

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

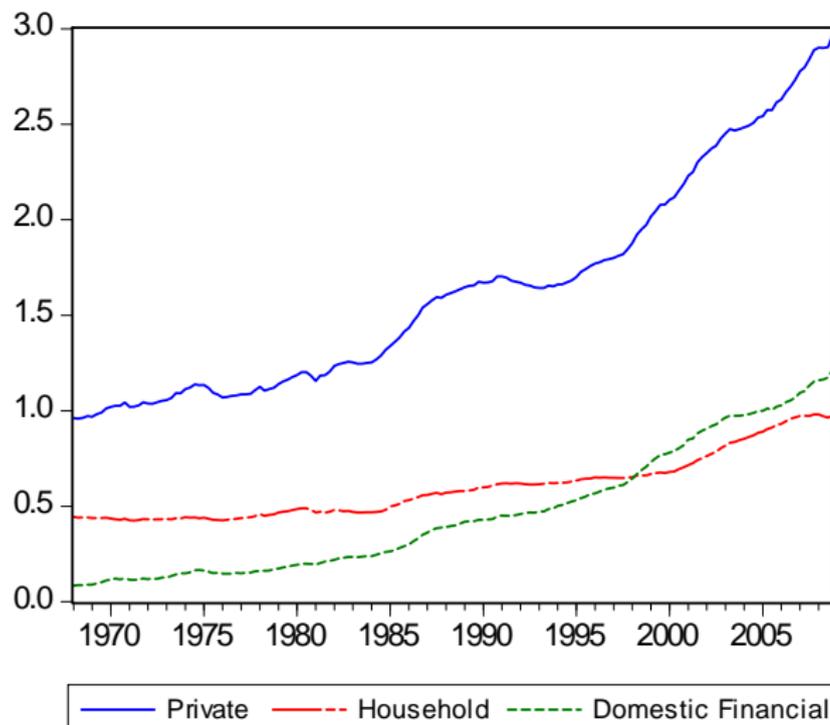
- ▶ Prevailing explanations
 - ▶ Governance and regulation issues
 - ▶ Monetary policy
 - ▶ Global imbalances
- ▶ All these likely have some truth
- ▶ But they all rely on mistakes and errors

Our Approach

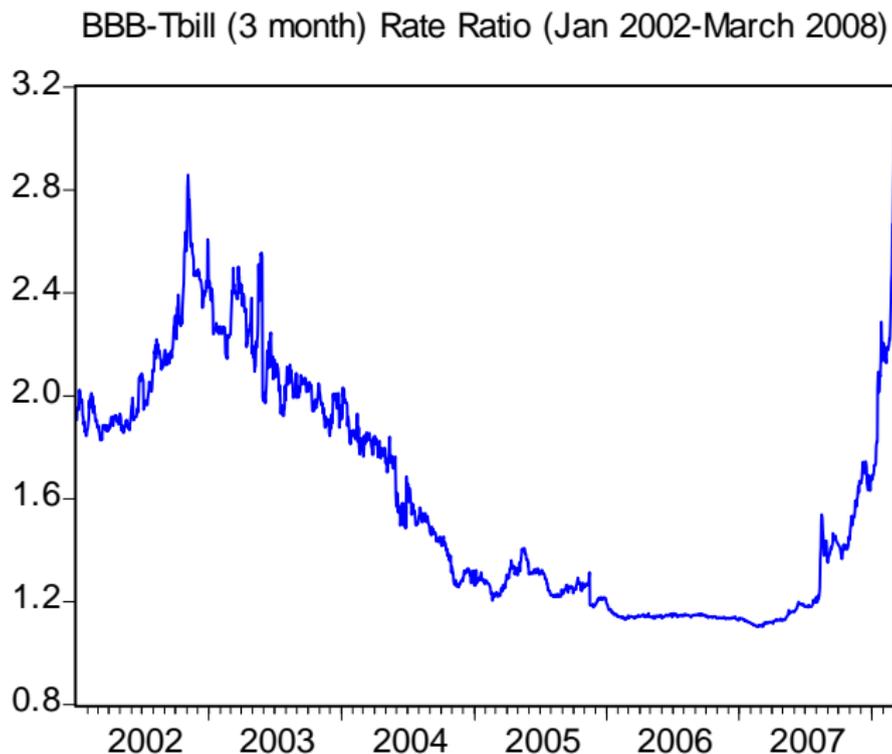
- ▶ Can the episode be understood as the outcome of optimal behavior, not errors?
 - ▶ was it the market solution to a specific allocation problem faced by the economy during this period?
- ▶ If so, the mechanism needs to be able explain both the expansion between 2001-07 and the collapse
- ▶ How could 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)

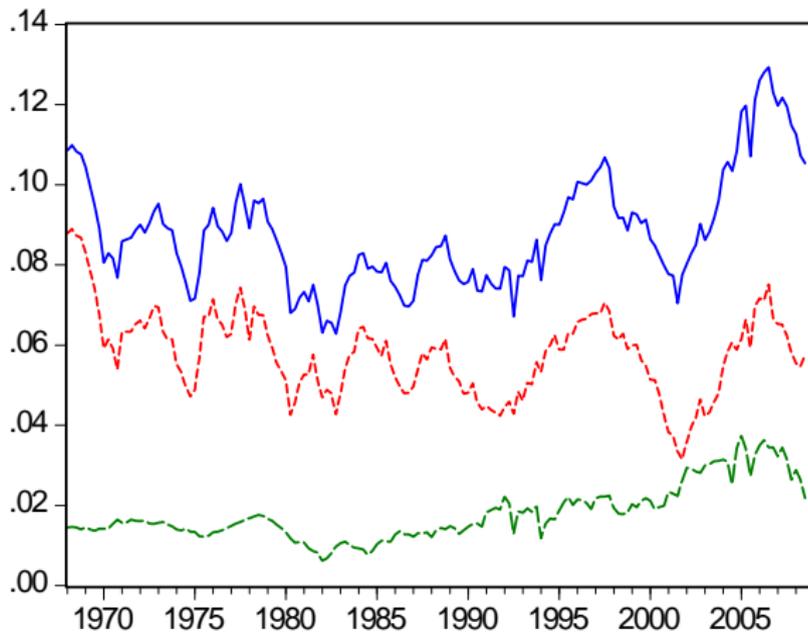


Motivating data: Declining risk premium



Motivating data: Rising Profits

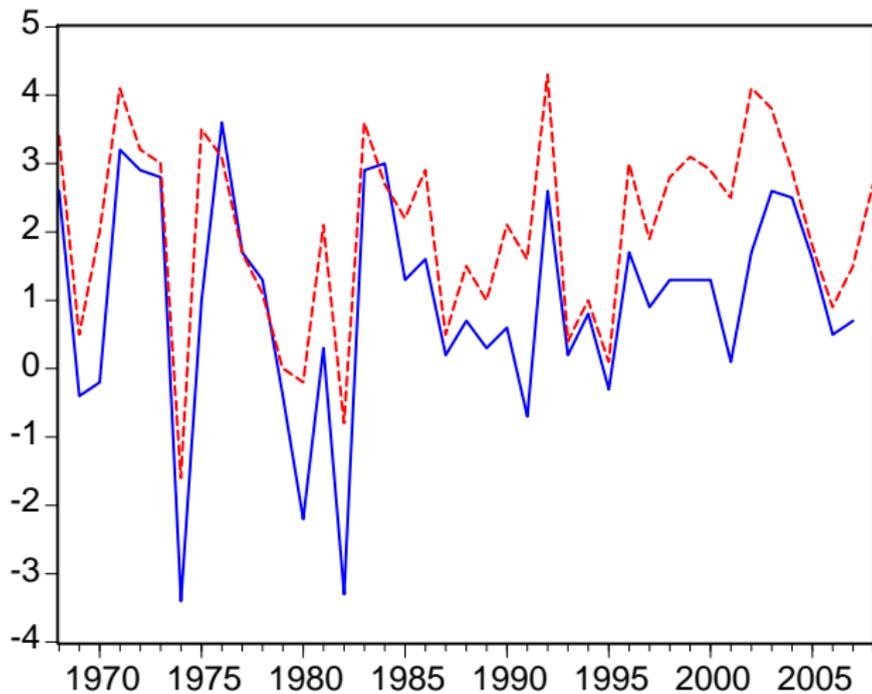
Net Corporate Profit-GDP Ratio (1968Q1-2008Q4)



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

Motivating data: Rising Productivity

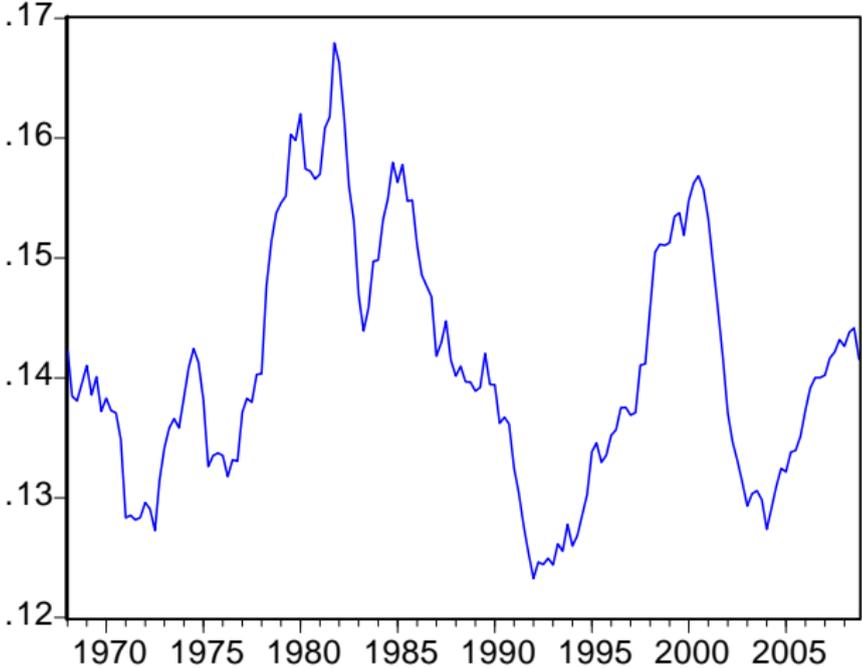
Productivity Growth (1968-2008)



— 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

Technology

- ▶ 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
 - ▶ θ units of the good in a bad state
- ▶ Firms maximize $p^s S - w l$
 - ▶ subject to the solvency constraint $S \leq l$

Worker-Households

- ▶ Workers have one unit of labor time: market work or leisure
- ▶ Start with initial debt d
- ▶ They maximize

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

- ▶ State-contingent budget constraints

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

$$c_g^w = s^w + b^w - d$$

$$c_b^w = \theta s^w + b^w - d$$

Financiers

- ▶ Start with initial financier assets d
- ▶ Risk-neutral financiers maximize

$$V^F = E \left[c^F \right]$$

- ▶ State-contingent budget constraints

$$p^s s^F + p^b b^F = 0$$

$$c_g^F = s^F + b^F + d$$

$$c_b^F = \theta s^F + b^F + d$$

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 p^s/p^b (inverse of risk premium) since $w = p^s$

Equilibrium Employment Increasing in Debt

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 $d \geq \tilde{d}$.

Risk Premium Decreasing in Debt

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, $\phi^p(d) < \frac{p_a^b}{p_a^s}$ 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

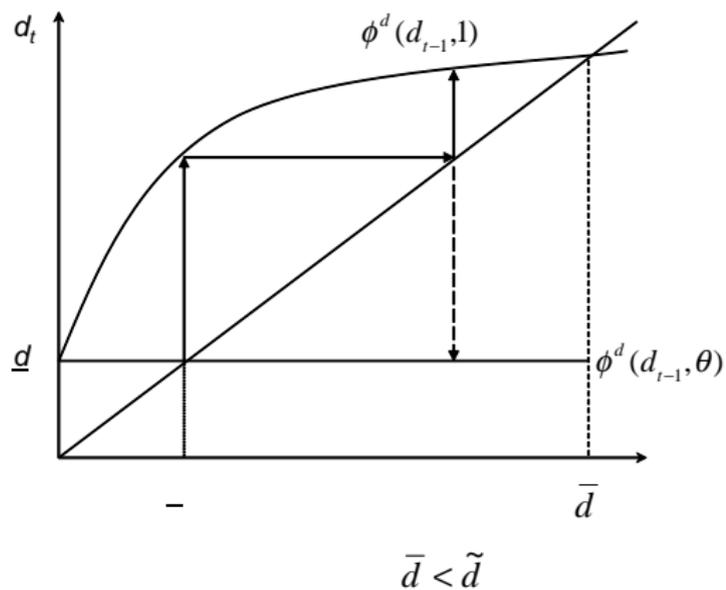
- ▶ Embed the static structure in an OLG setting
- ▶ Two-period lived workers and financiers
- ▶ Workers choose borrowing (d) when young
- ▶ Mature financiers make positive bequests to young financiers in good states
- ▶ Provides a link between periods

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: $\bar{d} < \tilde{d}$



Default Risk

- ▶ Suppose worker i has a probability ψ^i that he will have productive market labor
- ▶ Each workers 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

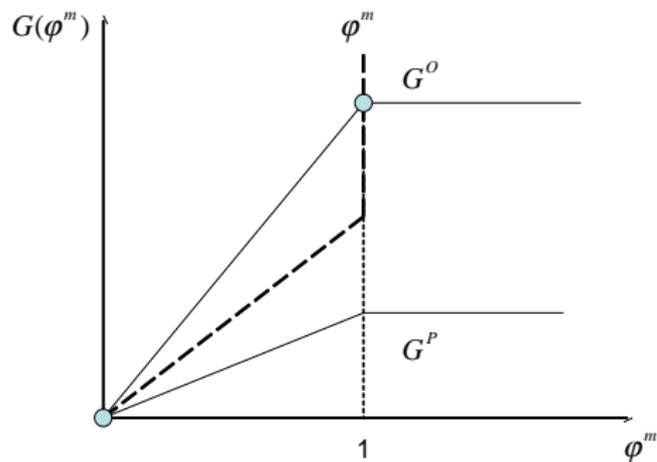
Debt Repackaging

- ▶ 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 ψ on their portfolio before the debt repackaging market opens
- ▶ Adverse selection problem
 - ▶ High ψ debt holders have an incentive to hold their debt back
 - ▶ Market return on debt pools all ψ '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