

Technology Shocks and Hours Revisited: A Supply-Side Interpretation

Hikaru Saijo

University of California, Santa Cruz

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Introduction

- Two views of business cycle: RBC and New Keynesian.
- Gali (1999)'s empirical finding: Positive technology shock reduces aggregate hours. → 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.

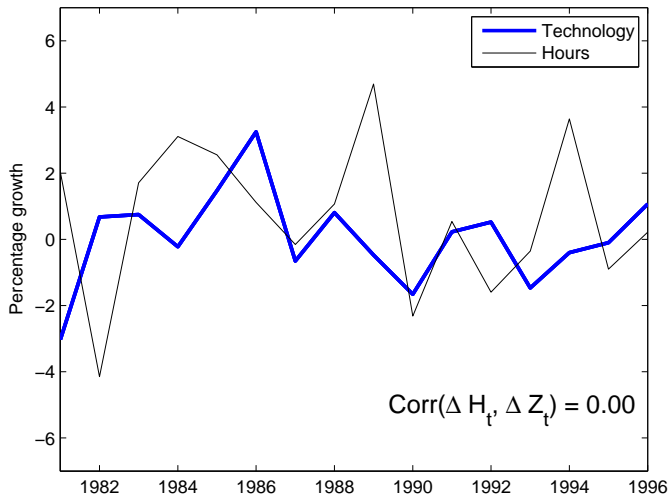
CEX Data

- 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.

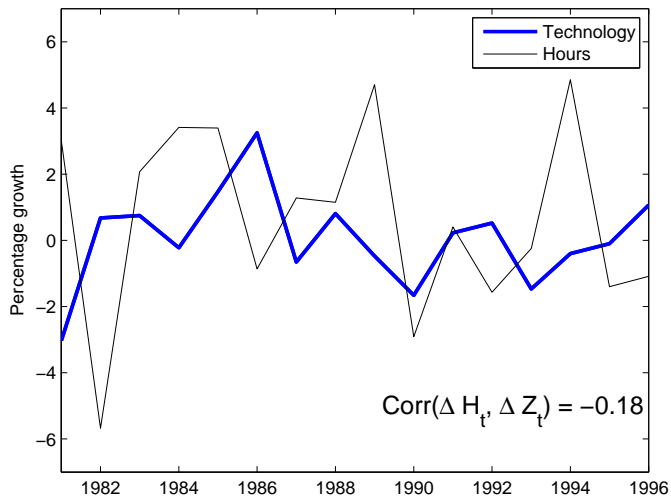
Technology Shock

- Measure technology shocks using the “purified” Solow residuals constructed in Basu, Fernald, and Kimball (2006).
- Control for non-technological effects in measured TFP such as utilization, nonconstant returns, and imperfect competition.

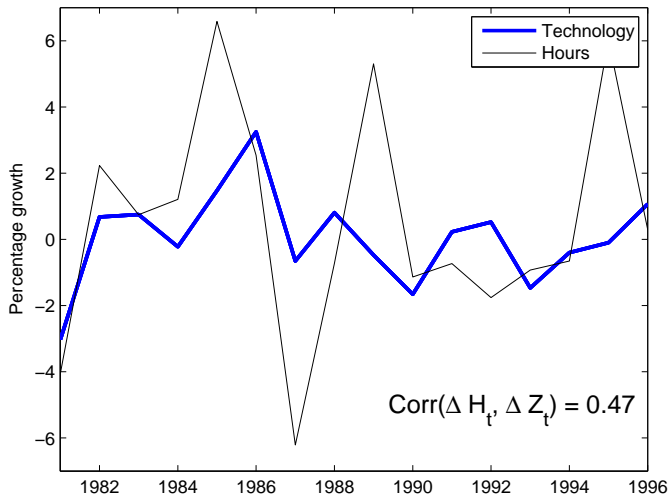
All Households



Non-Asset Holders



Asset Holders



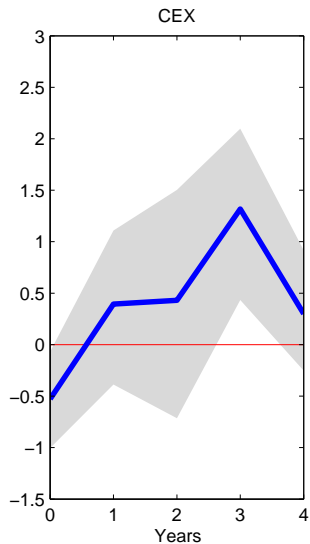
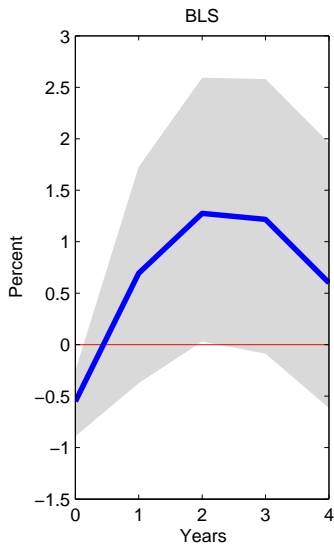
Measuring Impulse Responses

- Run a regression on current and lagged technology:

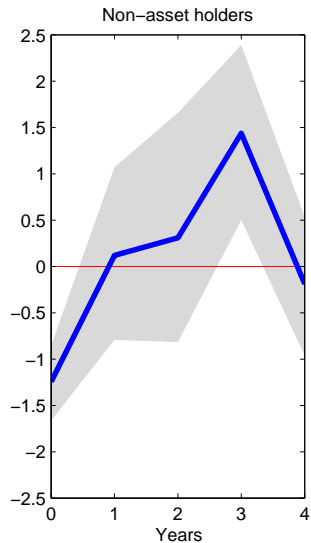
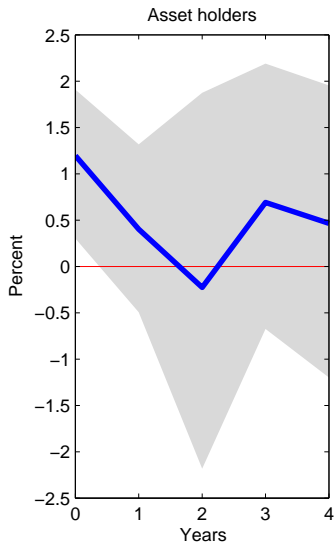
$$\Delta H_t = a + \sum_{j=0}^4 c_j \Delta Z_{t-j} + e_t$$

- Obtain impulse responses in levels by cumulating coefficients on the technology growth (the c_j 's).

Aggregate Impulse Response: BLS vs. CEX Data





Household-Level Impulse Response



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 → Substantial nominal rigidities.
- Limited asset market participation model estimated with aggregate and household IRF → Flexible prices and wages.

Model

- DSGE model with limited asset market participation.
- $(1 - \chi)$ fraction of households participate in the stock and bond market and the remaining χ fraction do not.
- When $\chi = 0$, standard model.

Model

- Asset holders:

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

subject to

$$P_t C_t^a + P_t^E S_t^a + B_t^a \leq W_t H_t^a + (D_t^E + P_t^E) S_{t-1}^a + R_{t-1} B_{t-1}^a + T_t^a.$$

- Non-asset holders:

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

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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.

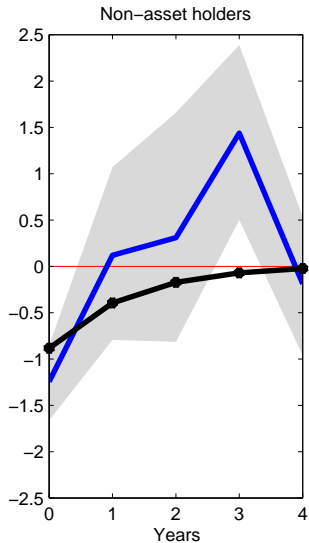
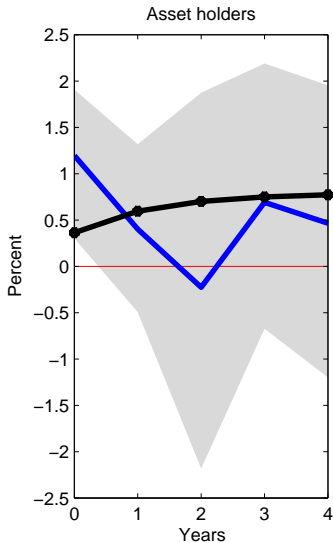
Estimation

	Description	Baseline	Full participation
δ_2/δ_1	Utilization curvature	0.00 (0.000)	0.00 (0.007)
η	Inverse Frisch elasticity	0.03 (0.002)	0.00 (0.001)
b	Consumption habit	0.83 (0.003)	0.84 (0.028)
κ	Investment adj. cost	0.00 (0.005)	0.00 (0.013)
φ	Elasticity of labor b/w asset and non-asset holders	8.44 (0.003)	–
ϕ_P	Price adj. cost	0.04 (0.002)	33.74 (0.013)
ϕ_W	Wage adj. cost	0.00 (0.002)	200.00
ρ_R	Taylor rule smoothing	0.07 (0.002)	0.90
ϕ_π	Taylor rule inflation	1.00 (0.000)	2.38 (0.008)
ϕ_Y	Taylor rule output	0.88 (0.002)	1.10 (0.016)
$100\sigma_z$	Technology shock	0.55 (0.072)	0.54 (0.036)

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Impulse Response, Baseline Model



Intuition

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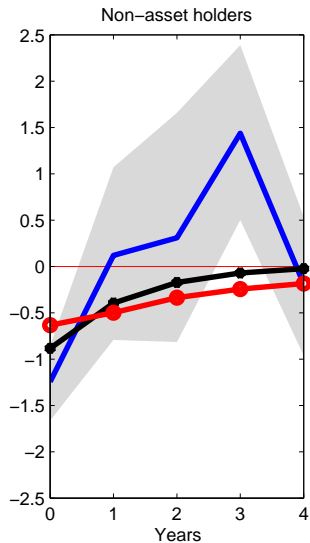
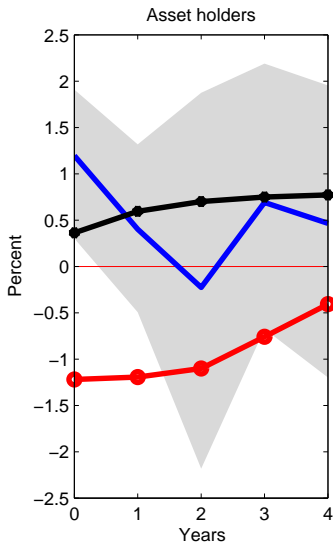
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- Asset holders increase hours to reap the benefit of the higher return.
- Non-asset holders reduce hours because of the income effect.
- Most households non-asset holders \rightarrow In the aggregate, hours fall.

Impulse Response, Increasing Price and Wage Stickiness



Intuition

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

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- Positive technology shock \rightarrow Higher markups in the short run.
- Lower wages and return on investment.

Intuition

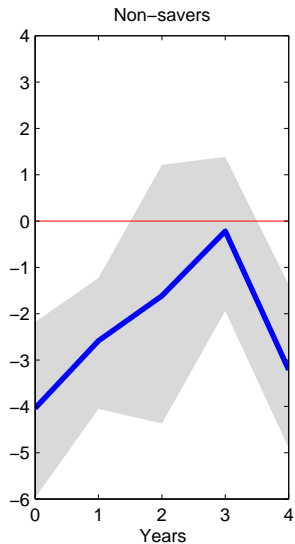
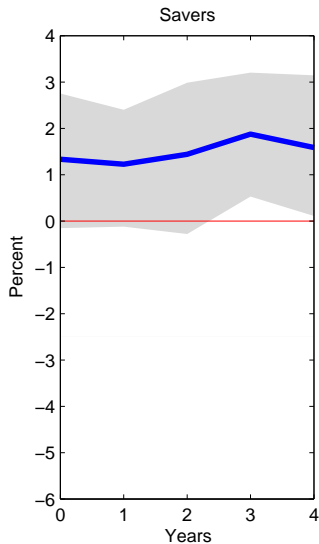
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- Lower wages and return on investment.
- Asset holders reduce hours.

Conclusion

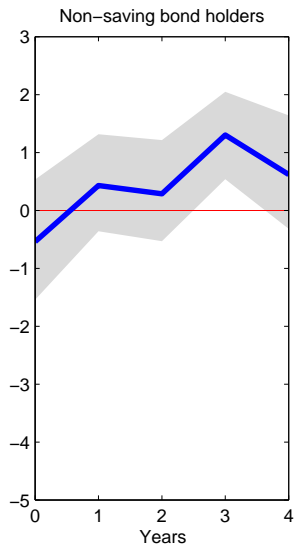
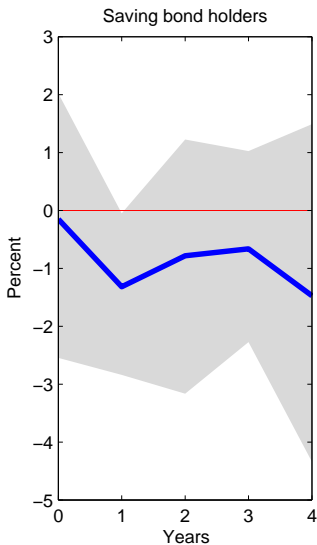
- Exploit cross-sectional heterogeneity at the household level.
- Finding: Negative response of aggregate hours to technology shocks driven by the income effect.
- RBC with limited asset market participation consistent with data.
- New Keynesian model inconsistent with micro evidence.

Backup slides

Household-Level Impulse Response



Household-Level Impulse Response



Impulse Response, Baseline Model

