The Relationship Dilemma: Hysteresis in Management Practices and the Adoption of Credit Scoring Technology

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Credit Scores in Retail Lending

- Introduced in India in 2007

- Use of credit scores is a clear marker of technology adoption

- 2 types of banks with very different adoption patterns
  - Public sector banks (PSBs)
  - New private banks (NPBs)

- Perhaps more remarkably, two types of _borrowers_ with different adoption patterns
  - Current clients
  - New customers

The paper in a picture and 5 Slides

Picture

Bureau Usage

NPB

PSB
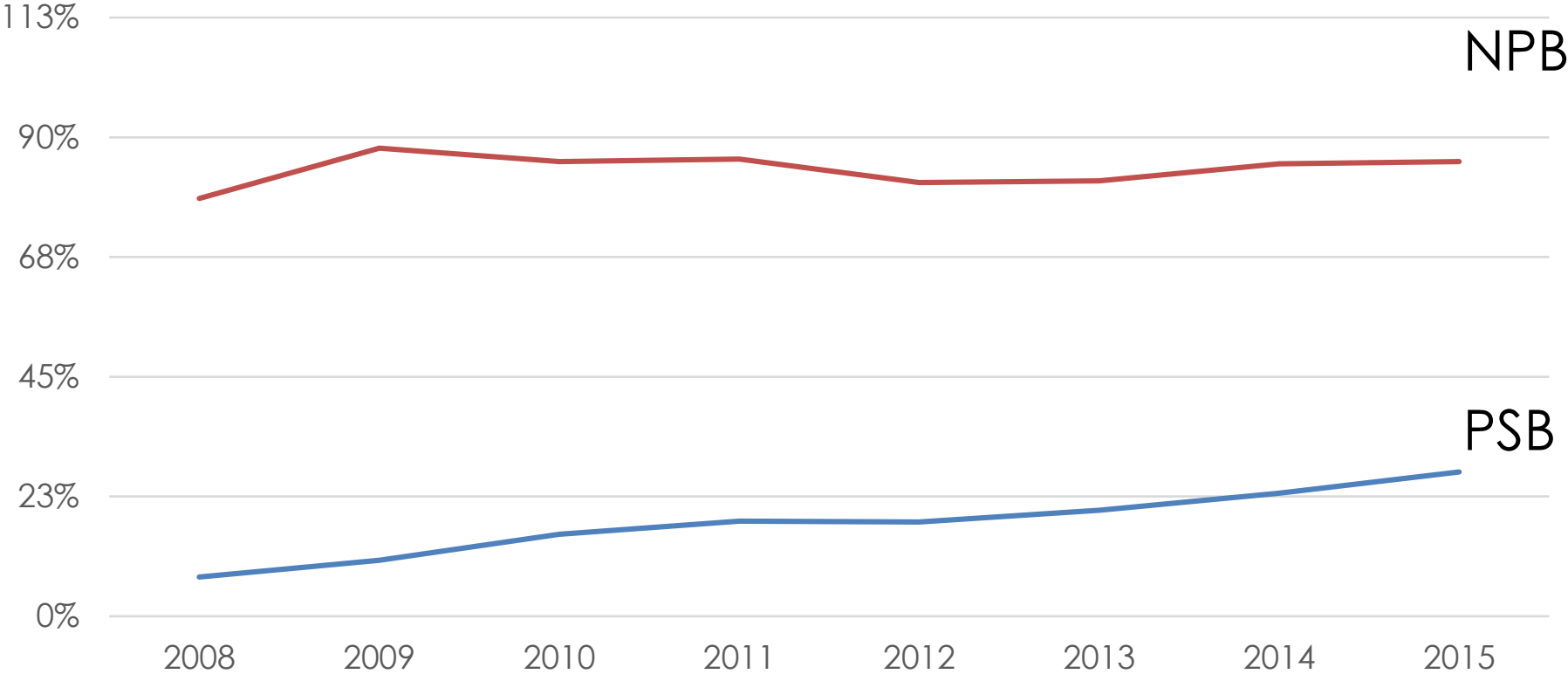
Findings

- Slow adoption of technology by PSBs
  - Only for borrowers with prior lending relationships
  - Reluctance to inquire fading over time

- Inquiries are useful.
  - Associated with lower ex post delinquencies

- Counterfactual
  - What if PSBs inquired more?
  - We obtain the scores they would have seen
  - Under a variety of plausible policy functions for using the score data, delinquency rates would be lower.

Interpretation

- Is it different loan portfolio, different customers, non-availability of credit scores, or PSBs being less conservative? No.

- Technology aversion? No.
  – No, new relationships show full adoption at inception

- Do PSBs find external information useless? No
  – Inquiries are associated with lower delinquency rates
  – Counterfactuals suggest that information is left on table

- Standard Bank characteristics ? No
  – Size, profits, capitalization
  – Test of difference in means (except size, rest statistically different)

- Ownership? No.
  – OPBs of similar vintage as PSBs but private

➤ Potential explanation: differences in management practices

➤ Formative experiences drive these differences

  ➤ Bureau usage negative related to bank age
  ➤ OPBs adoption patterns identical to PSBs

➤ Competition and learning induce an outward orientation, and better management practices

Broader Relevance

- A study of the adoption of technology
    - Technical progress drives growth (Solow, 1956)
    - Generation of innovation episodic
    - Adoption drives progress

- Our study fills in a gap
    - Process — rather than product — innovation for organizations
    - Clear marker of adoption
    - Clear measure of outcomes — delinquency
    - Micro data: some decisions with adoption, others without
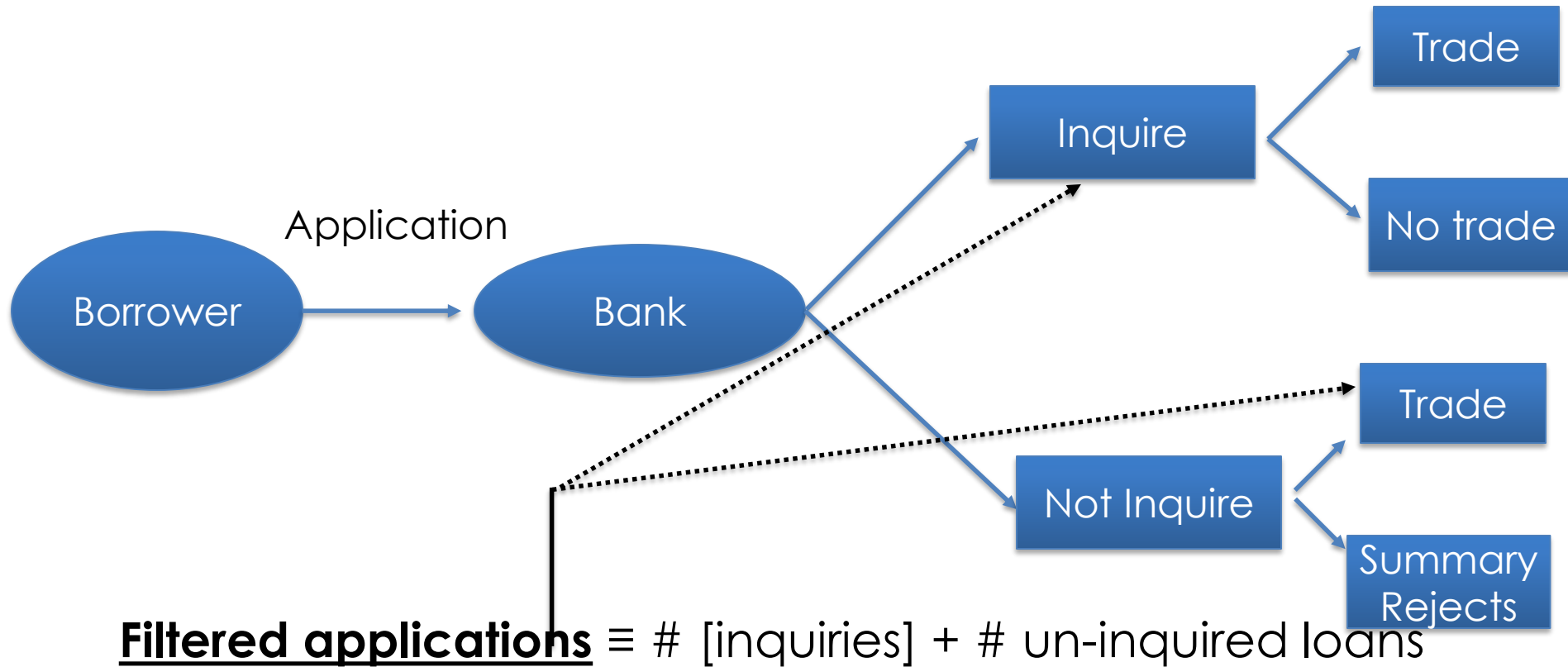   - Estimate consequences of non-adoption

- (Non)-adoption of modern management practices in emerging markets (Bloom et. al. 2007)
  - Driver of low productivity in firms in emerging markets
  - Demonstrate an instance, in services industry

Outline

- Data
- Empirical results
- Discussion
- Conclusions

Data Definitions

Trade

Inquire

No trade

Application

Borrower → Bank

Not Inquire

Trade

Summary Rejects

Filtered applications ≡ # [inquiries] + # un-inquired loans

Bureau Usage ≡ # inquiries/#filtered applications

Prior relation =1 If the borrower associated with the loan/inquiry had at least one prior loan with the same bank since 2006

Master Data Files

- Transunion CIBIL

- Inquiry file: FID, bank, date, risk-management or lending

- Trade file: FID, date, amount, product
  - Inquired: loan preceded by inquiry in [L, L-180]

- Delinquency file
  - LQ360 = 1 if DPD > 90 in [L, L+360]

- Point in time credit score for loans

- Geography indicators
  - Tiers

- 1,854 institutions, 255 million people, 472 million records

1% Working Sample

- 4.3 million "Filtered Applications"

- 3 million loans for INR 896 million ($14 billion)
  - No inquiry 2.3 million loans, INR 455 million
  - Inquiry   0.7 million loans, INR 441 million
  - Inquiry rate 23% (#), 51% (amount)

- We have two sub-samples
  - Descriptive sample: 2006-2015.
  - Sample with DRs and scores: 2013 and 2014

Information Left on the Table
Quantitative Estimates

PSBs Inquire Less

	(1)	(2)
PSB (=1)	-0.2536***	-0.1593***
	(0.002)	(0.002)
Past Relationship (=1)	-0.0807***	0.0663***
	(0.002)	(0.001)
Past Relationship (=1)*PSB		-0.2965***
		(0.004)
Male (=1)	0.0260***	0.0222***
	(0.002)	(0.002)
LN(Age)	-0.0026	0.0113***
	(0.003)	(0.003)
Time FE	Y	Y
#	348,158	348,158
R²	0.121	0.169

Delinquency LQ360

	First Stage	Second Stage
TWE 180		-0.0115***
		(0.003)
PSB (=1)	-0.2229***	
	(0.002)	
Past Relationship (=1)	-0.1412***	-0.0060***
	(0.002)	(0.001)
Low Score	0.1773***	0.0224***
	(0.002)	-0.003
Medium Score	0.1398***	-0.0027***
	(0.002)	-0.001
High Score	0.1778***	-0.0057***
	(0.002)	-0.001
Male (=1)	0.0101***	0.0019**
	(0.002)	-0.001
LN(Age)	-0.0259***	-0.0074***
	(0.003)	(0.001)
LN(1+Amt)		-0.0037***
		(0.000)
Acct Type FE	N	Y
Qtr-Year FE	Y	Y
Observations	331,961	107,284

- ➢ Results robust to

  - ➢ Borrower geography fixed effects
    - ➢ Low tiers less likely to be inquired

  - ➢ Geography x PSB
    - ➢ Low tiers less likely to be inquired even more for PSBs

  - ➢ Sample of unscored borrowers

New findings (contd)

➢ Results robust to controlling for
  ➢ Bank characteristics
    ➢ size, capitalization, profits
  ➢ Broader definition of prior relationship
    ➢ include relationship with other banks
      ➢ 16% of new borrowers have prior relations with other banks
  ➢ Long relationship (> 1 year)
    ➢ median 3 years, 25th pct is 1 year

Counterfactual Approach

➤ Counterfactual loan supply (1)

$$Q_{NI \to I}(PSB) = \sum p_c(NPB, X_c, S_c) \times L_C \times \delta_{c,NI},$$

➤ Counterfactual delinquency rate (1)

$$LQ360_{NI \to I}(PSB) = \sum p_c(NPB, X_c, S_c) \times L_C \times \delta_{c \ NI} \times LQ360_c(NPB,.)$$

➤ Counterfactual delinquency rate (2)

$$LQ360_{NI \to I}(PSB) = \sum p_c(PSB, X_c, S_c) \times L_C \times \delta_{c \ NI} \times LQ360_c(PSB,.)$$

Counterfactuals

Prior Relation	(1) P(I) * P(T|I) * Amt	(2) (1) * LQ360	(3) (1) * P(LQ360)	(4) LQ %	(5)= (2)/(1) CF LQ% LQ360	(6)= (3)/1 CF LQ% P(LQ360)
Panel A. NPB Model						
No	281,603	1,970	1,603	1.33%	0.70%	0.57%
Yes	719,841	6,997	4,135	1.29%	0.97%	0.57%
All	1,001,444	8,967	5,739	1.29%	0.90%	0.57%
Panel B. PSB Model						
No	153,104	1,160	1,505	1.33%	0.76%	0.98%
Yes	382,826	4,104	3,298	1.29%	1.07%	0.86%
All	535,931	5,264	4,803	1.29%	0.98%	0.90%

What is going on?

Explaining Slow PSB Adoption

- Size, profits, capitalization, etc.? No
  - PSB dummy is significant after these controls

- What determines stickiness of legacy process?
  - Vintage?
  - Ownership?
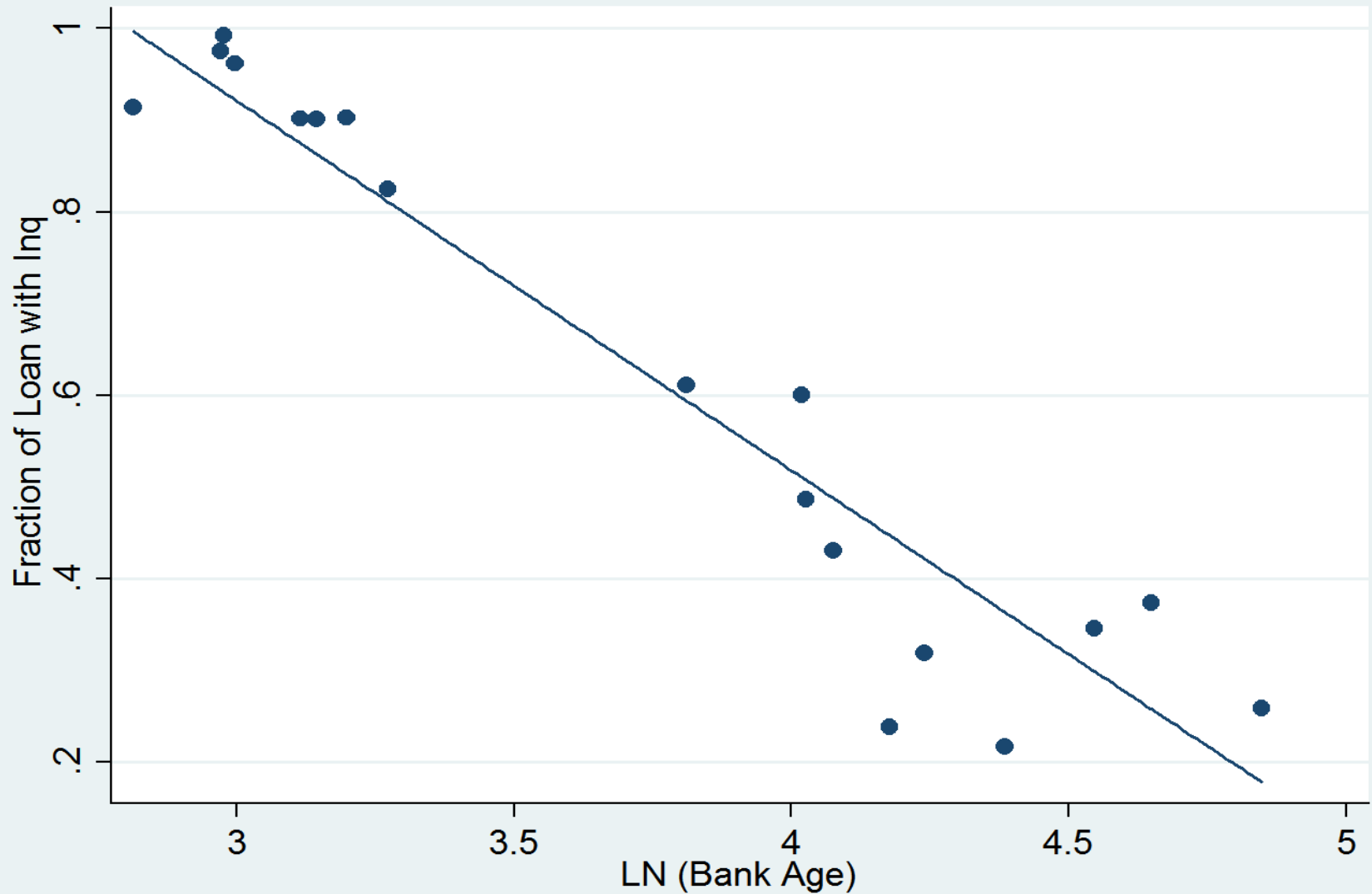
Simple bank level regression supports the importance of vintage

| Dependent variable: Fraction of loans with inquiry	
Ln(bank age)	-0.2226**
	(0.099)
Large Bank (=1)	0.0690
	(0.098)
Low Profit Bank (=1)	-0.027
	(0.088)
Low Capitalization Bank (=1)	-0.208
	(0.150)
R-squared	0.664
# Observations	18

The sample includes PSBs and NPBs. Large bank is an indicator for banks whose market value is greater than the median, while low profit and low capitalization bank denote indicators for banks whose profits and capitalization are below median as of end fiscal 2012. *** p<0.01, ** p<0.05, * p<0.1

Old Private Banks

- 14 OPBs
  - Formed at same time as PSBs, median 89 years (87 and 21 for PSBs and NPBs respectively),
  - Smaller than PSBs
  - Privately owned like NPBs, not nationalized in 1969 and 1980

- Do OPBs behave like PSBs? or NPBs?
  - If NPB, perhaps ownership drives adoption
  - If PSB, ownership and size do not drive adoption

OPBs similar to PSBs

In % of filtered apps

Bureau Usage

OPBs — NPBs — PSBs
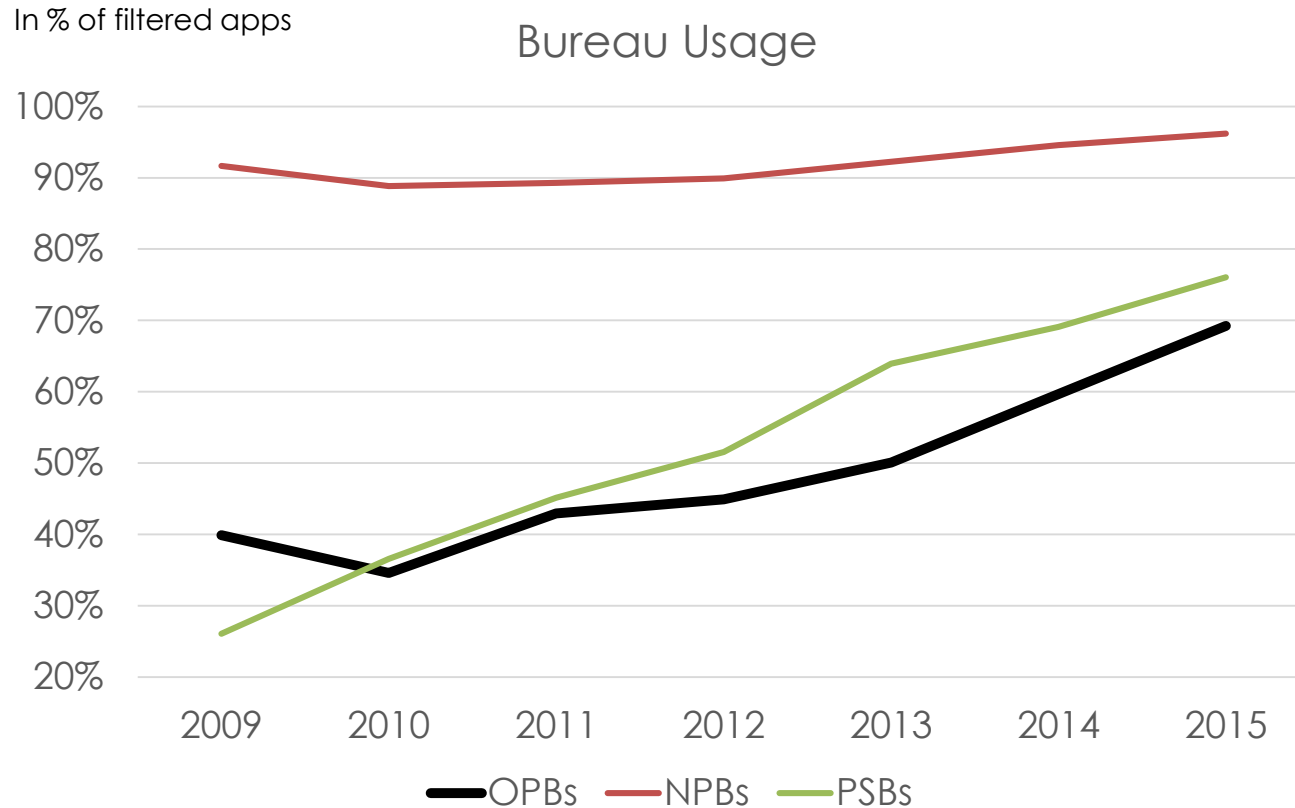
What is going on?

- Hysteresis in organizational practices?
  - Credit scores remove discretion from loan officer, and cede to scoring technology
  - PSBs reluctant to this shift
  - OPBs=PSBs ⟹ shared formative experience

- Competition and learning drives out status quo bias over time

Thank you!

Questions?