Artificial intelligence and relationship lending

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Discussion by

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This Paper in a Nutshell

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- Does AI adoption in credit scoring change relationship lending behavior?
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Data:

- **AnaCredit:** Quarterly loan volumes & interest rates (bank-firm level)
- **RBLS Survey:** Direct measure of AI adoption for credit scoring
- **Credit Registry:** Relationship duration since 2008
- **Cerved:** Firm balance sheets (2018-2020)

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Key Variables:

- **Relationship Duration**: Log(quarters) of bank-firm relationship
- **AI Indicator**: Bank uses AI/ML for credit evaluation (bank-level)
- **Crisis Period**: D(2020) dummy

Empirical Strategy and Main Findings

Identification: Khwaja & Mian (2008) approach

- **Firm-time FE:** and **Bank-time FE:** control for firm demand and bank supply factors
- **Comparison:** Same firm's different relationships, or same bank's different relationships

$$Y_{ijt} = \beta_1 \text{Duration}_{ijt-1} + \beta_2 \text{Duration}_{ijt-1} \times \text{AI}_{it-1} + \beta_3 \text{Duration}_{ijt-1} \times D(2020) + \beta_4 \text{Duration}_{ijt-1} \times \text{AI}_{it-1} \times D(2020) + \text{FEs}$$

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- AI banks: **Mitigate extraction** (↑ credit, ↓ rates for given duration)

⇒ AI banks offer better terms than traditional banks

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Real Effects: Firms more exposed to AI banks with longer main lender relationships see dampened increases in investment and employment during crisis

My Take on the Paper

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Less amplification of shocks vs. loss of insurance for certain firms

My Comments

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1. **Quick Win: Industry × Location × Size × Time FE**
2. **The Mechanism: What Drives the Results?**
3. **Size vs AI Confound**
4. **Guaranteed Loans and Identification**
5. **Minor Comments**

Quick Win: Industry × Location × Size × Time FE

Current Limitation: Firm-time FE requires firms with $\geqslant 2$ banks

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Solution: Industry × Location × Size × Time FE (Degryse et al., 2019)

- Use full sample (all firms, including single-bank)
- Controls for granular demand shocks

Especially valuable given selection concerns

The Mechanism: What Drives the Results?

What We Know (Stylized Facts):

- AI banks more sensitive to firm-specific conditions (Figure A1: EBITDA)
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- *Why* does this eliminate relationship insurance?
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H2: AI uses **different information** → Sees fundamentals, not relationships

These are **not mutually exclusive**, but have different implications

Candidate Mechanisms: How Does AI Change Relationship Lending?

Mechanism 1: State-Invariant Lending

AI Bank:

- Credit = Algorithm only
- No crisis adjustment
- Consistent rules across states

Prediction:

- AI effects should be *uniform* across firms
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Mechanism 2: Information Substitution

AI Bank:

- Uses: Real-time hard data
- Crisis → Different data still available
- Distinguish temporary vs. permanent shocks

Prediction:

- AI effects should vary by *data availability*
- Heterogeneity by:
  - Nature of COVID shock to sector
  - Firm size (data richness)

Testing the Mechanism: Heterogeneity Analysis

Key Insight: Mechanism 2 predicts heterogeneous effects while Mechanism 1 doesn't

Suggested Tests:

1. Heterogeneity by Sector COVID Impact

- Classify sectors by COVID shock severity
  - High impact: Hospitality, travel, retail (physical)
  - Low impact: Tech, finance, digital services
- **Prediction (if Mechanism 2):**
  - Smaller $|\beta_4|$ in digital sectors (real-time data available, conditions maintained)
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2. Heterogeneity by Firm Digital Footprint

- Proxies: Firm size, sector digitalization, transaction volume
- **Prediction (if Mechanism 2):**
  - AI effects stronger for firms with richer data
  - Weaker insurance loss for digitally active firms

Size vs. AI — I: Identification Challenge

"The probability for a bank to use AI for credit scoring increases with its size"

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Table 1: Adoption of AI for credit scoring and bank characteristics

Variables	(1) AI	(2) AI pre Covid
Capital ratio	0.1053	0.2237
	(2.948)	(3.000)
Liquidity ratio	1.9925	1.9506
	(2.177)	(2.335)
ROA	0.5066	0.0899
	(0.475)	(0.541)
Interbank funding ratio	-1.3867	-1.5532
	(1.430)	(1.478)
Size	0.7748***	0.8042***
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Moving from median to p75 of size → +35% in AI-bank

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Why Bank-Size matters independently: (Berger and Black, 2011)

- Large banks
  - Hard info, less relationship-based
  - May have low rent extraction or crisis insurance
- Small banks: Relationship-oriented
  - Soft info, relationship-dependent
  - Countercyclical lending pattern

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What the paper does: Bank-time FE control for Size_{it}, but not $\text{Size}_{it} \times \text{Duration}_{ij} \times \text{Crisis}$

Size vs. AI — II: Suggested Tests

Suggestions to Disentangle:

- **Horse race regression:**
  - Add: $\log(\text{Duration})_{ij} \times \text{Large}_i \times D(2020)$
  - Does AI interaction remain significant?

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Caveat: Cannot fully separate without exogenous AI adoption variation

Guaranteed Loans and Identification — I

Problem: COVID period had unprecedented government guaranteed credit

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- Guaranteed loans = large fraction of COVID lending
- (Jimenez et al., 2025): Firms with longer relationships are more likely to receive guarantees
  - Effect strongest for riskier firms

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Implication for Results:

- $\beta_3 > 0$ may conflate relationship insurance + guarantee effects
- $\beta_4 < 0$ unclear: AI effect or differential guarantee allocation?
  - If non-AI banks target guarantees to relationship firms...
  - ...but AI banks distribute uniformly

  $\rightarrow$ β_4 captures allocation differences, not AI

Guaranteed Loans and Identification — II: What the paper does

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But This Doesn't Resolve the Issue:

- Bank-level correlation ≠ Bank-Firm level correlation
- Doesn't test: Do AI banks allocate guarantees differently *across* borrowers?
- Key issue: Guarantee rate for relationship vs. non-relationship firms, by bank type

Suggestions:

- Show guarantee use by relationship duration for AI vs. non-AI banks
  - Is it uniform across bank types?
- Loan-level analysis:
  - Control for guarantee status explicitly in regression
  - Or: Subsample analysis (guaranteed vs. non-guaranteed loans)
- Test: Do results persist in non-guaranteed loan subsample?

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Important for External Validity:

- Alternative crisis shocks (e.g. tariffs, energy crisis)
- Do effects change as banks gain experience with AI → longer panel (2021-2023)

Thank you!