Bailouts and Regulation

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May 2010
QSPS Workshop

Bailouts were important this recession

Biggest bailout disbursements since 2008

Recipient	Amount Disbursed ($ billions)
Fannie Mae	$75.2
GM	$50.7
Freddie Mac	$50.7
AIG	$47.5
Bank of America	$45
Citigroup	$45
JP Morgan Chase	$25
Wells Fargo	$25

Recipients	Committed	Disbursed	Returned
833	$589 B	$513 B	$174 B

Source: Pro Publica, “Eye on the Bailout”.

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Ex post regulation has been important

- SEC regulatory oversight has increased
- Federal Reserve oversight has increased

April 29, 2010, *NYT* on financial regulation bill

"The bill, developed in months of talks between senators in both parties, would touch virtually every aspect of the financial system."

- Gov't can shut down risky financial institutions
- Consumer lending protection bureau
- Hedge fund oversight
- Derivatives market oversight

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Our question

- When can regulation and/or bailouts be welfare improving?
- We will look at *ex ante* (commitment) policy.
- We will look at revenue neutral bailout policy.

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Literature

1. Optimal policy with incomplete markets
    - Aiyagari (1994,1995), Diamond (2003), and more
2. Investor and manager incentive misalignment
    - Furlong and Keeley (1989, *JB&F*), Crawford and Sobel (1992), Benabou and Laroque (1992), Womack (1996),Chevalier and Ellison (1997, *JPE*), Morgan and Stocken (2003), Malmendier and Shanthikumar (2003)
3. Schneider and Tornell (*REStud*, 2004) International effects of bailout guarantees
4. Faccio, Masulis, and McConnell (*JoF*, 2010) estimates probability of bailout (implicit guarantees) using cross country data

Literature

5. Moral hazard cost of bailouts
   - Jeanne and Zettlemeyer (2001), Yeyati (2003), Panageas (2009)

6. Portfolio regulation
   - Peltzman (*JPE*, 1970), Koehn and Santomero (*JoF*, 1980), Milne (*JoBF*, 2002)

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What we're doing

- Bailouts
  - Benefits:
    - Add an asset to an incomplete market
    - Reduce variance in income
  - Costs:
    - Revenue neutrality implies future taxes
    - Induces moral hazard among firms
- Regulation
  - Benefits
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Competitive model (no gov't)

- Unit measure of identical risk averse households

$$\max_{c_t, s_{t+1}} E\left[\sum_{t=0}^{\infty} \beta^t \frac{c_t^{1-\gamma} - 1}{1-\gamma}\right]$$

$$\text{s.t.} \quad c_t \leq s_t R_t - s_{t+1}$$

- inelastic labor supply
- households' only asset is firm capital investment

Household optimal savings/investment

- Household intertemporal Euler equation

$$(c_t)^{-\gamma} = \beta E\left[R_{t+1}\left(c_{t+1}\right)^{-\gamma}\right]$$

- Analytical solution: conjecture savings rate ϕ

$$\begin{aligned} s_{t+1} &= \phi_t s_t R_t \\ c_t &= (1-\phi_t) s_t R_t \end{aligned}$$

- Solution for savings rate is:

$$\phi = \left(\beta E\left[R_{t+1}^{1-\gamma}\right]\right)^{\frac{1}{\gamma}} \quad \forall t$$

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Household optimal savings/investment

- Transversality condition must hold

$$\lim_{t \to \infty} \beta^t E\left[s_t R_t (c_t)^{-\gamma}\right] = 0$$

- Discounted expected marginal value of savings far in the future goes to zero
- Ensures that $\phi < 1$

Firms optimal portfolio choice

- Unit measure, identical, risk-neutral, perfectly competitive
- Receive household capital investment s_t
- Allocate s_t *ex ante* between riskless and risky asset
- α_t is percent of portfolio in risky asset
- Riskless (gross) return is $\theta > 1$ for all t
- Risky return is $X_t \sim \text{LN}(\mu, \sigma^2)$
- $E[X_t] > \theta$

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Firms optimal portfolio choice

- Firms' production function is linear in capital

$$y_t = K_t$$

  - where K_t is *ex post* capital

- capital K_t is some aggregator of risky and riskless portion of the portfolio

$$K_t = s_t\left[\alpha_t X_t + (1-\alpha_t)\theta\right]$$

- CES function is more general

$$K_t = s_t\left[\alpha_t X_t^{\frac{\rho-1}{\rho}} + (1-\alpha_t)\theta^{\frac{\rho-1}{\rho}}\right]^{\frac{\rho}{\rho-1}}, \quad \rho > 0$$

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Firms optimal portfolio choice

- Assume Cobb-Douglas $\rho = 1$ production function

$$y_t = s_t X_t^{\alpha_t} \theta^{1-\alpha_t}$$

  - two assets are still substitutes
  - but have a degree of complementarity
  - provides some analytical tractability

- Firm's problem is choose α_t to max expected profits

$$\max_{\alpha_t} E\left[s_t X_t^{\alpha_t} \theta^{1-\alpha_t} - s_t R_t\right]$$

- Because $E[X_t] > \theta$

$$\alpha_t = 1, \quad \forall t$$

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Competitive equilibrium

- Zero profit condition requires that $R_t = X_t^{\alpha_t}\theta^{1-\alpha_t}$
- The goods market clears: $y_t = c_t + s_{t+1}$

Definition 1: Competitive Equilibrium

1. Households optimize: $\phi = \left(\beta E\left[R_{t+1}^{1-\gamma}\right]\right)^{\frac{1}{\gamma}} \quad \forall t$
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- $\alpha_t = 1$ implies $R_t = X_t$
- Competitive equilibrium savings rate becomes

$$\phi_c = \left(\beta E\left[X_{t+1}^{1-\gamma}\right]\right)^{\frac{1}{\gamma}} = \left[\beta e^{(1-\gamma)\mu + \frac{(1-\gamma)^2\sigma^2}{2}}\right]^{\frac{1}{\gamma}}$$

- Discounted expected lifetime utility is

$$V^c(s_0 R_0) = \begin{cases} \frac{1}{1-\gamma}\left[(1-\phi_c)^{-\gamma}(s_0 R_0)^{1-\gamma} - \frac{1}{1-\beta}\right] & \text{if} \quad \gamma > 1 \\ \frac{1}{1-\beta}\left[\log([1-\phi_c] s_0 R_0) + \frac{\beta}{1-\beta}(\log(\phi_c) + \mu)\right] & \text{if} \quad \gamma = 1 \end{cases}$$

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Planner's regulation problem

- Planner chooses s_{t+1} and α_{t+1} to max household welfare
- $\hat{\alpha}$ is an upper bound on firms' choice $\alpha \leq \hat{\alpha}$

$$\max_{s_{t+1}, \alpha_{t+1}} E\left[\sum_{t=0}^{\infty} \beta^t \frac{\left(s_t X_t^{\alpha_t} \theta^{1-\alpha_t} - s_{t+1}\right)^{1-\gamma} - 1}{1-\gamma}\right]$$

$$s_{t+1} \geq 0, \quad \alpha_{t+1} \in [0,1] \quad \forall t$$

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Definition 2: Planner's Regulation Equilibrium

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2. Firms optimize: $\alpha_t \leq \hat{\alpha}_r \quad \forall t$
3. Zero profits: $R_t = X_t^{\alpha_t}\theta^{1-\alpha_t}$
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Planner's regulation equilibrium

- Firms choose $\alpha_t = \hat{\alpha}$
- Equilibrium savings rate as a function of α

$$\phi_r(\alpha) = \left[\beta\theta^{(1-\alpha)(1-\gamma)} e^{\alpha(1-\gamma)\mu + \frac{\alpha^2(1-\gamma)^2\sigma^2}{2}}\right]^{\frac{1}{\gamma}}$$

- Lifetime discounted expected utility as function of α

$$V^r(s_0R_0,\alpha) = \begin{cases} \frac{1}{1-\gamma}\left[\Big(1-\phi_r(\alpha)\Big)^{-\gamma}(s_0R_0)^{1-\gamma} - \frac{1}{1-\beta}\right] & \text{if} \quad \gamma > 1 \\ \frac{1}{1-\beta}\Big[\log\Big(\left[1-\phi_r(\alpha)\right]s_0R_0\Big) + \frac{\beta}{1-\beta}\Big(\log\big(\phi_r(\alpha)\big) + \ldots \\ \qquad (1-\alpha)\log(\theta) + \alpha\mu\Big)\Big] & \text{if} \quad \gamma = 1 \end{cases}$$

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- The optimal regulated upper bound is

$$\hat{\alpha} = \begin{cases} \frac{\mu - \log(\theta)}{(\gamma-1)\sigma^2}, \quad \hat{\alpha} \in [0, 1] & \text{if} \quad \gamma > 1 \\ 1 & \text{if} \quad \gamma = 1 \end{cases}$$

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  - $\hat{\alpha}$ aligns household and firm incentives

- Welfare under $\hat{\alpha}$ dominates competitive solution for some parameters

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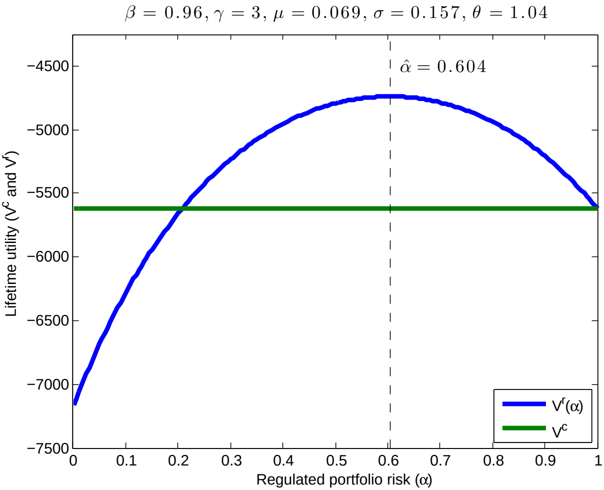
  - Calibration: $\mu = 0.069, \sigma = 0.157, \theta = 1.04, \beta = 0.96, \gamma = 3$

Regulation vs. competitive equilibria



Planner's bailout problem

- Bailout policy is minimum guaranteed return a

$$\tilde{R}_t = \max\left\{X_t^{\alpha_t}\theta^{1-\alpha_t}, a\right\}$$

- Policy a only reinforces firm's optimal decision $\alpha = 1$

$$\max_{\alpha_t} \; E\left[s_t(1-\tau)\max\left\{X_t^{\alpha_t}\theta^{1-\alpha_t}, a\right\} - s_t R_t\right]$$

- Revenue neutrality: a associated with capital gains tax $\tau(a)$

$$\int_0^a (a - X_t) f(X_t) dX_t = \tau\left[F(a)a + \left(1 - F(a)\right)\int_a^\infty X_t f(X_t) dX_t\right]$$

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Planner's bailout problem

- Zero profit condition pins down R_t

$$R_t = (1-\tau)\max\left\{X_t^{\alpha_t}\theta^{1-\alpha_t}, a\right\} \quad \forall t$$

- Planner chooses s_{t+1} and a to maximize household welfare

$$\max_{s_{t+1},a} E\left[\sum_{t=0}^{\infty}\beta^t \frac{(s_t R_t - s_{t+1})^{1-\gamma}-1}{1-\gamma}\right], \quad s_{t+1}, a \geq 0, \quad \forall t$$

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Planner's bailout equilibrium

Definition 3: Planner's Bailout Equilibrium

1. Households optimize: $\phi_b = \left(\beta E\left[R_{t+1}^{1-\gamma}\right]\right)^{\frac{1}{\gamma}} \quad \forall t$
2. Firms optimize: $\alpha_t = 1 \quad \forall t$
3. Zero profits: $R_t = (1-\tau)\max\left\{X_t^{\alpha_t}\theta^{1-\alpha_t}, a\right\} \quad \forall t$
4. Planner chooses revenue neutral $\hat{a}$ to maximize household welfare
5. Goods market clears $y_t = c_t + s_{t+1}$

Planner's bailout equilibrium

- Equilibrium interest gross return R_t is

$$R_t = (1-\tau)\max\{X_t, a\} \quad \forall t$$

- Equilibrium savings rate as a function of a

$$\phi_b(a) = \left(\beta[1-\tau(a)]^{1-\gamma} E\left[\max\{X_t, a\}^{1-\gamma}\right]\right)^{\frac{1}{\gamma}}$$

- Lifetime discounted expected utility as function of a

$$V^b(s_0R_0, a) = \begin{cases} \frac{1}{1-\gamma}\left[\left(1-\phi_b(a)\right)^{-\gamma}(s_0R_0)^{1-\gamma} - \frac{1}{1-\beta}\right] \\ \frac{1}{1-\beta}\left[\log\left([1-\phi_b(a)]s_0R_0\right) + \frac{\beta}{1-\beta}\left(\log(\phi_b(a)) + \mu\right)\right] \end{cases}$$

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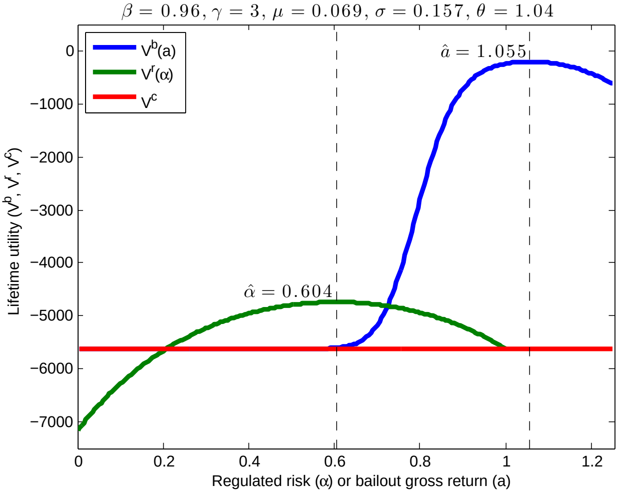
Bailout vs. regulation equilibria



Comparison

- Regulation aligns household and firm incentives
- Bailouts increase market completeness
- Sometimes market incompleteness wedge dominates misaligned incentives wedge
- Bailout and regulation policy would be optimal
- Can we test this model with data?

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What do the data say?

- The following are functions of average returns μ and variance of returns σ^2
  - Regulation $\hat{\alpha}$
  - Tax rates τ
  - Savings rates ϕ
  - Consumption c
  - Estimate probability of bailout (implicit guarantees)

Summary of findings

- Regulation can align household and firm incentives
- Bailouts can increase market completeness
- Must know relative size of market incompleteness and incentive misalignment
- Some combination of regulation and bailouts can be optimal

Where we are going

- Take model to the data
- General CES production function $\rho \geq 1$
- Persistent X_t
  - Firms sometimes choose $\alpha_t = 0$, quantify moral hazard
  - Government revenue neutrality depends on X_t and β
- Allow firms to use leverage, quantify moral hazard
- What is optimal nonlinear tax rate τ?