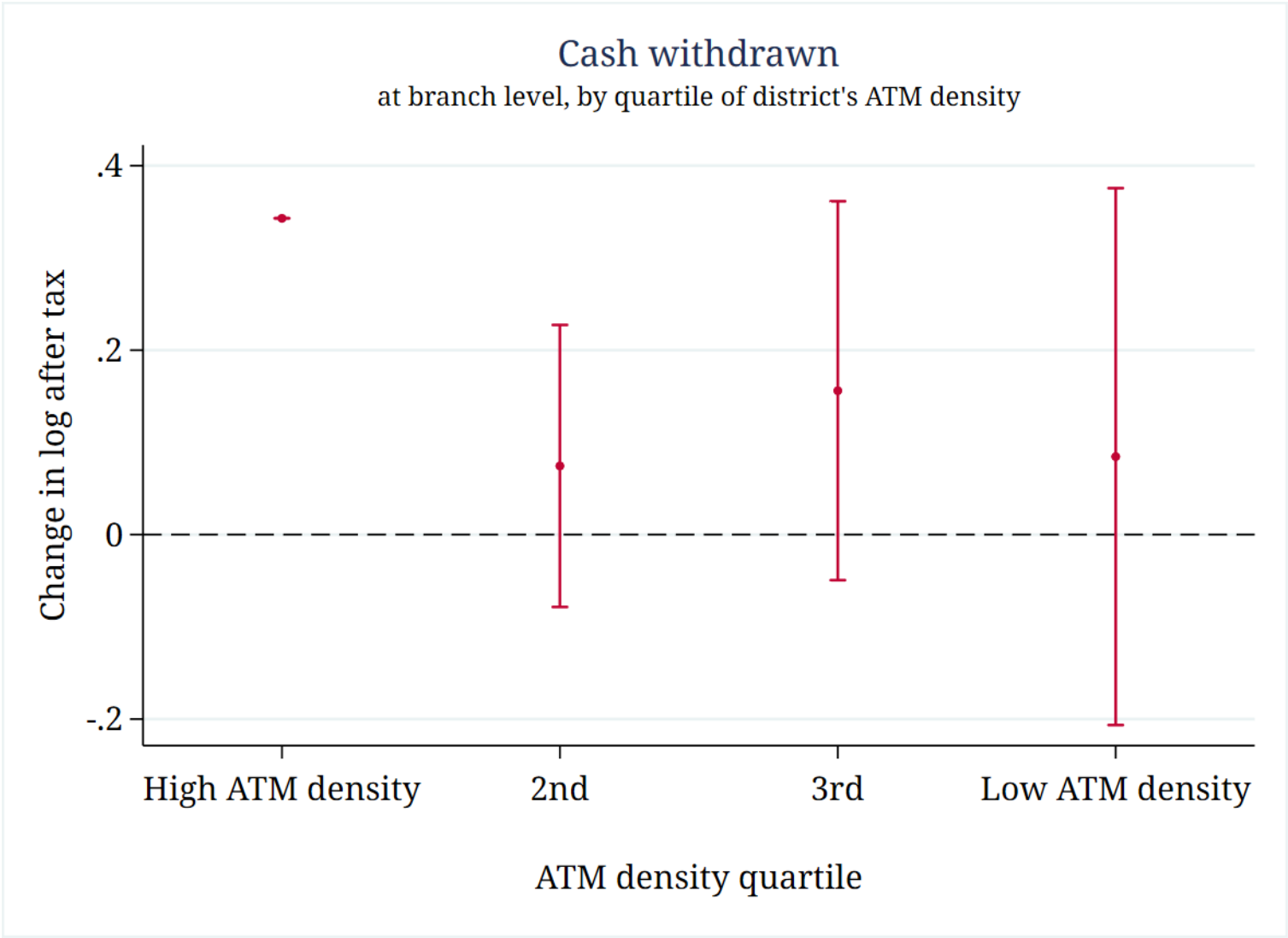
| | (0.199) | (0.155) | (0.068) | (0.044) | (0.071) |
| Bank FE | Yes | Yes | Yes | Yes | Yes |
| Time FE | Yes | Yes | Yes | Yes | Yes |
| Obs. | 831 | 831 | 831 | 831 | 831 |
| Adj. R sq. | 0.442 | 0.949 | 0.997 | 0.992 | 0.984 |
| Mean Dep. Var. | 1.848 | 31.439 | 30.504 | 60.233 | 5.874 |

Cash ↑ & ATM withdrawals ↑

# Demand for cash: district level

Figure 5: % change in cash withdrawn by ATM density quartile

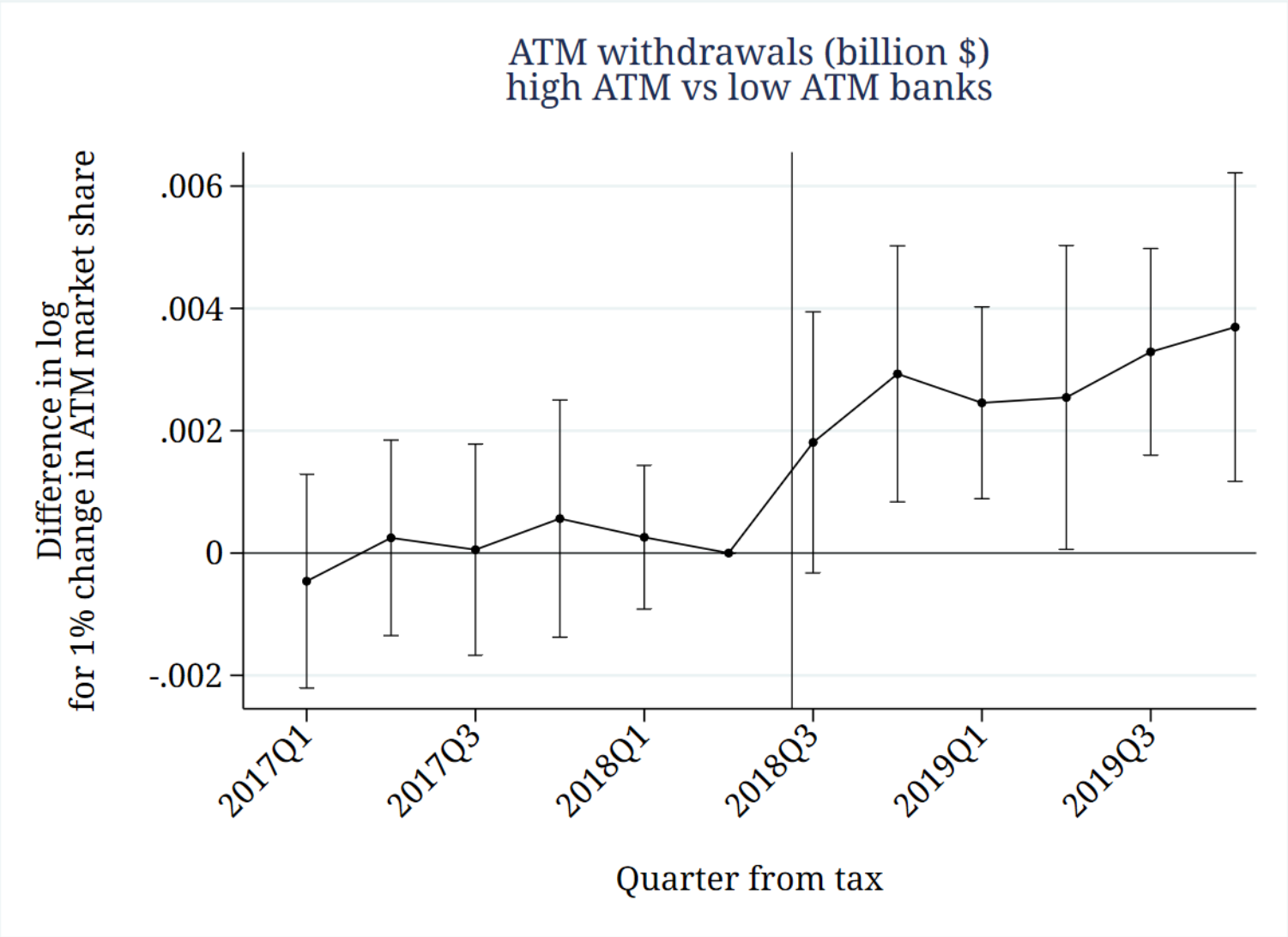


# ATM withdrawals: bank level

Table 3: ATM withdrawals & Technology adoption

| | ATM withdrawals | |
|---|---|---|
| | Log | Log |
| | (1) | (2) |
| Post Tax × I[ATM Market share] | 0.029** | |
| | (0.012) | |
| Post Tax × Market share of urban ATMs | | 0.003*** |
| | | (0.000) |
| Bank FE | Yes | Yes |
| Time FE | Yes | Yes |
| Obs. | 263 | 263 |
| Adj. R sq. | 0.984 | 0.992 |
| Mean Dep. Var. | 0.025 | 0.025 |

# ATM withdrawals: bank level



# What have we shown sofar

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Banks experience:

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- $\uparrow$ inflow of money

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New liquidity, but

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- $\Longrightarrow$ higher turnover of cash: $\uparrow$ demand deposits' stock

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Banks experience:

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- $\uparrow$ outflow of money

New liquidity, but high turnover

- $\Longrightarrow$ higher turnover of cash: $\uparrow$ demand deposits' stock
- $\Longrightarrow$ Credit market?

# 4. Credit registry

Khawja & Mian (2008) for estimating **bank lending channel**: control for (1) district×time FE, (2) bank FE

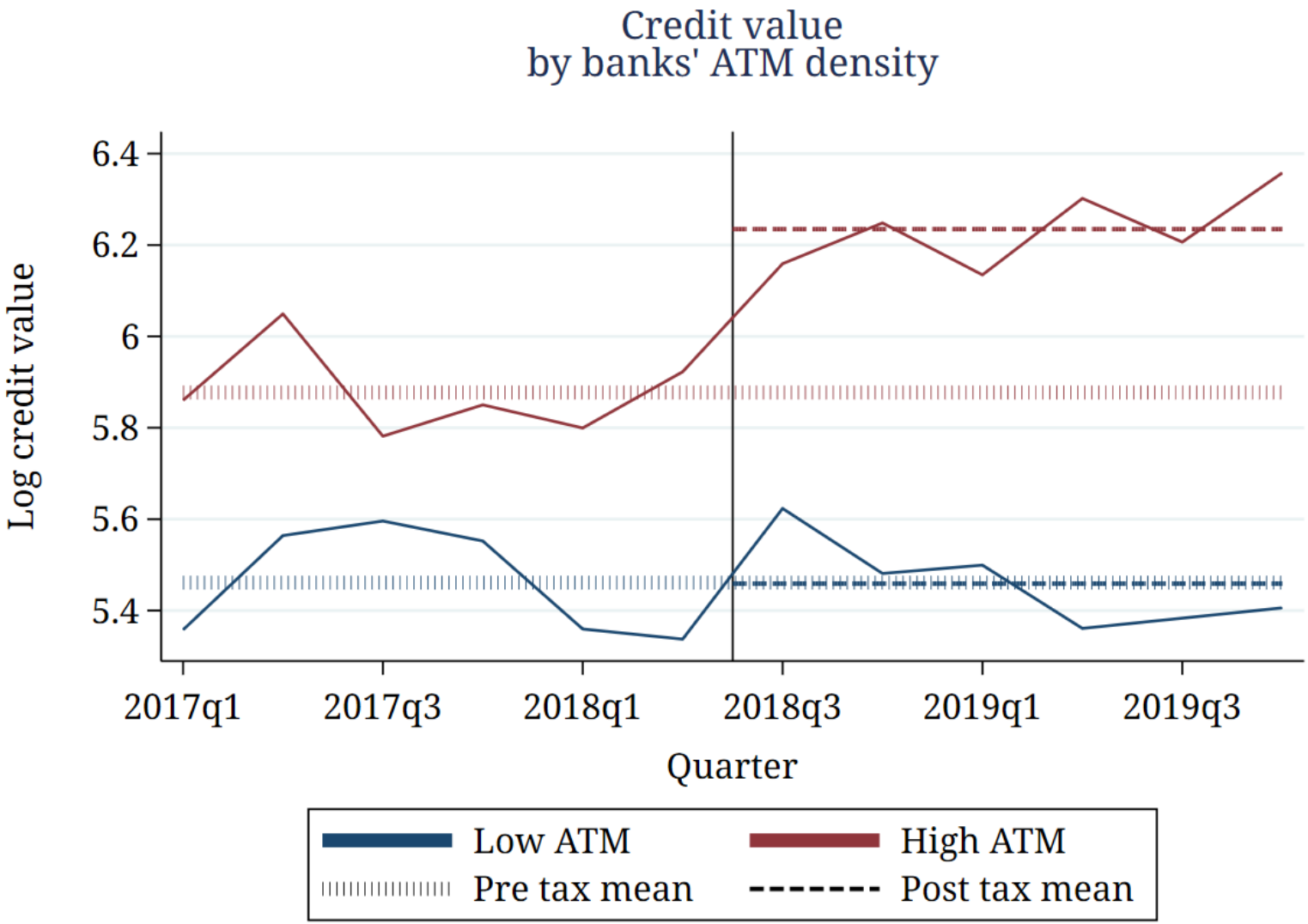
$$Y_{bdt} = \alpha_b + \alpha_{dt} + \text{Post Tax}_t \times \mathbf{I}\left[\text{ATM market share}\right]_b + \epsilon_{bdt}$$

Outcome

1. Term of repayment (log)
2. Total amount and number (log)
3. Interest rate

# Increase in loans

Figure 6: Loans over time (log million $)



# Intensive margin: Credit amount

Outcome: **log** amount lent

- ↑ credit to non-risky known borrowers
- ↓ credit to risky unknown borrowers

| | w/ Credit history | | w/o Credit History | |
|---|---|---|---|---|
| | Low risk (1) | High risk (2) | Low risk (3) | High risk (4) |
| Tax dummy$_{qy}$ × **I** [ATM share]$_b$ | 0.152** | -0.027 | -0.023 | -0.043*** |
| | (0.063) | (0.037) | (0.026) | (0.013) |
| Bank FE | Yes | Yes | Yes | Yes |
| District-Time FE | Yes | Yes | Yes | Yes |
| N. of banks | 26 | 22 | 26 | 21 |
| Adj. R sq. | 0.372 | 0.329 | 0.357 | 0.141 |
| Mean Dep. Var. | 0.251 | 0.059 | 0.189 | 0.034 |

Number of loans

# Credit length

Outcome: log term of repayment (in days)

- $\downarrow$ to all borrowers

| | w/ Credit history | | w/o Credit History | |
|---|---|---|---|---|
| | Low risk (1) | High risk (2) | Low risk (3) | High risk (4) |
| Tax dummy$_{qy}$ $\times$ **I**[ATM share]$_b$ | -0.459** | -0.155** | -0.455** | -0.162** |
| | (0.180) | (0.110) | (0.195) | (0.068) |
| Bank FE | Yes | Yes | Yes | Yes |
| District-Time FE | Yes | Yes | Yes | Yes |
| N. of banks | 26 | 22 | 26 | 21 |
| Adj. R sq. | 0.923 | 0.719 | 0.907 | 0.691 |
| Mean Dep. Var. (days) | 1084.820 | 860.557 | 1219.507 | 853.978 |

# Credit cost

Outcome: interest rate

- ↑ credit to risky borrowers

| | w/ Credit history | | w/o Credit History | |
|---|---|---|---|---|
| | Low risk (1) | High risk (2) | Low risk (3) | High risk (4) |
| Tax dummy$_{qy}$ × **I**[ATM share]$_b$ | 0.681 | 5.130** | -2.966 | 3.588*** |
| | (4.063) | (1.905) | (2.004) | (0.699) |
| Bank FE | Yes | Yes | Yes | Yes |
| District-Time FE | Yes | Yes | Yes | Yes |
| N. of banks | 26 | 22 | 26 | 21 |
| Adj. R sq. | 0.892 | 0.725 | 0.831 | 0.750 |
| Mean Dep. Var. | 22.690 | 26.240 | 23.460 | 26.964 |

# Concluding remarks

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   - $\rightarrow$ data on universe of Mobile Money transactions

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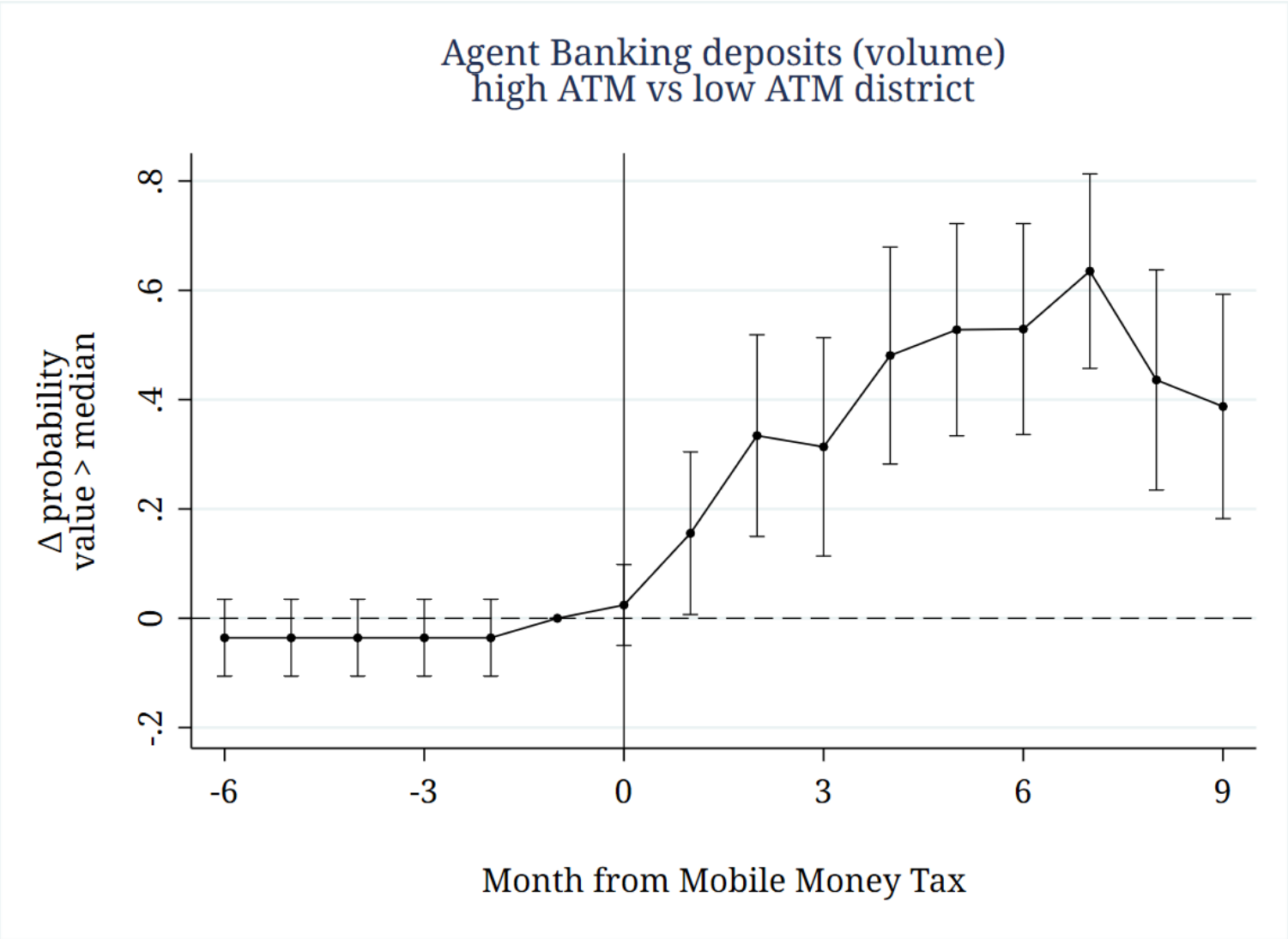
   - $\rightarrow$ FinTech monopoly prevents financial innovation
   - $\rightarrow$ Banks facing volatile liquidity
     - reduce maturity
     - transfer rent from high to low risk borrowers

3. Contribution to limited literature on regulation of fin. institutions & payment systems in LMICs

# Appendix

# Deposits: district level

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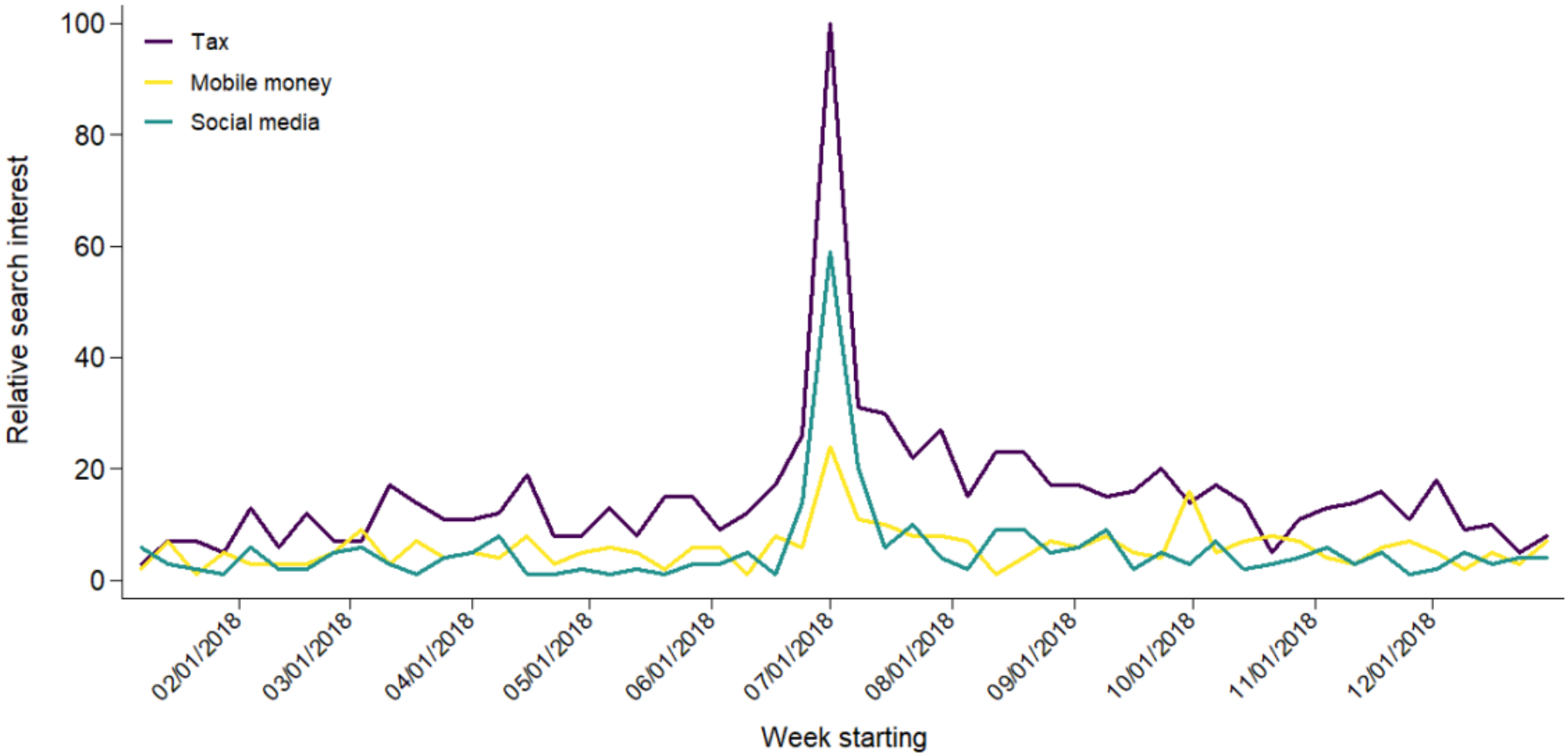
# Was the tax unexpected?

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# How does Mobile Money work?

Telecom
company

Back

# How does Mobile Money work?

Mobile Money agent

Telecom company

Mobile Money agent

Back

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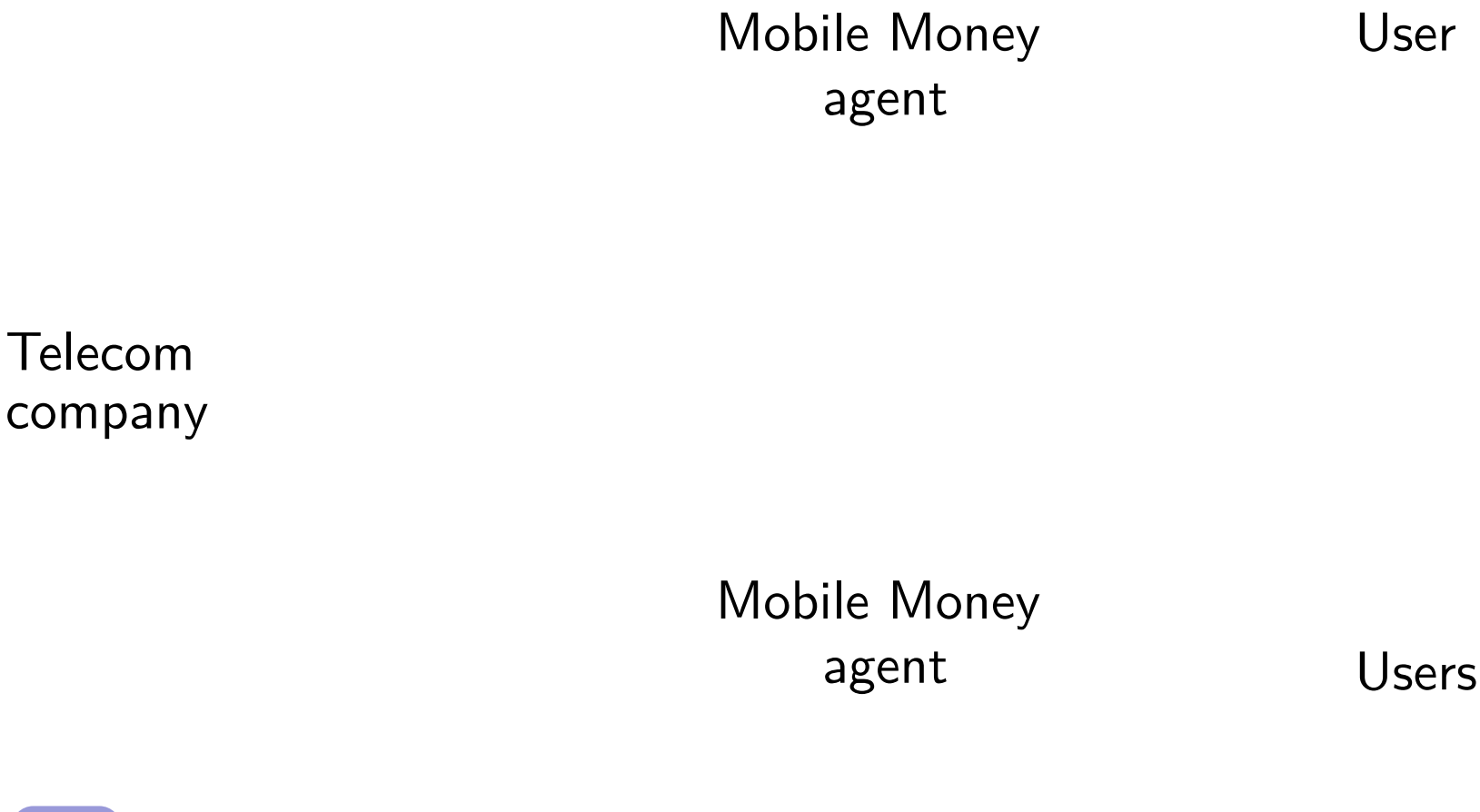


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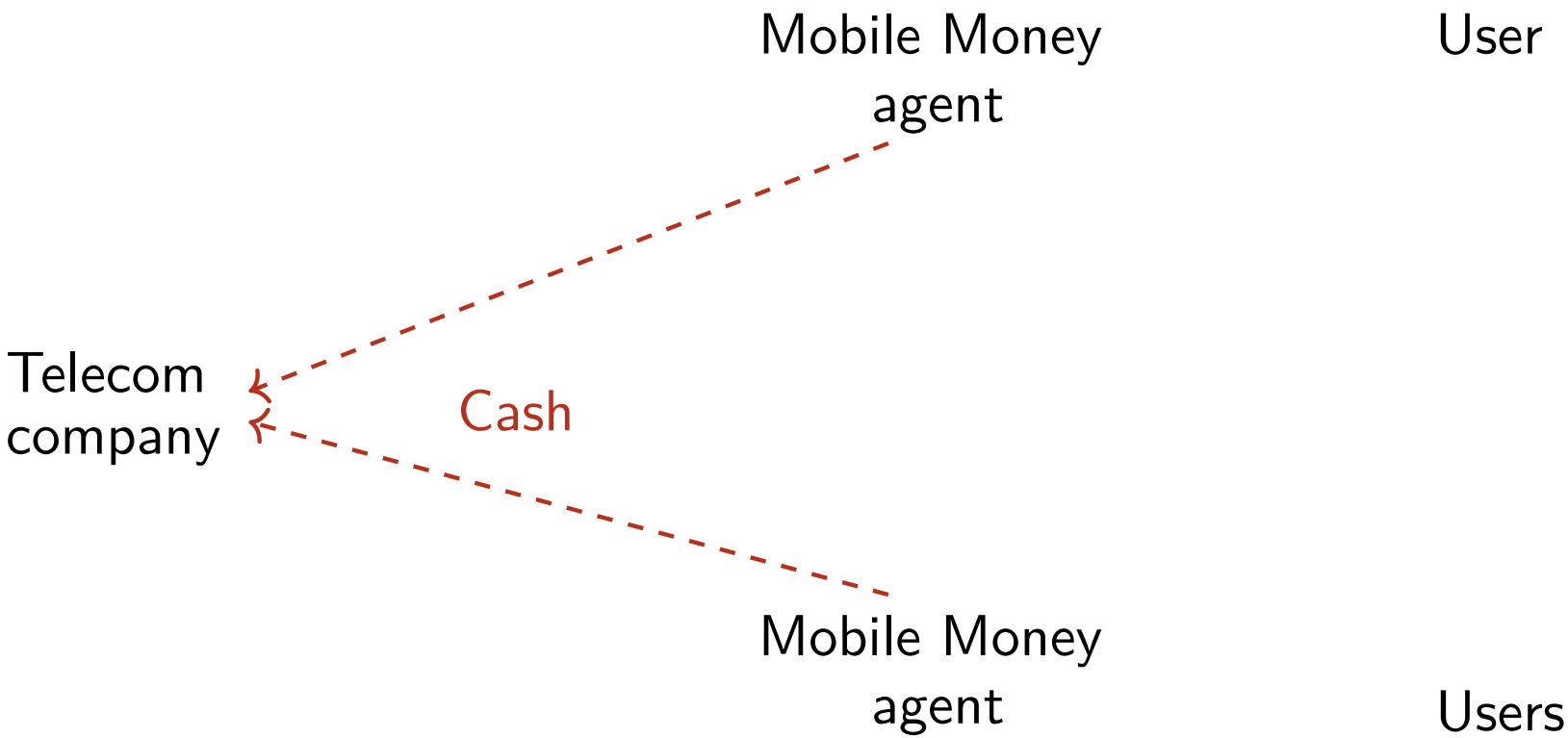


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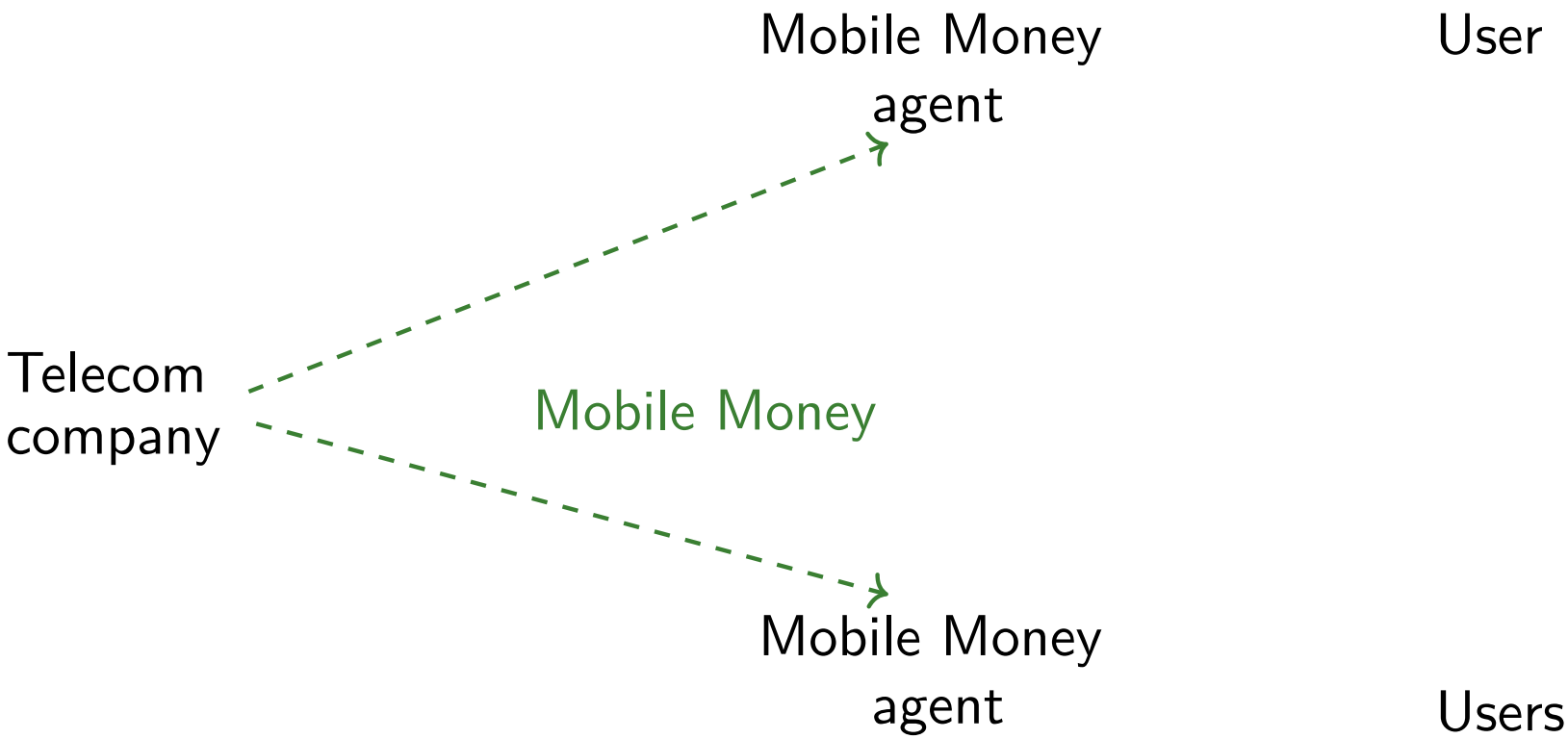


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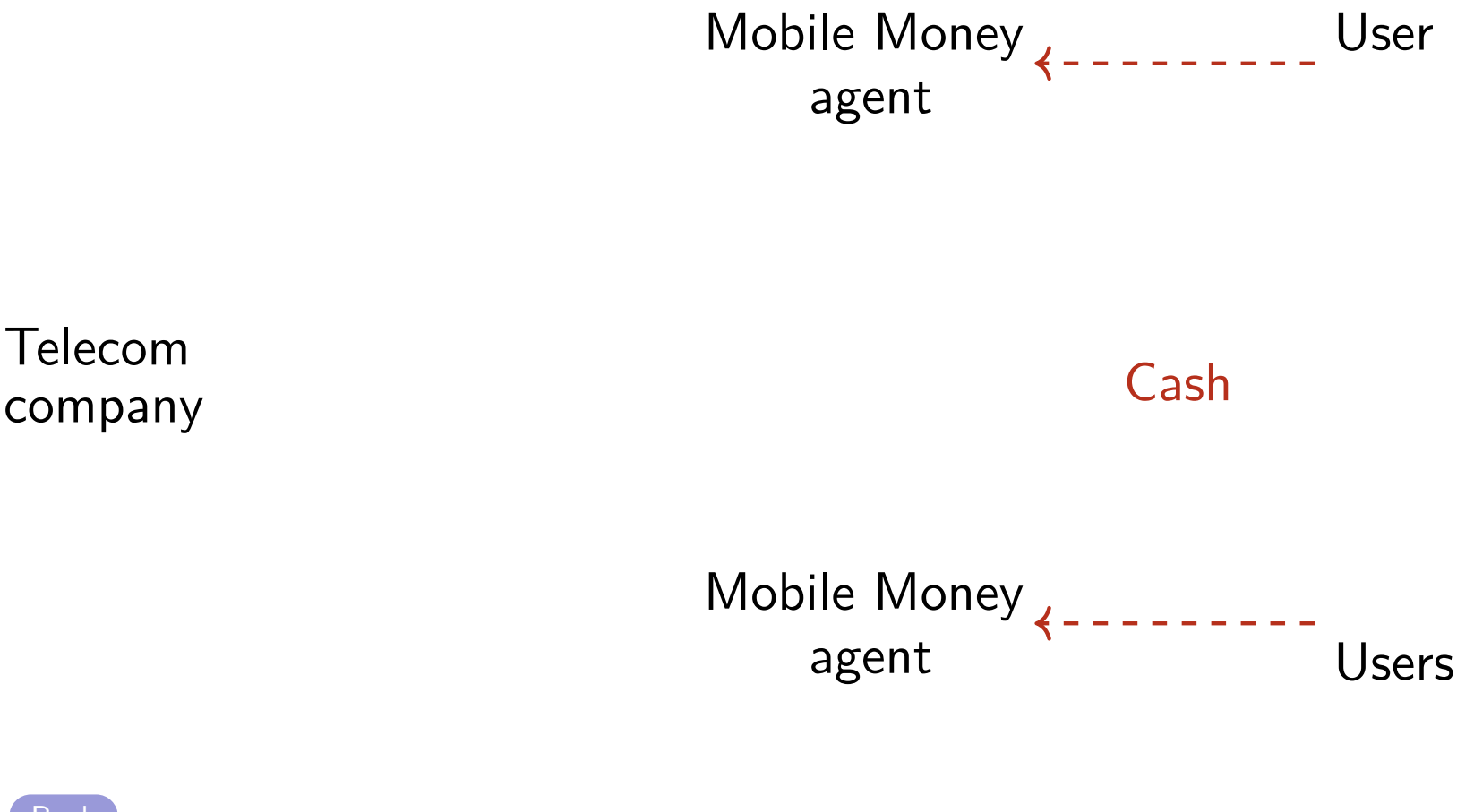


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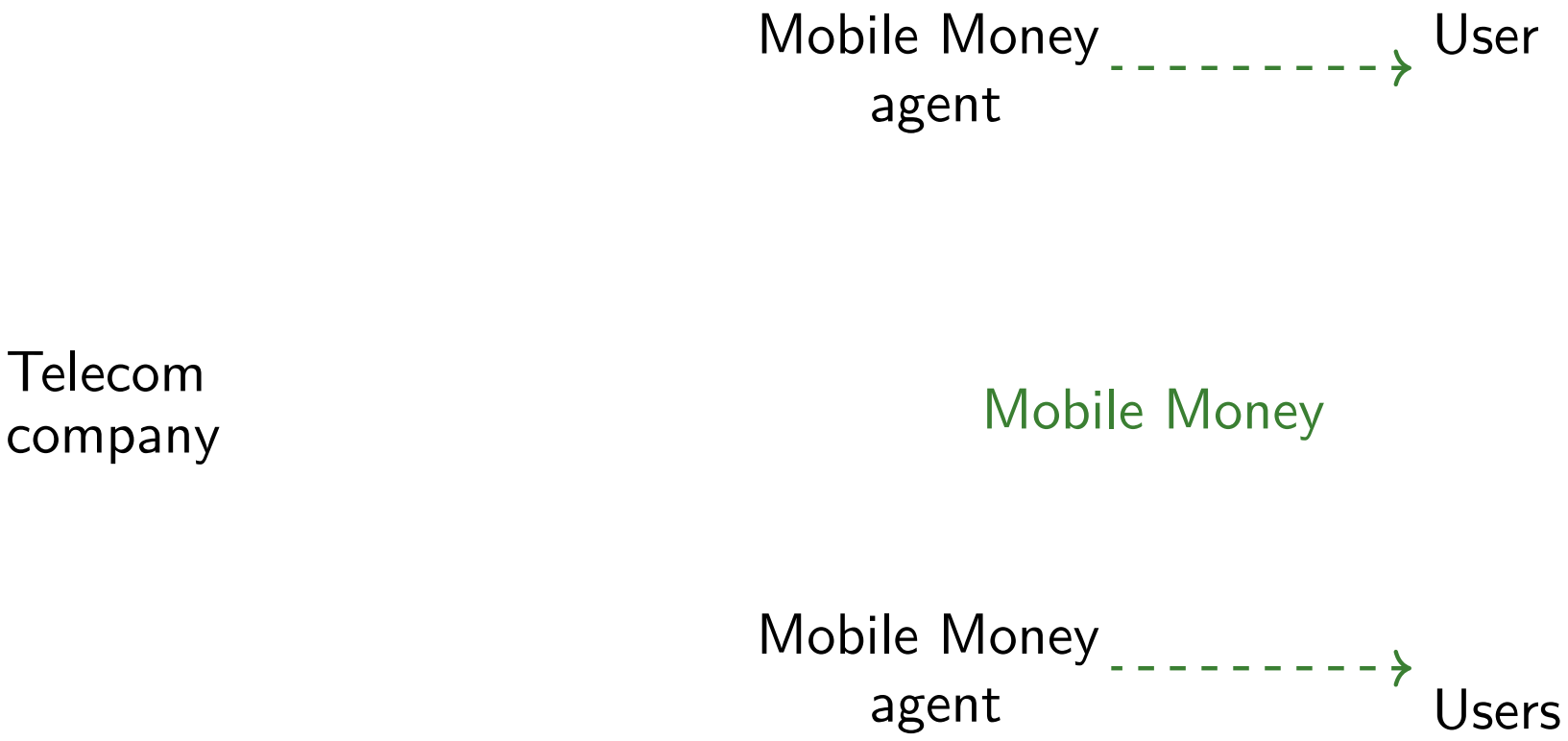


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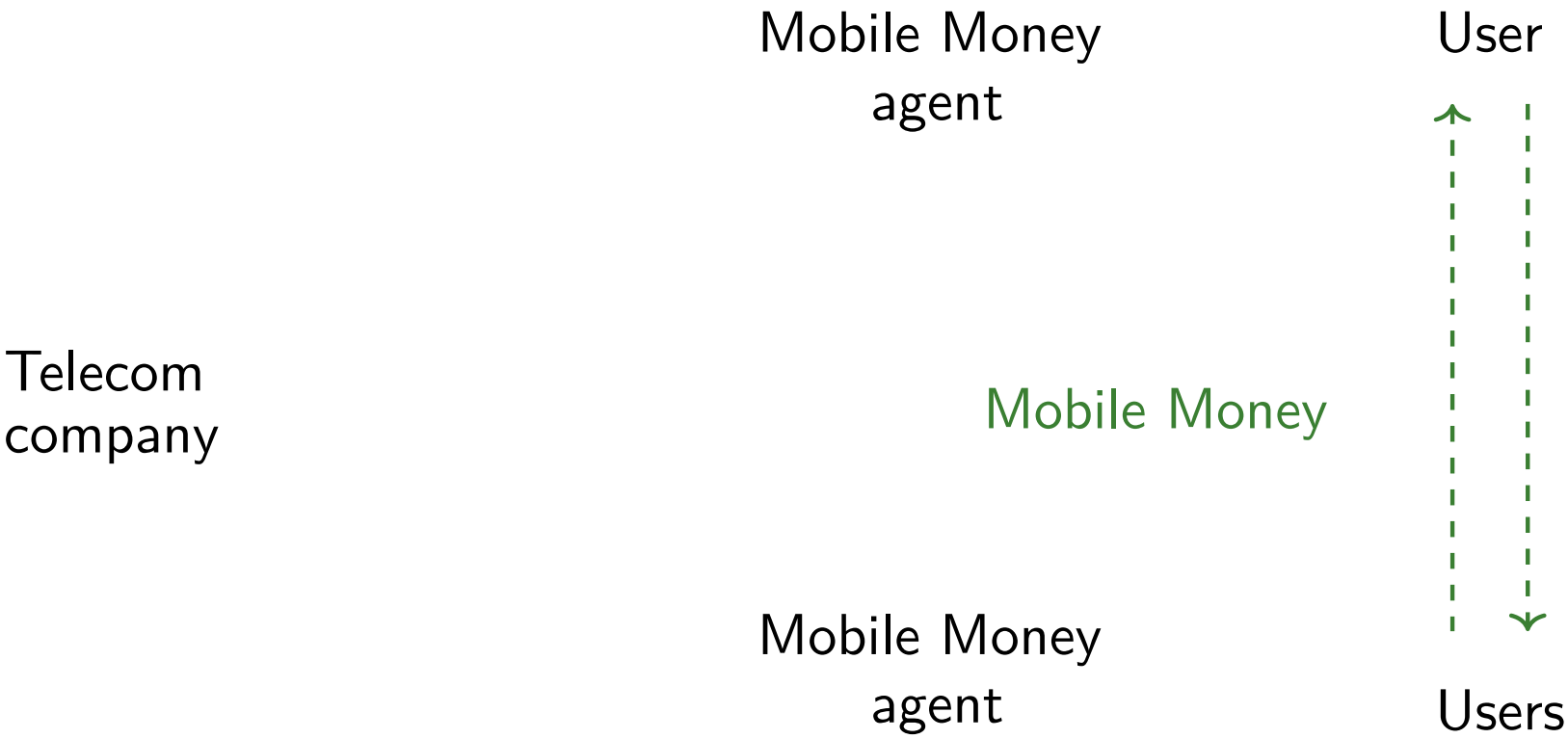


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# Statistics

Mobile Money

- Active users: 58% population
- Total value of all types of transactions: 56% of GDP
- Total value of P2P: 12.5% of GDP
- P2P: 1.92$ average amount sent daily
- P2P: 82% within the district, 18% cross-district
- Median fee: 0.5% for P2P, 2.5% for withdrawal

Loans (to individuals):

- Maturity: average 645 days
- Annual Rate: average 27%
- Amount: average 1960$

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