# Making Sense of Soft Information: Interpretation Bias and Ex-post Lending Outcomes

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# Research question

- **Can cognitive constraints impede the effective processing of soft information in private lending and lead to worse ex-post credit outcomes?**

  - Soft information refers to the private, qualitative and costly to obtain and verify information that loan officers collect through their repeated interactions with borrowers (e.g., Petersen 2004, Drexler and Schoar 2014).

# Motivation

- Collecting and using private soft information allows lenders to better screen and monitor their borrowers, reducing the likelihood of future defaults (e.g., Petersen and Rajan 1994, 1995, Berger and Udell 2002, Petersen 2004, Cassar et al. 2015).

- A few recent studies suggest that soft information may adversely affect loan quality due to loan officers' incentives to hide unfavorable borrower performance (e.g., Banerjee et al. 2009, Hertzberg et al. 2010, Paravisini and Schoar 2016).

*Our approach:*

- Cognitive constraints affect the interpretation and processing of less salient, qualitative information (e.g., Cyert and March 1962, Libby et al. 2002, Bloomfield 2002, Gibbons 2003, Kahneman 2011).

- Loan officers' cognitive constraints can adversely affect the use of soft information and ex-post lending outcomes.

# Primary findings

**Lending based on soft information leads to worse credit outcomes when loan officers are subject to the following cognitive constraints:**

- **Limited attention (or distraction).**
  - Loan officers are busy or originate loans just before weekends or around national holidays.
- **Task-specific human capital.**
  - Loan officers have earlier professional non-banking experience, particularly sales-related experience.
- **Peer perception.**
  - Both loan officers and borrowers are men.

# Setting

- **A large U.S. federal credit union that operates in a single state and offers traditional investment, depository and lending products.**
  - With approximately $1.6 billion in assets and 140,000 customers.

- **Loan officers in this credit union have authority over decisions involving borrowers.**
  - While certain credit guidelines are in place, loan officers can discretionarily override them and alter loan issuance/rejection decisions as well as loan terms.

- **We utilize the credit union's internal reporting system.**
  - Employees use this internal reporting system to record the information they collect through their routine interactions with customers.

- **Sample.**
  - 49,680 unique loans (mortgages, auto, personal loans) originated in 2005-2008 by 415 loan officers in 41 branches to 31,601 borrowers.

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# Example of employees' notes (1)

- "Member was in yesterday… very upset and distraught as to what is going to happen here in the future due to action that her husband has taken. Her husband has a drinking problem as he is a recovering alcoholic and he has been clean now for about 4 years. Her husband has been to recovery a number of times as this will be his fourth relapse. He ended up taking the new truck that he had purchased in the ditch while he was drinking and member and the kids were on a short summer vacation. So when member was getting calls from the neighbors and she had not heard from him she knew something was not right. She then returned home to find this out. He is in jail right now with a 12K bail over his head which member is not going to satisfy for him… she will be pursuing a divorce. Member can't put the kids through this anymore or herself. Member and I discussed a number of items that she can list for sale as she has to move back towards family in Iowa and rent an apartment."

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# Example of employees' notes (2)

- "How do I even begin...P. in today to determine how to deal with 120K - her mother's funeral was just yesterday and she just drove in from M.. P.'s divorce just finalized last month and today she received the settlement check of 120K. Wow! P. seems like a strong woman- her divorce took 4 years to complete - she has three children, one is studying at L. to be an Opera Singer, one is at the University studying to be a dentist and one is a sophomore at R. High School and enjoys Drama. The reason P. originally wanted to sit down with someone today was to express her immense gratitude to [the credit union] for taking a chance back in 2007 when we issued a 20K loan at 7.5% to her. Her husband had drained her accounts and they had just begun divorce - she needed money to pay her attorney & support herself and daughter at the time. [The credit union] took a chance and P. is soooooooo thankful - she paid off that loan, her [loans] today and is now going to buy a 2008-09 Subaru Outback or Legacy, paying 10K and doing a loan for the rest. and here's the best part.....for 10 years, before having kids, P. was a NUN! How about that. It was a joy to meet her today."

# Example of employees' notes (3)

- "I met J. today...what a guy! He slapped me on the back about eight times through the course of our conversation. He's looking to buy a motorcycle and/or a crotch rocket. He just found one he fell in love with, so we looked over some financing options."

- "Followed up with K. regarding opportunities on the loan approval. Discussed importance of looking back at previous loan applications. Also making sure we have vehicle value in the system. We had already paid off negative equity in the truck 2 years ago and now we moved them out to a 5 year loan again. Also follow up on credit cards and if we can help them pay those off, or come up with a plan for them."

# Soft information measure 1

- ***Soft information 1*** **is based on the soft-information-related keywords in employees' notes.**

- ***Soft keywords*** **are words related to:**
  - **A borrower's social** (e.g., "friends", "holidays", "hobby", etc.), **professional** (e.g., "job", "manager", "business"), **educational** (e.g., "graduate", "education", "degree") and **personal** (e.g., "family", "child(ren)", "parent(s)") **background**.
  - **A borrower's or the employee's feelings**, such as "overwhelmed", "frustrated", and "stress" (Plutchik 1980, Parrot 2001).
  - **Employees' judgments and assessments** ("I think", "I assess", "I believe").

- ***Soft information 1*** **is the ratio of** ***soft keywords*** **in employees' notes on the borrower to the total number of words in these notes (excl. stop-words), estimated based on notes written during the 45-day period prior to a loan's origination.**

# Soft information measure 2

- ***Soft information 2*** **is the absolute value of the residual from the regression of the total number of words in borrower-related notes during the 45-day window prior to a loan's origination on a borrower's hard and transaction-related information.**
  - **Hard information:** a borrower's credit score, debt-to-income ratio and the number of quantitative (numerical) words written in the notes.
  - **Transaction-related information**: a borrower's tenure with the credit union and the number and the balance of different products the borrower maintains with the union.
  - **Fixed effects:** employee, branch, loan types and year.

# Validation tests

| | (I) | | (II) | | (III) | | (IV) | |
|---|---|---|---|---|---|---|---|---|
| | *Charge off* | | *Delinquency* | | *Bad customer* | | *Credit score decline* | |
| ***Soft information 1*** | **-0.066*** ** | | **-0.125*** ** | | **-0.160** ** | | **-0.056** | |
| | **(-4.585)** | | **(-3.033)** | | **(-2.188)** | | **(-0.920)** | |
| ***Soft information 2*** | | **-0.007*** ** | | **-0.021*** ** | | **-0.017** | | **-0.030*** ** |
| | | **(-2.890)** | | **(-3.269)** | | **(-1.423)** | | **(-3.260)** |
| *Credit score* | -0.018*** | -0.018*** | -0.139*** | -0.136*** | -0.284*** | -0.279*** | -0.051*** | -0.050*** |
| | (-5.278) | (-5.212) | (-12.402) | (-12.541) | (-11.907) | (-12.054) | (-3.076) | (-2.995) |
| *Debt to income ratio* | 0.010** | 0.013*** | 0.115*** | 0.118*** | 0.147*** | 0.149*** | 0.157*** | 0.158*** |
| | (2.358) | (2.990) | (11.871) | (12.018) | (8.361) | (8.338) | (11.147) | (11.175) |
| *Loan interest rate* | 0.004*** | 0.004*** | 0.037*** | 0.036*** | 0.033*** | 0.033*** | 0.017*** | 0.017*** |
| | (9.353) | (9.285) | (38.027) | (37.730) | (19.096) | (18.915) | (12.619) | (12.632) |
| *Exception* | 0.001 | 0.002 | 0.019*** | 0.021*** | 0.039*** | 0.041*** | -0.005 | -0.004 |
| | (0.492) | (0.637) | (3.074) | (3.361) | (3.424) | (3.510) | (-0.465) | (-0.415) |
| *Secured* | 0.004 | 0.003 | 0.005 | 0.004 | -0.054*** | -0.057*** | 0.015* | 0.014* |
| | (1.451) | (1.120) | (0.781) | (0.570) | (-4.450) | (-4.546) | (1.674) | (1.647) |
| *Loan amount* | 0.000 | -0.000 | -0.009*** | -0.009*** | -0.011** | -0.012*** | -0.018*** | -0.018*** |
| | (0.011) | (-0.065) | (-3.766) | (-4.152) | (-2.499) | (-2.780) | (-5.610) | (-5.658) |
| *Loan maturity* | -0.001 | -0.001 | -0.001 | -0.001 | 0.003 | 0.003 | 0.014*** | 0.014*** |
| | (-0.971) | (-1.153) | (-0.804) | (-0.871) | (0.943) | (1.030) | (4.182) | (4.144) |
| *Borrower tenure* | -0.000 | 0.000 | -0.004* | -0.003 | -0.007* | -0.007* | -0.005 | -0.005 |
| | (-0.289) | (0.048) | (-1.664) | (-1.443) | (-1.817) | (-1.698) | (-1.428) | (-1.426) |
| *Total number of accounts* | -0.004*** | -0.004*** | 0.004 | 0.005 | 0.007 | 0.005 | -0.006 | -0.006 |
| | (-3.408) | (-3.070) | (1.232) | (1.564) | (1.339) | (0.934) | (-1.147) | (-1.128) |
| Fixed effects: | | | | | | | | |
| Loan officer, branch, year, loan type | | | | | | | | |
| Economic significance of *Soft information* | -12.000% | -8.909% | -3.311% | -3.894% | -2.700% | | | -4.352% |
| Obs. | 49,680 | 49,680 | 49,680 | 49,680 | 15,972 | 15,972 | 27,807 | 27,807 |
| Adj-$R^2$ | 3.39% | 3.34% | 18.12% | 17.53% | 26.79% | 26.65% | 6.26% | 6.33% |

# Limited attention

**H1. Lending based on soft information by inattentive loan officers leads to worse ex-post credit outcomes relative to when loan officers are not subject to inattention constraints.**

- Investors and analysts tend to underweight less salient qualitative information (Abarbanell and Bushee 1997, Teoh and Wong 2002, Lim and Teoh 2010), because this information is more costly and time-consuming to process (e.g., Hirshleifer and Teoh 2003).
  - Market participants' inattention or distraction is stronger on busy days (e.g., Hirshleifer et al. 2009, DeHaan et al. 2014) and just before weekends (DellaVigna and Pollett 2009).

- Limited attention measures:
  - *Busy loan officer (*the number of notes a loan officer writes).
  - *Before weekends (*loans issued after 4pm on Friday or on Saturday).
  - *Holidays (*loans issued within a [-4, +4] day window around major national holidays).

# Limited attention – findings

| | (I) | | (II) | | (III) | | (IV) | |
|---|---|---|---|---|---|---|---|---|
| | *Charge off* | | *Delinquency* | | *Bad customer* | | *Credit score decline* | |
| *Soft information 1* | -0.065*** | | -0.119*** | | -0.160** | | -0.055 | |
| | (-4.539) | | (-2.881) | | (-2.182) | | (-0.897) | |
| *After Friday 4pm* | -0.004 | | 0.004 | | 0.015 | | -0.018* | |
| | (-1.495) | | (0.497) | | (1.078) | | (-1.748) | |
| ***Soft information 1 × Before weekends*** | **0.263**** | | **0.537***** | | **0.692*** | | **-0.030** | |
| | **(2.420)** | | **(7.709)** | | **(1.747)** | | **(-0.108)** | |
| *Soft information 2* | | -0.007*** | | -0.021*** | | -0.016 | | -0.030*** |
| | | (-3.150) | | (-3.310) | | (-1.313) | | (-3.269) |
| *After Friday 4pm* | | -0.083* | | -0.034 | | -0.004 | | -0.017 |
| | | (-1.787) | | (-0.983) | | (-0.191) | | (-1.115) |
| ***Soft information 2 × Before weekends*** | | **0.011***** | | **0.161***** | | **0.058***** | | **0.048** |
| | | **(4.294)** | | **(3.784)** | | **(3.665)** | | **(0.122)** |
| Controls | YES | YES | YES | YES | YES | YES | YES | YES |
| Fixed effects: | | | | | | | | |
| Loan officer, branch, year, loan type | | | | | | | | |
| $\beta_1 + \beta_3$ | 0.198 | 0.004 | 0.418 | 0.140 | 0.532 | 0.042 | -0.025 | 0.018 |
| Statistical significance of $\beta_1 + \beta_3$ (*p*-values) | 0.000 | 0.736 | 0.000 | 0.008 | 0.015 | 0.040 | 0.761 | 0.960 |
| Economic effect of *Soft information* when loan officers are subject to cognitive bias | 36.000% | | 11.073% | 25.960% | 8.979% | 4.962% | | |
| Obs. | 49,680 | 49,680 | 49,680 | 49,680 | 15,972 | 15,972 | 27,807 | 27,807 |
| Adj. $R^2$ | 3.35% | 5.01% | 18.24% | 17.53% | 26.81% | 26.85% | 6.27% | 6.33% |

# Task-specific human capital

**H2. Lending based on soft information by loan officers with earlier non-banking or sales-related professional experience leads to worse ex-post credit outcomes relative to when loan officers do not have such experience.**

- Agents' early professional experiences "imprint" specific skills that are carried over through their subsequent careers (e.g., Gibbons and Waldman 2004, Marquis and Tilcsik 2013).
  - These task-specific skills persist despite significant environmental or professional changes (Schoar and Zuo 2016).
- Inferring soft signals on borrower quality should be more difficult when loan officers' judgment is influenced by the skills and habits acquired through their previous non-banking tasks.
  - In particular, loan officers with sales-related professional experience will focus on prospecting for new loans without effectively interpreting less salient information cues.

# Task-specific human capital – findings

| | (I) | | (II) | | (III) | | (IV) | |
|---|---|---|---|---|---|---|---|---|
| | *Charge off* | | *Delinquency* | | *Bad customer* | | *Credit score decline* | |
| *Soft information 1* | -0.104*** | | -0.265*** | | -0.198 | | -0.202*** | |
| | (-3.207) | | (-3.065) | | (-1.127) | | (-3.361) | |
| *Sales background* | -0.002 | | -0.009 | | -0.004 | | -0.010 | |
| | (-0.489) | | (-0.845) | | (-0.209) | | (-0.607) | |
| ***Soft information 1 × Sales background*** | **0.271*** ** | | **0.541*** ** | | **0.846** ** | | **0.808** ** | |
| | **(3.707)** | | **(2.877)** | | **(2.038)** | | **(2.478)** | |
| *Soft information 2* | | -0.007 | | -0.039** | | 0.018 | | -0.085*** |
| | | (-1.049) | | (-2.354) | | (0.547) | | (-3.117) |
| *Sales background* | | 0.002 | | -0.034*** | | 0.016 | | -0.005 |
| | | (0.493) | | (-2.713) | | (0.688) | | (-0.770) |
| ***Soft information 2 × Sales background*** | | **0.004** | | **0.210*** ** | | **0.197** | | **0.255*** ** |
| | | **(0.204)** | | **(3.344)** | | **(1.626)** | | **(2.729)** |
| Controls | YES | YES | YES | YES | YES | YES | YES | YES |
| Fixed effects: | | | | | | | | |
| Branch, year, loan type | | | | | | | | |
| $\beta_1 + \beta_3$ | 0.167 | -0.003 | 0.276 | 0.171 | 0.648 | 0.215 | 0.606 | 0.170 |
| Statistical significance of $\beta_1 + \beta_3$ ($p$-values) | 0.023 | 0.875 | 0.168 | 0.001 | 0.015 | 0.088 | 0.055 | 0.030 |
| Economic effect of *Soft information* when loan officers are subject to cognitive bias | 30.364% | | | 31.709% | 11.270% | 26.174% | 12.560% | 24.663% |
| Obs. | 9,364 | 9,364 | 9,364 | 9,364 | 2,926 | 2,926 | 5,472 | 5,472 |
| Adj. $R^2$ | 3.48% | 3.18% | 17.24% | 16.92% | 28.69% | 28.56% | 4.77% | 5.01% |

# Peer perception – common identity

**H3A. Lending based on soft information when loan officers and borrowers share a common identity leads to better or worse credit outcomes relative to when loan officers do not share a common identity.**

- Similar characteristics between the sender and receiver of a signal decrease processing costs and thus allow for a more accurate interpretation of salient information (e.g., Dewatripont and Tirole 2005).
  - Common traits between loan officers and their borrowers allow loan officers to better process, understand and judge less verifiable qualitative information(e.g., Uzzi and Lancaster 2003, Fisman et al. 2012).

- *However*, common identity increases liking, leading people to act more favorably towards peers who share with them important attributes (e.g., Tajfel and Turner 1979, Tajfel 1982).
  - Common identity will adversely affect how loan officers process soft information because they will perceive borrowers with whom they share common characteristics as more trustworthy and less risky.

# Peer perception – common identity – findings

| | (I) | | (II) | | (III) | | (IV) | |
|---|---|---|---|---|---|---|---|---|
| | *Charge off* | | *Delinquency* | | *Bad customer* | | *Credit score decline* | |
| *Soft information 1* | -0.083*** | | -0.138*** | | -0.202** | | -0.100 | |
| | (-5.291) | | (-2.959) | | (-2.322) | | (-1.420) | |
| *Male to male* | -0.007* | | 0.024** | | 0.014 | | 0.012 | |
| | (-1.650) | | (2.288) | | (0.769) | | (0.809) | |
| ***Soft information 1 × Male to male*** | **0.292*** ** | | **0.465** ** | | **0.502** ** | | **0.332** | |
| | **(2.868)** | | **(2.090)** | | **(2.413)** | | **(0.988)** | |
| *Soft information 2* | | -0.010*** | | -0.042*** | | 0.004 | | -0.061*** |
| | | (-3.982) | | (-5.296) | | (0.284) | | (-5.132) |
| *Male to male* | | -0.008 | | 0.017* | | 0.029 | | -0.015 |
| | | (-0.170) | | (1.777) | | (1.635) | | (-1.047) |
| ***Soft information 2 × Male to male*** | | **0.007** ** | | **0.144*** ** | | **0.099** | | **0.226*** ** |
| | | **(2.494)** | | **(4.353)** | | **(1.508)** | | **(4.701)** |
| Controls | YES | YES | YES | YES | YES | YES | YES | YES |
| Fixed effects: Loan officer, branch, year, loan type | | | | | | | | |
| $\beta_1 + \beta_3$ | 0.209 | -0.003 | 0.327 | 0.102 | 0.300 | 0.103 | 0.232 | 0.165 |
| Statistical significance of $\beta_1 + \beta_3$ (*p*-values) | 0.052 | 0.804 | 0.048 | 0.000 | 0.011 | 0.092 | 0.469 | 0.000 |
| Economic effect of *Soft information* when loan officers are subject to cognitive bias | 38.000% | | 8.662% | 18.914% | 5.217% | 12.539% | | 24.316% |
| Obs. | 40,747 | 40,747 | 40,747 | 40,747 | 13,251 | 13,251 | 22,140 | 22,140 |
| Adj. $R^2$ | 3.35% | 3.23% | 18.49% | 17.21% | 25.89% | 25.62% | 5.81% | 5.98% |

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# Supplementary analyses

- **Endogeneity:**
  - We focus on loans issued by call-center loan officers to alleviate the concern that our results are driven by non-random matching between loan officers and borrowers.
  - Although our sample size declines drastically, the majority of our findings continue to hold.

- **Information collection effort:**
  - We categorize soft information into information collected by the approving loan officer vs. other employees. Our results continue to hold.

- **Hard information.**
  - We find no evidence that cognitive constraints affect the interpretation of the hard information available to loan officers.

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# Conclusions

- Prior studies attributed low loan quality to loan officers' moral hazard and risk taking.
- We show that bad credit decisions may be also explained by the fact that humans are inherently subject to cognitive limitations.
- We thus provide novel evidence of non-agency-related costs in the use of soft information in credit decisions.

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# Contribution (1)

- **We add to the private lending literature.**
  - *By showing that bad credit decisions may be explained by loan officers being subject to cognitive constraints.*
  - *Although behavioral traits have been shown to influence agents' investment decisions and information processing in the equity market, our paper is one of the first to explore the role of cognitive constraints in private lending.*

- **We expand the extensive literature on the role of soft information in the lending process.**
  - *By providing novel evidence on the non-agency costs associated with lending based on soft information.*

# Contribution (2)

- **We contribute to the growing literature that examines the information demand of financial institutions.**
  - *By showing how the processing of less silent, qualitative information influences the lending process.*
  - *By adding new evidence on the cyclical properties of lenders' information demand.*

- **We contribute to the emerging literature on the role of behavioral factors in credit origination.**
  - *By identifying a specific aspect of the lending process – the interpretation of soft information – that may adversely effect the quality of loan decisions.*

# THANK YOU!