Technology Shocks and Hours Revisited: A Supply-Side Interpretation

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Dec 26 2014, End of Year Tokyo Conference, CIGS
Introduction

• Two views of business cycle: RBC and New Keynesian.

• Gali (1999)’s empirical finding: Positive technology shock reduces aggregate hours. \(\rightarrow\) Evidence in favor of NK.

• This paper: When household heterogeneity taken into account, evidence in favor of RBC.
Introduction

• Intertemporal substitution of labor supply central to modern business cycle theories.
  
  - Households’ ability to transfer wealth across periods critical.

• More than half of the U.S. households do not participate in the asset market.

• Suggests theory overstates the intertemporal substitution effect.

• Verifies this hypothesis using micro data.
CEX Data

- Consumer Expenditure Survey (CEX) collected by BLS.
- Interview survey since 1980.
- Sample size $\approx$ 5,000 households.
CEX Data

- Financial information collected: Amounts in
  1. “Checking accounts, brokerage accounts and other similar accounts”
  2. “Savings accounts at banks, savings and loans, credit unions, etc”
  3. “Stocks, bonds, mutual funds and other such securities”
  4. “U.S. savings bonds”

- Refer to households with positive responses to “Stocks, bonds, mutual funds and other such securities” as asset holders.

- According to this definition, 85% of households are asset holders.

- Later check alternative definitions.
Technology Shock


- Control for non-technological effects in measured TFP such as utilization, nonconstant returns, and imperfect competition.
Corr(Δ H_t, Δ Z_t) = 0.00
Non-Asset Holders

\[ \text{Corr}(\Delta H_t, \Delta Z_t) = -0.18 \]
Asset Holders

Corr(\(\Delta H_t, \Delta Z_t\)) = 0.47
Measuring Impulse Responses

- Run a regression on current and lagged technology:

\[ \Delta H_t = a + \sum_{j=0}^{4} c_j \Delta Z_{t-j} + e_t \]

- Obtain impulse responses in levels by cumulating coefficients on the technology growth (the \( c_j \)'s).
Aggregate Impulse Response: BLS vs. CEX Data

BLS

CEX
Household-Level Impulse Response

Asset holders

Non-asset holders
Household-Level Impulse Response

- When technology improves,
  - Asset holders increase hours.
  - Non-asset holders reduce hours.
- Within asset holders, the hours increase is larger for households with larger asset holdings.
- Results robust to
  - Including lagged dependent variables.
  - Controlling for other macro shocks.
Household-Level Impulse Response

- Results mixed if other definitions are used to split households.
  - Savings accounts.
  - U.S. savings bonds.

**Interpretation**

- Return on these assets less correlated with technology.
- People hold these assets mainly for precautionary reasons / long-term savings (e.g., retirements).
- Liquidity constraints unlikely to explain the finding. (Details in paper)
Structural Estimation

- Estimate a DSGE model using the impulse response to a technology shock.

- Full asset market participation model estimated with aggregate IRF only $\rightarrow$ Substantial nominal rigidities.

- Limited asset market participation model estimated with aggregate and household IRF $\rightarrow$ Flexible prices and wages.
• DSGE model with limited asset market participation.

• \((1 - \chi)\) fraction of households participate in the stock and bond market and the remaining \(\chi\) fraction do not.

• When \(\chi = 0\), standard model.
Model

- Asset holders:

\[
\max_{\{C_t^a, H_t^a, S_t^a, B_t^a\}} \quad E_0 \sum_{t=0}^{\infty} \beta^t \left[ \ln(C_t^a - bC_{t-1}^a) - \frac{(H_t^a)^{1+\eta}}{1 + \eta} \right],
\]

subject to

\[
P_tC_t^a + P_tE_t^a S_t^a + B_t^a \leq W_t H_t^a + (D_t^E + P_tE_t^a) S_{t-1}^a + R_{t-1} B_{t-1}^a + T_t^a.
\]

- Non-asset holders:

\[
\max_{\{C_t^n, H_t^n\}} \quad E_0 \sum_{t=0}^{\infty} \beta^t \left[ \ln(C_t^n - bC_{t-1}^n) - \frac{(H_t^n)^{1+\eta}}{1 + \eta} \right],
\]

subject to

\[
P_tC_t^n \leq W_t H_t^n + T_t^n.
\]
Model

1. Intermediate goods firms
   - Monopolistically competitive, maximize dividends.
   - Price adjustment cost, investment adjustment cost, variable capital utilization.
   - Technology shock: $\ln z_t = \bar{z} + \ln z_{t-1} + \epsilon_t$.

2. Final goods firms
   - Perfectly competitive, produce final goods by combining intermediate goods.

3. Wage setting
   - Households sell differentiated labor service to “labor packer”.
   - Wage adjustment cost.

4. Central bank
   - Taylor-type rule responding to inflation and output growth.
Estimation

- Some parameters are pre-fixed. The participation rate is set to 15% (source: CEX).

- Minimum distance method: Match the model IRF with the data.

- Variables used: IRF of Output, consumption, investment, hours (all households), hours (asset holders), hours (non-asset holders), real wage, inflation, FF rate, utilization rate.
## Estimation

<table>
<thead>
<tr>
<th>Description</th>
<th>Baseline</th>
<th>Full participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\delta_2/\delta_1$</td>
<td>Utilization curvature</td>
<td>0.00</td>
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<tr>
<td>$\eta$</td>
<td>Inverse Frisch elasticity</td>
<td>0.03</td>
</tr>
<tr>
<td>$b$</td>
<td>Consumption habit</td>
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<td>$\kappa$</td>
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<tr>
<td>$\varphi$</td>
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<tr>
<td>$\phi_P$</td>
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<tr>
<td>$\phi_W$</td>
<td>Wage adj. cost</td>
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<tr>
<td>$\rho_R$</td>
<td>Taylor rule smoothing</td>
<td>0.07</td>
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<tr>
<td>$\phi_\pi$</td>
<td>Taylor rule inflation</td>
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<tr>
<td>$\phi_Y$</td>
<td>Taylor rule output</td>
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The table above presents estimated values for various economic parameters. The values in parentheses represent standard errors.
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- Positive technology shock $\rightarrow$ Higher wages and return on investment.
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• Asset holders increase hours to reap the benefit of the higher return.
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• Non-asset holders reduce hours because of the income effect.
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• Positive technology shock $\rightarrow$ Higher wages and return on investment.

• Asset holders increase hours to reap the benefit of the higher return.

• Non-asset holders reduce hours because of the income effect.

• Most households non-asset holders $\rightarrow$ In the aggregate, hours fall.
Impulse Response, Increasing Price and Wage Stickiness
Intuition

- Positive technology shock $\rightarrow$ Higher markups in the short run.
Intuition

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- Lower wages and return on investment.
Intuition

- Positive technology shock $\rightarrow$ Higher markups in the short run.
- Lower wages and return on investment.
- Asset holders reduce hours.
Conclusion

• Exploit cross-sectional heterogeneity at the household level.

• Finding: Negative response of aggregate hours to technology shocks driven by the income effect.

• RBC with limited asset market participation consistent with data.

• New Keynesian model inconsistent with micro evidence.
Backup slides
Household-Level Impulse Response

[Graph showing impulse response for Savers and Non-savers over 4 years.]
Impulse Response, Baseline Model