Interbank Payment Timing is Still Closely Coupled

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Policy backdrop

- Monetary policy normalisation
- Balance sheet reduction
- **Gauging reserve "ampleness"**
  - Afonso, Giannone, La Spada, and Williams (2022)
  - Avdjiev, Du, Koch, and Shin (2019)
  - Correa, Du, and Liao (2020)
  - Copeland, Duffie, and Yang (2020)

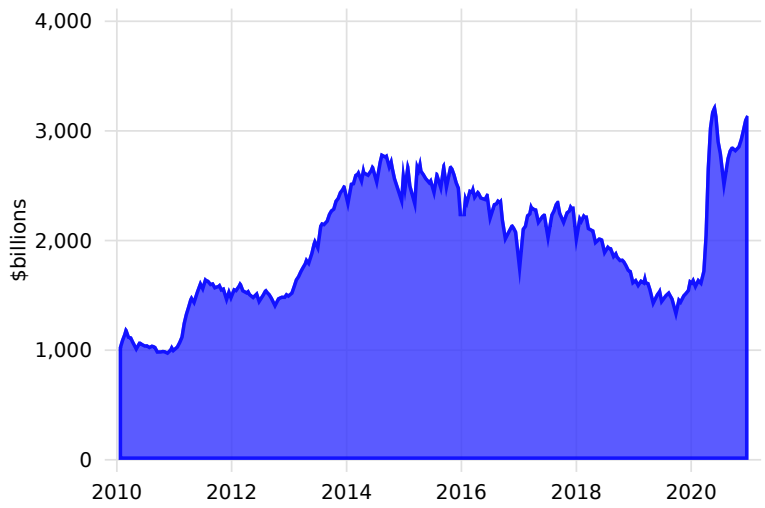
Payment flows as a mirror to gauge ampleness of reserves

- Prior to the Global Financial Crisis,
  - Reserves were low relative to payments
  - Banks relied on incoming payments to make payments
  - Strategic complementarities in payments

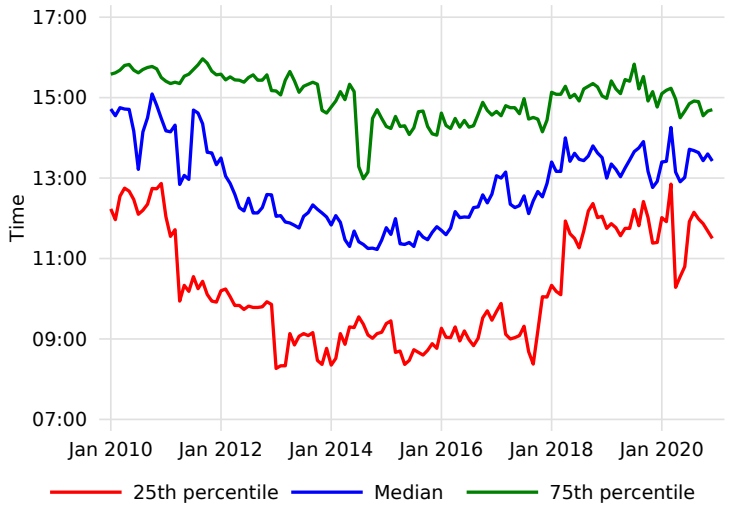
- Since then,
  - Central banks have expanded balance sheets (LSAPs, liquidity facilities)
  - Large increase in reserve balances in many jurisdictions

Reserves and timing of payments in Fedwire

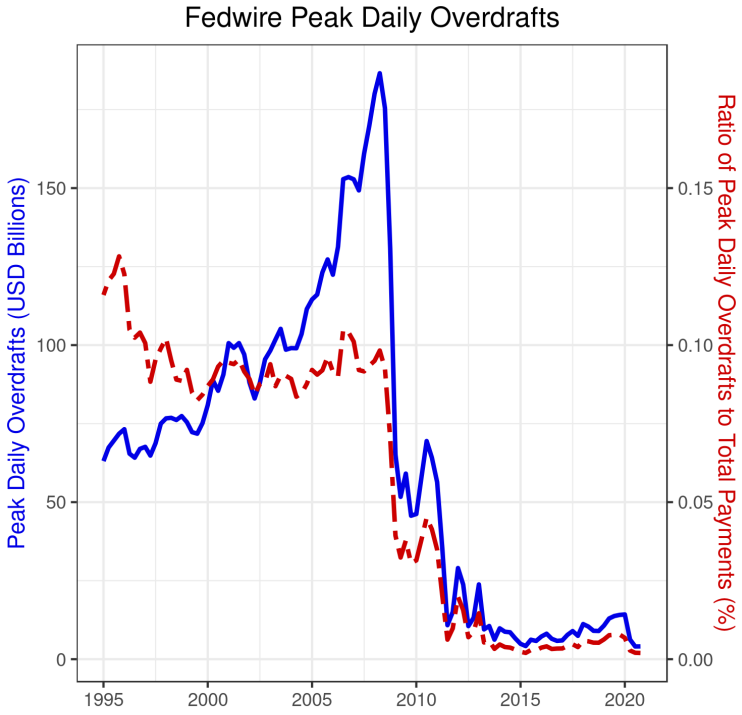
(a) Reserves

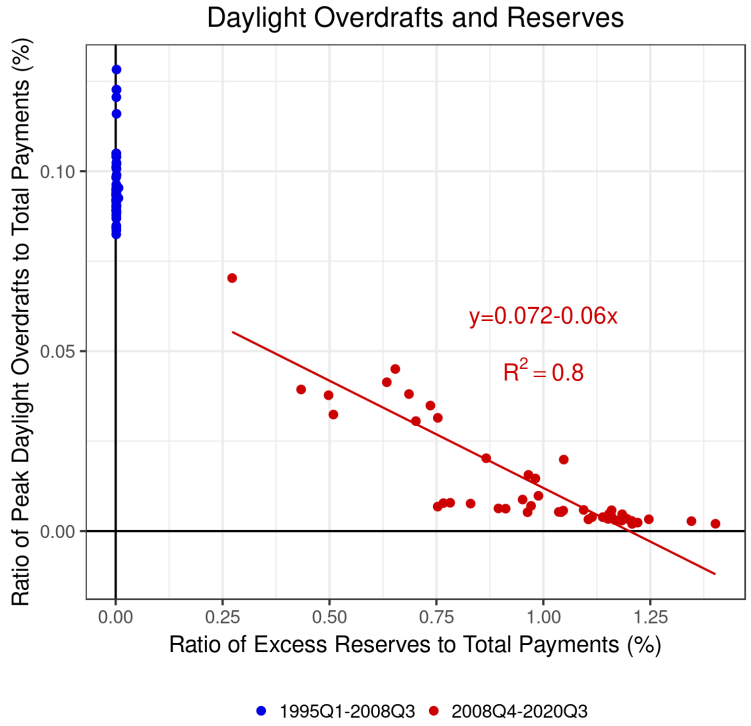


(b) Time of median payment



Daylight overdrafts in Fedwire





This paper

- Contributes to discussion on reserves ampleness through payment dynamics in the U.S.

- Gauges extent of strategic complementarities in payments
  - Finds positive and significant relationship between a bank's outgoing payments and recent incoming payments even with ample reserves

- Sheds light on thresholds where disruptions may kick in

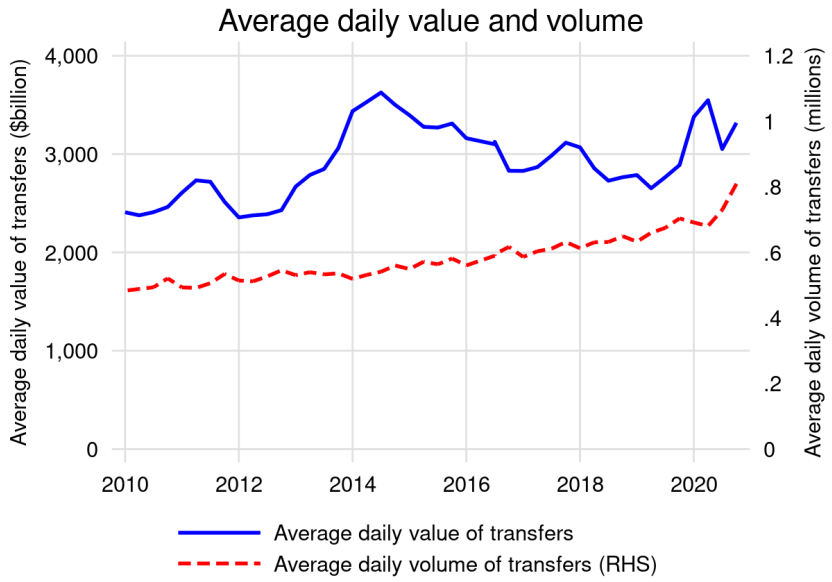
Outline

- Data
- Empirical results
- Robustness

Data

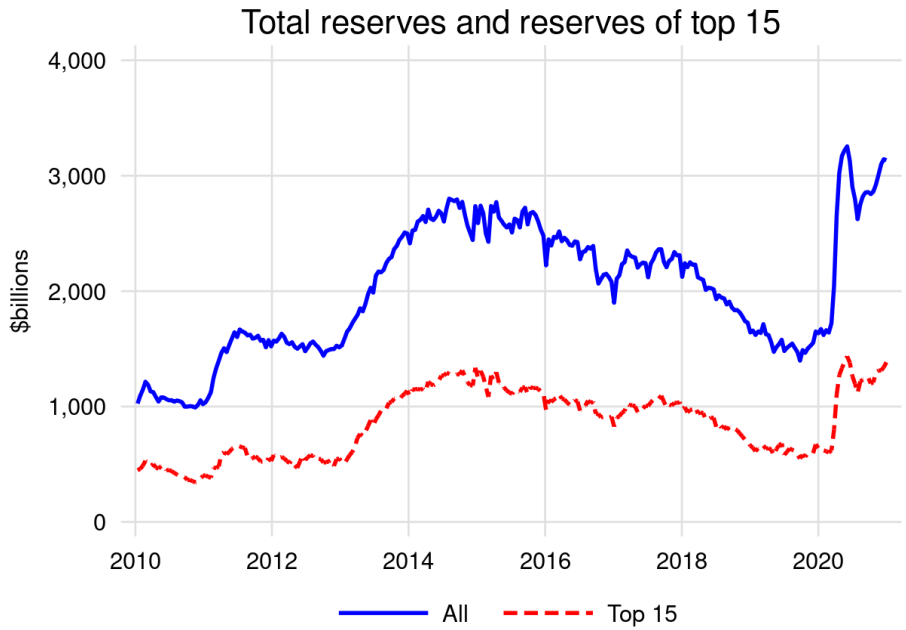
1. Payment transactions
   - Fedwire Funds Service
     - Real time gross settlement (RTGS) system
     - 21.5 hour day: 9:00 pm - 6:30 pm ET
     - Daily volume (2020): $\sim$ 700,000 transfers
     - Daily value (2020): $\sim$ \$3.3 trillion
   - Our sample:
     - First 100 business days of 2020; 2010-2020
     - Minute-by-minute

* Banks - Excludes "special" accounts (ACH, CHIPS, CLS, TGA,...)
* Largest top 100 accounts by average daily dollar value of payments
* Dollar value (2020)
  - Top 100 captures 89% of dollar value (∼$3 tn per day)
  - Top 15 captures 76% of top 100 value



2. Reserve balances

- Internal Federal Reserve accounting records
- Top 15 accounts hold 40% of the reserves in the U.S. banking system



Strategic complementarity in payments

- Prior to GFC, banks relied heavily on incoming funds to make their own payments

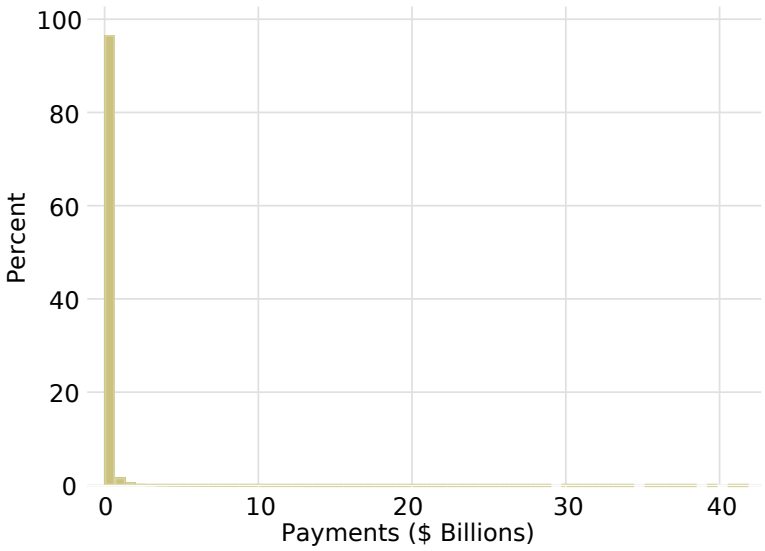
- Do strategic complementarities in payments still exist?

- Key relationship

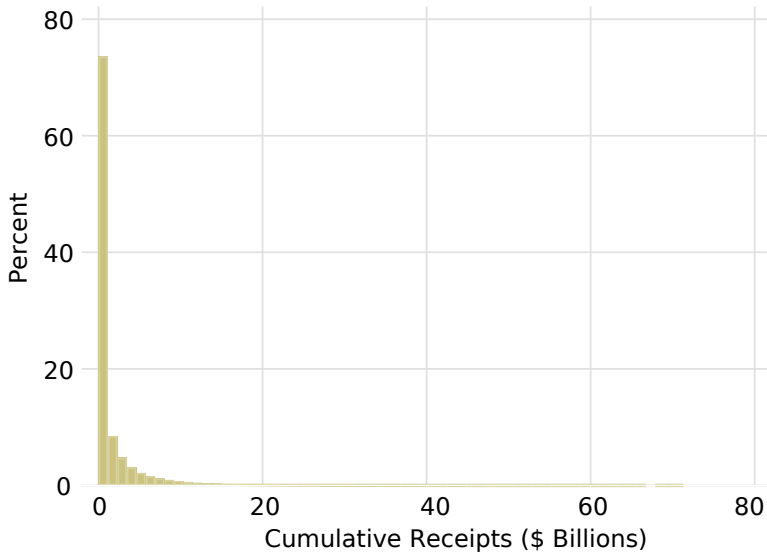
$$\text{Payments} = f(\text{Cumulative Receipts})$$

Distribution of payments and cumulative receipts

(a) Payments

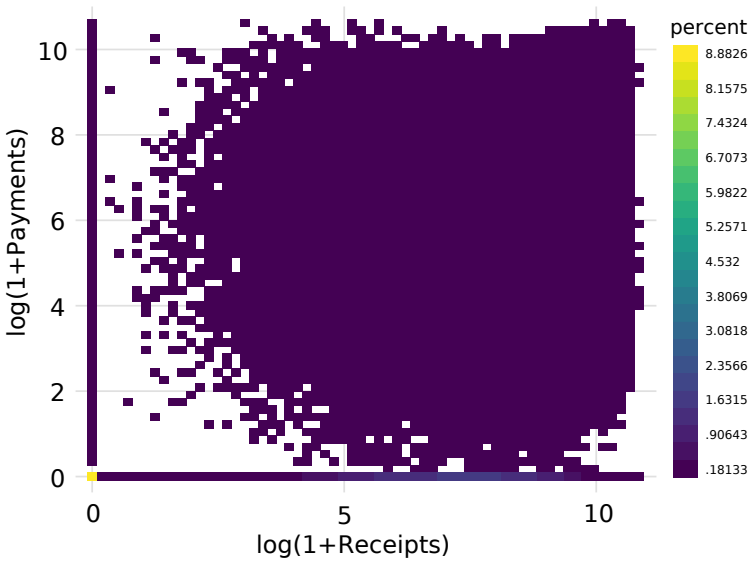


(b) Cumulative receipts

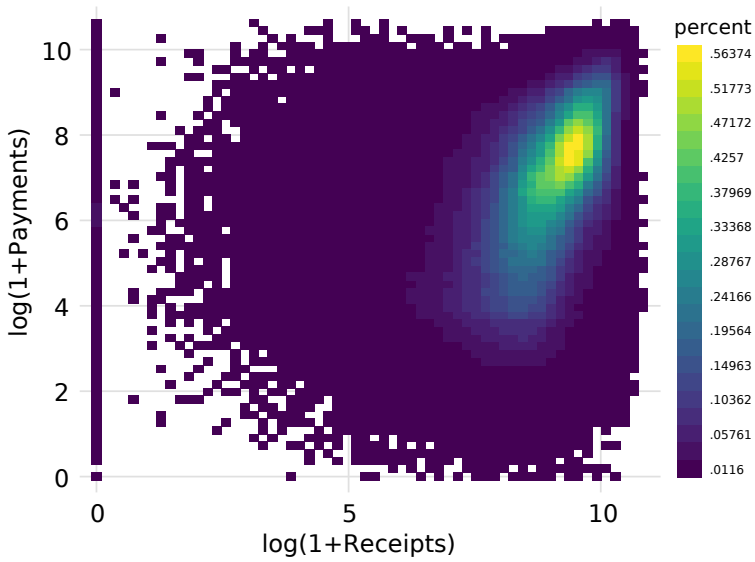


Payments vs. cumulative receipts

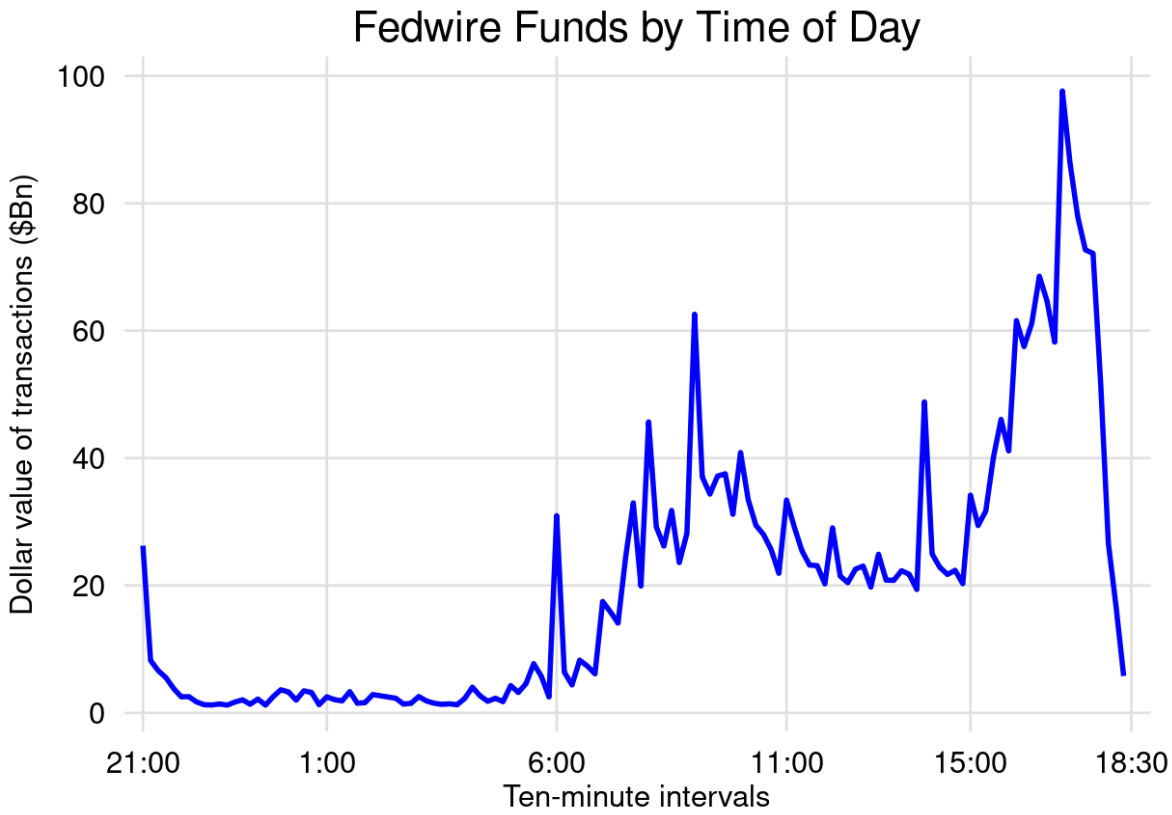
(a) All Payments



(b) Non-zero payments



Intraday timing of payments



Our model

◇ Baseline specification (Tobit model)

$$\log(1 + P_{imt}) = \beta_0 + \beta_1 \log\left(1 + \sum_{s=m-15}^{m-1} R_{ist}\right) + \gamma_i + \gamma_t + \gamma_m^p + u_{imt}$$

where

- P_{imt} total dollar value payments from bank i to its counterparties in minute m on day t
- $\sum_{s=m-15}^{m-1} R_{ist}$ bank i's cumulative receipts during previous 15 minutes
- γ_i and γ_t are bank and date FEs
- $\gamma_m^p = \{\gamma_m^{open}, \gamma_m^{early}, \gamma_m^{afternoon}, \gamma_m^{eod}\}$ are period-of-day FEs
- u_{imt} is an error term

Standard errors clustered at the bank level

Main results

	$\log(1+P_{imt})$	
	Tobit (MLE)	
	(1) Coefficient	(2) Marginal
$\log(1+\sum_{s=m-15}^{m-1} R_{ist})$	0.575***	0.395
	(0.179)	
Clustering	Bank	
Bank FEs	Y	
Date FEs	Y	
Early dummy	Y	
EOD dummy	Y	
Afternoon dummies	Y	
Open dummy	Y	
N	1,935,000	
Left-censored	875,098	
Pseudo R^2	0.228	
Log-likelihood	-3,157,609.4	

Marginal effect. A 1% increase in the cumulative payments received by bank i in the previous 15 minutes translates into a 0.4% increase in the value of payments that bank i makes over the next minute.

Robustness

1. Bank, date and period-of-the-day fixed effects
2. Control for balances
   - Opening balances
   - Past payments
3. Gauging strategic complementarities

   Complementarity is stronger when banking system reserves are lower

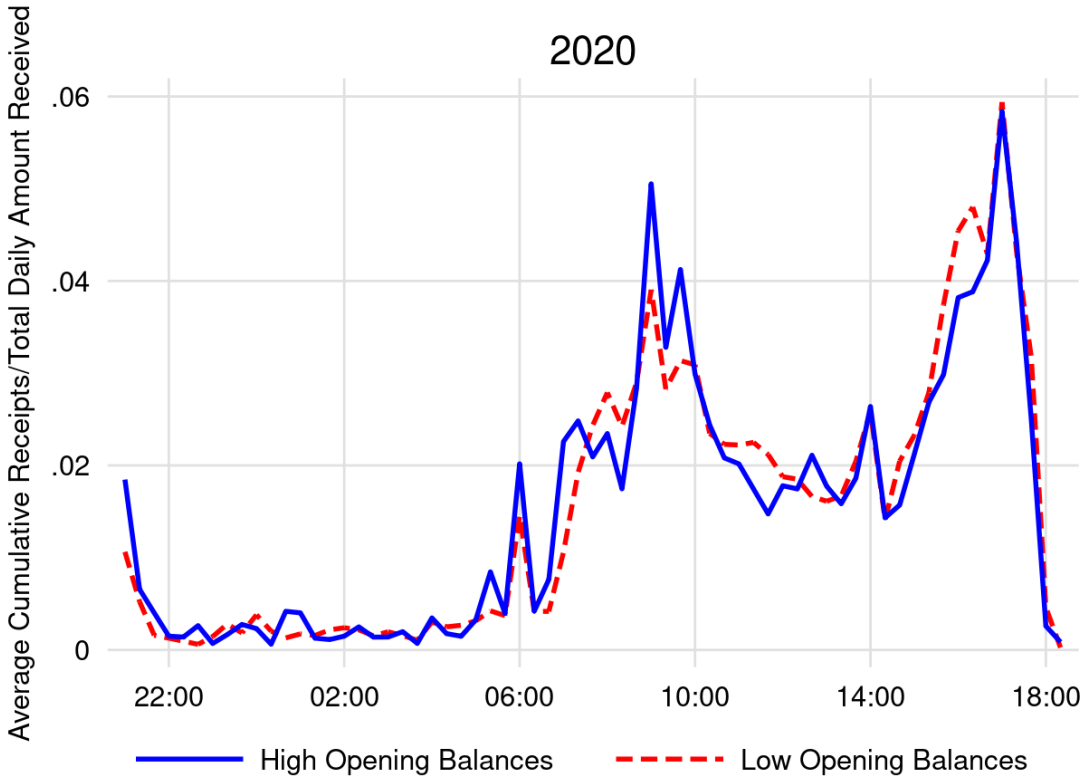
Complementarity and reserve balances

- Complementarity creates conditions for shocks to propagate through the payment system

- Especially when banking system reserve balances are low; question is how low is too low

- We find that, on days with high balances, banks synchronize their payments less
  - Is the timing of intraday payments different on those days?

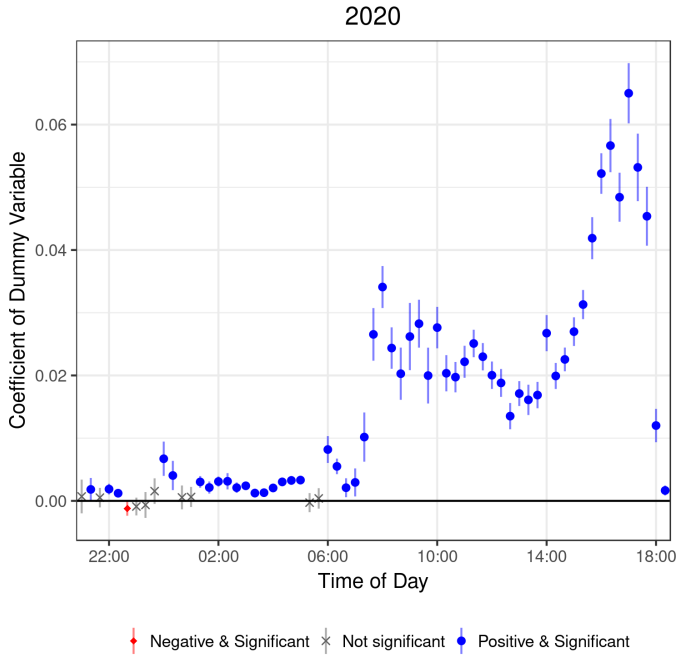
Share of payments by time of day



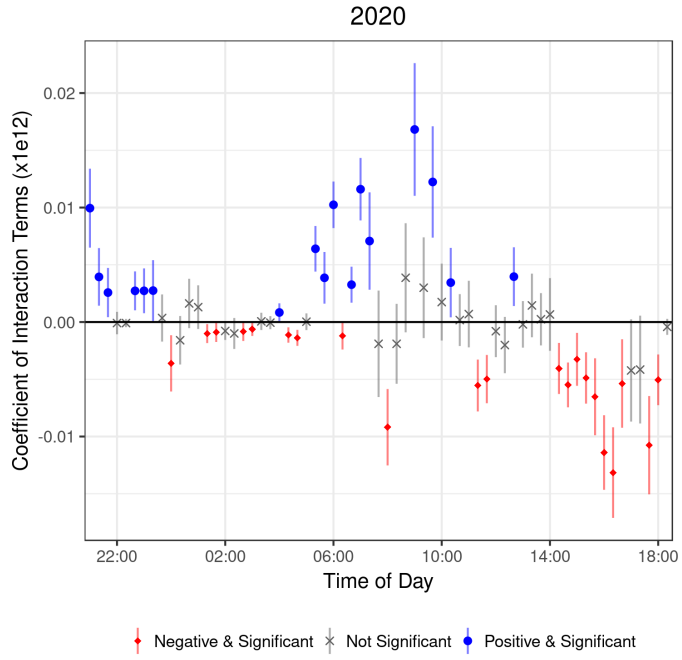
Share of receipts by time of day

$$ShareReceipts_t^s = \beta_0^s + \beta_1^s B_t + u_t^s$$

(a) $\widehat{\beta}_0^s$



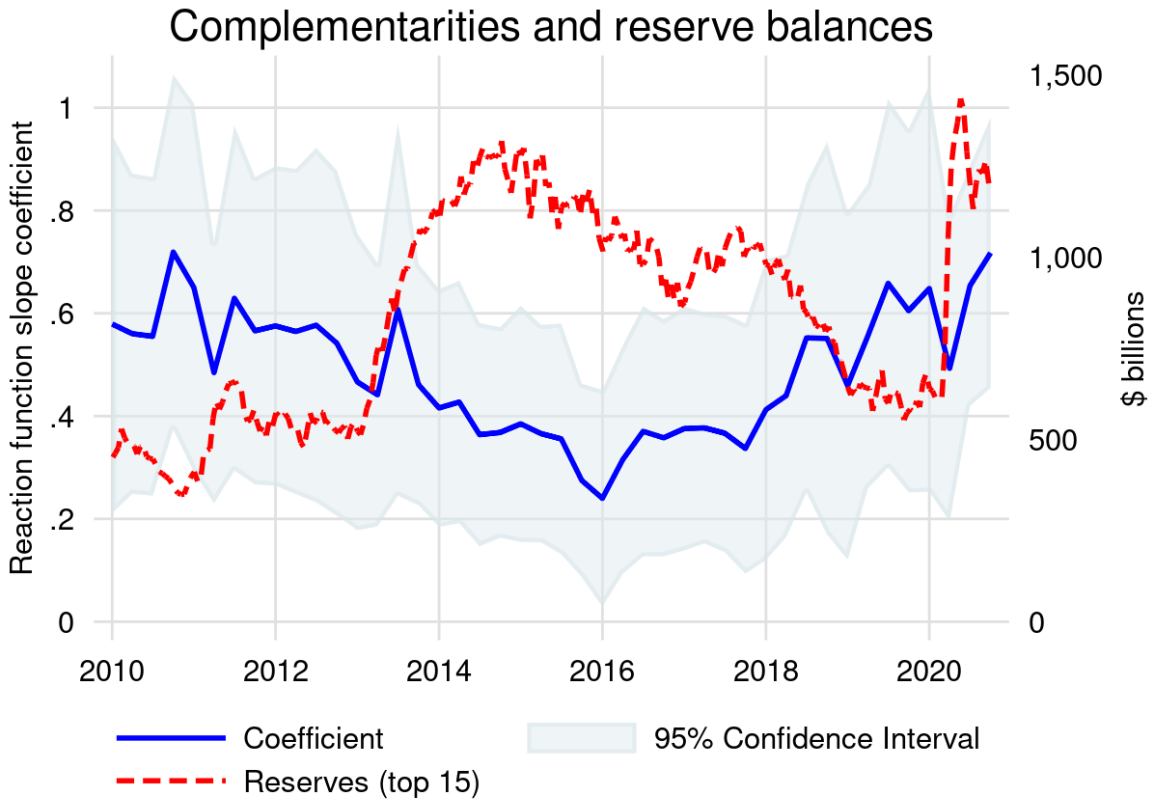
(b) $\widehat{\beta}_1^s$



On high reserve days, banks receive a higher share of receipts in the morning

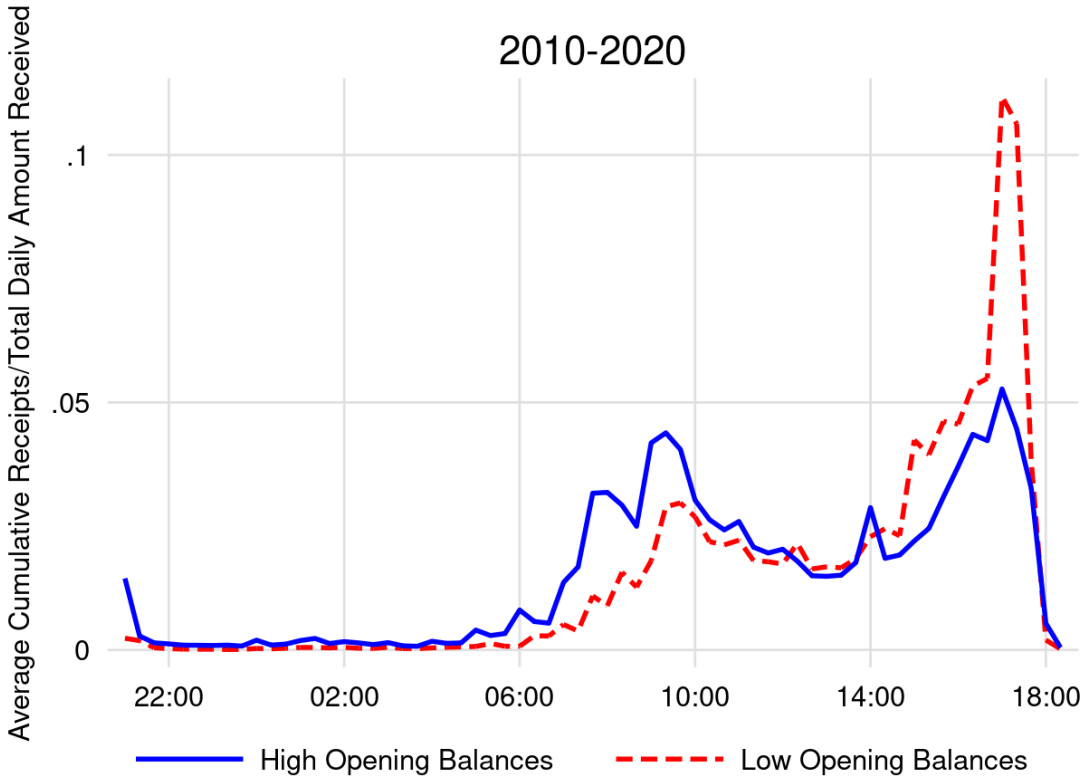
A feature of 2020?

Complementarities in payments

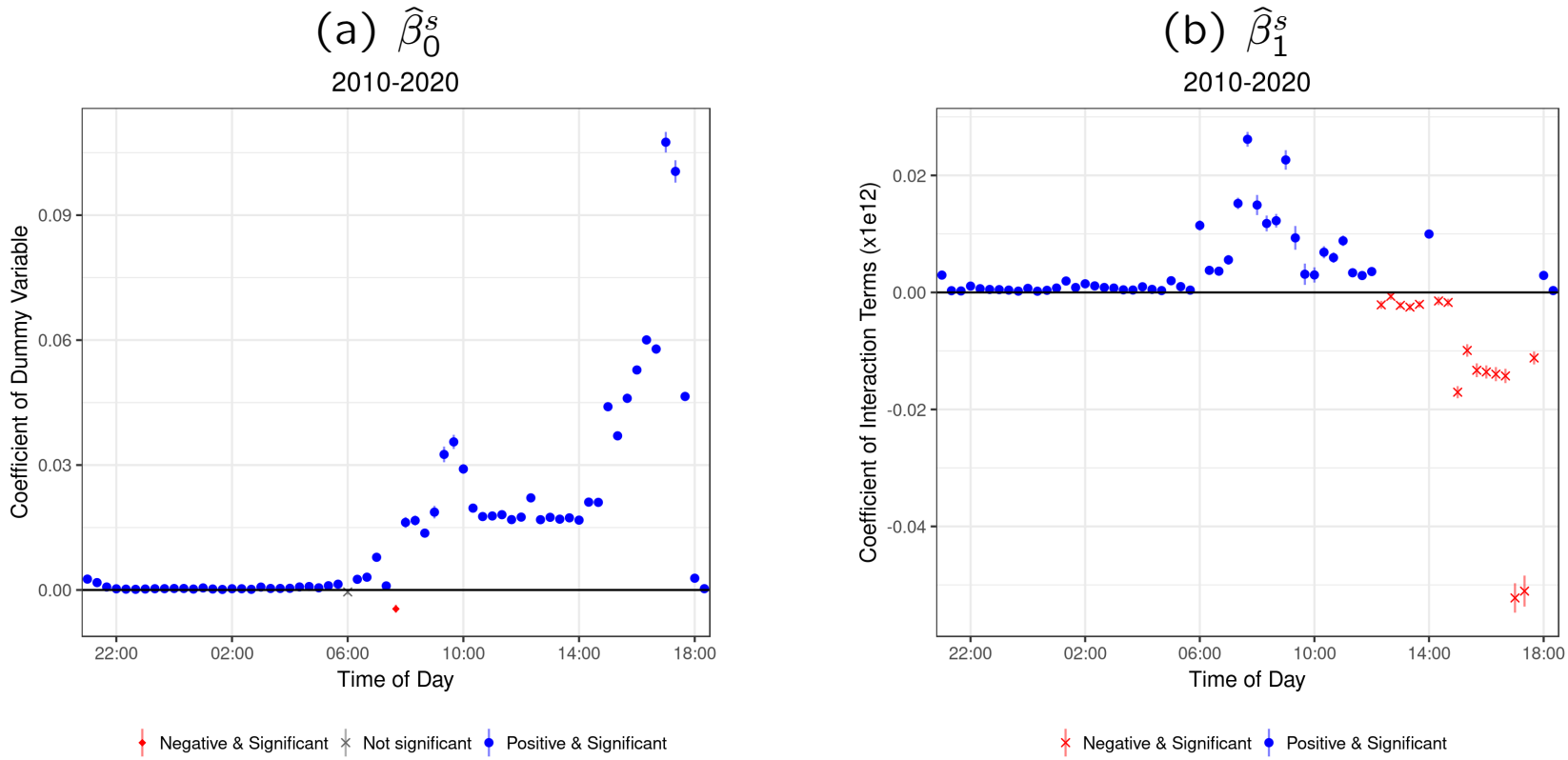


Coordination is higher when reserves are lower

Share of payments by time of day



Reserves and timing of intraday payments



On high reserve days, banks still receive a higher share of receipts in the morning

Concluding remarks

- Shed light on "ampleness" of reserves through revealed actions in payments
  - A 1% increase in the payments a bank receives in previous 15 minutes translates into a 0.4% increase in the payments it makes next minute
- This effect is robust feature, even in era of high reserve balances
  - Lower magnitude on days with high reserve balances
- On those days, banks receive a higher fraction of their receipts in the morning

Other questions

- Functioning of short-term funding markets
  - Vulnerabilities: Operational and cyber risk
- Complementarities amplified by market fragmentation?
  - Central Bank Digital Currency, stablecoin,...
- Post GFC, reserves play many roles
  - Liquidity regulation, risk management practices, supervisory internal stress tests, living wills, intraday payments,...