Rise of the Machines:
The Impact of Automated Underwriting
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Summary

- **Question:** can algorithmic underwriting outperform human underwriting?
  - ▸ And what are the mechanisms behind performance differences?

- **Approach:** experiment assigning auto loans to human vs. "machine" underwriters

- **Main Findings:**
  - ▸ Machine-underwritten loans are 10.2% more profitable and default 6.8% less often
  - ▸ When gains to strategic manipulation are highest $\Rightarrow$ humans underperform worse
  - ▸ Humans perform worse as loans become more "complex"

- **Comments:** mechanisms, the experiment, external validity

Mechanisms

Better Incentives *and* Better Info Processing?

- Underwriter incentives not perfectly aligned with profit maximization
  - ▸ Paid on average $41 per contract and get quarterly compensation for portfolio perf.
  - ▸ Loans with LTV > 125% require higher APR ($\Rightarrow$ less competitive bid)

- Underwriters bunch under 125% – consistent with strategic manipulation

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  - ▸ Are more complex loans easier to manipulate?
  - ▸ Importance: evidence of superior ability or more evidence of incentive misalignment?

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  - ▸ **Test:** more manipulation of the 125% LTV cutoff among high vs. low complexity loans?
  - ▸ **Test:** do humans outperform machines in terms of maximizing human compensation?

- Risk averse humans may pick lower-return loans than risk-neutral machines

- However, higher default rate doesn't suggest humans being extra cautious

- **Test:** are returns on human-originated loans less variable? If so, risk aversion is not a compelling explanation here

	Human (N=70,033)		Machine (N=70,990)			
	Mean	S.D	Mean	S.D	Difference	t-stat
Credit Score	530.8	48.5	525.9	46.9	-4.96***	(-19.10)
Homeowner Indicator	0.046	0.21	0.037	0.19	-0.0088***	(-8.27)
Bankruptcy	0.28	0.45	0.33	0.47	0.052***	(21.15)
Debt-to-Income Ratio	0.39	0.20	0.38	0.32	-0.010***	(-7.10)
Vehicle Age (years)	2.68	1.85	2.75	1.90	0.067***	(6.70)
Vehicle Book Value	13859.0	3970.8	13601.5	3995.7	-257.5***	(-12.14)
Vehicle Mileage	40618.7	21799.4	41040.5	22573.7	421.8***	(3.57)
Vehicle Make Reliability	53.0	17.2	53.3	17.4	0.31***	(3.40)
Vehicle Import Indicator	0.66	0.47	0.68	0.46	0.021***	(8.53)
Vehicle Luxury Indicator	0.037	0.19	0.033	0.18	-0.0039***	(-4.01)

Randomization

Evidence of Randomization

- Ideal data would include characteristics of rejected loan applicants (not just accepted)
  - ▸ Would want to see balance on observables (consistent with randomization)

- Would build confidence in design to know more about how firm randomized

- Possible to look for balance in characteristics we don't think would influence underwriting decisions?
  - ▸ E.g., loan application dates (day of the week, month, etc.)

External Validity

- Would algorithmic lending perform worse in more soft-info intensive settings?
  - E.g., small business loans?

- Would algorithmic lending perform worse in settings with more strategic default?
  - "You can sleep in your car, but you can't drive your house to work"
  - Higher APR might have a less negative effect on default in auto loan markets
  - How good are algorithms at separating adverse selection & moral hazard?
    (similar challenge to separating correlation & causation)

External Validity (Macro)

- How would widespread adoption of algorithmic pricing impact lender competition?
  - ► Convergence in pricing?
  - ► Reduced labor costs $\Rightarrow$ reduced barriers to entry?

- Algorithmic pricing can be both *prediction-enhancing* and *commitment-enhancing*
  - ► Without managerial override, can commit to irrational strategies *off the path*
  - ► Ease of override can affect degree of competition (Leisten, 2021)

- Will enhanced competition erode profit gains in equilibrium?

Conclusion

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- Great paper! Valuable look into by how much and *why* machines beat humans

- Sheds light on impact of loan complexity and misaligned underwriter incentives on lending outcomes

- Future work: even if machines can out-profit humans, *should* we switch to this kind of underwriting? What degree of managerial override is desirable?
  - Algorithmic lending can exacerbate racial disparities (Fuster, Goldsmith-Pinkham, Ramadorai, and Walther, 2021)
  - Impacts on competition? Financial stability?

Thanks!