WHY FINANCIAL MARKETS?

Strong comovement unemployment and debt flows
Recessions more severe and long-lasting with banking crisis.
POSSIBLE LINKS?

• As a consequence of a credit contraction, employers lack the liquidity for investment and hiring:
  – Credit Channel.

• As a consequence of a credit contraction, employers face weaker bargaining conditions with workers.
  – Bargaining channel.
THEORETICAL INTUITION

• Suppose that there are only two periods. No discounting.
  
  – **Period 1**: The firm issues debt $b$ and hires a worker.
  
  – **Period 2**: The firm produces $z$ and splits the net surplus:
    
    $$\text{Wage} = \frac{1}{2}(z - b), \quad \text{Dividend} = \frac{1}{2}(z - b)$$

• The value of hiring a worker in period 1 (**Value of a Match**) is:

    $$b + \frac{1}{2}(z - b)$$
MODEL

• Agents have utility $E_0 \sum_{t=0}^{\infty} \beta^t c_t$.
  – They could be employed or unemployed.
  – They are the owners of firms. The interest rate is $r = 1/\beta - 1$.

• A firm is created when a vacancy is filled with an unemployed worker.
  – The cost of posting a vacancy is $\kappa$.
  – A vacancy is filled with probability $q_t = m(v_t, u_t)/v_t$.
  – An unemployed worker finds a job with probability $p_t = m(v_t, u_t)/u_t$.
  – The match is separated with probability $\lambda$.

• Wages are determined through bargaining ($\eta=$Workers’ Power).
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• Wages are determined through bargaining ($\eta=$Workers’ Power).

• Added features:
  1. Firms can issue debt $b_t$ and pay dividends $d_t = z_t - w_t + \frac{b_{t+1}}{R} - b_t$.
  2. There are credit shocks ($\phi_t$) that affect the borrowing limit.
TIMING FOR INCUMBENTS

Standard model

$z_t$  
Wage bargaining, $w_t$  
Payment of dividends, $d_t$.

Separation with probability $\lambda$

$z_{t+1}$
Timing for Incumbents

Standard model with added features

$z_t, \phi_t, b_t$

Wage bargaining, $w_t$

Payment of dividends, $d_t$.
Choice of new debt, $b_{t+1}$

Separation with probability $\lambda$

$z_{t+1}, \phi_{t+1}, b_{t+1}$

Choice to default
BORROWING LIMIT

Firm’s value:

\[ J_t(b_t) = d_t + \beta(1 - \lambda)E_t J_{t+1}(b_{t+1}) \]

Enforcement constraint:

\[ \phi_t E_t J_{t+1}(b_{t+1}) \geq b_{t+1} \]
WAGE BARGAINING

Bargaining problem:

\[
\max_{w_t} \left\{ \hat{J}_t(b_t, w_t)^{1-\eta} \left[ \hat{W}_t(b_t, w_t) - U_t \right]^{\eta} \right\}
\]

Wage equation:

\[
w_t = \eta \cdot (z_t - b_t) + \eta \cdot \left\{ \frac{[p_t + (1 - \lambda)\phi_t] \kappa}{q_t(1 + \phi_t)(1 - \lambda)} \right\}
\]
CHOICE OF DEBT

\[ J_t = \max_{b_{t+1}} \left\{ z_t - w_t - b_t + \frac{b_{t+1}}{R} + \beta(1 - \lambda)(1 - \eta) E_t S_{t+1}(b_{t+1}) \right\} \]

subject to

\[(1 - \eta) \phi_t E_t S_{t+1}(b_{t+1}) \geq b_{t+1} \]
First order condition

\[ \mu_t = \left( \frac{1}{1 + (1 - \eta) \phi_t} \right) \times \left( \frac{1}{R} - \frac{1 - \eta}{R} \right). \]

RESULT: Borrowing constraint binding if \( \eta > 0 \).
TIMING FOR NEW FIRMS AND JOB CREATION

Vacancies are filled with probability $q_t$

Job posting (vacancy)

Payment of dividends, $d_t$
Choice of new debt, $b_{t+1}$

$z_t, \phi_t$

$z_{t+1}, \phi_{t+1}, b_{t+1}$
FREE ENTRY AND JOB CREATION

\[ q_t Q_t = \kappa \]

- \( q_t \) = Probability of finding a worker.
- \( Q_t \) = Value of a filled vacancy.
- \( \kappa \) = Cost of posting a vacancy.
SENSITIVITY OF $Q_t$ TO CREDIT SHOCK

$$\frac{\partial Q_t}{\partial \phi_t} = \eta \cdot \left[ \frac{\beta E_t J_{t+1}(b_{t+1})}{1 + \phi_t(1 - \eta)} \right]$$
## NUMERICAL IMPULSE RESPONSES

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discount factor for entrepreneurs, $\beta$</td>
<td>0.990</td>
</tr>
<tr>
<td>Matching parameter, $\xi$</td>
<td>0.773</td>
</tr>
<tr>
<td>Matching parameter, $\alpha$</td>
<td>0.649</td>
</tr>
<tr>
<td>Relative bargaining power, $\eta$</td>
<td>0.672</td>
</tr>
<tr>
<td>Probability of separation, $\lambda$</td>
<td>0.049</td>
</tr>
<tr>
<td>Cost of posting vacancy, $\kappa$</td>
<td>0.711</td>
</tr>
<tr>
<td>Utility flow unemployed, $a$</td>
<td>0.468</td>
</tr>
<tr>
<td>Enforcement parameter, $\phi$</td>
<td>3.637</td>
</tr>
</tbody>
</table>
Response credit shock

A) STOCK OF DEBT

B) EMPLOYMENT

C) OUTPUT

D) PER-WORKER WAGE
EXTENSION: Monopolistic competition

• Each firm is a monopolistic producer of differentiated goods, $y_i$.

• Aggregate production: $Y = \left( \int_0^N y_i^\varepsilon \, di \right)^{\frac{1}{\varepsilon}}$

• Demand function: $P_i = Y^{1-\varepsilon} y_i^{\varepsilon-1}$

• Production: $y_i = z l_i$; Cost: $\frac{A l_i^{1+\varphi}}{1+\varphi}$.

IN REDUCED FORM: Replace $z_t$ with $\tilde{z}_t N_t^\nu$. 
PARAMETERS

- Price mark-up, $\frac{1}{\varepsilon} - 1 = 0.33$.

- Elasticity of intensive margin $\frac{1}{\varphi} = 1$. 
Response credit shock

A) STOCK OF DEBT

B) EMPLOYMENT

C) OUTPUT

D) PER-WORKER WAGE
STRUCTURAL ESTIMATION

• Three AR(1) shocks:
  1. Productivity, \( z_t \)
  2. Credit, \( \phi_t \)
  3. Matching, \( \xi_t \)

• Three empirical variables in first differences:
  1. Log-GDP, \( Y_t \)
  2. Log-employment, \( N_{t+1} \)
  3. New debt over GDP in business sector, \( \frac{B_{t+1}-B_t}{Y_t} \)

• Three parameters are pre-determined: \( \beta, \lambda, \kappa \).
## PARAMETERS

<table>
<thead>
<tr>
<th>Estimated parameter</th>
<th>Prior[mean, std]</th>
<th>Mode</th>
<th>Posterior thresholds</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Below 5%</td>
</tr>
<tr>
<td>Productivity shock persistence, $\rho_z$</td>
<td>Beta[0.5, 0.20]</td>
<td>0.944</td>
<td>0.937</td>
</tr>
<tr>
<td>Productivity shock volatility, $\sigma_z$</td>
<td>IGamma[0.001, 0.05]</td>
<td>0.005</td>
<td>0.004</td>
</tr>
<tr>
<td>Credit shock persistence, $\rho_\phi$</td>
<td>Beta[0.5, 0.20]</td>
<td>0.965</td>
<td>0.954</td>
</tr>
<tr>
<td>Credit shock volatility, $\sigma_\phi$</td>
<td>IGamma[0.001, 0.05]</td>
<td>0.143</td>
<td>0.135</td>
</tr>
<tr>
<td>Matching shock persistence, $\rho_\xi$</td>
<td>Beta[0.5, 0.20]</td>
<td>0.983</td>
<td>0.977</td>
</tr>
<tr>
<td>Matching shock volatility, $\sigma_\xi$</td>
<td>IGamma[0.001, 0.05]</td>
<td>0.056</td>
<td>0.052</td>
</tr>
<tr>
<td>Matching share parameter, $\alpha$</td>
<td>Beta[0.5, 0.1]</td>
<td>0.650</td>
<td>0.638</td>
</tr>
<tr>
<td>Bargaining power workers, $\eta$</td>
<td>Beta[0.5, 0.1]</td>
<td>0.674</td>
<td>0.676</td>
</tr>
<tr>
<td>Utility flow unemployed, $a$</td>
<td>Beta[0.4, 0.1]</td>
<td>0.470</td>
<td>0.433</td>
</tr>
<tr>
<td>Mean enforcement parameter, $\bar{\phi}$</td>
<td>IGamma[8, 5]</td>
<td>3.621</td>
<td>3.607</td>
</tr>
<tr>
<td>Mark-up parameter, $\varepsilon$</td>
<td>Beta[0.8, 0.05]</td>
<td>0.937</td>
<td>0.932</td>
</tr>
<tr>
<td>Elasticity of effort, $\varphi$</td>
<td>Beta[1, 0.2]</td>
<td>1.033</td>
<td>1.002</td>
</tr>
</tbody>
</table>
## VARIANCE DECOMPOSITION

<table>
<thead>
<tr>
<th>Variable</th>
<th>$TFP_{\text{shock}}$</th>
<th>$Credit\ shock$</th>
<th>$Matching\ shock$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>46.2</td>
<td>29.2</td>
<td>24.6</td>
</tr>
<tr>
<td>Employment</td>
<td>0.4</td>
<td>54.1</td>
<td>45.5</td>
</tr>
<tr>
<td>New debt/output</td>
<td>0.1</td>
<td>66.7</td>
<td>33.1</td>
</tr>
<tr>
<td>Hourly wage</td>
<td>12.0</td>
<td>57.0</td>
<td>31.0</td>
</tr>
</tbody>
</table>
Quarter-by-quarter decomposition
TESTING THE BARGAINING CHANNEL
Quadrini & Sun (2012)

• We start from an industry dynamics model.

• Model is an extension of the previous model:
  – Multi-workers firms.
  – Firm-level idiosyncratic shocks to productivity and credit.
  – Collectively bargaining of wages.
  – The bargaining power of workers $\eta$ differ across firms.
  – Partial equilibrium analysis.
Optimality condition for hiring

\[ \beta \left[ (1 - \eta) \mathbb{E}_t \bar{s}_{t+1} + \frac{\eta g^B_{t+1}}{g^N_{t+1}} b_t \right] = \gamma' \left( g^N_{t+1} - 1 + \lambda \right) \]
LINEARIZED OPTIMALITY CONDITION

\[ g_{t+1}^N = \alpha_c + \alpha_s \cdot \mathbb{E}_t \bar{s}_{t+1} + \alpha_b \cdot b_t + \alpha_g(\eta) \cdot g_{t+1}^B \]

where

\[ \alpha_s = \frac{(1 - \eta)\gamma(g^N - 1 + \lambda)g^N}{[\eta \gamma(g^N - 1 + \lambda)/g^N + \eta(1 - \gamma) + (1 - \eta)(1 - \gamma)(1 + \xi)/\xi]bg^B}, \]

\[ \alpha_b = \frac{\eta \gamma(g^N - 1 + \lambda)}{[\eta \gamma(g^N - 1 + \lambda)/g^N + \eta(1 - \gamma) + (1 - \eta)(1 - \gamma)(1 + \xi)/\xi]b'}, \]

\[ \alpha_g(\eta) = \frac{\eta \gamma(g^N - 1 + \lambda)}{[\eta \gamma(g^N - 1 + \lambda)/g^N + \eta(1 - \gamma) + (1 - \eta)(1 - \gamma)(1 + \xi)/\xi]g^B}. \]
The sensitivity of employment to credit increases with the bargaining power of workers.
\[ \Delta \text{employ}_{it} = \beta_1 \cdot \text{union}_{cic,t} \cdot \Delta \text{debt}_{it} + \]
\[ \beta_2 \cdot \text{union}_{cic,t} + \]
\[ \beta_3 \cdot \Delta \text{debt}_{it} + \]
\[ \beta_4 \cdot \text{leverage}_{it-1} + \]
\[ \beta_5 \cdot \log(\text{employ}_{it-1}) + \]
\[ \beta_6 \cdot Q_{it} + \]
\[ \beta_7 \cdot \text{cashflow}_{it} + \nu_i + \tau_t + \varepsilon_{it} \]
<table>
<thead>
<tr>
<th></th>
<th>Unionization Rate</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High</td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>union\textsubscript{cic,t} \cdot \Delta debt\textsubscript{it}</strong></td>
<td>0.252***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.087)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>union\textsubscript{cic,t}</strong></td>
<td>-0.009</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.111)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>\Delta debt\textsubscript{it}</strong></td>
<td>0.051***</td>
<td>0.092***</td>
<td>0.051***</td>
</tr>
<tr>
<td></td>
<td>(0.010)</td>
<td>(0.011)</td>
<td>(0.009)</td>
</tr>
<tr>
<td><strong>leverage\textsubscript{it-1}</strong></td>
<td>-0.038</td>
<td>0.003</td>
<td>-0.088**</td>
</tr>
<tr>
<td></td>
<td>(0.025)</td>
<td>(0.031)</td>
<td>(0.038)</td>
</tr>
<tr>
<td><strong>log(employ\textsubscript{it-1})</strong></td>
<td>-0.314***</td>
<td>-0.352***</td>
<td>-0.292***</td>
</tr>
<tr>
<td></td>
<td>(0.022)</td>
<td>(0.047)</td>
<td>(0.028)</td>
</tr>
<tr>
<td><strong>Q\textsubscript{it}</strong></td>
<td>0.018***</td>
<td>0.034***</td>
<td>0.011</td>
</tr>
<tr>
<td></td>
<td>(0.007)</td>
<td>(0.013)</td>
<td>(0.009)</td>
</tr>
<tr>
<td><strong>cashflow\textsubscript{it}</strong></td>
<td>0.118***</td>
<td>0.138***</td>
<td>0.117***</td>
</tr>
<tr>
<td></td>
<td>(0.025)</td>
<td>(0.048)</td>
<td>(0.029)</td>
</tr>
</tbody>
</table>

- Firm Fixed Effects: Yes, Yes, Yes
- Year Dummies: Yes, Yes, Yes
- Adjusted R\textsuperscript{2}: 0.40, 0.41, 0.39
- Observations: 9,148, 4,441, 4,707
CONCLUSION

- We have proposed a mechanism through which leverage affects the hiring decision of employers.

- The mechanism is not based on the typical credit channel but on the wage determination process.

- This may explain why in a tight credit market firms do not invest and hire even if they are not short of cash.

- The mechanism finds empirical support at the micro level.