Aggregate Unemployment and Household Unsecured Credit

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What this paper is about

Broad Question:

How do credit frictions influence the aggregate labor market?

- Empirical evidence that credit to households matters for employment changes, through consumer spending.

- Household unsecured credit
  - tripled from 1978 to 2008 (10% of annual consumption)
What we do

Objective:

1. Provide a model that links:

   • labor market
   
   • goods market
   
   • household unsecured credit
What we do

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- labor market: Mortensen-Pissarides
- goods market
- household unsecured credit
What we do

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What we do

Objective:

1 Provide a model that links:

- labor market: Mortensen-Pissarides
- household unsecured credit: Kehoe-Levine (1993)
What we do

Objective:

② Calibrate: How much of the decline in unemployment can be accounted for by the expansion of unsecured debt?

- Unsecured debt = revolving debt outstanding / consumption
What we do

Objective:

2. Calibrate: How much of the decline in unemployment can be accounted for by the expansion of unsecured debt?

- Unsecured debt = revolving debt outstanding / consumption
- Liquid assets = M2 + treasuries / total assets
What we do

Objective:

Calibrate: How much of the decline in unemployment can be accounted for by the expansion of unsecured debt?

- Unsecured debt = revolving debt outstanding / annual consumption
- Liquid assets = M2 + treasuries / total assets
Key Mechanism

1. Credit affects job creation through firm productivity
   - higher credit limits and more borrowing increase firm’s expected revenue from trade in the goods market

2. (Aggregate) unemployment affects credit limit through incentive constraints
   - low unemployment leads to more sellers in the goods market, more costly for the household to default
Literature

Unemployment & Money


Unemployment & Firm Financial Frictions


Credit, Limited Commitment & Incentive Constrained Debt


What’s new:

1. consider labor, credit, and goods markets together.
2. credit is to households; limited commitment
3. punishment from default is not autarky, can still use liquid assets
Environment

- Discrete time, infinite horizon, $\beta = \frac{1}{1+r}$

- Agents
  - Unit measure of households
  - Large measure of firms

- Each period is divided into 3 sub-periods
  1. Frictional Labor Market (LM)
     - matching of workers and firms
  2. Decentralized Retail Market (DM)
     - households and firms meet, trade $y_t$ for assets or debt
  3. Centralized Settlement (CM)
     - consume/produce general good $c_t$, pay back debt
Households

- Quasi-linear Utility

\[ E \sum_{t=0}^{\infty} \beta^t [\ell(1 - e_t) + \nu(y_t) + c_t] \]

- LM value of leisure, \( \ell \); employment status: \( e_t \in \{0, 1\} \)
- DM consumption good: \( y_t \)
- CM consumption good: \( c_t \)

- Assets (numeraire) are storable: \( a_t \)
  - storage technology, \( Ra_t \), with \( R < 1 + r \)
  - fraction \( \nu \) can be used for payment in DM (partially liquid)
Firms

- Firms enter labor market at cost: $k$

- Production of firm/worker match: $\bar{z}$
  - firm sell $y_t \in [0, \bar{z}]$ in DM
  - inventories $x_t = \bar{z} - y_t$ in CM

- Exogenous separation rate: $\delta$
Frictions

- Labor market
  - matching rate of workers and job openings: $m(u_t, o_t)$
  - labor market tightness: $\theta_t = o_t / u_t$

- DM Goods Market
  - all households search
  - sellers are the measure of filled (productive) firms: $n_t = 1 - u_t$
  - matching: $\alpha(n_t)$

- Lack of commitment to repay debt in CM
  - Incentive constrained debt (no equilibrium default)
  - Monitoring technology
    - $\omega$ fraction of households monitored
    - $\rho$ probability that default is recorded publicly
Timing

Labor Market (LM)

- matching
- wage bargaining

Retail Market (DM)

- matching
- terms of trade \((y, \tau, d)\)

Settlement (CM)

- wage payment
- debt payment
- asset accumulation

job separation
Equilibrium

- Focus on steady state equilibria
- Upon a recorded default, household loses access to credit
- Solution approach: solve backward
  1. CM problem
  2. Trade in DM
  3. Labor market outcomes
Household with debt $d$, assets $a$, and no default record

$$W_e(d, a) = \max_{c, a' \geq 0} \{c + (1 - e)\ell + \beta U_e(a')\}$$

s.t. \quad c + d + a' = ew + (1 - e)b + Ra + \Delta
CM Decision Problem

- Household with debt $d$, assets $a$, and no default record

$$W_e(d, a) = Ra - d + ew + (1 - e)(\ell + b) + \Delta + \max_{a' \geq 0} \left[ -a' + \beta U_e(a') \right]$$

- Linear in wealth
- Independent of current assets

- Firm with $x$ inventories, $d$ units of debt, $a$ assets, and $w$ wage promises

$$\Pi(x, d, a, w) = x + d + Ra - w + \beta(1 - \delta)J$$

- Total revenue
- Wages
- Value next LM
CM Decision Problem

- Household with debt $d$, assets $a$, and no default record

$$W_e(d, a) = Ra - d + ew + (1 - e)(\ell + b) + \Delta + \max_{a' \geq 0} \left[ -a' + \beta U_e(a') \right]$$

linear in wealth

independent of current assets

- those with no access to credit

$$\tilde{W}_e(a) = Ra + ew + (1 - e)(\ell + b) + \Delta + \max_{a' \geq 0} \left\{ -a' + \beta \tilde{U}_e(a') \right\}$$
CM Decision Problem

- Household with debt $d$, assets $a$, and no default record

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$$\Pi(x, d, a, w) = x + d + Ra - w + \beta (1 - \delta) J$$

  total revenue

  wages

  value next LM
Terms of trade in DM

• Contract is a triple \((y, \tau, d)\)
  - \(y\): DM output transferred to household
  - \(\tau\): transfer of liquid assets to firm
  - \(d\): unsecured credit

• Proportional bargaining solution (Kalai)
  - \(\mu\): household’s share

• Feasibility
  - \(d \leq \bar{d}\)
  - \(\tau \leq \nu a\)

• \(y\) is a function of household’s total payment capacity \(\bar{d} + R\nu a\)
Trade depends on household’s total payment capacity

\[ S^F = \frac{1-\mu}{\mu} S^H \]

Pareto frontier
Proportional solution

Pareto frontier
DM output depends on total payment capacity

- $y$ only depends on payment capacity $y(\bar{d} + R\nu a)$

- If payment capacity is high enough, trade $y = y^*$

- Otherwise, trade is constrained

$$ (1 - \mu)v(y) + \mu y = \bar{d} + R\nu a $$

- note: The price of one unit of DM output is

$$ 1 + \underbrace{(1 - \mu)[v(y) - y]}_{\text{average markup}}/y $$
Labor Market - Households

- Household with no default record, employment status $e \in \{0, 1\}$, assets $a$

\[
U_1(a) = \alpha(n)\mu[\nu(y) - y] + (1 - \delta)W_1(0, a) + \delta W_0(0, a)
\]

\[
U_0(a) = \alpha(n)\mu[\nu(y) - y] + pW_1(0, a) + (1 - p)W_0(0, a)
\]
Job Creation - Firms

• Value of a filled job in DM

\[ J = \frac{z - w}{1 - \beta(1 - \delta)} \]

• Productivity depends endogenously on credit limit through \( y \)

\[ z = \bar{z} + \frac{\alpha(n)}{n} (1 - \mu) \{ \omega [\nu(y) - y] + (1 - \omega) [\nu(\tilde{y}) - \tilde{y}] \} \]

• Rest is as in Mortensen-Pissarides
  - free entry \( \Rightarrow k = \beta fJ \)
  - wages are determined by Nash Bargaining
Credit affects unemployment through firm productivity

- Beveridge Curve

\[ u = \frac{\delta}{m(1, \theta) + \delta} \]

- Job creation condition

\[ \frac{(r + \delta)k}{m(\frac{1}{\theta}, 1)} + \beta\lambda\theta k = (1 - \lambda)\left\{ z - \ell - b \right\} \]

- Unemployment \( u \) is decreasing in trade \( y(\overline{d}, a) \) and \( \tilde{y}(\tilde{a}) \) through productivity.
Need to determine payment capacity

- Asset accumulation
- Debt constraint
Asset accumulation

- Given \( y(\bar{d} + R\nu a) \), households solve

\[
\max_{a \geq 0} \quad \alpha(n)\mu [v(y) - y] - (1 + r - R)a
\]

- Expected surplus

- Cost of holding \( a \)
Asset accumulation

- Given \( y(\bar{d} + R\nu a) \), households solve

\[
\max_{a \geq 0} \begin{bmatrix}
\alpha(n) \mu [v(y) - y] - (1 + r - R)a \\
\text{expected surplus} \\
\text{cost of holding } a
\end{bmatrix}
\]

- FOC

\[
\alpha(n) \mu \nu R \left[ \frac{v'(y) - 1}{(1 - \mu)v'(y) + \mu} \right] - (1 + r - R) \leq 0
\]

- Asset choice depends on \( \bar{d} \) through \( y \)
Debt Limit

- Debt limit = lifetime cost of losing access to credit

- Two components

\[ \bar{d} = \frac{\rho}{r} \left\{ \alpha(n)\mu \left[ v(y) - y \right] - \left[ v(\tilde{y}) - \tilde{y} \right] \right\} + (1 + r - R)(\bar{a} - a) = \Gamma(\bar{d}) \]

  - *net change in surplus*
  - *portfolio adjustment cost*

- Cost of losing access to credit is increasing in debt limit \( \bar{d} \)

- Forms a fixed point problem
If there is a positive debt limit, HH hold no assets
Credit and liquid assets depend positively on employment

As employment $n$ increases:

- Liquidity premium rises $\Rightarrow \tilde{a}$ increases
- Cost of default rises $\Rightarrow \tilde{d}$ increases
GE: Multiple Steady States

- Debt limit is decreasing with unemployment
- Unemployment decreasing with debt limit
- Strategic complementarity leads to multiple equilibria
  - credit and unemployment are negatively correlated across equilibria
Calibration
Calibration

- Model period is one month, $\beta = 0.997$
- **Experiment**: Consider an exogenous change in financial technology
  - change $(\omega, \rho)$ to match unsecured debt outstanding in:
    1. 1978-1986
    2. 2011
- Compare steady state unemployment
## Labor Market

- Match labor flows, unemployment, vacancy rate

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<th>Description</th>
<th>Value</th>
<th>Source/Target</th>
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<tbody>
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<td><strong>Labor Market</strong></td>
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<td><strong>Directly Match</strong></td>
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<tr>
<td>Unemployment benefits, $b$</td>
<td>0.53</td>
<td>$b = .5w$</td>
</tr>
<tr>
<td>Value of leisure, $\ell$</td>
<td>0.48</td>
<td>$b + \ell = .95w$, Hagedorn &amp; Manovskii (2008)</td>
</tr>
<tr>
<td>Elasticity of LM matching, $\eta$</td>
<td>0.50</td>
<td>Petrolongo &amp; Pissarides (2001)</td>
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<tr>
<td><strong>Jointly Match</strong></td>
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<tr>
<td>LM matching efficiency, $A$</td>
<td>0.50</td>
<td>Vacancy rate, JOLTS</td>
</tr>
<tr>
<td>LM bargaining, $\lambda$</td>
<td>0.50</td>
<td>Hosios condition</td>
</tr>
<tr>
<td>Job destruction rate, $\delta$</td>
<td>0.019</td>
<td>Unemployment rate, CPS</td>
</tr>
<tr>
<td>Vacancy cost, $k$</td>
<td>0.10</td>
<td>Job finding probability, CPS</td>
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### Credit and Goods Market

- Survey of Consumer Finance (SCF): credit & charge cards

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<td><strong>Directly Match</strong></td>
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<tr>
<td>DM production, $\bar{z}$</td>
<td>1</td>
<td>Normalization</td>
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<tr>
<td>Access to unsecured credit, $\omega$</td>
<td>0.74</td>
<td>% with at least 1 cc (SCF)</td>
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<tr>
<td>Elasticity of DM matching function, $\psi$</td>
<td>0.50</td>
<td>Equal contribution in matching</td>
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<tr>
<td>Return on Liquid Assets, $R$</td>
<td>1.0025</td>
<td>Real user cost of M2 (SL Fed.)</td>
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<tr>
<td><strong>Jointly Match</strong></td>
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<tr>
<td>Detection Rate, $\rho$</td>
<td>0.30</td>
<td>Debt financed consumption</td>
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<tr>
<td>DM matching efficiency, $\epsilon$</td>
<td>0.24</td>
<td>Average cc utilization rate</td>
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<tr>
<td>DM bargaining, $\mu$</td>
<td>0.13</td>
<td>Retail Markup 30%</td>
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<tr>
<td>Utility level parameter, $\nu_0$</td>
<td>1.42</td>
<td>M2 to consumption</td>
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<tr>
<td>Utility elasticity, $\gamma$</td>
<td>0.03</td>
<td>Elasticity of M2 to cost (0.17)</td>
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<tr>
<td>Liquidity measure, $\nu$</td>
<td>0.05</td>
<td>Middle range for coexistence</td>
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Experiment: Tighten Credit

- Consider exogenous changes in financial technology
  1. Access to unsecured credit $\omega$
  2. Monitoring technology $\rho$

- 1978-1986
  - Change $\omega$ from 73% to 65%
  - Adjust $\rho$ to match fall in unsecured credit of 16 percentage points

- 2011
  - Change $\omega$ from 73% to 68%
  - Adjust $\rho$ to match fall in unsecured credit of 5 percentage points

- Compare steady state unemployment
## Unemployment and Credit, 1978-1986

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<tr>
<td>Credit to Con., $\alpha(n)\omega \bar{d}/C$</td>
<td>0.23</td>
<td>0.07</td>
<td>-0.16</td>
<td>-0.16</td>
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<tr>
<td>M2 to Cons., $(1 - \omega)R\bar{a}/C$</td>
<td>0.74</td>
<td>0.93</td>
<td>0.19</td>
<td>0.14</td>
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<tr>
<td>Agg. productivity, $z$</td>
<td>1.07</td>
<td>1.06</td>
<td>-4.45%</td>
<td>-</td>
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<td><strong>Labor Market</strong></td>
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<tr>
<td>Unemployment rate (%)</td>
<td>5.13</td>
<td>6.82</td>
<td>1.69</td>
<td>2.39</td>
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## Unemployment and Credit, 2011

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<td>0.23</td>
<td>0.18</td>
<td>-0.05</td>
<td>-0.05</td>
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<tr>
<td>M2 to Cons., $(1 - \omega)R\bar{a}/C$</td>
<td>0.74</td>
<td>0.92</td>
<td>0.18</td>
<td>0.08</td>
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<tr>
<td>Agg. productivity, $z$</td>
<td>1.07</td>
<td>1.06</td>
<td>-1.44%</td>
<td>-</td>
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<td><strong>Labor Market</strong></td>
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<td>Unemployment rate (%)</td>
<td>5.13</td>
<td>5.53</td>
<td>0.40</td>
<td>3.80</td>
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Credit - Amplification Channel

- Change exogenous component of productivity, $\bar{Z}$

- Decompose changes in unemployment into
  - Mortensen-Pissarides channel
  - Credit & goods market channel
Credit amplifies exogenous productivity changes
Conclusion

- Tractable model linking labor and household credit markets.
- Complementarities between job creation and credit limits.
- Coexistence of liquid assets and unsecured debt.
- Calibrated the model to assess the effect of a credit crunch: potentially large, but mitigated by the availability of liquidity.
- More work to do: dynamics.
Credit Card Limits

Source: Mian and Sufi (2012)