Can Credit Market Signalling Improve Labor Market Outcomes?

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Question

- Spence’s (1973) Question: Can observable education choices help separate workers with unobservable productivity differences?

- There is increasing use of credit checks by employers. According to the Survey by the Society for Human Resource Management
  - 25% in 1998.
  - 43% in 2004.

- Our Question: Can observable credit market choices help with separation in the labor market?
Motivation

Environment

Equilibrium

Examples

Intuition

- Observable education choices may not perfectly reveal agents’ productivity if there are many unobservable labor productivity types.
- Observable borrowing and default decisions may be correlated with unobservable worker productivity.
- If firms include credit market decisions in their information set, they may be better able to separate workers.
- Bottom line: If there are more unobservable types than observable signals in one market, look to other markets to try to separate agents.
Implications

- Some incomplete markets models with endogenous default use “stigma” in order to keep households from always defaulting.
- If employers use bad credit as a separating device, the implications of a household’s asset market decisions has a big impact on future earnings (i.e. we don’t need stigma).
“Your advertisement for cashiers nets 100 applications. You want credit reports on each applicant. You plan to eliminate those with poor credit histories. What are your obligations?”

“As an employer, you may use consumer reports when you hire new employees and when you evaluate employees for promotion, reassignment, and retention as long as you comply with the Fair Credit Reporting Act (FCRA).”

FCRA requires written authorization from the consumer before credit checks.

Additional State Variation: WA and HI prohibit credit checks for employment screening.

The Equal Employment for All Act (currently in committee) would prohibit the use of consumer credit checks for the purpose of making employment decisions.
Credit Reporting Companies

- Equifax Persona, Experian Employment Insight, TransUnion PEER

- Information in the report includes
  - Personal: SSN, names, addresses
  - Employment: previous work history
  - Public record: on bankruptcies, liens and judgments
  - Credit history
Related Literature - We need help here

- Spence (1973 QJE): 2 types and discrete education choice can perfectly separate agents.
  - Show that relaxing credit market constraints can increase income inequality using Spence’s signalling model.
  - When borrowing for education is difficult, lack of a college education could mean that one is either of low ability or of high ability but with low financial resources.
  - When government programs make borrowing or lower tuition more affordable, high-ability persons become educated and leave the uneducated pool, driving down the wage for unskilled workers and raising the skill premium.
- HSW don’t allow employers to condition on credit market info.
Outline

- Environment
- Full Info Example
- Private Info Examples
  - 2 unobservable types, 2 education choices - perfect separation
  - 3 unobservable types, 2 education choices - partial pooling
  - 3 unobservable types, but add observable credit market choices - perfect separation
  - credit market observations alone yields pooling unless there are type specific costs to access credit markets.
- Welfare implications of restricting credit market observations by employers.
Environment

- People
  - Agents live for two periods.
  - Three types of agents $i \in \{L, M, H\}$.

- Education
  - Available in first period, $h = \{0, 1\}$, with cost $\kappa_i(h)$.
  - $\kappa_i(0) = 0$ for all $i$.
  - $\kappa_L(1) > \kappa_M(1) > \kappa_H(1) > 0$.

- Preferences
  - Agents discount future at rate $\beta_i$.
  - The lifetime utility is $\log(c - \kappa_i(h)) + \beta_i \log(c')$. 

Environment - Continued

- **Production**
  - Period 1: \( y = e_i \), where \( e_L < e_M < e_H \).
  - Period 2: \( y' = e_M \) for all \( i \).

- **Employment**
  - First period wage offers depend on observable actions in the information set \( \mathcal{I} \).
  - For example, \( \mathcal{I} = \{h\} \) in the Spence model.

- **Credit markets**
  - Agents can choose assets \( a' \in A \) at risk free rate \( 1/(1 + r) \).
  - No default is allowed.
Timing

- **Period 1**
  - Choose whether to obtain costly education, \( h \in \{0, 1\} \), and make asset choice decisions, \( a' \in A \).
  - Firms make wage offers \( w(I) \).
  - Production and consumption occurs.

- **Period 2**
  - Firm makes wage offer \( w' = e_M \).
  - Production, repayment if \( a' < 0 \), and consumption occurs.
Evaluating Household Outcomes

- If agent type $i$ chooses outcome $(h, a')$ under information set $\mathcal{I}$ their payoff is given by:

$$V_i(h, a'; \mathcal{I}) = \log(w(\mathcal{I}) - a'(1 + r) - \kappa_i(h)) + \beta_i \log(e_M + a')$$

- Household problem is:

$$\max \{ \max_{a'} V_i(0, a'; \mathcal{I}), \max_{a'} V_i(1, a'; \mathcal{I}) \}$$

- Suppose $\mathcal{I}$ does not include $a'$, then foc is given by:

$$a'_{h*} = \frac{\beta_i(1 + r) [w(\mathcal{I}) - \kappa_i(h)] - e_M}{1 + \beta_i}$$

- Hence asset market decisions are increasing in labor market outcomes.
Firms compete for workers simultaneously offering wages \( w(I) = E[y|I] \).

Expected productivity is given by:

\[
E[y|I] = \sum_{i=\{L,M,H\}} e_i \cdot pr(i|I)
\]

where

\[
pr(i|I) = \frac{pr(I|i)pr(i)}{pr(I|i)pr(i) + pr(I\backslash i)pr(\backslash i)}
\]

by Baye’s rule.
Assuming $A = \{-b, 0\}$ and $\beta_i = \beta$ for all $i$, parameters given by.

<table>
<thead>
<tr>
<th>$e_L$</th>
<th>$e_M$</th>
<th>$e_H$</th>
<th>$b$</th>
<th>$\beta$</th>
<th>$r$</th>
<th>$\kappa_L(1)$</th>
<th>$\kappa_M(1)$</th>
<th>$\kappa_H(1)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>1</td>
<td>1.01</td>
<td>0.3</td>
<td>0.8</td>
<td>0.1</td>
<td>0.55</td>
<td>0.25</td>
<td>0.05</td>
</tr>
</tbody>
</table>
Full info example: $\mathcal{I} = \{i\}$

- Equilibrium wage $w(i) = e_i$ for all $i$.
- Since wages don’t depend on education choice and education is costly, no one chooses $h = 1$ for any asset choice (i.e. $V_i(0, a'; \{i\}) > V_i(1, a'; \{i\})$).
- Only $i = L$ agents borrow (i.e. $V_L(0, -b; \{L\}) > V_L(0, 0; \{L\})$ and $V_i(0, 0; \{i\}) > V_i(0, -b; \{i\})$ for $i = \{M, H\}$.

Numerical example
Private Info Spence case: 2 types \((e_M = e_H)\), 2 signals \(\Rightarrow\) Perfect Separation when \(I = \{h\}\)

- Wages depend on education: \(w(0) = e_L\) and \(w(1) = e_H\).
- Agents decisions:
  - High type agents use costly education to signal their type \((h_H = 1)\) and do not borrow \((a'_H = 0)\).
  - Low type agents choose no education \((h_L = 0)\) and borrow \((a'_L = -b)\).
- Incentive compatibility conditions:
  
  \[
  V_H(1, 0, \{h\}) \geq V_H(h, a'; \{h\}), \forall a' \in A, h = \{0, 1\}
  \]
  
  \[
  V_L(0, -b, \{h\}) \geq V_L(h, a'; \{h\}), \forall a' \in A, h = \{0, 1\}
  \]

- Wage rates are consistent with agents decisions.

  \[
  w(h = 0) = e_L \cdot pr(L|h = 0) + e_H \cdot pr(H|h = 0)
  = e_L \cdot 1 + e_H \cdot 0 = e_L
  \]

  \[
  w(h = 1) = e_L \cdot pr(L|h = 1) + e_H \cdot pr(H|h = 1)
  = e_L \cdot 0 + e_H \cdot 1 = e_H
  \]
Spence cont.: Numerical example

- Wage offers are \( w(0) = 0.5, w(1) = 1.01 \).
- Agents decisions

1. For \( i = L \):

<table>
<thead>
<tr>
<th>h</th>
<th>( a' )</th>
<th>(-b)</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-0.5432</td>
<td>-0.6931</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>-0.5963</td>
<td>-0.7765</td>
<td></td>
</tr>
</tbody>
</table>

\( \Rightarrow h_L = 0 \) and \( a'_L = -b \)

2. For \( i = H \):

<table>
<thead>
<tr>
<th>h</th>
<th>( a' )</th>
<th>(-b)</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-0.5432</td>
<td>-0.6931</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>-0.0761</td>
<td>-0.0408</td>
<td></td>
</tr>
</tbody>
</table>

\( \Rightarrow h_H = 1 \) and \( a'_H = 0 \)
Private Info case: 3 types, 2 signals
\[ \Rightarrow \text{Partial Pooling with } \mathcal{I} = \{h\} \]

- **Wages depend on education:**
  \[
  w(0) = e_L \quad \text{and} \quad w(1) = (e_M + e_H)/2.
  \]

- **Agents’ decisions:**
  - Type \( M \) and \( H \) choose education \( h_i = 1, \ i \in \{M, H\} \) but cannot separate from each other despite different asset choices since now type \( M \) borrow to pay for education cost \( (a'_H = 0 \text{ and } a'_M = -b) \)
  - Type \( L \) choose \( (h_L = 0) \) and to borrow \( (a'_L = -b) \).

- **Incentive compatibility conditions:**
  \[
  V_H(1, 0; \{h\}) \geq V_H(h, a'; \{h\}), \ \forall a' \in A, h = \{0, 1\}
  \]
  \[
  V_M(1, -b; \{h\}) \geq V_M(h, a'; \{h\}), \ \forall a' \in A, h = \{0, 1\}
  \]
  \[
  V_L(0, -b; \{h\}) \geq V_L(h, a'; \{h\}), \ \forall a' \in A, h = \{0, 1\}
  \]

- **Wage rates are consistent with agents’ decisions.**
  \[
  w(0) = e_L \cdot pr(L|h = 0) + e_M \cdot pr(M|h = 0) + e_H \cdot pr(H|h = 0)
  \]
  \[
  = e_L \cdot 1 + e_M \cdot 0 + e_H \cdot 0 = e_L
  \]
  \[
  w(1) = e_L \cdot pr(L|h = 1) + e_M \cdot pr(M|h = 1) + e_H \cdot pr(H|h = 1)
  \]
  \[
  = e_L \cdot 0 + e_M \cdot 1/2 + e_H \cdot 1/2 = (e_M + e_H)/2
  \]
Wage offers are $w(0) = 0.5$, $w(1) = 1.005$

Agents decisions

1. For $i = L$:

<table>
<thead>
<tr>
<th></th>
<th>$a'$</th>
<th>$-b$</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>$h$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td></td>
<td>-0.5432</td>
<td>-0.6931</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>-0.6032</td>
<td>-0.7875</td>
</tr>
</tbody>
</table>

⇒ $h_L = 0$ and $a'_L = -b$

2. For $i = M$:

<table>
<thead>
<tr>
<th></th>
<th>$a'$</th>
<th>$-b$</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>$h$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td></td>
<td>-0.5432</td>
<td>-0.6931</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>-0.2580</td>
<td>-0.2810</td>
</tr>
</tbody>
</table>

⇒ $h_M = 1$ and $a'_M = -b$

3. For $i = H$:

<table>
<thead>
<tr>
<th></th>
<th>$a'$</th>
<th>$-b$</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>$h$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td></td>
<td>-0.5432</td>
<td>-0.6931</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>-0.0802</td>
<td>-0.0460</td>
</tr>
</tbody>
</table>

⇒ $h_H = 1$ and $a'_H = 0$
Private Info case: 3 types, include asset market signals
⇒ Perfect Separation with $\mathcal{I} = \{h, a'\}$

- Wages depend on both $\{h, a'\}$.

\[
    w(h, a') = \begin{cases}
        e_L, & \text{if } \{h, a'\} = \{0, -b\} \\
        e_M, & \text{if } \{h, a'\} = \{1, -b\} \\
        e_H, & \text{if } \{h, a'\} = \{1, 0\} \\
        \tilde{e}, & \text{if } \{h, a'\} = \{0, 0\}
    \end{cases}
\]

where $\tilde{e}$ represent “off-the-equilibrium path” beliefs about wages if action tuple $\{h, a'\} = \{0, 0\}$ is taken.

- For example, o-e-p belief could be $e_L$ since agent is choosing no education.
Agents’ decisions for education and asset choices:
- Type $L$ choose no education and borrow ($h_L = 0$ and $a'_L = -b$).
- Type $M$ choose to separate from $L$ through education $h_M = 1$ but prefer borrowing for consumption smoothing $a'_M = -b$.
- Type $H$ choose to separate from $L$ and $M$ through education $h_H = 0$ and no borrowing $a'_H = 0$.

Incentive compatibility conditions:

\[
V_H(1, 0; \{h, a'\}) \geq V_H(h, a'; \{h, a'\}), \quad \forall a' \in A, h = \{0, 1\}
\]
\[
V_M(1, -b; \{h, a'\}) \geq V_M(h, a'; \{h, a'\}), \quad \forall a' \in A, h = \{0, 1\}
\]
\[
V_L(0, -b; \{h, a'\}) \geq V_L(h, a'; \{h, a'\}), \quad \forall a' \in A, h = \{0, 1\}
\]
Private Info Example cont.: 3 types, include asset market

- Wages are consistent with agents’ decisions.

\[ w(1, 0) = e_L \cdot pr(L|(1, 0)) + e_M \cdot pr(M|(1, 0)) + e_H \cdot pr(H|(1, 0)) \]
\[ = e_L \cdot 0 + e_M \cdot 0 + e_H \cdot 1 = e_H \]

\[ w(1, -b) = e_L \cdot pr(L|(1, -b)) + e_M \cdot pr(M|(1, -b)) + e_H \cdot pr(H|(1, -b)) \]
\[ = e_L \cdot 0 + e_M \cdot 1 + e_H \cdot 0 = e_M \]

\[ w(0, -b) = e_L \cdot pr(L|(0, -b)) + e_M \cdot pr(M|(0, -b)) + e_H \cdot pr(H|(0, -b)) \]
\[ = e_L \cdot 1 + e_M \cdot 0 + e_H \cdot 0 = e_L \]

- Off-equilibrium-path wage \( \tilde{e} \) can be of any values such that IC conditions are satisfied. Here we assume \( \tilde{e} = e_L \).
**Private Info Example cont.: 3 types, include asset market**

- Wage offers are $w(0, -b) = 0.5$, $w(0, 0) = 0.5$, $w(1, -b) = 1$, $w(1, 0) = 1.01$.
- Agents decisions

1. For $i = L$:
   
   \[
   \begin{array}{c|cc}
   & a' & -b & 0 \\
   \hline
   h & \hline
   0 & -0.5432 & -0.6931 \\
   1 & -0.6101 & -0.7765 \\
   \end{array}
   \]
   
   $\Rightarrow h_L = 0$ and $a_L' = -b$

2. For $i = M$:

   \[
   \begin{array}{c|cc}
   & a' & -b & 0 \\
   \hline
   h & \hline
   0 & -0.5432 & -0.6931 \\
   1 & -0.2629 & -0.2744 \\
   \end{array}
   \]

   $\Rightarrow h_M = 1$ and $a_M' = -b$

3. For $i = H$:

   \[
   \begin{array}{c|cc}
   & a' & -b & 0 \\
   \hline
   h & \hline
   0 & -0.5432 & -0.6931 \\
   1 & -0.0843 & -0.0408 \\
   \end{array}
   \]

   $\Rightarrow h_H = 1$ and $a_H' = 0$
Social welfare

- Is the economy better off from a law which restricts employers not to use credit market information?
- Change in lifetime utilities for agents when information is restricted from \((h, a')\) to \(h\):

<table>
<thead>
<tr>
<th></th>
<th>(I)</th>
<th>((h, a'))</th>
<th>(h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(L)</td>
<td>-0.5432</td>
<td>-0.5432</td>
<td></td>
</tr>
<tr>
<td>(M)</td>
<td>-0.2629</td>
<td>-0.2580</td>
<td></td>
</tr>
<tr>
<td>(H)</td>
<td>-0.0408</td>
<td>-0.0460</td>
<td></td>
</tr>
</tbody>
</table>

- Tradeoff: Since pooling wages are \((e_M + e_H)/2\), type \(M\) hhs are better off with pooling but type \(H\) are worse off.
- Average social welfare decreases from -0.2824 to -0.2823 by restricting the use of credit market information.
Asset choices alone fail to separate agents

- If $\beta_i = \beta$, there does not exist a separating equilibrium when $\mathcal{I} = \{a'\}$ for general $A$.
- Since wage offers do not depend on education and education acquisition is costly, $h_i = 0 \ \forall i$ is strictly dominant.
- Given any wage function $w(a')$, type $i$ agents choose $a'$ to maximize $V_i(0, a')$ or
  $$\max_{a' \in A} \log(w(a') - a'/(1 + r)) + \beta \log(e_M + a')$$

- The foc are identical across types (i.e. you don’t see $i$ anywhere since $\kappa_i(h) \cdot 0$). Thus every agent makes the same asset choice $\Rightarrow$ asset choice alone in the information set fails to generate a separating equilibrium.
### Numerical example for full info

#### Agent decisions:

1. **For \( i = L \),**
   - \( h_L = 0 \) and \( a_L' = -b \)
   - Table:
     - \( h \) | \( a' \) | \(-b\) | 0
     - 0  | -0.5432 | -0.6931 | (\( c < 0 \))
     - 1  | -1.7871 |

2. **For \( i = M \),**
   - \( h_M = 0 \) and \( a_M' = 0 \)
   - Table:
     - \( h \) | \( a' \) | \(-b\) | 0
     - 0  | -0.0442 | 0.0000 |
     - 1  | -0.2629 | -0.2877 |

3. **For \( i = H \),**
   - \( h_H = 0 \) and \( a_H' = 0 \)
   - Table:
     - \( h \) | \( a' \) | \(-b\) | 0
     - 0  | -0.0364 | 0.0100 |
     - 1  | -0.0761 | -0.0408 |