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Making Sense of Soft Information: Interpretation Bias and Loan Quality

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Research question

- **Can behavioral biases impede the effective processing of soft information in private lending and lead to worse loan quality?**

  - 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).

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Motivation

- Collecting and using soft information allows lenders to better screen 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:

- Behavioral biases affect the interpretation and processing of qualitative information (e.g., Cyert and March 1962, Libby et al. 2002, Kahneman 2011).
- Loan officers' behavioral biases can adversely affect the use of soft information and consequently loan quality.

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Primary findings

Lending based on soft information leads to worse loan quality when loan officers are subject to the following behavioral biases:

- **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 sales-related experience.
- **Common identity.**
  - Both loan officers and borrowers are men.

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Setting (1)

- **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.

- **Credit unions are member-owned depository institutions, with the primary objective to maximize the surplus from deposits and loan accounts to better serve their members.**
  - As of the beginning of 2013, there were 6,819 credit unions in the U.S. with total assets under management of $1 trillion and $600 billion loans outstanding, serving about 94 million members.

- **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.

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Setting (2)

- **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.
  - We focus on notes written during the 45-day period prior to loan origination.
  - There are 117,738 notes for our sample borrowers over this period (or 3 notes per loan).

- **Additional Data.**
  - The credit union's loan, borrower and employee characteristics (from the credit union and LinkedIn).
  - Borrower's performance on credit obligations outside the credit union (from a national credit bureau).

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Example of employees' notes (1)

- **"**Worked with N. and C. today and yesterday (extensively) as to help them with their finances. N. has struggled with her finances and the stress is evident in their relationship. They want to take a trip to Mexico in Mar. 2006, as to achieve that goal, we're setting $445 into [deposit account] to cover it. The $475 is going to C. to cover housing expenses as they have separate accounts to cover individual expenses with their individual children (from previous marriages) and the related expenses. We are going to operate on a cash-basis ($200 this pay period) and see where it goes from there. After the 3/9/06 paycheck we can allocate the $445 differently into additional (new?) accounts for i.e., hockey, vacations, etc."

- "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."

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Example of employees' notes (2)

- "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 (3)

- "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."

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Example of employees' notes (4)

- "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."

- "A. and I met and I am committed to helping her pull her home out of foreclosure and to stay on track. She has a better budget plan in place and has a solid tenant lined up for her rental. She is moving in with her daughter to share expenses while awaiting the sale of her home/rental property…. I know A. has had many struggles but I like her and I know she is a fighter. She is so caring as she took care of her terminally ill husband until he passed and her passion for people is evident in that she has worked in day care for 40 years! I will keep in close contact with A. and see how she is doing under her new budget and efforts on selling one of her properties."

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Soft information measure

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

- ***Soft keywords*** **are words related to:**
  - **Borrowers' 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**.
  - **Borrowers' or employees' feelings**, such as "overwhelmed", "frustrated", and "stress" (Plutchik 1980, Parrot 2001).
  - **Employees' judgments and assessments** ("I think", "I assess", "I believe").

- ***Soft information*** **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.**

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Validation tests

	(I) *Charge off*	(II) *Delinquency*	(III) *Bad customer*	(IV) *Credit score decline*
Soft information	**-0.066*** **	**-0.125*** **	**-0.160** **	**-0.056**
	(-4.585)	(-3.033)	(-2.188)	(-0.920)
Credit score	-0.018***	-0.139***	-0.284***	-0.051***
	(-5.278)	(-12.402)	(-11.907)	(-3.076)
Debt-to-income ratio	0.010**	0.115***	0.147***	0.157***
	(2.358)	(11.871)	(8.361)	(11.147)
Loan interest rate	0.004***	0.037***	0.033***	0.017***
	(9.353)	(38.027)	(19.096)	(12.619)
Loan exception	0.001	0.019***	0.039***	-0.005
	(0.492)	(3.074)	(3.424)	(-0.465)
Secured loan	0.004	0.005	-0.054***	0.015*
	(1.451)	(0.781)	(-4.450)	(1.674)
Loan amount	0.000	-0.009***	-0.011**	-0.018***
	(0.011)	(-3.766)	(-2.499)	(-5.610)
Loan maturity	-0.001	-0.001	0.003	0.014***
	(-0.971)	(-0.804)	(0.943)	(4.182)
Borrower tenure	-0.000	-0.004*	-0.007*	-0.005
	(-0.289)	(-1.664)	(-1.817)	(-1.428)
Total number of accounts	-0.004***	0.004	0.007	-0.006
	(-3.408)	(1.232)	(1.339)	(-1.147)
Fixed effects: Loan officer, branch, year, loan type				
Economic significance of *Soft information*	-12.000%	-3.311%	-2.700%	
Obs.	49,680	49,680	15,972	27,807
R^2	4.20%	18.19%	27.34%	6.56%

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Limited attention

H1. Lending based on soft information by inattentive loan officers leads to worse loan quality relative to when loan officers are not subject to inattention bias.

- When inattentive, investors and analysts fail to accurately interpret qualitative information, as this information is costly and time-consuming to process (e.g., Hirshleifer and Teoh 2003; Lim and Teoh 2010; Huang et al. 2017).
  - Market participants' inattention or distraction is stronger on busy days (e.g., Hirshleifer et al. 2009, DeHaan et al. 2014), and just before weekends and around holidays (DellaVigna and Pollett 2009; Pantzalis and Ucar 2014).

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

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Limited attention – findings (1)

	(I) *Charge off*	(II) *Delinquency*	(III) *Bad customer*	(IV) *Credit score decline*
Soft information	-0.091***	-0.180***	-0.109***	-0.040
	(-5.874)	(-6.115)	(-3.972)	(-0.587)
Busy day	0.000	-0.020	-0.001	0.008
	(0.086)	(-1.137)	(-0.358)	(1.071)
Soft information* × *Busy day	**0.057***	**0.483*****	**0.416*****	**0.196**
	(1.945)	**(6.023)**	**(2.798)**	**(1.576)**
Controls	YES	YES	YES	YES
Fixed effects:				
Loan officer, branch, year, loan type				
β1 +β3	-0.034	0.303	0.307	0.156
Statistical significance of β1 +β3 (p-values)	0.197	0.000	0.000	0.350
Economic effect of *Soft information* when loan officers are subject to biases		8.026%	6.477%	
Obs.	49,680	49,680	15,972	27,807
R^2	4.24%	18.25%	27.39%	6.67%

Limited attention - findings (2)

	(I) *Charge off*	(II) *Delinquency*	(III) *Bad customer*	(IV) *Credit score decline*
Soft information	-0.065***	-0.119***	-0.160**	-0.055
	(-4.539)	(-2.881)	(-2.182)	(-0.897)
Before weekends	-0.004	0.004	0.015	-0.018*
	(-1.495)	(0.497)	(1.078)	(-1.748)
Soft information × Before weekends	**0.263****	**0.537*****	**0.692***	**-0.030**
	(2.420)	**(7.709)**	**(1.747)**	**(-0.108)**
Controls	YES	YES	YES	YES
Fixed effects: Loan officer, branch, year, loan type				
β1 +β3	0.198	0.418	0.532	-0.025
Statistical significance of β1 +β3 (p-values)	0.000	0.000	0.015	0.761
Economic effect of *Soft information* when loan officers are subject to biases	36.000%	11.073%	8.979%	
Obs.	49,680	49,680	15,972	27,807
R^2	4.23%	18.32%	27.37%	6.60%

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Limited attention - findings (3)

	(I) *Charge off*	(II) *Delinquency*	(III) *Bad customer*	(IV) *Credit score decline*
Soft information	-0.068***	-0.130***	-0.164**	-0.062
	(-4.745)	(-3.154)	(-2.237)	(-1.009)
Around holidays	0.001	-0.002	-0.007	-0.010
	(0.237)	(-0.335)	(-0.603)	(-1.095)
Soft information* × *Around holidays	**0.192*** **	**0.582*** **	**0.302**	**0.620** **
	(3.861)	**(2.725)**	**(0.797)**	**(2.071)**
Controls	YES	YES	YES	YES
Fixed effects: Loan officer, branch, year, loan type				
β1 +β3	0.124	0.452	0.138	0.558
Statistical significance of β1 +β3 (p-values)	0.000	0.043	0.724	0.033
Economic effect of *Soft information* when loan officers are subject to biases	22.545%	11.974%		11.565%
Obs.	49,680	49,680	15,972	27,807
R^2	4.25%	18.21%	27.36%	6.62%

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Task-specific human capital

H2. Lending based on soft information by loan officers with earlier sales-related professional experience leads to worse loan quality relative to when loan officers do not have such experience.

- Agents' early-career professional experiences "imprint" professional mindset which affect their decision-making in the long term (e.g., Gibbons and Waldman 2004, Marquis and Tilcsik 2013, Schoar and Zuo 2016).

- Salespeople learn to be optimistic and develop a mindset of reaching or maximizing sales goals (e.g., Seligman and Schulman 1986; Seligman 1990).
  - Optimism directs people's attention to more positive information cues (e.g., Hecht 2013; Kress et al. 2018) as well as a goal implementation mindset directs their attention to information that supports the chosen goal (e.g., Heckhausen and Gollwitzer 1987; Gollwitzer and Bayer 1999; Griffith et al. 2015).
  - A *loan-sale-goal-oriented* mindset versus a *loan-quality-oriented* mindset.

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Task-specific human capital - findings

	(I) *Charge off*	(II) *Delinquency*	(III) *Bad customer*	(IV) *Credit score decline*
Soft information	-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 × Sales background	**0.271*** **	**0.541*** **	**0.846** **	**0.808** **
	(3.707)	**(2.877)**	**(2.038)**	**(2.478)**
Controls	YES	YES	YES	YES
Fixed effects: Branch, year, loan type				
β1 +β3	0.167	0.276	0.648	0.606
Statistical significance of β1 +β3 (p-values)	0.023	0.168	0.015	0.055
Economic effect of *Soft information* when loan officers are subject to biases	30.364%		11.270%	12.560%
Obs.	9,364	9,364	2,926	5,472
R^2	4.14%	17.54%	29.07%	5.41%

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Common identity

H3. Lending based on soft information when loan officers and borrowers share a common identity leads to better or worse loan quality relative to when loan officers do not share a common identity.

- Similar characteristics typically reduce the processing costs of soft information and thus allow for its more accurate interpretation (e.g., Uzzi 1999; Uzzi and Lancaster 2003; Dewatripont and Tirole 2005).

- *However*, similarity leads to more positive attitudes and greater trust (e.g., Byrne 1971; Clore and Byrne 1974; Glaeser et al. 2000).
  - Loan officers may have more affirmative judgement of and perceive as more trustworthy borrowers who resemble them, thus viewing the soft information about these borrowers as more credible and processing it less diligently.

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Common identity – findings (1)

	(I) *Charge off*	(II) *Delinquency*	(III) *Bad customer*	(IV) *Credit score decline*
Soft information	-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* × *Male to male	**0.292*** **	**0.465** **	**0.502** **	**0.332**
	(2.868)	**(2.090)**	**(2.413)**	**(0.988)**
Controls	YES	YES	YES	YES
Fixed effects: Loan officer, branch, year, loan type				
β1 +β3	0.209	0.327	0.300	0.232
Statistical significance of β1 +β3 (p-values)	0.052	0.048	0.011	0.469
Economic effect of *Soft information* when loan officers are subject to biases	38.000%	8.662%	5.217%	
Obs.	40,747	40,747	13,251	22,140
R^2	4.29%	18.55%	26.20%	6.32%

Consistent with prior evidence that: 1) male loan officers are more likely to query the commitment of female loan applicants and develop a bond with male borrowers (Carter et al. 2007);
2) men being more supportive of other men than women (e.g., Grunspan et al. 2016).

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Common identity – findings (2)

	(I) *Charge off*	(II) *Delinquency*	(III) *Bad customer*	(IV) *Credit score decline*
Soft information	-0.069***	-0.115**	-0.148*	-0.087
	(-4.519)	(-2.529)	(-1.762)	(-1.289)
Female to female	-0.039	-0.214*	-0.146	-0.006**
	(-0.802)	(-1.908)	(-1.109)	(-1.984)
Soft information × Female to female	**-0.026**	**0.057**	**0.024**	**-0.277****
	(-0.869)	**(0.713)**	**(0.160)**	**(-2.230)**
Controls	YES	YES	YES	YES
Fixed effects: Loan officer, branch, year, loan type				
β1 +β3	-0.095	-0.058	-0.124	-0.364
Statistical significance of β1 +β3 (p-values)	0.000	0.523	0.474	0.000
Economic effect of *Soft information* when loan officers are subject to biases	-17.273%			-7.544%
Obs.	40,747	40,747	13,251	22,140
R^2	4.27%	18.28%	23.10%	6.34%

Factors that mitigate the adverse effect of biases: Soft information collection

- **When soft information is based primarily on notes written by the approving loan officer, rather than by other employees.**
  - Consistent with lower soft information processing costs.

	(I) *Charge off*	(II) *Delinquency*	(III) *Bad customer*	(IV) *Credit score decline*
Soft information	-0.136***	-0.324***	-0.391***	-0.013
	(-7.696)	(-5.433)	(-4.318)	(-0.146)
Soft information × Busy day	0.143***	0.883***	0.663***	0.518***
	(3.600)	(7.482)	(3.298)	(2.680)
Soft information × Busy day × Loan officer's notes	**-0.111*** **	**-0.736*** **	**-0.385**	**-0.547** **
	(-2.956)	**(-4.618)**	**(-1.312)**	**(-2.146)**
Obs./ R^2	49,680/4.29%	49,680/18.31%	15,972/29.30%	27,807/6.70%

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Factors that mitigate the adverse effect of biases: A loan officer's experience

- **When a loan officer is more experienced.**
  - Experience alleviates limited attention bias….

	Charge off	*Delinquency*	*Bad customer*	*Credit score decline*
Soft information	-0.093***	-0.329***	-0.378***	-0.091
	(-4.898)	(-6.408)	(-4.434)	(-1.167)
Soft information × Busy day	0.109***	0.694***	0.619***	-0.184
	(3.157)	(7.700)	(3.662)	(-1.262)
Soft information × Busy day × Experienced loan officer	**-0.122*** **	**-0.609*** **	**-0.589** **	**0.025**
	(-3.079)	**(-4.132)**	**(-2.248)**	**(0.095)**
Obs./ R^2	49,680/4.24%	49,680/18.27%	15,972/27.40%	27,807/6.70%

Factors that mitigate the adverse effect of biases: A loan officer's experience

- **When a loan officer is more experienced.**
  - … but it is not helpful for imprinted biases driven by early career experience or common identity.

	(I)	(II)	(III)	(IV)
	Charge off	*Delinquency*	*Bad customer*	*Credit score decline*
Soft information	-0.097***	-0.356***	-0.247**	-0.378**
	(-2.684)	(-3.812)	(-2.343)	(-2.178)
Soft information × *Sales background*	0.166***	0.827***	0.866**	0.880**
	(3.373)	(3.978)	(2.264)	(2.356)
Soft information* × *Sales background* × *Experienced loan officer	**0.008**	**-0.492**	**-0.162**	**-0.277**
	(0.052)	**(-1.379)**	**(-1.013)**	**(-0.363)**
Obs./ R^2	9,364/4.14%	9,364/18.11%	2,926/29.08%	5,472/5.41%

Factors that mitigate the adverse effect of biases: Soft information tone

- **When soft information about the borrower contains consistently positive or consistently negative information.**
  - Consistent with soft information being easier to process.

	(I)	(II)	(III)	(IV)
	Charge off	*Delinquency*	*Bad customer*	*Credit score decline*
Soft information	-0.072***	-0.088**	-0.149**	-0.023
	(-5.574)	(-2.076)	(-2.003)	(-0.355)
Soft information × *Before weekends*	0.155**	0.809***	0.781**	-0.041
	(2.447)	(8.138)	(1.993)	(-0.150)
Soft information* × *Before weekends* × *Non-ambiguous notes	**-0.034***	**-0.269***	**-0.119*****	**-0.010**
	(-1.727)	**(-1.654)**	**(-2.549)**	**(-0.024)**
Obs./ R^2	31,894/4.20%	31,894/18.57%	10,774/28.60%	18,773/6.30%

Factors that mitigate the adverse effect of biases: Lending relationships

- **A borrower's prior relationships with the credit union.**
  - Weak support.

	(I) *Charge off*	(II) *Delinquency*	(III) *Bad customer*	(IV) *Credit score decline*
Soft information	-0.088***	-0.324***	-0.283***	0.014
	(-5.152)	(-6.399)	(-3.504)	(0.175)
Soft information × Busy day	0.068**	0.590***	0.471***	0.312**
	(2.002)	(6.649)	(2.948)	(2.177)
Soft information × Busy day × Relationship intensity	**-0.000**	**-0.665*** **	**-0.115**	**0.503***
	(-0.613)	**(-3.244)**	**(-0.955)**	**(1.711)**
Obs./ R^2	49,680/4.34%	49,680/18.93%	15,972/27.70%	27,807/6.69%

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Additional tests

- **Do loan officers subject to behavioral biases underweight (overweight) soft information (hard information)?**
  - Loan officers' reliance on soft and hard information in loan pricing and exception decisions is unaffected by behavioral biases.
  - Loan officers do not charge higher interest rates to compensate for worse loan quality when they are subject to behavioral biases.

- **Endogeneity: we focus on loans issued by call-center loan officers.**
  - Call-center loan officers randomly receive calls from customers when loan officers in the branch are busy or absent.

- **Do behavioral biases affect the use of hard information?**
  - Behavioral biases have no effect on the use of hard information in lending (e.g., borrower's credit score and debt-to-income ratio), consistent with the interpretation of quantitative information not being influenced by these biases (e.g., Hirshleifer and Teoh 2003).

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Are Loan Officers Aware of Biases?

Panel A: The effect of a borrower's soft and hard information on loan pricing when loan officers are subject to behavioral biases

	Loan interest rate				
		Limited attention		Task-specific human capital	Common identity
	(I)	(II)	(III)	(IV)	(V)
	Busy day	*Before weekends*	*Around holidays*	*Sales background*	*Male to male*
Soft information	-0.895***	-0.758***	-0.759***	-0.345	-0.743**
	(-2.952)	(-2.880)	(-2.887)	(-0.568)	(-2.379)
Behavioral bias	-0.995	-0.547	5.234***	0.034	1.569
	(-0.922)	(-0.209)	(2.623)	(0.476)	(0.894)
Soft information x Behavioral bias	**0.510**	**0.593**	**-0.957**	**0.579**	**1.126**
	(0.936)	**(0.563)**	**(-0.682)**	**(0.428)**	**(1.183)**
Credit score	-4.267***	-4.218***	-4.211***	-4.332***	-4.321***
	(-44.375)	(-52.187)	(-52.239)	(-21.623)	(-45.820)
Credit score x Behavioral bias	**0.157**	**0.097**	**-0.757****	**-1.181****	**-0.202**
	(0.964)	**(0.246)**	**(-2.500)**	**(-2.463)**	**(-0.761)**
Debt to income ratio	0.142**	0.125*	0.134**	0.238	0.102
	(1.937)	(1.903)	(2.035)	(1.512)	(1.376)
Debt to income ratio x Behavioral bias	**-0.059**	**-0.352**	**-0.318**	**-0.107**	**-0.261**
	(-0.443)	**(-1.338)**	**(-1.574)**	**(-0.336)**	**(-1.270)**
Controls	YES	YES	YES	YES	YES
Obs.	49,680	49,680	49,680	9,364	40,747
R^2	60.81%	60.81%	60.83%	59.93%	61.15%

Endogeneity

		Limited attention			Common identity
		(I)	(II)	(III)	(IV)
Dependent variables:	Interaction variables:	*Busy day*	*Before weekends*	*Around Holidays*	*Male to male*
Charge off	*Soft information* x *Behavioral bias*	0.258*	0.244**	0.279*	-0.005
		(1.860)	(1.979)	(1.749)	(-0.018)
	Obs.	4,777	4,777	4,777	4,127
	R^2	13.45%	10.25%	3.41%	3.35%
Delinquency	*Soft information* x *Behavioral bias*	0.117	0.184***	0.071	0.023
		(0.375)	(3.447)	(0.092)	(0.043)
	Obs.	4,777	4,777	4,777	4,127
	R^2	17.03%	17.97%	17.89%	18.67%
Bad customer	*Soft information* x *Behavioral bias*	0.006	-0.336	0.428*	0.980*
		(0.010)	(-0.245)	(1.911)	(1.922)
	Obs.	1,933	1,933	1,933	1,655
	R^2	24.26%	30.74%	27.01%	24.15%
Credit score decline	*Soft information* x *Behavioral bias*	0.178***	-0.141	0.265	-0.343
		(7.994)	(-0.182)	(1.010)	(-0.404)
	Obs.	3,007	3,007	3,007	2,641
	R^2	7.16%	6.22%	6.31%	6.60%

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Hard information and behavioral biases

		Limited attention			Task specific human capital	Common identity
		(I)	(II)	(III)	(IV)	(V)
Dependent variables:	Interaction variables:	*Busy day*	*Before weekends*	*Around holidays*	*Sales background*	*Male to male*
Charge off	*Credit score* x *Behavioral bias*	-0.016***	0.018	0.018	-0.037**	-0.006
		(-2.476)	(0.912)	(1.098)	(-1.993)	(-0.602)
	Debt to income ratio x *Behavioral bias*	-0.019***	0.010	0.015	0.009	0.020
		(-2.524)	(0.843)	(1.057)	(0.558)	(1.314)
	Obs.	49,680	49,680	49,680	9,364	40,747
	R^2	4.23%	4.23%	4.23%	4.03%	4.28%
Delinquency	*Credit score* x *Behavioral bias*	0.021	0.060	0.022	-0.101*	-0.036
		(1.030)	(1.119)	(0.561)	(-1.774)	(-1.086)
	Debt to income ratio x *Behavioral bias*	0.001	0.006	0.001	-0.047	0.000
		(0.063)	(0.184)	(0.019)	(-1.106)	(0.006)
	Obs.	49,680	49,680	49,680	9,364	40,747
	R^2	18.20%	18.20%	18.20%	17.50%	18.35%
Bad customer	*Credit score* x *Behavioral bias*	-0.001	0.110	0.050	-0.098	-0.114*
		(-0.032)	(1.335)	(0.660)	(-1.003)	(-1.718)
	Debt to income ratio x *Behavioral bias*	-0.010	0.146**	-0.002	-0.093	0.055
		(-0.318)	(2.429)	(-0.046)	(-1.097)	(1.067)
	Obs.	15,972	15,972	15,972	2,926	13,251
	R^2	27.36%	27.41%	27.34%	29.02%	26.20%
Credit score decline	*Credit score* x *Behavioral bias*	0.003	-0.050	0.049	-0.046	-0.044
		(0.095)	(-0.771)	(0.900)	(-0.519)	(-0.847)
	Debt to income ratio x *Behavioral bias*	0.002	0.024	-0.013	0.054	0.018
		(0.083)	(0.507)	(-0.318)	(0.772)	(0.423)
	Obs.	27,807	27,807	27,807	5,472	22,140
	R^2	6.56%	6.58%	6.58%	5.29%	6.32%

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Conclusions

- **We show that bad credit decisions may be explained by the fact that loan officers 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.**

- **Our findings do not indicate that an automated lending process can efficiently substitute for the role of loan officers.**
  - Different organizational designs and incentive plans may alleviate the adverse effect of behavioral biases.

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Contribution

- We expand the literature on the role of soft information in the lending process (e.g., Petersen and Rajan 1994, 1995; Berger and Udell 2002; Agarwal and Hauswald 2010).
  - In particular, studies that examine the adverse effects of using soft information (e.g., Banerjee et al. 2009; Hertzberg et al. 2010; Paravisini and Schoar 2016).

- We add to the growing literature on the role of behavioral factors in lending decisions.
  - Loan officers' sentiment, due to weather and outcomes of sport games and TV shows (e.g., Agarwal et al. 2013; Cortes et al. 2016).
  - Robberies (e.g., Morales-Acevedo and Ongena 2018) and religious practices (e.g., Demiroglu et al. 2017).

- We add to the literature that examines how behavioral biases harm decision-making (e.g., Libby et al. 2002; Hirshleifer et al. 2009; Schoar and Zuo 2016; Guiso et al. 2009).

THANK YOU!

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Descriptive Statistics

	Obs.	Mean	STD	Median
Loan quality				
Charge off	49,680	0.022	0.135	0.000
Delinquency	49,680	0.151	0.364	0.000
Bad customer	15,972	0.237	0.412	0.000
Credit score decline	27,807	0.193	0.394	0.000
Soft information				
Soft information	49,680	0.055	0.040	0.034
Behavioral biases				
Limited attention				
Busy day	49,680	0.260	0.461	0.000
Before weekends	49,680	0.063	0.215	0.000
Around holidays	49,680	0.069	0.238	0.000
Task-specific human capital				
Sales background	9,364	0.222	0.420	0.000
Common identity				
Male to male	40,747	0.126	0.332	0.000
Female to female	40,747	0.309	0.462	0.000
Borrower and loan characteristics				
Credit score	49,680	6.590	0.210	6.580
Debt-to-income ratio	49,680	0.372	0.230	0.352
Loan interest rate	49,680	8.967	3.841	8.050
Loan exception	49,680	0.795	0.439	1.000
Secured loan	49,680	0.368	0.448	0.000
Loan amount	49,680	8.899	1.243	9.137
Loan maturity	49,680	4.090	1.274	4.108
Borrower tenure	49,680	0.845	0.951	0.688
Total number of accounts	49,680	1.602	0.905	1.791

Soft information residual

- *Soft information residual* 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 borrower's hard and transaction-related information.

	(I) *Charge off*	(II) *Delinquency*	(III) *Bad customer*	(IV) *Credit score decline*
Soft information residual	-0.008***	-0.021*	-0.013	-0.034***
	(-3.729)	(-2.969)	(-1.016)	(-3.419)
Busy day	-0.002	-0.008*	-0.023**	-0.006
	(-0.790)	(-1.673)	(-2.492)	(-0.734)
Soft information residual × Busy day	**0.016*** (3.184)**	**0.032*** (2.590)**	**0.045* (1.829)**	**0.021 (1.205)**
Controls	YES	YES	YES	YES
Fixed effects: Loan officer, branch, year, loan type				
β1 +β3	0.008	0.011	0.032	-0.013
Statistical significance of β1 +β3 (p-values)	0.000	0.286	0.014	0.427
Economic effect of *Soft information residual* when loan officers are subject to biases	10.182%		3.781%	
Obs.	49,680	49,680	15,972	27,807
R^2	4.28%	18.50%	27.32%	6.76%