On the Rise of FinTechs – Credit Scoring using Digital Footprints

Tobias Berg, Frankfurt School of Finance & Management
Valentin Burg, Humboldt University Berlin
Ana Gombović, Frankfurt School of Finance & Management
Manju Puri, Duke University, FDIC and NBER

Motivation

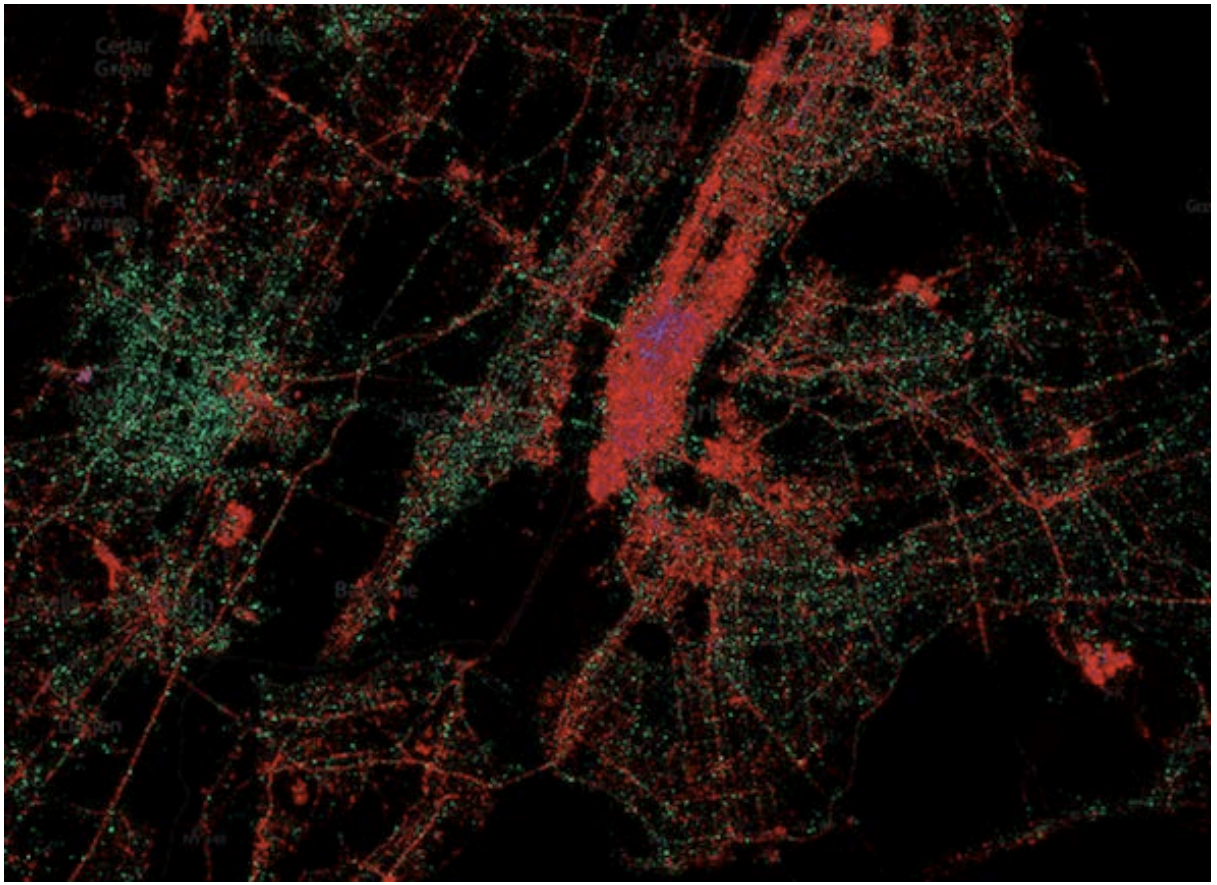
- Digital footprint: Trace of simple, easily accessible information about almost every individual worldwide

- One key reason for existence of financial intermediaries/banks: Superior ability to access and process information for screening borrowers

- This paper: How much information does simply surfing the internet and registering on websites leave behind? How well does it predict default rates?

- Wide implications
  - Financial intermediaries‘ business models
  - Access to credit for unbanked
  - Behavior of consumers, firms, and regulators in the digital sphere

Motivation: New York – Use of operating systems



Red = iOS, Green = Android, Purple = Blackberry

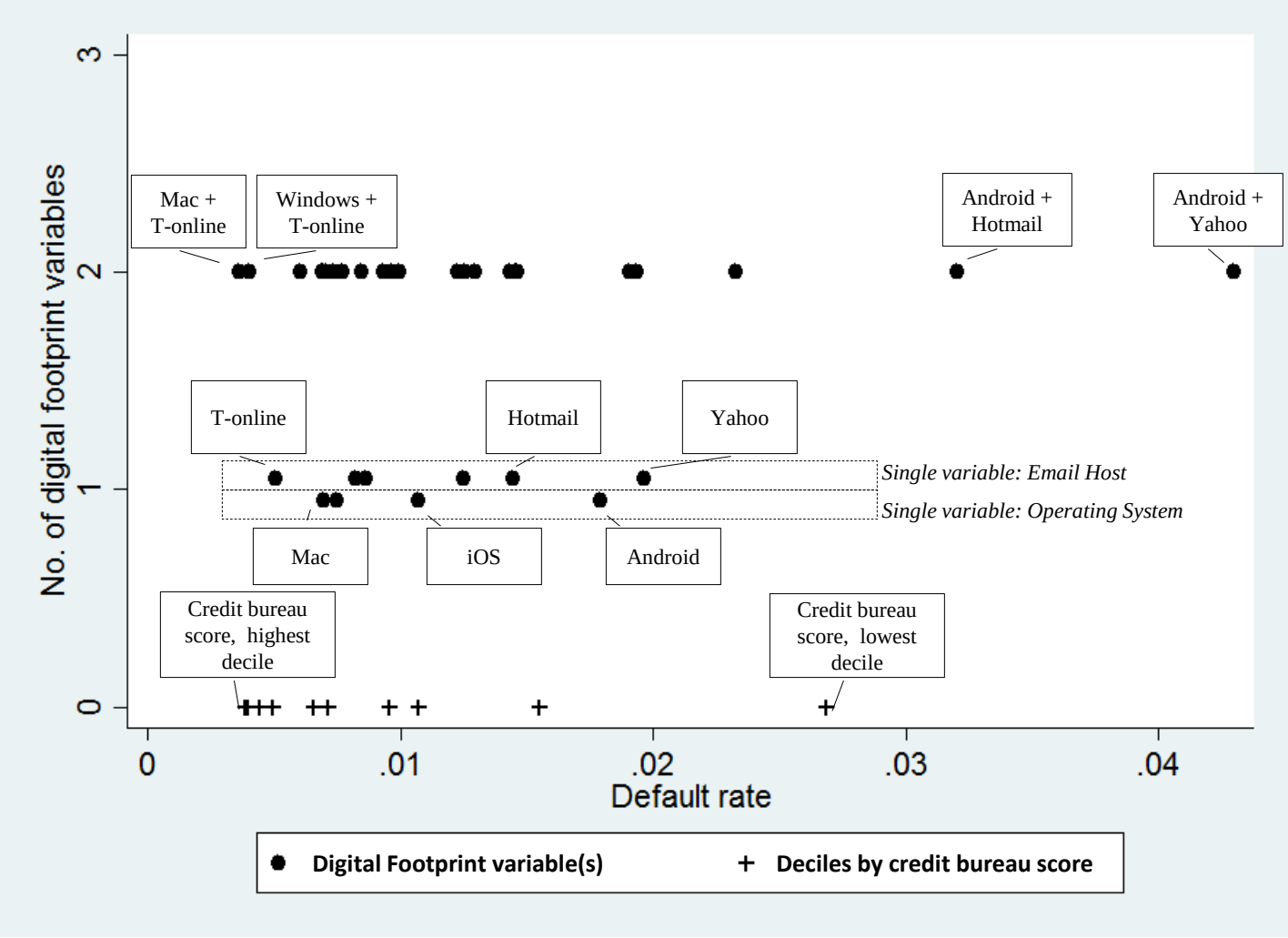
Information about customers' operating system available to every website without any effort

Source: Gnip, MapBox, Eric Fischer, Data 2011-2013

Digital footprint – 10 easily accessible variables

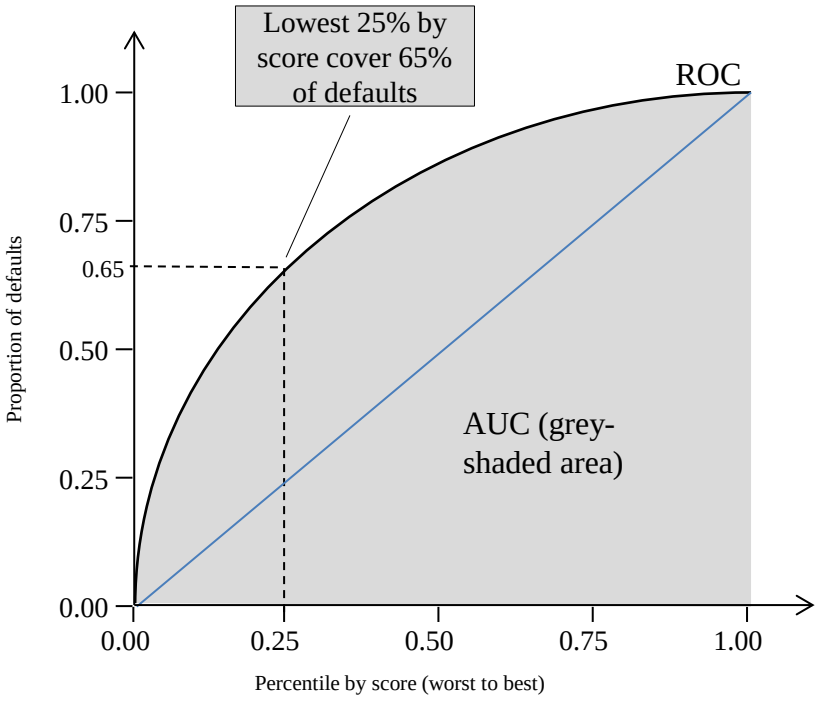
Variable	Description	Information content
Device Type	Main examples: Desktop, Tablet, Mobile.	**Income** e.g. Bertrand and Kamenica (2018): iOS best predictor for being in Top-Quartile by income
Operating System	Main examples: Windows, iOS, Android.	
Email Provider	Main examples: Gmail, Yahoo, T-Online.	
Channel	Channel through which customer has arrived at homepage of the firm. Main examples: paid click vs organic search; affiliate such as price comparison site; direct entering of URL	**Character** e.g. Rook (1987) and Wells et al. (2011): personality traits and impulse shopping
Check-Out Time	Time of day of purchase (morning, afternoon, evening, night)	
Do not track setting	Customer does not allow tracking of device and operating system information, and channel.	
Email Error	Email address contains an error in the first trial (Note: Clients can only order if they register with a correct email address).	
Name in Email	First or last name of customer is part of email address.	**Reputation** e.g. Belenzon, Chatterji, and Daley (2017) and Stern and Guzman (2016): Eponymous Entrepreneurs Effect
Number in Email	Email address contains number.	
Is Lower Case	First name, last name, street, or city are written in lower case.	

Bivariate results



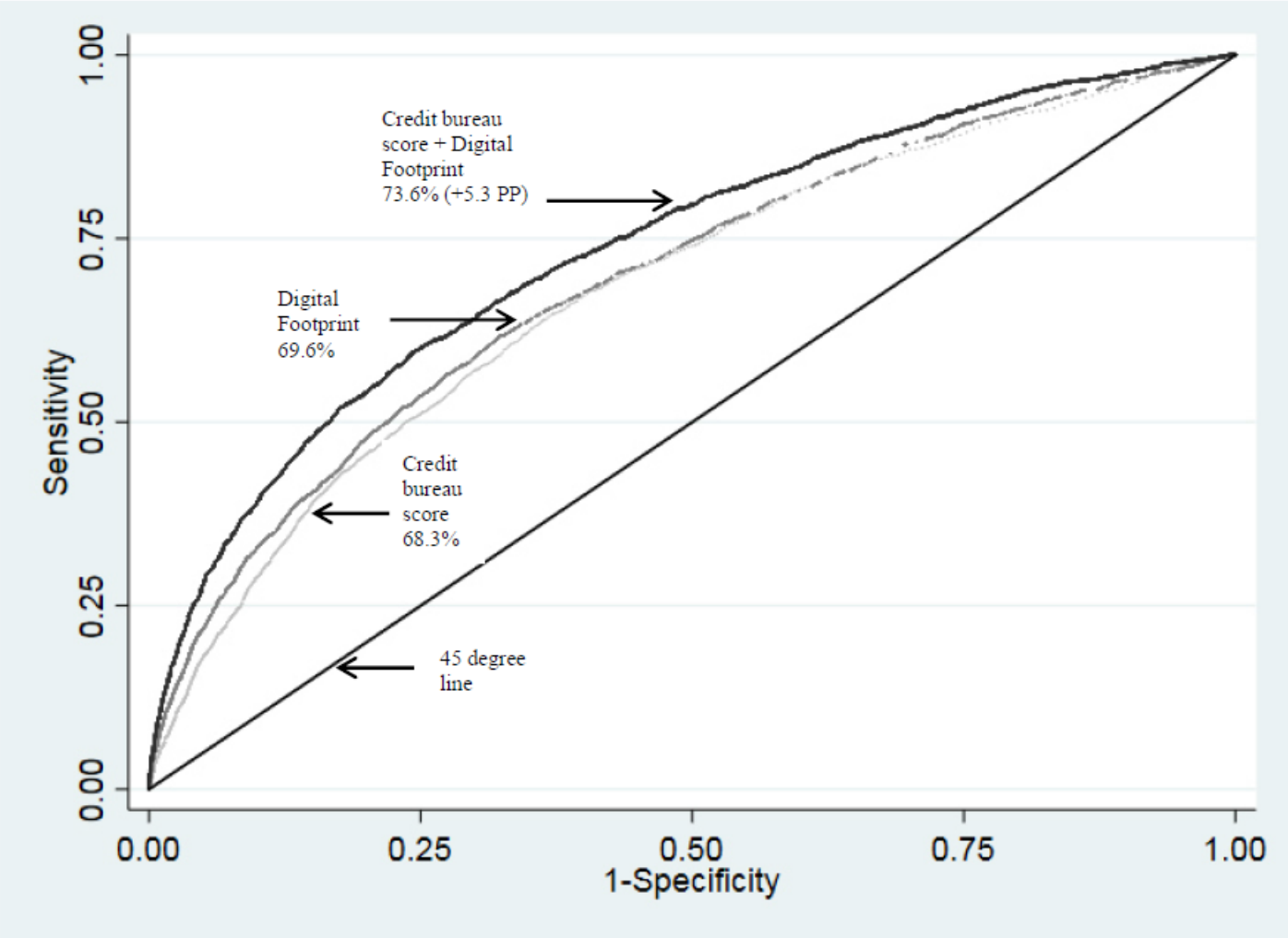
Judging discriminatory power: AUC

- Method: logistic regression with default dummy as the dependent variable
- Formal analysis of discriminatory power: Receiver Operating Characteristics (ROC) and Area-under-the-Curve (AUC)



- Range: 50% (random prediction) to ~ 100% (perfect prediction)
- Closely related to GINI: GINI = 2·AUC – 1
- Interpretation: Probability of correctly identifying good case if faced with random (good, bad)-pair
- Iyer, Khwaja, Luttmer, Shue (2016): 60% desirable in information-scarce environments, 70% in information-rich environments
- See also Vallee and Zeng (2018) and Fuster, Plosser, Schnabl, and Vickery (2018)

Area-under-Curve: Credit bureau score versus digital footprint



External validity: Idea

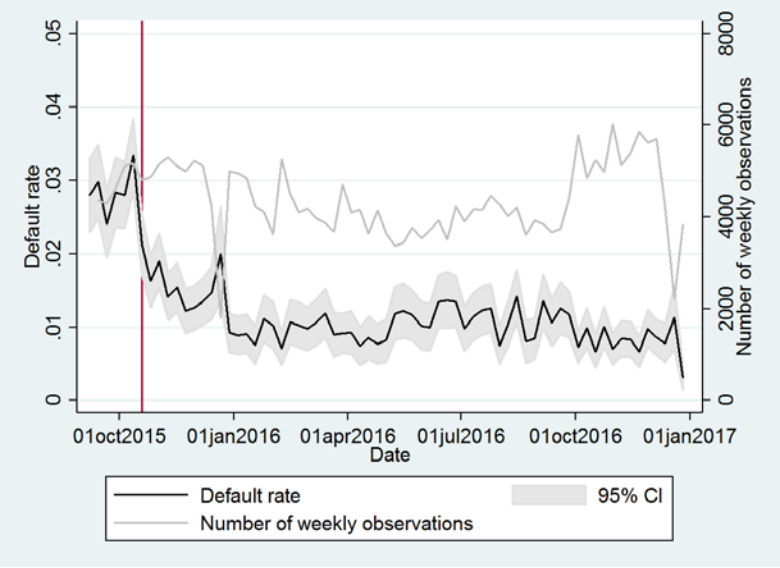
- Evidence so far: Predictive power of digital footprint for short-term loans for products purchased online

- Now: Test whether digital footprint with predictive power for traditional loan products as well.

- Idea: Does the digital footprint predict future changes in the credit bureau score? Answer is yes.

Economic impact of introducing digital footprint: Default rates go down

October 19, 2015 = Introduction of digital footprint and extension of bureau score



Pre-October 19:

- No digital footprint
- Credit bureau score for >€1100 and "unknowns" ("unknowns = customer not known to basic credit bureau")

Post-October 19:

- Digital footprint for every observation
- Credit bureau score for every observation

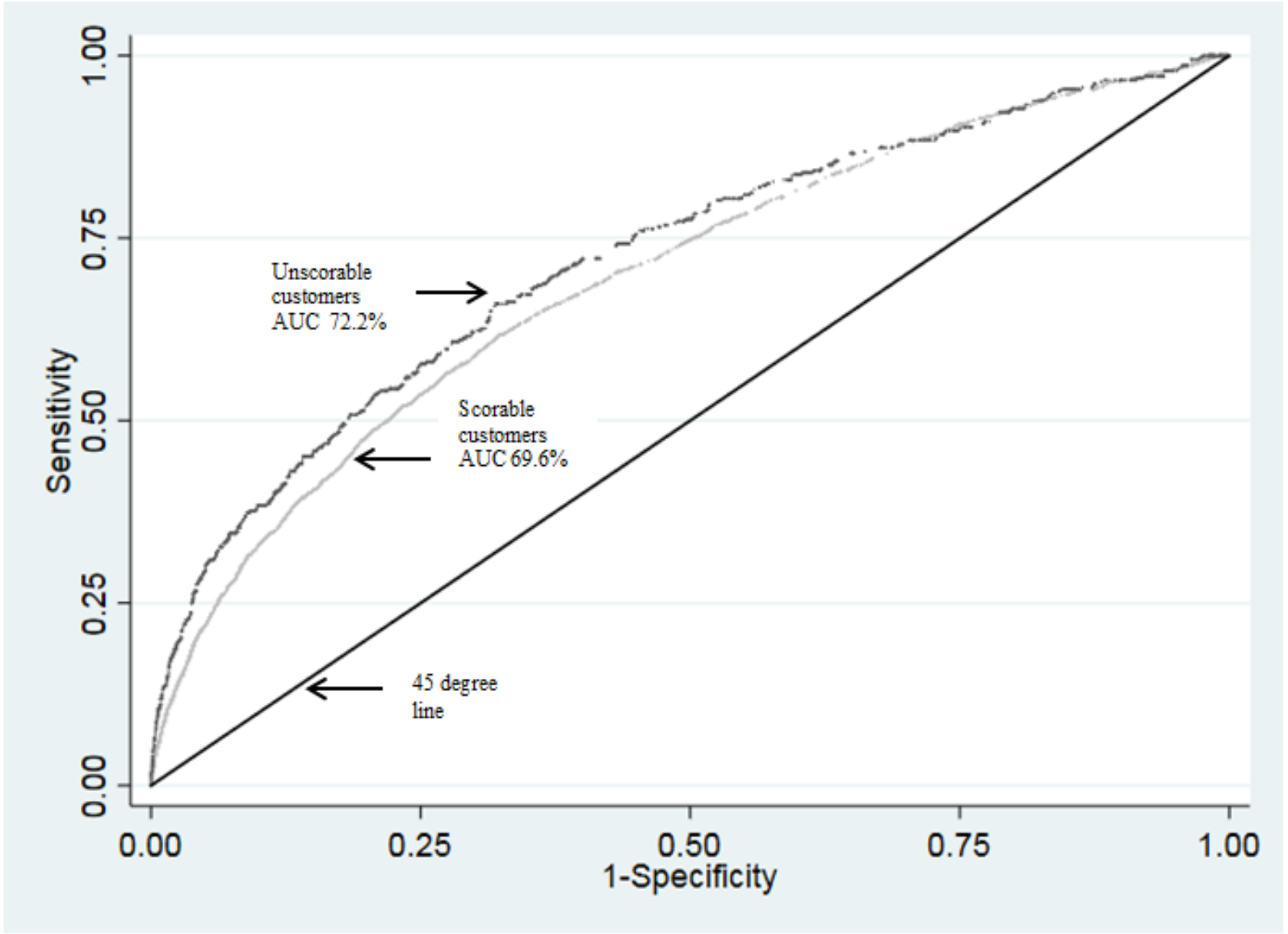
Access to credit for unbanked

- Two billion working-age adults lack access to financial services

- High expectations in digital footprints
  - World Bank: “Can digital footprints lead to Greater Financial Inclusion?”
  - Harvard Business Review: Fintech Companies Could Give Billions of People More Banking Options
  - Prior evidence on availability of credit and credit scores (Japelli and Pagano, 1993; Brown, Japelli, and Pagano, 2009; Djankov, McLiesh, and Shleifer, 2009; Beck, Demirguc-Kunt, and Honohan, 2009)

- Our paper: Digital footprint help to alleviate credit constraints for unscorables
  - ~6% of our sample: no credit bureau score (but: existence of customer confirmed and customer not in private bankruptcy)
  - Discriminatory power for unscorable customers is similar
  - Digital footprint helps to access credit for this sample

Unscorable vs. scorable customers: AUC comparison



Implication 3: Behavior of consumers, firms, and regulators in digital sphere

- Lucas critique: Change in consumers behavior if digital footprint is used by intermediaries
  - Some variables costly to manipulate
  - Others require change in consumer habits

- If Lucas critique applies
  - Risk of costly signaling equilibrium (Spence 1973): expensive suit vs. expensive phone
  - Lucas critique: consumers react to use of digital footprint. Implication: considerable impact on everyday' s life

- Beyond consumer behavior
  - Firms: Response by firms associated with low-creditworthiness products
  - Regulators: May intervene in case of violation of fair lending acts, incumbant banks might lobby regulators to intervene

Conclusion

- Is digital footprint useful for predicting payment behavior?
  - Simple, easily accessible variables with predictive power as credit bureau score
  - Complement rather than substitute to credit bureau score
  - Works equally well for unscorable customers

- Potentially wide implications
  - Financial intermediaries' business model: Digital footprint helps to overcome information asymmetries between lenders and borrowers
  - Access to credit for the unbanked
  - Behavior of consumers, firms, and regulators in the digital sphere