Employer Credit Checks: Poverty Traps versus Labor Market Efficiency

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Views expressed are those of the authors and not of the Federal Reserve Bank of Kansas City or the Federal Reserve System.
Pre-Employment Credit Screening (PECS)

- SHRM, 2009 study: 60% of HR reps check job applicants credit report

- Demos, 2012 survey: 1 in 7 low-mid income workers claim bad credit cost job offer

- PECS restrictions proposed, federal and state (eleven passed)

- Poverty trap concern:
  “We want people who have bad credit to get good jobs. Then they are able to pay their bills and get the bad credit report removed... the overuse of credit reports takes you down when you are down.” Michael Barrett (D-Lexington, MA).
Some Effects of PECS Bans Are Measurable

- Local labor market: Cortes, Glover & Tasci (2022) find ↓ of 6 – 10% in posted vacancies in affected occupations post ban.
Our Question

What are the aggregate and distributional welfare consequences of a policy that restricts pre-employment credit screening (PECS)?
Model Mechanism

- Model: Labor search with short term credit under adverse selection about worker type $i \in \{H, L\}$ which determines time preference and productivity $(\beta_i, h_i)$. 
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  - Bad credit $\rightarrow$ lower job finding rate

MH: Ban on PECS:
- Eliminates labor demand channel for poverty trap (bad credit $\rightarrow$ longer unemployment spell $\rightarrow$ inability to improve credit)
- Lowers matching efficiency (job finding rates) for highly productive agents
- Model accounts for interactions between labor and credit markets.
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The environment is populated by

- Unit measure of two types of workers indexed by $i \in \{H, L\}$, $\pi_i$ fraction each.

- Markov type change: transition to other type with prob $1 - \rho$.

- Workers die at rate $\delta$, replaced with unemployed newborns with $s = \pi_H$.

- Large number of identical potential employers (firms).

- Large number of identical lenders/credit scorers.
Timing, Preferences, Tech

- Timing: each period has two sub-periods (start & end of month)
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• Preferences:
  • Workers differ in inter-period discount factor (patience), \( \beta_i \in \{\beta_L, \beta_H\} \) with \( \beta_L < \beta_H \)
  • Period utility: \( U(c_{1,t}, c_{2,t}, n_t) = c_{1,t} + \psi c_{2,t} + z(1 - n_t) \) where \( \psi < 1 \) is intra-period discount factor
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• Technology
  • Labor \( n_t \in \{0, 1\} \) supplied in 1st sub-period
  • Production in 2nd sub-period: \( y_t = h_i n_t \)
  • Unemployed workers match with vacant firms via \( M(u, v) \)
  • Type specific productivity: \( h_i \in \{h_L, h_H\} \)
  • Lenders borrow (abroad) in 1st sub-period, pay gross interest rate \( R \) in 2nd
Information

- Record keeping technology:
  - Worker’s adverse events (i.e. defaults) are observed
  - Summarized by “score” $s_t$ (i.e. probability of being high type)
  - Score updated using observable events via Bayes Rule
  - Score observed firms unless law bans it
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• Labor Market
  • Firms do not observe type $i$ (i.e. human capital $h_i$) until after worker is hired (PECS).
  • Type perfectly revealed once matched (simplifies bargaining) and helps us match low $\text{cov}_i(w, s)$ in the data.
  • Expected profits still depend on $s$ ex-ante since:
    • High $s \rightarrow$ high expected surplus from match ($h_H > h_L$)
    • Also affects worker’s threat point (higher job-finding rate if separated)
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• Credit Market
  • Lenders do not observe $i$ or consumption (segmented)
Unemployed Worker’s Timeline

An unemployed type $i$ worker starts with score $s$ and the period unfolds as:

- **In first subperiod:**
  - Do not work $n = 0$ so receive flow utility $z$

- **In second subperiod:**
  - Survive to next period with prob. $1 - \delta$
  - Search in labor submarket indexed by score $s$
    - Tightness $\theta(s) = \frac{v(s)}{u(s)}$ is ratio of vacancies posted in submarket $s$ to job seekers
    - Prob. of matching with employer is $f(\theta(s))$
  - Enter next period with score $s$ (since there is no income/credit activity, there is no updating)
  - Transition to type $-i$ with prob. $1 - \rho$
  - Choose next period’s productivity $h' \in \{\underline{h}, \overline{h}\}$ with cost $\phi(h' = \underline{h})$. 
Employed Worker’s Timeline

An employed worker starts with $i, h$ with score $s$ and the period unfolds as:

- **In the first subperiod:**
  - Nash bargain over wage $w$ and work $n = 1$
  - Choose credit contract from available menu: $\{(Q_j, b_j)\}_{j=1}^J$
    - Credit market contracts are endogenous, see paper for details.
  - Consume $c_1 = Q_j$

- **In the second subperiod:**
  - Receive $w$
  - Draw unobservable, iid expenditure (e.g. med) shock $\tau$
  - Make default choice, $d \in \{0, 1\}$
    - Defaulters pay $\epsilon$ legal fees in $t+1$
  - Consume $c_2 = w - (1-d)(b + \tau)$
  - Survive to next period with prob. $1 - \delta$, remain employed with prob. $1 - \sigma$, and transition to other type with prob $1 - \rho$.
  - Choose next period’s productivity $h' \in \{h, \bar{h}\}$ with cost $\phi(h' = h)$.
  - Enter next period with updated score $s'_d(s)$
Firm’s Timeline

For firm without a worker:

- Post vacancy in $s$—submarket of their choice at cost $\kappa$
- Fill job with probability $q(\theta(s))$ per vacancy

For firm with a type $i$ worker

- Bargain over wage $w_i$ and employ worker in first subperiod
- Receive output $h_i$ and pay worker $w_i$ in second subperiod.
- Retain worker with prob. $(1 - \sigma)(1 - \delta)$
We now describe a steady-state equilibrium, which consists of:

- Value functions for workers $W_i(s), U_i(s)$
- Default choices for workers, $\tau_i^*(b, s)$
- Credit contracts $\{(Q_i^*(s), b_i^*(s))\}_{i \in \{L, H\}}$ which maximize $H$-type utility s.t. lender and $L$-type participation, and incentive compatibility.
- Firm value functions $J_i(s)$
- Market tightness $\theta^*(s)$ satisfies free entry
- Wages $w_i^*(s)$ satisfy Nash bargaining
- Scoring functions $s'_d(s)$ satisfy Bayes’ Rule
- Stationary cross-sectional distributions $\mu_{i,n}^*(s)$ conditional on employment status $n \in \{0, 1\}$. 

Equilibrium
Functional Forms, Fit

Monthly model. Exp. shocks $\tau$: $F(\tau) = 1 - e^{-\gamma \tau}$. Matching function: $f(\theta) = \theta^\alpha$.

**Table: Model Fit**

<table>
<thead>
<tr>
<th>Moment</th>
<th>Data Value</th>
<th>Model Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Super Prime CC Rate, top 49%</td>
<td>0.87%</td>
<td>0.84%</td>
</tr>
<tr>
<td>Prime CC Rate, 34 – 50%</td>
<td>1.17%</td>
<td>1.19%</td>
</tr>
<tr>
<td>Sub-Prime CC Rate, 0 – 33%</td>
<td>1.60%</td>
<td>1.61%</td>
</tr>
<tr>
<td>Debt to Labor Income</td>
<td>21.24%</td>
<td>21.23%</td>
</tr>
<tr>
<td>Delinq. Rate</td>
<td>0.95%</td>
<td>0.96%</td>
</tr>
<tr>
<td>Residual Earnings 50 – 10</td>
<td>0.57</td>
<td>0.57</td>
</tr>
<tr>
<td>Monthly Job Finding Rate</td>
<td>45.0%</td>
<td>45.0%</td>
</tr>
<tr>
<td>Persistence of Super Prime Status</td>
<td>85%</td>
<td>87%</td>
</tr>
</tbody>
</table>

Note: Appendix 2 has definitions of model moments.
Cross-sectional distribution of scores

Unconditional Histogram

• Unconditional shares from CFPB (on lhs) with default probabilities in black.
• Type conditional distribution (on rhs) is unobservable.
• Most low-type borrowers are subprime and vice versa.
• Score drops due to default.
• Little info from repayment in our calibration.
Covariance of Earnings and Scores

- Calibrated model features an untargeted $COV(w, s) > 0$.
- Occurs for two reasons
  - More productive workers have higher scores ($COV$ Across Type)
  - Conditional on productivity, workers get larger share of surplus as score rises ($COV$ Within Type)
- Covariance decomposition by type $i$:
  \[
  COV(w, s) = COV\left(\mathbb{E}[w|i], \mathbb{E}[s|i]\right) + \mathbb{E}\left[COV(w, s|i)\right]
  \]
- Our calibration: Across accounts for 98.5% of Total
- While we do not have wage data, small within component is comparable to existing empirical evidence.
• Job finding rates \( f(\theta(s)) \) are increasing in score.
• But (higher) lower than full info for (low) high types.
Wage Losses From Default

- Many models have reduced form wage loss from default (e.g. CCNR (2007) has 1.9%).
- This is endogenous in our model

**Table:** EPDV Wage Losses, Amortized Over 10 Years

<table>
<thead>
<tr>
<th></th>
<th>Employed</th>
<th>Unemployed</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>High types ($\beta_H$)</td>
<td>1.32%</td>
<td>1.75%</td>
<td>1.34%</td>
</tr>
<tr>
<td>Low types ($\beta_L$)</td>
<td>0.31%</td>
<td>0.48%</td>
<td>0.32%</td>
</tr>
<tr>
<td>Overall</td>
<td>0.97%</td>
<td>1.25%</td>
<td>0.89%</td>
</tr>
</tbody>
</table>
• 10 day longer duration for bottom 10%, 19 days for 1%.
• Context: Card & Levine (2000) estimate one week longer unemployment duration from 13 week benefit extension.
PECS Ban

We now imagine that vacancies cannot condition on type score.

- Credit market unchanged

- Post-match wages still depend on score:
  - Match surplus depends on score through credit
  - As does worker’s threat point

- Now only one labor market tightness determined by free entry:

  \[ \kappa = R^{-1} q(\theta) \mathbb{E}[J_i(s)] \]

- Instead of, \( \forall s \):

  \[ \kappa = R^{-1} q(\theta(s)) \mathbb{E}[J_i(s)|s] \]
Aggregate Effects of Ban

Table: Labor and Credit Market Effects of Employer Credit Ban

<table>
<thead>
<tr>
<th>Moment</th>
<th>Baseline</th>
<th>After Ban</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median Job Finding Rate</td>
<td>47.0%</td>
<td>45.7%</td>
</tr>
<tr>
<td>Average Labor Prod.</td>
<td>81.4</td>
<td>81.3</td>
</tr>
<tr>
<td>Default Rate</td>
<td>0.96%</td>
<td>1.16%</td>
</tr>
<tr>
<td>Average CC Rate</td>
<td>1.16%</td>
<td>1.24%</td>
</tr>
<tr>
<td>Average Debt to Income</td>
<td>21.34%</td>
<td>17.40%</td>
</tr>
<tr>
<td>Unemployment Rate</td>
<td>5.88%</td>
<td>5.80%</td>
</tr>
</tbody>
</table>

- Finding rate at median unemployed score falls.
  - Falls (rises) for high (low) productivity
- Higher finding rate for low productivity → less productive composition of labor force
- Less incentive to repay → higher default rates, less lending
- Unemp. falls: Wage changes imply higher profits on average generating higher average tightness.
Poverty Trap Elimination

- Duration declines by 27% for bottom 20% of scores $p^2_{HU}$
- Friedberg, et al. (2017) estimate 25% for financially distressed
- Nonetheless, increased duration for most $\beta_H$ types $> p^2_{HU}$.
Reduced Matching Efficiency

- Most high types finding rates fall, most low types rise, both farther from efficient (FI).
- Average reduction in efficiency is 3.4%.  

\[
\begin{align*}
&\text{Private Info} \\
&\text{Full Info, } \delta_L \\
&\text{Full Info, } \delta_H \\
&\text{Without Credit Checks}
\end{align*}
\]
Effect of Ban: Welfare

• How much would a person be willing to pay to implement the ban (+) or keep the ban from being implemented (-)?
• Reported in consumption equivalent units, averaged over scores by type and employment.

Table: Welfare Effects of Banning PECS

<table>
<thead>
<tr>
<th></th>
<th>High-Type</th>
<th>Low-Type</th>
<th>Ex Ante</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employed</td>
<td>-0.61%</td>
<td>0.38%</td>
<td></td>
</tr>
<tr>
<td>Unemployed</td>
<td>-0.74%</td>
<td>3.70%</td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>-0.62%</td>
<td>0.59%</td>
<td>-0.09%</td>
</tr>
</tbody>
</table>

• Linear utility → no losses from consumption volatility. Larger welfare losses with curvature.
Concluding Remarks

- Important distributional effects of ban on PECS (i.e. constraining information across markets).
  - Target population - subprime unemployed - see big gains in finding rates and welfare.
  - However, prime and superprime employed see drops in finding rates and welfare.

- Repayment incentives weakened for all (default rates rise). Credit market screening (separation) weakened.

- Large heterogeneity of welfare effects, even though ex-ante effect is small (−0.1%).

- Only 43% of workers favor the ban, though losers suffer little and winners gain big.
Appendix: Credit Score From Type Score

Our score is the probability that the household is high type. This can be related to realistic credit scores in equilibrium by:

\[ \tilde{s}(s) = sG_0\left(\tau_H^*(b_H^*(s), \bar{h}, s)\right) + (1 - s)G_0\left(\tau_L^*(b_L^*(s), h, s)\right) \] (1)

Which is the equilibrium probability of repayment.
Appendix: Definition of Model Averages

We use the stationary distribution to compute means. For variable $x$:

\[
\bar{x} = \int_0^1 \sum_{i \in \{L,H\}} \sum_{\ell \in \{U,E\}} x_{i\ell}(s) d\mu^*_{i\ell}(s)
\]

\[
\bar{x}_i = \frac{\int_0^1 \sum_{\ell \in \{U,E\}} x_{i\ell}(s) d\mu^*_{i\ell}(s)}{\sum_{\ell} \mu^*_{i\ell}(1)}
\]

\[
\bar{x}_\ell = \frac{\int_0^1 \sum_{i \in \{U,E\}} x_{i\ell}(s) d\mu^*_{i\ell}(s)}{\sum_i \mu^*_{i\ell}(1)}
\]
Appendix: Percentiles

We reference percentiles of the score distribution. For unconditional percentiles we use:

$$\mu^*(s) \equiv \sum_{i \in \{L,H\}} \sum_{\ell \in \{U,E\}} \mu^*_{i\ell}(s)$$

And to find the score $p^x$ which is above fraction $x$ of the population’s score:

$$x = \mu^*(p^x)$$
Appendix: Consumption Equivalent Welfare

Denoting $W^{nc}$ and $U^{nc}$ as the value functions without employer credit checks, we define $\gamma_{i\ell}(s)$ by:

\[
W_{ih_i^*}(s)[1 + \gamma_i E(s)] = W^{nc}_{ih_i^*}(s)
\]
\[
U_{ih_i^*}(s)[1 + \gamma_i U(s)] = U^{nc}_{ih_i^*}(s)
\]

Note: $\gamma_{i\ell}(s) > 0 \rightarrow$ worker would pay to switch (gains from ban).
Contract Determination: Cross Subsidizing

For high $s$, “cross-subsidizing” contracts.
Properties:

- Optimal contract never distorts $b_L$
  - $MRS_L = MRT_L + \text{linearity} \rightarrow b_L \text{ ind. of } Q_L$

- Cross-subsidizing: fix $b_L$, choose $Q_L \geq \text{LCS value}$

- Increasing $Q_L$ trade off:
  - Reduces $Q_H$ relative to $R^{-1} G(\tau^*_H(b_H, s)) b_H$
  - Allows higher value of $b_H$ (less distortion)

- Survives cream-skimming due to withdrawal round of game
Moral Hazard Interpretation

- End of period, worker decides whether to invest in human capital for next period.
- Investing costs $\phi$ utils, delivers $h_H$ human capital instead of $h_L < h_H$ at the beginning of next period.
- $H$ types choose $h_H$ and $L$ types choose $h_L$ provided:

$$-\phi + \beta_H (1 - \delta) W_H(s) \geq \beta_H (1 - \delta) W_H^d(s; h_L)$$

$$\iff \beta_H (1 - \delta) \left[ W_H(s) - W_H^d(s; h_L) \right] \geq \phi$$

$$\beta_L (1 - \delta) W_L(s) \geq -\phi + \beta_L (1 - \delta) W_L^d(s; h_H)$$

$$\iff \beta_L (1 - \delta) \left[ W_L^d(s; h_H) - W_L(s) \right] \leq \phi$$
Gains From Investing in Human Capital
What Are Effects of PECS Ban?

• Quarterly vacancy data from Conference Board Help Wanted Online Index.

• Panel regression, $c$ county, $o$ occupation, $t$ quarter, $v_{c,o,t}$ vacancies

$$\log \text{vacancies}_{c,o,t} = \sum_{k=-4}^{5} \beta_{o}^{c} \text{BAN}_{c,o,t-k} + F_{E,t} + F_{E_{c,o}} + \epsilon_{c,o,t},$$

• $\text{Ban}_{c,o,t-k} = 1$ in the period $k$ quarters before county $c$ implements a PECS ban.
  
  • $\hat{\beta}_{t-k}^{o} = 0$ for both exempt and nonexempt (i.e. no pretrends)
  
  • $\text{Ban}_{c,o,t+k} = 1$ in the period $k$ quarters after county $c$ implements an PECS ban in the affected occupation.
    
    • $\hat{\beta}_{t+k}^{o} = 0$ for exempt, $\hat{\beta}_{t+k}^{o} < 0$ for non exempt (i.e. fall in vacancies for occupations affected by ban)
We define inefficiency as:

\[ \mathcal{E} = \mathbb{E}_{HU} \left[ |f(\theta(s)) - f^F_H| \right] + \mathbb{E}_{LU} \left[ |f((\theta(s)) - f^F_L| \right] \]

- Since Hosios condition holds, full info implies \( \mathcal{E}^{FI} = 0 \).

- For the baseline calibration, \( \mathcal{E}^B = 2.72\% \).
  - Average finding rate is 2.72\% above/below efficient.

- For the no-check equilibrium, \( \mathcal{E}^{NC} = 6.1\% \).
  - Ban makes labor market 2.3 times less efficient than baseline case.
Some Relevant Literature


- With AS, reputation in one market can help incentivize another market.
  - Cole and Kehoe (1998, IER) Exogenous utility loss in labor market can incentivize sovereigns not to default.
  - Chatterjee, et. al. (2008, JET) Endogenous reputation costs in insurance market can help incentivize households not to default.


Worker Decisions

Second subperiod default choice \( (d) \) given \( b, \tau \):

\[
\max_{d \in \{0, 1\}} \beta_i (1 - \delta) \left[ V_i(s'_d(s)) - \psi d \epsilon \right] - (1 - d)(b + \tau)
\]  

(2)

where

\[
V_i(s'_d) = \left[ (1 - \sigma) W_i(s'_d) + \sigma U_i(s'_d) \right].
\]  

(3)

This implies a (strategic) default decision rule:

\[
d = 1 \iff \tau > \tau^*_i(b, s) = \beta_i (1 - \delta) \left[ \psi \epsilon + V_i(s'_0(s)) - V_i(s'_1(s)) \right] - b
\]  

(4)

For given \( V_i(s'_d) \) and \( b \), higher \( \beta \rightarrow \) higher \( \tau^* \) (lower default prob)
For given \( V_i(s'_d) \) and \( \beta \), higher \( b \rightarrow \) lower \( \tau^* \) (higher default prob)
Costs of Default

Figure: Endogenous Costs of Default (Relative to Exogenous)

Endogenous costs $V_i(s'_0(s)) - V_i(s'_1(s))$ vary with $s$. Level and shape depends on $\beta_i$ since $\beta_L < \beta_H$. 

back
Firm Profit Effects

High Type Profits By Credit Rating

- Ban lowers (raises) profits from employing low (high) score workers of given type
Lender Profits

- Lender’s expected discounted profit on contract \((Q, b)\) for a given \(s\) and borrower type \(i\):

\[
P_i(s; Q, b) = -Q + R^{-1} F(\tau_i^*(b, s)) b
\]

- Lender gives worker credit \(Q\) at beginning of month in return for payment \(b\) at end of month provided she does not default (which happens with probability \(F(\tau_i^*)\)).

- Since low types more likely to default, \(\tau_L^* < \tau_H^*\) which means lender charges workers who are more likely to default a higher interest rate.
Credit Contract Determination

Netzer and Scheuer: for \( k \approx 0 \), unique SPE solves:

\[
\max_{Q_H, b_H, Q_L, b_L} Q_H + \psi \int_0^{\tau_H^*(b; s)} F(\tau) d\tau, \text{s.t. :}
\]

\[
sP_H(Q_H, b_H; s) + (1 - s) P_L(Q_L, b_L; s) \geq 0 \tag{6}
\]

\[
Q_L + \psi \int_0^{\tau_L^*(b_L; s)} F(\tau) d\tau \geq Q_H + \psi \int_0^{\tau_H^*(b_H; s)} F(\tau) d\tau \tag{7}
\]

\[
Q_H + \psi \int_0^{\tau_H^*(b_H; s)} F(\tau) d\tau \geq Q_L + \psi \int_0^{\tau_L^*(b_L; s)} F(\tau) d\tau \tag{8}
\]

\[
Q_L + \psi \int_0^{\tau_L^*(b_L; s)} F(\tau) d\tau \tag{9}
\]

\[
\geq \max_{b} R^{-1} F(\tau_L^*(b; s)) b_L + \psi \int_0^{\tau_L^*(b; s)} F(\tau) d\tau
\]

Condition (6) is lender participation. (7) and (8) are IC’s, (9) says high-risk must get at least LCS utility.
Credit Contract Determination: Full Info

High types get more credit at lower rates than low
→ Full info allocation not incentive compatible
LCS contract (10,11,13 bind): tight constraint on H borrowing. Optimal for low scores (s < 0.3 i.e. mostly L borrowers).
Contract Determination: Cross Subsidized Separating

Survives cream skimming due to withdrawal round of game. Increases credit to L and reduces distortion on H (10,11 bind). Optimal for intermediate scores (0.3 ≤ s ≤ 0.4 in calibration).
CSS contract may be too generous to L borrower, causing H IC (12) to bind along with (10,11) → pooling. Holds for $s > 0.4$ in calibration (almost all H borrowers are in pooling contracts).
Score Updating

The Bayesian updating function is given by:

\[
s_d'(s) = \frac{\rho F_d\left(\tau^*_H(s, b^*_H(s))\right) s + (1 - \rho) F_d\left(\tau^*_L(s, b^*_L(s))\right)(1 - s)}{F_d\left(\tau^*_H(s, b^*_H(s))\right) s + F_d\left(\tau^*_L(s, b^*_L(s))\right)(1 - s)},
\]

where \( F_0(\tau) = F(\tau) \) and \( F_1(\tau) = 1 - F(\tau) \)

- \( s'_0(s) \geq s'_1(s) \) (score updates higher upon repayment than default)
- Credit score given by

\[
Pr(d = 0 | s) = F_0\left(\tau^*_H(s, b^*_H(s))\right) s + F_0\left(\tau^*_L(s, b^*_L(s))\right)(1 - s).
\]
Stationary Distributions $\mu_{i,n}(s)$

- Maps current number of people of type $i$ and employment status $n$ with score below $s$ into future number using equilibrium contracts, default decisions, and shocks.

- Suppose $\rho = 1$ (messier otherwise), then for employed we have:

$$
\mu'_{i,1}(s') = (1 - \delta) \int_0^{s'} f(\theta(s)) d\mu_{i,0}(s)
$$

$$
+ (1 - \delta)(1 - \sigma) \int_0^1 \left\{ \mathbb{I}_{s'_0(s) \leq s'} F_0(\tau^*_i(s, b^*_i(s))) \right\} d\mu_{i,1}(s)
$$

$$
+ \mathbb{I}_{s'_1(s) \leq s'} F_1(\tau^*_i(s, b^*_i(s))) d\mu_{i,1}(s)
$$

- Similar for unemployed (see paper)
Definition of Wage Loss From Default

- Take employed of type $i$ with score $s$
- Calculate expected discounted sum of future wages for $s'_0(s)$ and $s'_1(s)$ using $R$ to discount
- Amortize difference over 120 periods (10 yr)
- Report as % of average wage
Calculating Wage Loss From Default

Present value of wages for employed \((n = 1)\) and unemployed \((n = 0)\)

\[
\mathcal{W}_i^1(s) = w_i^*(s) + (1 - \delta)R^{-1}\mathbb{E}\left[ (1 - \sigma)\mathcal{W}_i^1(s') + \sigma\mathcal{W}_i^0(s') | s \right]
\]

\[
\mathcal{W}_i^0(s) = 0 + (1 - \delta)R^{-1}\left[ f(\theta(s))\mathcal{W}_i^1(s) + [1 - f(\theta(s))]\mathcal{W}_i^0(s) \right]
\]

And use these to calculate present value of losses from default for \(n \in \{0, 1\}\):

\[
LOSS_i^n(s) = (1 - \delta)R^{-1}\left[ \mathcal{W}_i^n(s'_0(s)) - \mathcal{W}_i^n(s'_1(s)) \right]
\]

Amortize using \(R\) and report averages.
Worker Indirect Utility

- Given cutoff default rule on contract \((Q, b)\), after integrating by parts indirect utility given by:

\[
W_i(s; Q, b) = Q + \psi \int_0^{\tau_i^*(b,s)} F(\tau) d\tau + \psi w + \beta_i(1 - \delta) \left[ V_i(s_1') - \psi \epsilon \right]
\]  

which is increasing in \(Q\) and decreasing in \(b\).

- Can show single-crossing property on MRS with \(MRS_H > MRS_L\) (i.e. slopes of type indifference curves).

- Evaluating at \(Q_i^*(s), b_i^*(s)\) gives \(W_i(s)\).
Firm Value and Wage Determination

• Firms know $i$ and $h$, but $s$ still relevant since it affects outside option when bargaining:

$$J_i(s; w) = h_i^* - w + R^{-1}(1-\sigma)(1-\delta)\mathbb{E}\left[J_i(s_d'(s); w^*(s_d'(s))\right]|i, s$$

• Given full info and linearity in wages, Nash Bargaining (with worker weight $\lambda$) yields:

$$w^*_i(s) = \arg\max_w \left[W_i(s; w) - U_i(s)\right]^\lambda J_i(s; w)^{1-\lambda}$$

(12)

• Free entry $\forall s \in [0, 1]$ pins down $\theta^*(s)$:

$$\kappa = q(\theta^*(s)) R^{-1}\left\{sJ_H(s; w^*_H(s)) + (1 - s)J_L(s; w^*_L(s))\right\}$$
Model Fit: Interest Rates

Monthly Interest Rates (%) By Credit Rating

- **Sub Prime** (0-33%)
- **Prime** (34-50%)
- **Super Prime** (51-100%)

- Blue: Model
- Red: Data
Understanding Decomposition In Calibrated Model

- **Total covariance:**
  - Avg. Prime earnings 20.4% higher than Sub Prime
  - Avg. Super Prime 34.4% higher than Prime
- **Within covariance:**
  - Cond. on type, Super prime earnings 1% $>_{subprime}$
- Within covariance is 1.5% of total
Empirical Total Covariance

- 2016 Survey of Consumer Finances asks credit questions:
  - Q1: Have you been late on payments in past year?
  - Q2: Have you been more than 60 day late?
  - Q3: Have you been turned down for credit in past year?

- Cross-sectional regression of person-\( j \) residual earnings on adverse credit events

\[
y_j = \beta_1 Q1_j + \beta_2 Q2_j + \beta_3 Q3_j + \text{controls}_j + \varepsilon_j
\]

- Controls include tenure, tenure^2, and fixed effects for education, occupation, industry, race, and sex
Empirical Covariance Decomposition

- Large negative cov. between adverse credit and resid. earnings (s.e. in parenthesis)

\[ y_j = -13.6Q1_j -12.7 Q2_j -10.4 Q3_j + \text{controls}_j + \varepsilon_j \]

\[ R^2=0.33 \]

- Sum of coeff. proxy for large difference in credit score
  - Total covariance of 36.7%

- Herkenhoff, Phillips, & Cohen-Cole (2016) find approx 1% rise in individual earnings following bankruptcy removal
  - Large increase in credit score
  - Small increase in individual’s earnings

- Suggests Within is small share of Total covariance
  - Large total covariance, small within → large across
Empirical Total Covariance

- Large and negative association between adverse credit event and resid. earnings

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All regressions include age, age² and FE for education, occupation, industry, race, and sex. Absolute value of robust t-statistics in parenthesis. \( N = 4451. \)
Untargeted Moments: Debt Shares

- Pooling contracts for high $s$ deliver realistic debt shares (LCS would generate counterfactually low shares).
Effect of Ban: Interest Rates

With Ban, future score less important, weakening punishment (raising default incentives).
Consistent with Cortes, et al: ↑ delinq. post ban.
Effect of Ban: Welfare of Unemployed

Low-score $\beta_L$ gains big relative to high-score $\beta_H$ loss. Median unemployed loses.
Effect of Ban: Welfare of Employed

Welfare Effects of Ban, Employed

Median employed loses.
Existence of Private Info Benchmark Equilibrium

**Theorem**

*Under certain additional assumptions (see paper), there exists a private information steady-state Markov equilibrium.*

- We define a continuous operator over a Lipschitz space of functions that maps into the same space with the same Lipschitz constants and apply Schauder’s fixed point theorem.
- In practice need sufficiently large variance of expenditure shocks so that slope of scoring function doesn’t explode.
Wage/Profits Effects of Ban Across Ratings

Unemp. falls: lower threat point for high-score workers
• Default is less informative of type after labor market ban (credit market punishment weakened).

• Less separation of types by credit rating: rise in share of subprime high types, fall in share of super prime high types.
**Value Functions**

- **Unemployed workers have value:**

\[ U_i(s) = z + (1 - \delta) \beta_i \left[ f(\theta(s)) W_i(s) + \left(1 - f(\theta(s))\right) U_i(s) \right] \]

where

\[
W_i(s) = \rho W_i^*(s) + (1 - \rho) W_{-i}(s),
\]

\[
U_i(s) = \rho U_i^*(s) + (1 - \rho) U_{-i}(s).
\]

- **Employed workers have value:**

\[
W_i(Q, b, w, s) = Q + \psi w + \psi \int_{0}^{\infty} \max_d \left[ \beta_i (1 - \delta) \left( V_i(s_d') - d\psi \epsilon \right) - (1 - d)(b + \tau) \right] dF(\tau),
\]

where

\[
V_i(s_d') = \left[ (1 - \sigma) W_i(s_d') + \sigma U_i(s_d') \right].
\]
Effect of Ban: Welfare

-4
-2
0
2
4
6
8
% of Monthly Consumption
High Unemployed
Low Unemployed
High Employed
Low Employed

More Welfare