Risk Allocation, Debt Fueled Expansion and Financial Crisis

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Introduction

- The US and a number of other economies went into a financial crisis in 2008
- Widening risk spreads and credit markets freezing up
- A recession also set in around the same time
- No apparent change in productivity
- Recession appears to be driven by the financial crisis
Introduction

- Prevailing explanations
  - Governance and regulation issues
  - Monetary policy
  - Global imbalances
- All these likely have some truth
- But they all rely on mistakes and errors
Our Approach

- Can the episode be understood as the outcome of optimal behavior, not errors?
  - was it the market solution to a specific allocation problem faced by the economy during this period?

- If so, the mechanism needs to be able explain both the expansion between 2001-07 and the collapse

- How could a freeze in a secondary debt market have such big effects?
  - our main contribution: link between the financial and real sides
Motivating data: Leverage ratio

Debt-GDP ratios (1968Q1-2008Q4)

- Private
- Household
- Domestic Financial
Motivating data: Declining risk premium
Motivating data: Rising Profits

Net Corporate Profit-GDP Ratio (1968Q1-2008Q4)

- Total net profit
- Domestic Non-financial
- Domestic Financial

- 0.00 0.02 0.04 0.06 0.08 0.10 0.12 0.14
Motivating data: Rising Productivity

Productivity Growth (1968-2008)

- Multifactor productivity
- Labor productivity
Motivating data: Tepid investment

Non-Residential Investment-GDP Ratio (1968Q1-2008Q4)
Key takeaways from this data

- Profits were very high and productivity was strong
- Investment was tepid
- Yet borrowing was rising and the risk premium was falling

Our interpretation

- Financial innovation allowed more insurance and better risk allocation
- Credit driven expansion
Goal of desired model

- Have a clear link between the financial and real sectors
- Generate expansion through credit growth
- Expansion shouldn’t be driven by the standard investment margin
- Contraction in activity should be possible due to financial sector developments alone
Three Key Questions

- Under aggregate risk, how does an economy adjust to high profits in the absence of profitable investment avenues?
- Can such an adjustment explain a credit-driven boom?
- Could such an economy be particularly sensitive to a market freeze?
Model Building Blocks

- Labor input is risky as labor productivity is stochastic
  - greater risk exposure reduces labor supply to market

- Availability of insurance is key to employment decisions
  - financial sector becomes important player

- Heterogeneity of agents in risk tolerance
  - markets allocate risk to those with higher tolerance
The Model

- Static version
  - highlights the key allocation problem

- Two types of agents
  - Worker-households
  - Financiers
Environment

- Firms produce output using labor
- Workers allocate time between market and leisure
- Employment decisions made before the realization of labor productivity
- Claims against risky output can be traded in asset markets
Output is produced using

\[ y = A l \]

Productivity is stochastic and drawn from a binomial process

\[ A = \begin{cases} 
1 & \text{with probability } q \\
\theta & \text{with probability } 1 - q 
\end{cases} \]
Timing of events

- Beginning of period both asset markets and labor markets open
  - Agents trade risky claims (stocks) and risk-free bonds
  - Employment and wage decisions are made in labor markets
- $A$ is revealed, $y$ is produced
- Claims are settled
- Economy ends
Firms

- Hire labor to produce
- Wages paid before the realization of the productivity shock
- Firms issue shares (risky claims) to finance wages
- Each share pays
  - 1 unit of the good in a good state
  - $\theta$ units of the good in a bad state
- Firms maximize $p^s S - w l$
  - subject to the solvency constraint $S \leq I$
Workers have one unit of labor time: market work or leisure

Start with initial debt $d$

They maximize

$$V^w = E \left[ u(c^w + g(1 - l)) \right]$$

State-contingent budget constraints

$$p^s s^w + p^b b^w = wl$$

$$c^g = s^w + b^w - d$$

$$c^b = \theta s^w + b^w - d$$
Financiers

- Start with initial financier assets $d$
- Risk-neutral financiers maximize
  \[ V^F = E \left[ c^F \right] \]
- State-contingent budget constraints
  \[ p^s s^F + p^b b^F = 0 \]
  \[ c^F_g = s^F + b^F + d \]
  \[ c^F_b = \theta s^F + b^F + d \]
Key Optimality Conditions

- **Financier consumption:** \( c_b^F = 0 \) and \( c_g^F = \frac{(1-\theta)d}{\frac{p_s}{p_b} - \theta} \)

- **Portfolio positions:** \( s_F = \frac{(1-\theta)d}{\frac{p_s}{p_b} - \theta} \) and \( b_F = -\frac{\frac{p_s}{p_b} d}{\frac{p_s}{p_b} - \theta} \)

- **Optimal work:** \( \frac{w}{p_b^*} = g'(1 - l) \)

- **Firm optimality:** \( p_s = w \)

- \( l \) increasing in \( \frac{p_s}{p_b} \) (inverse of risk premium) since \( w = p_s \)
Proposition 1: The level of employment is a continuous and weakly increasing function of the initial debt level $d$. This function, which we denote by $l = \phi^l(d)$, is strictly increasing in $d$ when $d \in (0, \tilde{d})$, $\tilde{d} > 0$, and is constant for all $d \geq \tilde{d}$. 
Proposition 2: The risk premia is a continuous and weakly decreasing function of the debt level $d$. This function, which we denote by $\frac{p_b}{p_s} = \phi^p(d)$, is strictly decreasing in $d$ when $d \in (0, \tilde{d})$, $\tilde{d} > 0$, and is constant for all $d \geq \tilde{d}$. Moreover, $\phi^p(d) < \frac{p^b_a}{p^s_a}$ for all $d > 0$.

- $d > \tilde{d}$: no risk premium – economy becomes effectively riskless
Intuition

- Financial intermediaries use their assets to acquire risky claims
  - become residual claimants of risky output

- Greater initial assets of financial intermediaries
  - greater purchase of risky claims by intermediaries
  - lower risk premium

- Cheaper insurance against risk raises wages and employment
Dynamic Extension

- Embed the static structure in an OLG setting
- Two-period lived workers and financiers
- Workers choose borrowing \((d)\) when young
- Mature financiers make positive bequests to young financiers in good states
- Provides a link between periods
Mechanics

- Good shocks raise residual claims
- Financial intermediaries able to acquire more assets today
  - they buy more risky claims tomorrow
  - risk premium falls, employment rises tomorrow
- Bad productivity shock: process reverses
- Financial markets amplify and propagate shocks
- Gradual boom, sudden crash
Case 1
Debt dynamics: $\bar{d} < \tilde{d}$
Suppose worker $i$ has a probability $\psi^i$ that he will have productive market labor.

Each worker draws a $\psi \in [0, 1]$ from an i.i.d. distribution with density $f(\psi)$.

With probability $1 - \psi^i$ he will have no wage income and will default on debt.

Actual productivity of worker revealed to firms before hiring.
Debt Repackaging

- Each financier contracts with a specific worker type
- Financier has a portfolio with individual default risk $1 - \psi^i$
- Beginning of period, market for debt repackaging opens
  - All portfolios offered for repackaging are pooled and repackaged by an intermediary
  - New synthetic portfolio $k$ has no idiosyncratic risk
- Payoff on synthetic debt is $\hat{\psi}$
  - $\hat{\psi}$ is expected repayment rate of the whole distribution put up for pooling
Asymmetric information

- Suppose financiers learn the repayment rate $\psi$ on their portfolio before the debt repackaging market opens.

- Adverse selection problem
  - High $\psi$ debt holders have an incentive to hold their debt back.
  - Market return on debt pools all $\psi$’s.
Multiple equilibria: An Example

Example: $f$ is uniform in $[0,1]$
Financial Crisis

- Suppose economy is in optimistic equilibrium
  - sequence of good shocks, output and debt grow, risk premium falls
- Sudden switch in expectations to pessimistic
  - no new insurance as debt market freezes: financial crisis
  - employment falls below autarky levels
  - employment becomes independent of state – persistent
- Recession occurs due to the financial crisis
  - low employment and output can persist despite high productivity
Conclusion

- Model of a debt fueled expansion
- Financial sector propagates and amplifies shocks
- Mechanism translates a financial “freeze” into a persistent real shock
- Lack of standard investment options key to this fragility
- Operates without collateral constraints
  - key are financial sector assets, not firm assets