The Effect of Instant Payments on the Banking System: Liquidity Transformation and Risk-Taking

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Motivation

- **Instant payment systems (IPS):** real-time interbank transfers, spreading globally
  - **For customers:** faster, more convenient payments (similar to CBDCs)
  - **For banks:** deposits stay on balance sheets ($\neq$ CBDCs)

- **Key change in payment systems:**
  - Traditional: settlement delayed until end of day or more — payment netting possible
  - IPS: settlement immediate — **no delay → no netting**

- $\Rightarrow$ IPS exposes banks to more volatile **intraday payment shocks**

- **Research question:** How do banks adapt to loss of payment netting?
  - Do they still perform liquidity transformation?
  - What happens to credit supply and risk-taking?

This Paper

- **Setting:** Brazil's Pix (Nov 2020)
- **Approach**
  - Stylized facts on banks' transition to IPS
  - Theoretical model: netting loss → liquidity shift → risk-taking in lending
  - Empirical IV specification:

$$Y_{it} = \beta \cdot PixNettable_{it} + \gamma' X_{it} + \beta_i + \beta_t + \varepsilon_{it}$$

    - $PixNettable_{it}$: Bank i's nettable Pix flows / total assets
    - **Instrument:** Bank i's exposure to timeouts at counterparty banks

- **Main effects** (β)
  - **Balance sheets:** liquid assets ↑; loans ↓; demandable deposits ↑
  - **Loan portfolio:** prime ↓; subprime ↑; defaults ↑; loss reserves ↑
  - **Income:** loan income ↓; total income ↑ (gov. bonds + fees)

All are ratios per total assets, except loan portfolio (per total loans).

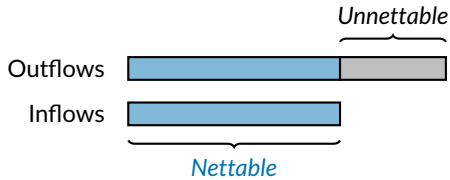
Roadmap

1. **Paper's Strengths**
2. **Regressor of Interest: PixUsage vs. PixNettable**
3. **Model Predictions vs. Empirical Design**
4. **Instrumental Variable Strategy**

#1: Paper's Strengths

- **Important and timely question with relevance beyond Brazil**
- **Exceptional setting + ambitious empirical aim**
  - Near-universal Pix adoption (85-88% of bank assets) with substantial cross-bank variation in customer usage
  - Transaction-level Pix data including timeout information
  - Empirical approach aims to estimate causal effects of instant settlement
- **Rich theoretical framework**
  - Testable predictions for liquidity, deposits, lending, and income
  - Novel mechanism: loss of payment netting → ↑ liquid buffers → ↑ credit risk-taking

#2: Regressor of Interest: *PixUsage*



$$PixUsage_{it} = \text{Outflows}_{it} + \text{Inflows}_{it}$$
$$= NettablePayments_{it} + UnnettablePayments_{it}$$

#2: Regressor of Interest: *PixUsage*

- Pix usage (customers' Pix activity) can be expressed as:

$$PixUsage_{it} = NettablePayments_{it} + UnnettablePayments_{it}.$$

where:

$NettablePayments_{it} = 2 \times \sum_{d \in t} \min(\text{Outflows}_{id}, \text{Inflows}_{id})$,

$UnnettablePayments_{it} = \sum_{d \in t} \left| \text{Outflows}_{id} - \text{Inflows}_{id} \right|$.

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- The paper's regressor of interest (scaled by total assets) is defined as:

$$PixUsage_{it} = \frac{\sum_{d \in t} \min(\text{Outflows}_{id}, \text{Inflows}_{id})}{\text{TotalAssets}_{it}}. \tag{3.1}$$

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- Equation (3.1) captures the **bank's** nettable payment ratio (i.e., the **loss of netting ability**), not the **customers'** Pix activity.

- These are distinct concepts that can be measured directly—there is no need to conflate them under the same label.

#2: Regressor of Interest: *PixUsage (cont.)*

$$\sout{\textit{PixUsage}_{it}} \;\Rightarrow\; \frac{\textit{NettablePayments}_{it}}{2 \times \text{TotalAssets}_{it}} = \frac{\sum_{d \in t} \min(\text{Outflows}_{id}, \text{Inflows}_{id})}{\text{TotalAssets}_{it}}. \tag{3.1}$$

- Even if (3.1) is appropriate for studying **loss-of-netting** effects, it is misleadingly interpreted as literal Pix usage in some sections:

1. **Effect of Pix on bank deposit ratios:**
   - *"We also find that Pix usage increases the ratio of demandable deposits, consistent with our model prediction that **demandable deposits become more attractive** with instant payments."*
   - If NettablePayments is a pure **bank-level** treatment, it should not directly affect customers' choices.
2. **Instrument validity (timeouts):**
   - *"Therefore, banks with more timeouts should have lower Pix usage not only because failed transactions directly reduce **Pix usage**, but also because, more importantly, frequent timeouts make Pix **less attractive to customers** and thereby reduce their adoption of the system."*
   - The instrument's **relevance** is ex ante weaker for NettablePayments than for overall Pix usage, since timeouts may also disrupt unnettable flows. If unnetable flows affect outcomes, the **exclusion restriction** will also be violated.

#3: Model Predictions vs. Empirical Design

- **Institutional setting:** Since November 2020, Pix participation has been mandatory for large institutions (> 500,000 accounts), optional for small ones.

$$\text{Actual transition: Traditional} \longrightarrow \text{Mixed (Traditional + Instant)}$$

  - **Extensive margin:** within-bank variation in losses around Pix entry.
  - **Intensive margin:** across- and within-bank variation in losses from customer Pix adoption.

- **Theoretical model** compares equilibrium outcomes across two distinct regimes:

$$\text{Model comparison: Traditional} \longrightarrow \text{Instant}$$

  - Captures **extensive-margin effects** from the shift of payments from traditional to instant system.

- **Empirical design** exploits within-bank variation in loss intensity, *conditional on a mixed system:*

$$\text{Empirical variation: } \Delta_t \text{ in nettable Pix payments}$$

  - Mismatch with model predictions: banks' response to marginal changes in loss intensity within a mixed system does not necessarily capture their response to the one-time losses at Pix entry.

#3: Model Predictions vs. Empirical Design *(cont.)*

Suggestions to strengthen empirical design

- **Exploit Pix entry as a regime shift**

$$Y_{it} = \beta_1 \widehat{PixExposure}_i \times PostAnnounce_t + \beta_2 \widehat{PixExposure}_i \times PostImplement_t + \dots$$

  - $\widehat{PixExposure}_i$ predicted using pre-Pix payment connectivity, two-sidedness, digital adoption, client mix, bank size, etc.
  - β_2 directly tests the **model's** predictions

- **Separate key channels through which Pix affects banks:**
  1. Loss of **netting** ability (Nettable payments)
  2. Loss of discretion over **outflow settlement timing** (Pix share in total outflows)
  3. Customers demand shift toward **demandable deposits** (Total Pix activity)

  Paper's current regressor (nettable payments) targets #1 yet its interpretation *also* bundles #2–#3.

- **Clarify substitution patterns:** To what extent does Pix substitute vs. complement traditional instruments (TED, DOC)? Effects may vary with substitution intensity.

#4: Instrumental Variable Strategy

- **Instrument definition:** Bank *i*'s exposure to counterparty timeouts, weighted by share of bilateral payment flows:

$$\text{Timeout}_{it} = \sum_{j \neq i} \underbrace{\frac{\text{Inflows}_{ijt}}{\text{Inflows}_{it}}}_{\substack{\text{time-varying} \\ \text{weights}}} \times \underbrace{\frac{\text{Inflows}_{ij}^{\text{timeouts}}}{\text{Inflows}_{ij}}}_{\substack{\text{cumulative??} \\ \text{timeout rate}}} + \sum_{j \neq i} \underbrace{\frac{\text{Outflows}_{ijt}}{\text{Outflows}_{it}}}_{\substack{\text{time-varying} \\ \text{weights}}} \times \underbrace{\frac{\text{Outflows}_{ij}^{\text{timeouts}}}{\text{Outflows}_{ij}}}_{\substack{\text{cumulative??} \\ \text{timeout rate}}}.$$

- **Identifying assumption (exclusion restriction):**
  "Timeouts induced by other banks affect bank i only through their impact on its customers' Pix usage, and not through any direct influence on bank i's balance sheet composition."

- **Key concern—conditional independence violated:**
  Identifying variation comes from within-bank changes in **payment-flow weights** over time, not from *plausibly exogenous* **timeout rate shocks**. Payment weights reflect bank *i*'s network position and customer behavior, both likely endogenous.

#4: Instrumental Variable Strategy *(cont.)*

- **Suggested fix—use predetermined weights:**

$$\text{Timeout}_{it} = \sum_{j \neq i} \underbrace{\frac{\text{Inflows}_{ij,t_0}}{\text{Inflows}_{i,t_0}}}_{\substack{\text{fixed weights} \\ \text{(pre-Pix)}}} \times \underbrace{\frac{\text{Inflows}_{ijt}^{\text{timeouts}}}{\text{Inflows}_{ijt}}}_{\substack{\text{time-varying} \\ \text{timeout rate}}} + \sum_{j \neq i} \underbrace{\frac{\text{Outflows}_{ij,t_0}}{\text{Outflows}_{i,t_0}}}_{\substack{\text{fixed weights} \\ \text{(pre-Pix)}}} \times \underbrace{\frac{\text{Outflows}_{ijt}^{\text{timeouts}}}{\text{Outflows}_{ijt}}}_{\substack{\text{time-varying} \\ \text{timeout rate}}}.$$

where t_0 is a pre-Pix period (e.g., 2019 average). This ensures variation comes from counterparty timeout shocks rather than bank i's endogenous network evolution.

- **Remaining validity concerns:**
  - **Relevance:** Timeout_{it} reduces *total* Pix usage; potentially weaker instrument for *nettable* Pix flows
  - **Exclusion restriction**—timeouts at bank j may affect bank i's outcomes through:
    - Unnettable Pix flows (if these also affect outcomes)
    - Traditional payment channels (if timeouts reflect bank-wide IT problems affecting TED/DOC)
    - Customer responses (switching banks or payment methods, directly affecting deposits)

#4: Instrumental Variable Strategy *(cont.)*

- **To assess validity, characterize timeout patterns:**
  - Frequency, duration, and persistence over time (autocorrelation of timeout rates)
  - Whether outages are transaction-specific, Pix-specific, or bank-wide
  - Cross-bank correlation (shared infrastructure concerns)
  - Do Pix timeouts predict failures in TED/DOC or other payment channels?
  - Do timeouts predict customer switching (deposit flows, account closures)?

- **If validity concerns persist:**
  - Only report OLS estimates with rich controls and explicitly discuss the likely direction of bias
  - Pursue alternative identification using predicted Pix exposure and entry timing (slide #3)

Other Suggestions

- **Clarify sample composition:** Number of banks and data frequency. Current number of observations appears low.

- **Define participating banks:** Exclude or separately analyze non-participant small banks. Describe participation determinants and timing.

- **Use loan origination data:** Analyze new issuance to isolate effects on illiquid assets. Effects of banks' lending policies may be diluted in full loan portfolio.

Conclusions

- **Timely and important topic**: IPS are rapidly expanding. Understanding bank adaptation matters for stability

- **Unique setting and clear mechanisms**
  - Near-universal Pix adoption + granular payment data
  - Mechanism: loss of netting → liquidity buffers → risk-taking
  - Informative patterns on banks' adjustments when transitioning to IPS

- **Areas to strengthen evidence**
  - Distinguish customer Pix usage from banks' nettable payment exposure
  - Consider exploiting Pix entry to align with model predictions
  - Revise and enhance the identification strategy

- **Bottom line**: Strengthening the empirical implementation would position this paper to make a substantial contribution to the banking literature.

Best of luck!