
Efficient Recapitalization

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Debt overhang

- Financial distress leads to underinvestment (Myers (1977))
 - Investment cost paid by equity holders
 - If debt is risky, investment returns partially captured by debt holders
 - As a result, equity holders may not want to make good investments
- Debt overhang in financial sector
 - Risky assets on bank balance sheets generate risky debt
 - Seen by many as cause of drop in bank lending (Ivashina and Scharfstein (2008)): Fama (2009), Diamond and Rajan (2009)
- “In today’s financial environment, debt overhang problems can be seen everywhere.” Allen, Bhattacharya, Rajan, and Schoar (2008)

What to do?

- Purchase risky assets, Inject equity, Guarantee new debt
- All of the above? None of the above?
- No agreement on solution:
 - Stiglitz (2008): equity injections
 - Bernanke (2009): purchase risky assets + debt guarantee
 - Diamond, Kaplan, Kashyap, Rajan, and Thaler (2008): purchase risky assets + equity injection

Our approach

- Write down textbook model of debt overhang
- Set up optimization problem for government intervention
 - Symmetric and asymmetric information
- Compare different interventions
 - Asset purchases, equity injections, debt guarantees, optimal mechanism
- Caveats
 - No other market failures
 - Nothing on ex-ante moral hazard (Farhi and Tirole (2009))

Results

1. Government intervention generates rents for banks
 - Macroeconomic rents: Non-participating banks benefit from intervention ("free riding")
 - Informational rents: Participating banks may not need the program ("opportunistic participation")
2. Optimal intervention
 - Use minimum participation requirements to extract macro rents
 - Use preferred stock and warrants to minimize informational rents

Debt overhang model

Model: Technology and Information

- Continuum of banks, three dates: $t=0,1,2$
- Banks
 - Own risky assets: $a = A$ or $a = 0$ (fixed at time 0, pay off at time 2)
 - Payoff depends on average repayment \bar{a} and bank-specific risk ε

$$p(\varepsilon, \bar{a}) \equiv \Pr(a = A | \varepsilon, \bar{a})$$

- New investment possible at time 1:

$$x \rightarrow v$$

- Bank type ε, v revealed to private sector at time 1 but not to government

Fig 1: Information & Technology

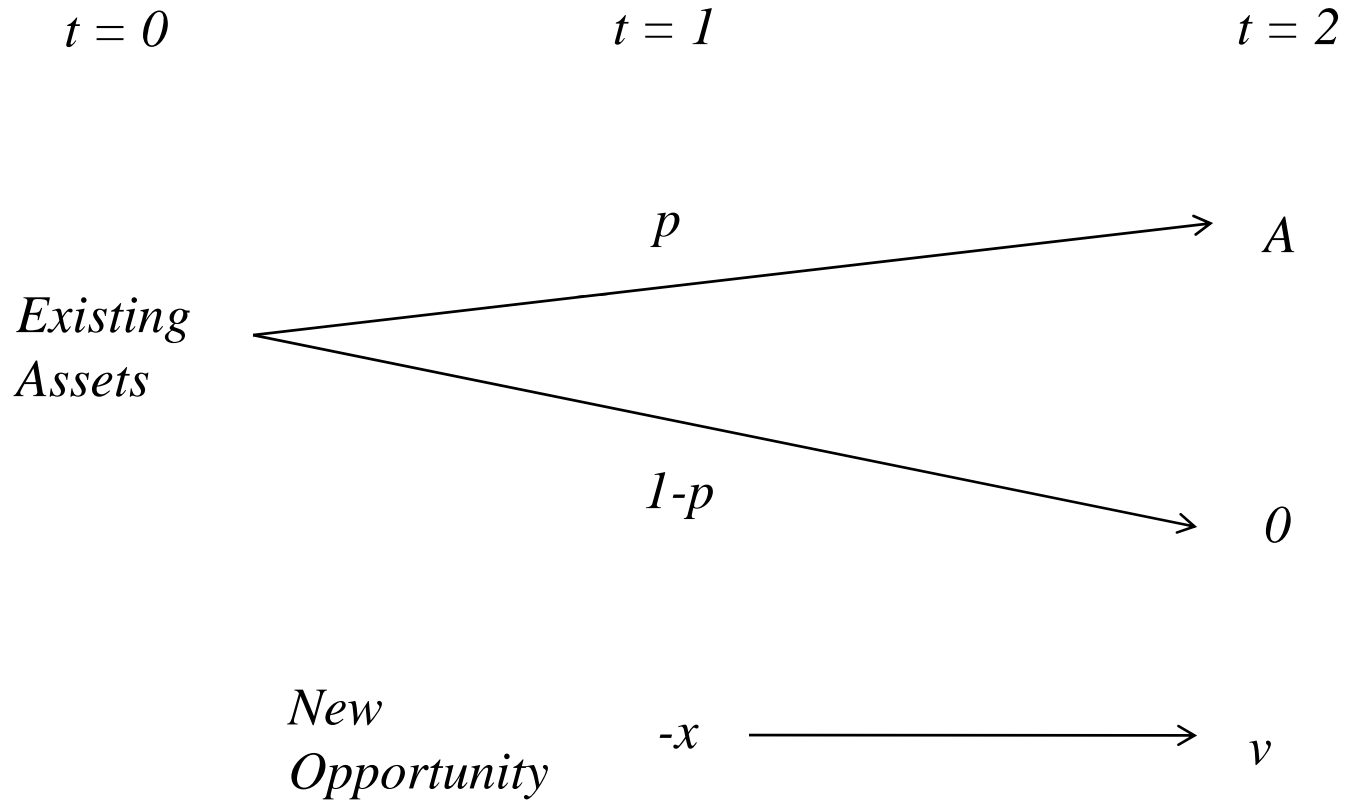
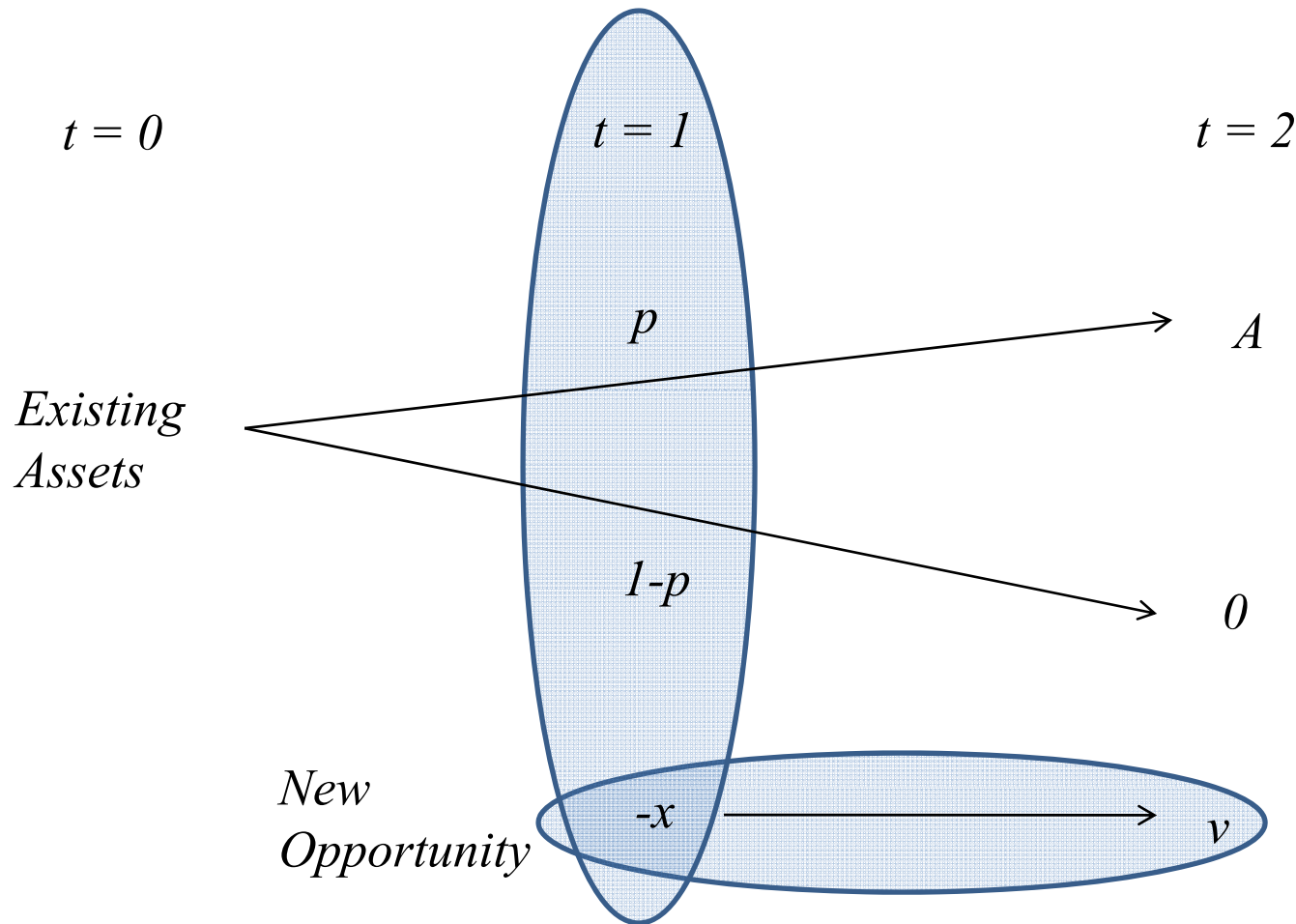


Fig 1: Information & Technology



Model: Technology and Information

- Continuum of households
 - Risk-neutral, identical, consume at time 2
 - Own banks *and* owe risky loans A
 - Can lend or store endowment at time 1
 - Receive risky endowment at time 2. If sufficient income repay A , otherwise default.

Equilibrium in three markets

- Lending market at time 1: Investment equals household lending

$$x \iint_I dF(\varepsilon, v) = l$$

- Risky asset market: Repayment \bar{a} equals expected repayment

$$p(\bar{a}) A = \bar{a}$$

- GDP: Bank income equals payments to households

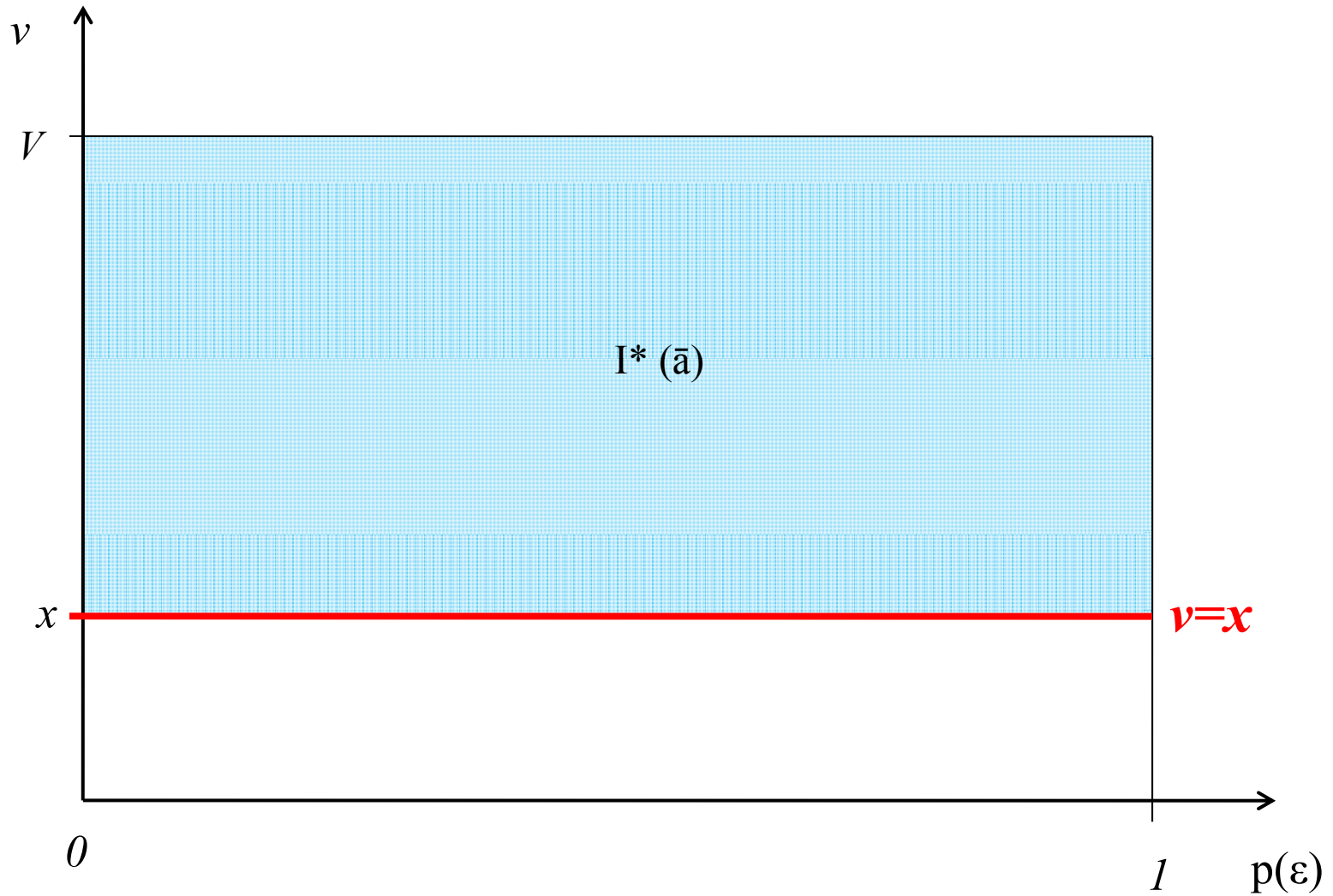
$$\bar{a} + \iint_I v dF(\varepsilon, v) = y^e + y^D + y^l$$

First best

- Households maximize consumption and banks maximize firm value
- Households charge riskless rate because loans are secured
- Banks invest if they have positive NPV project $v > x$
- Investment domain

$$I^*(\bar{a}) \equiv \{(\varepsilon, v) \mid v > x\}$$

Fig 3: First Best



Debt overhang assumptions

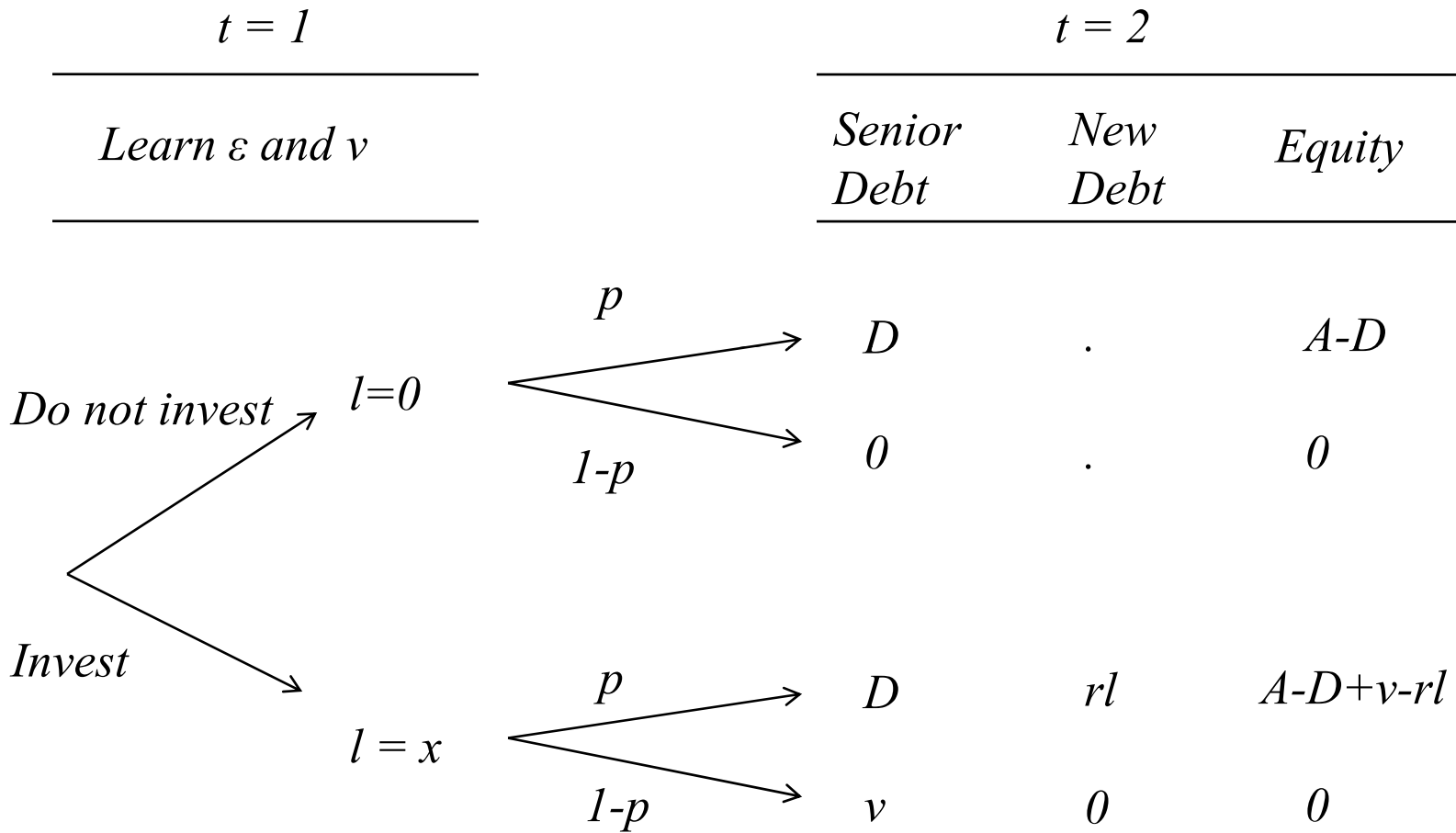
- Existing debt with face value D due at time 2
- Banks maximize equity value
- Debt has priority

$$y^d = \min(y, D)$$

- Assume risky debt

$$V < D < A$$

Fig 2: Payoffs



Interventions against debt overhang

Debt overhang equilibrium

- Banks invest iff

$$v > rx$$

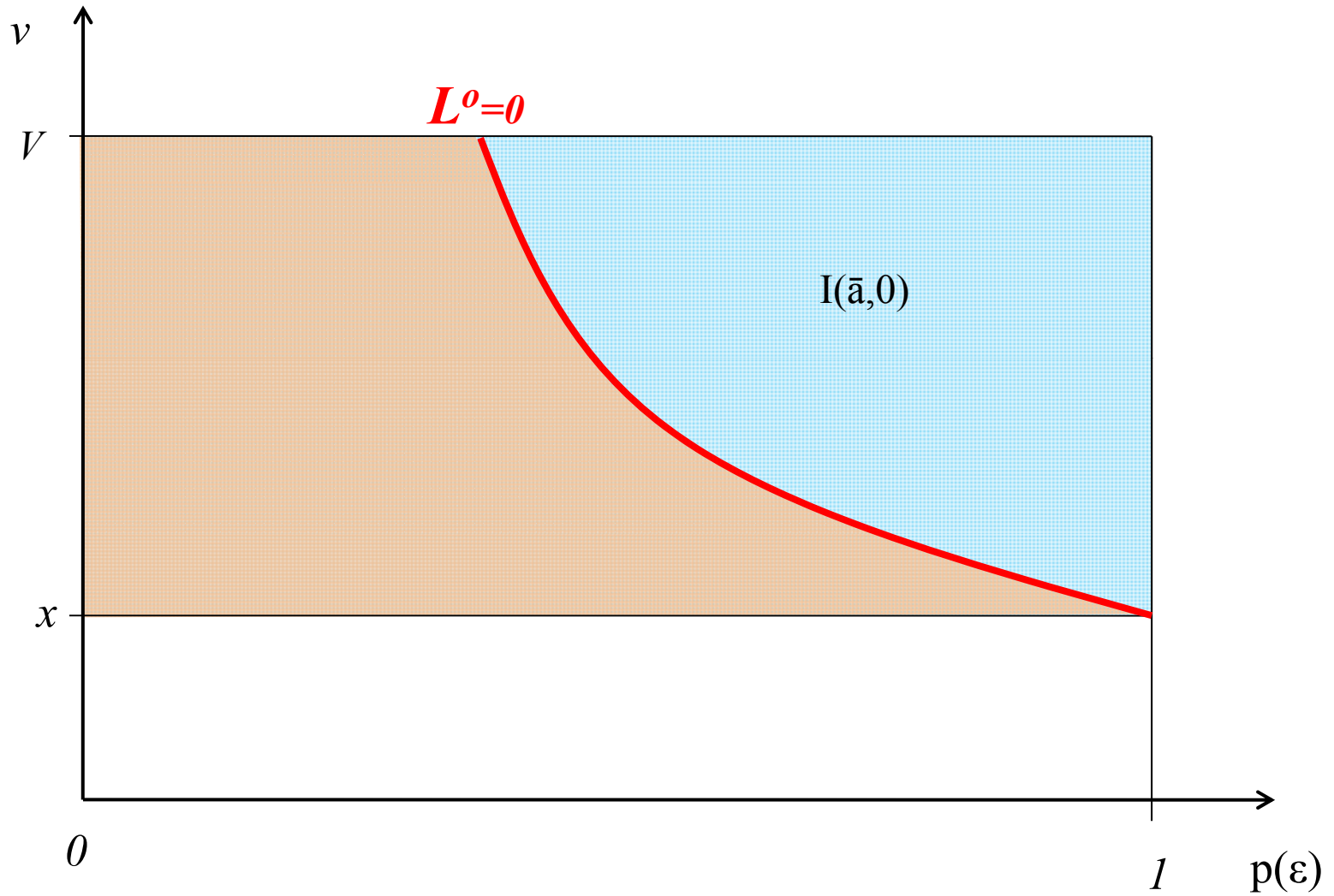
- Households charge premium for credit risk

$$r = \frac{1}{p(\varepsilon)}$$

- Investment domain

$$I(\bar{a}) \equiv \{(\varepsilon, v) \mid p(\varepsilon)v > x\},$$

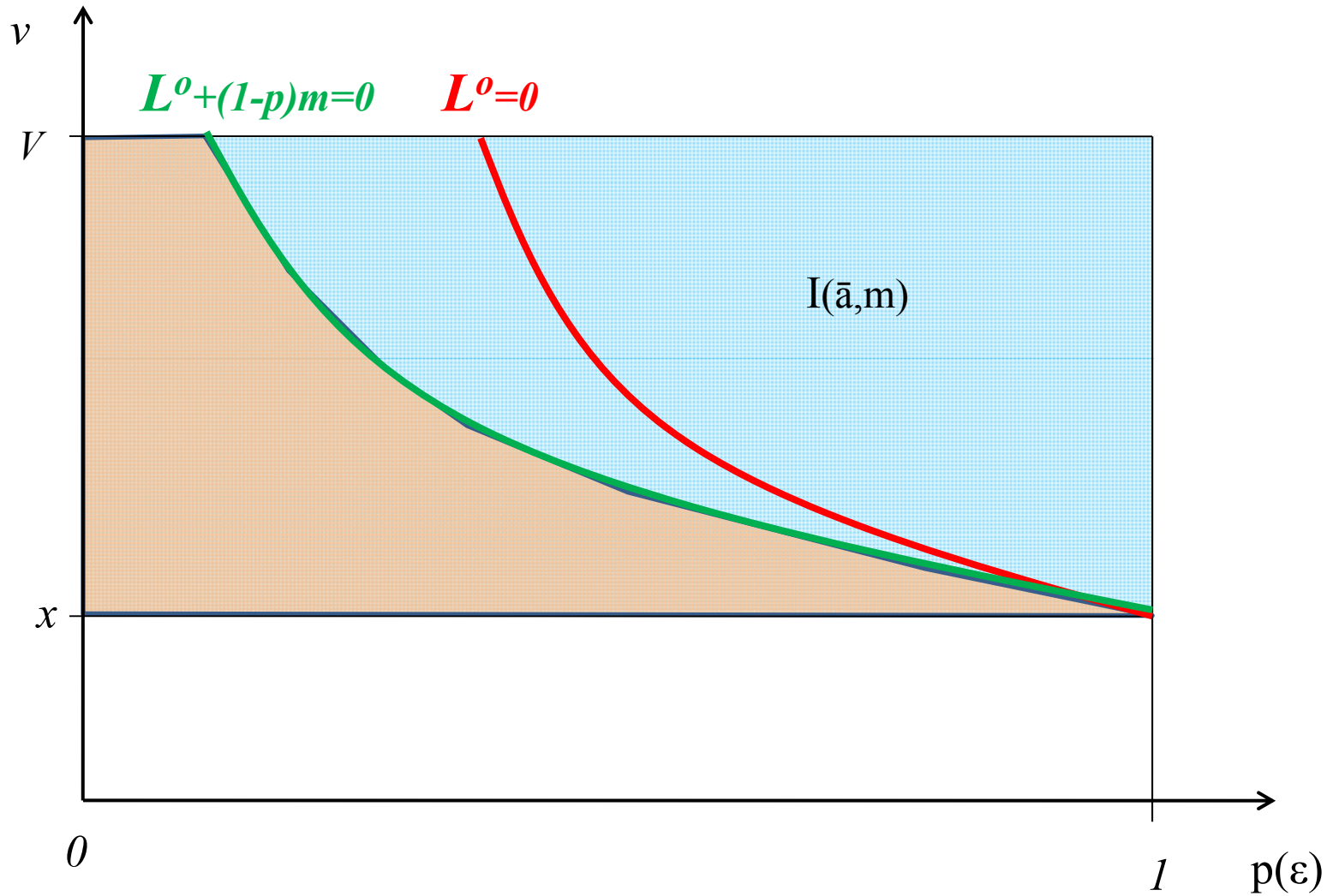
Fig 4: Debt Overhang



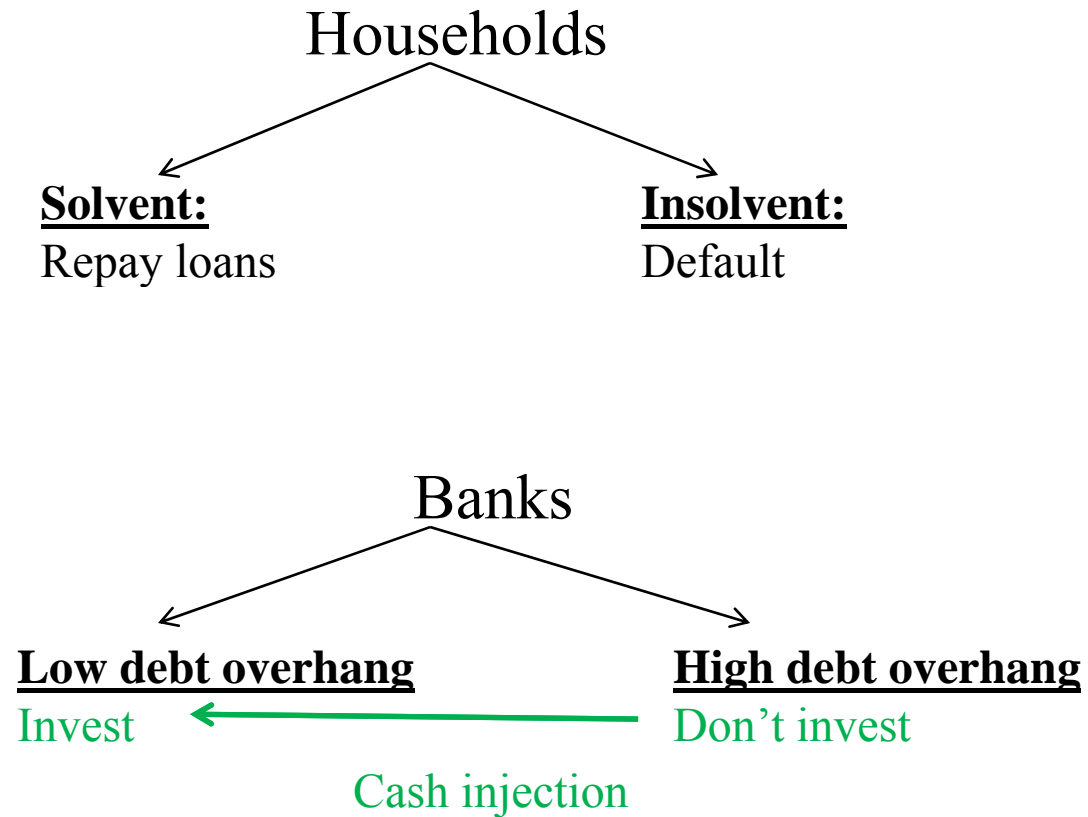
Debt overhang equilibrium is inefficient

Proposition: *The debt overhang equilibrium is inefficient. Non-distorting transfers from households to banks at time 1 lead to a Pareto superior outcome.*

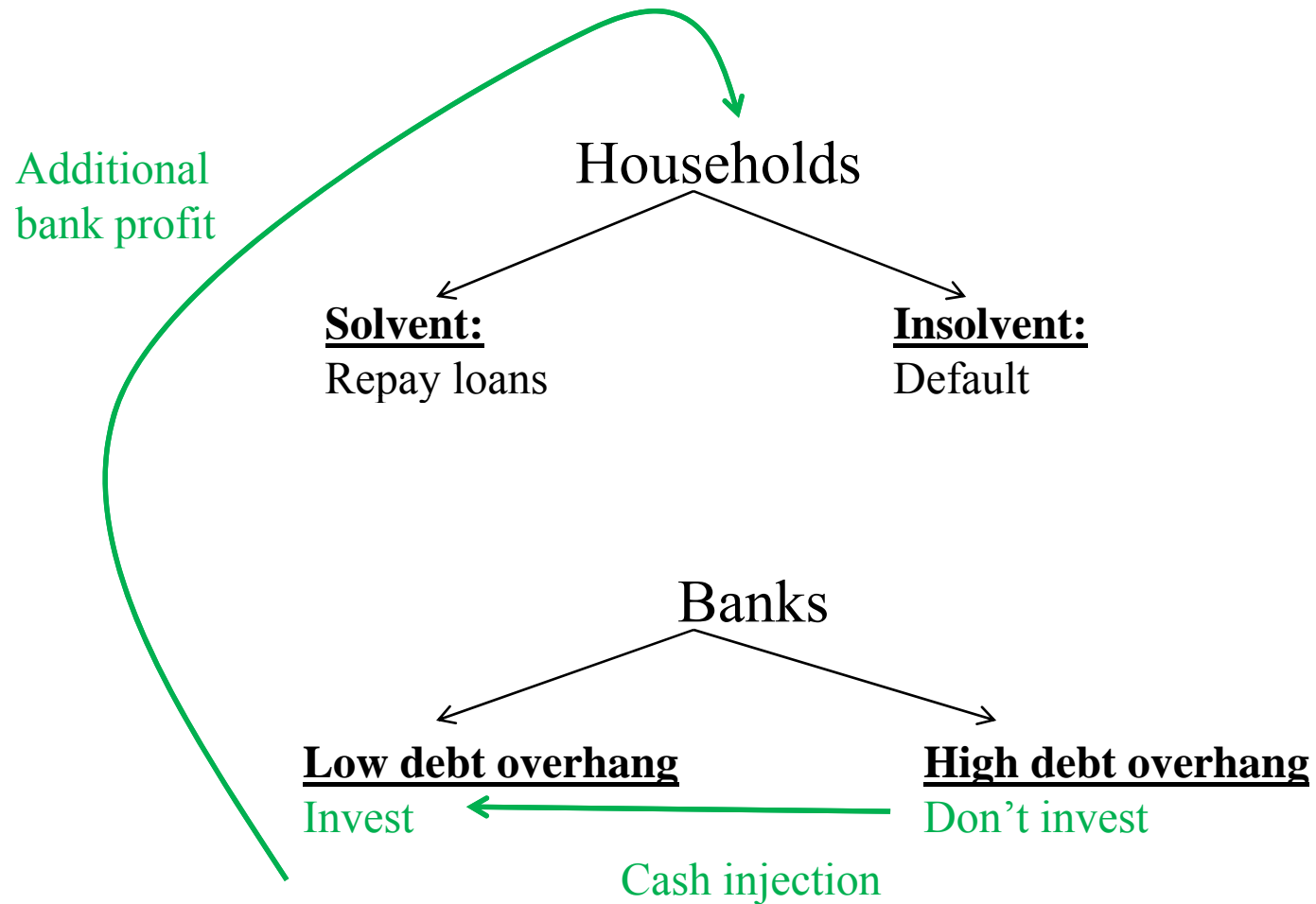
Fig 5: Cash at time 0



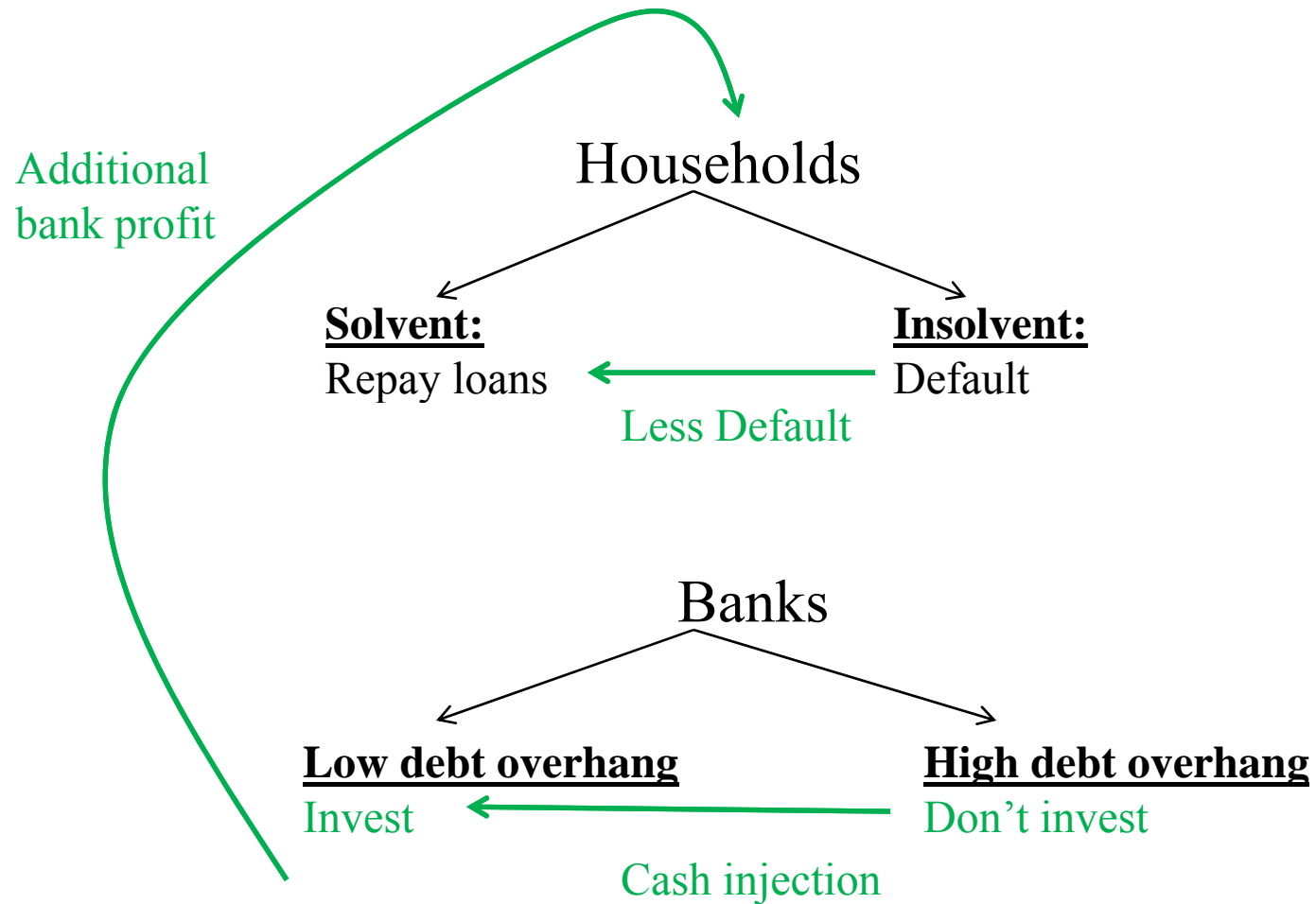
Complementarities: Investment



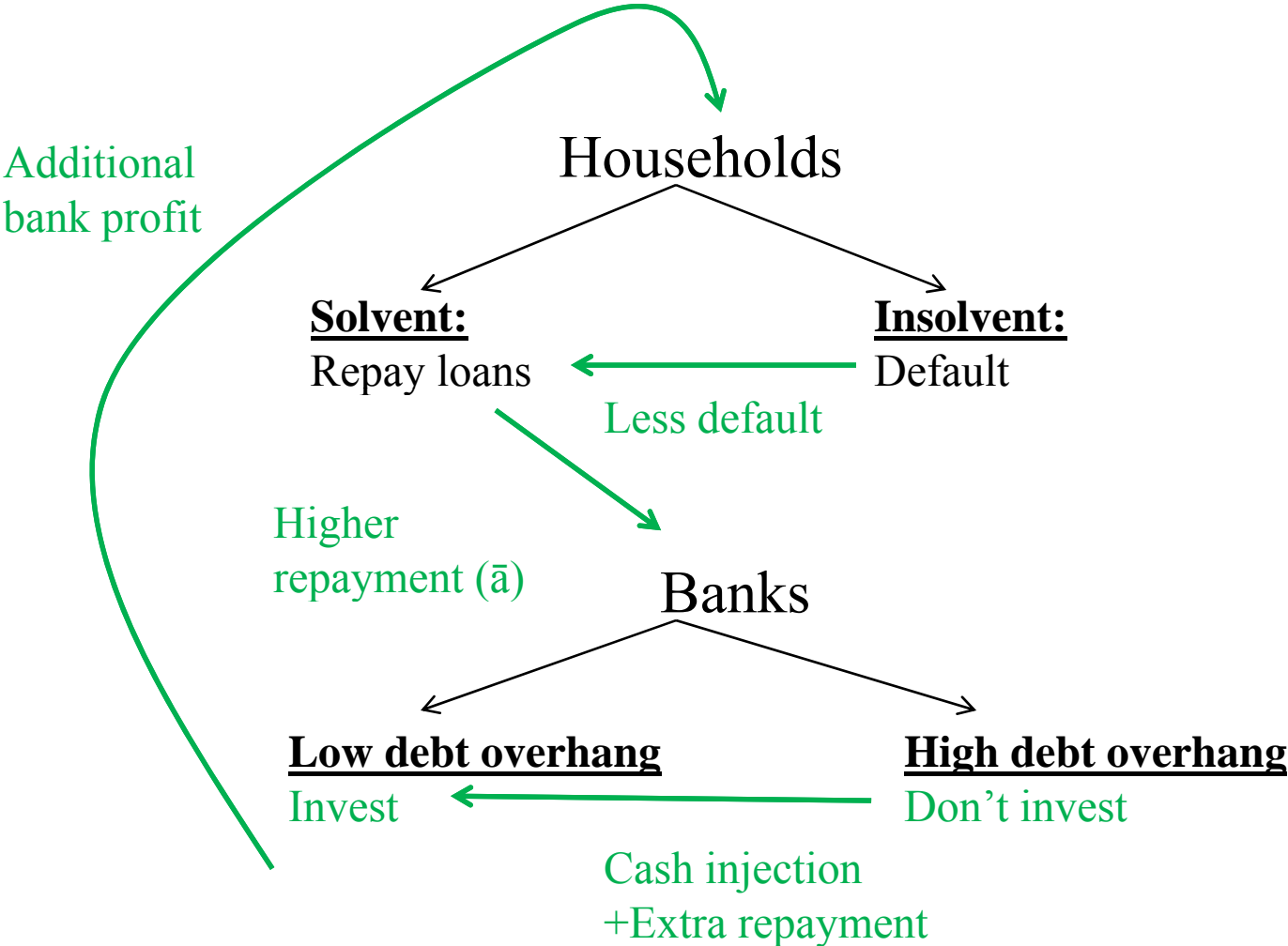
Complementarities: Investment



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Complementarities: Investment



Objective function

The objective function of the government is to maximize average household consumption:

$$\max_{\Gamma} E(c(\Gamma))$$

- Subject to
 - Deadweight loss of taxation
 - Symmetric and asymmetric information
 - Can restrict dividend payments (Scharfstein and Stein (2008))

Government interventions

- Two sources of rents for banks:
 - Macroeconomic rents: Non-participating banks benefit from intervention (free riding)
 - Informational rents: Banks participate but no change in investment (opportunistic participation)

Macroeconomic rents (symmetric information)

Theorem. Comparison of date 0 programs

Theorem: *The government must use a minimum participation requirement to extract macroeconomic rents from banks.*

Macroeconomic rents: Intuition

- Step 1: Intervention improves expected macro state from \bar{a}_L to \bar{a}_H
- Step 2: Bank's outside option improves because of intervention
- Step 3: Minimum participation extracts increase in outside option

$$E_0 [y^e (0) | \bar{a}_H] - E_0 [y^e (0) | \bar{a}_L] > 0$$

- Similar to mandatory program. Can turn a profit.
- Form of the intervention is irrelevant (asset purchase, debt guarantee, equity injection)

Informational rents (asymmetric information)

Reduce information rents

- Rule out inefficient participation
 - Banks who plan to sit on the cash. Charge high enough price to discourage inefficient participation.
- Limit opportunism
 - Banks who can invest on their own. About the upper bound.
- Minimize informational rents conditional on participation

Theorem. Comparison of date 1 programs

Theorem: *An optimal asset purchase program is equivalent to an optimal debt guarantee program.*

Theorem: *For any optimal asset purchase program, there is an optimal equity program that achieves the same allocation at a lower cost for the government.*

Fig 6: Asset Purchase at time 1

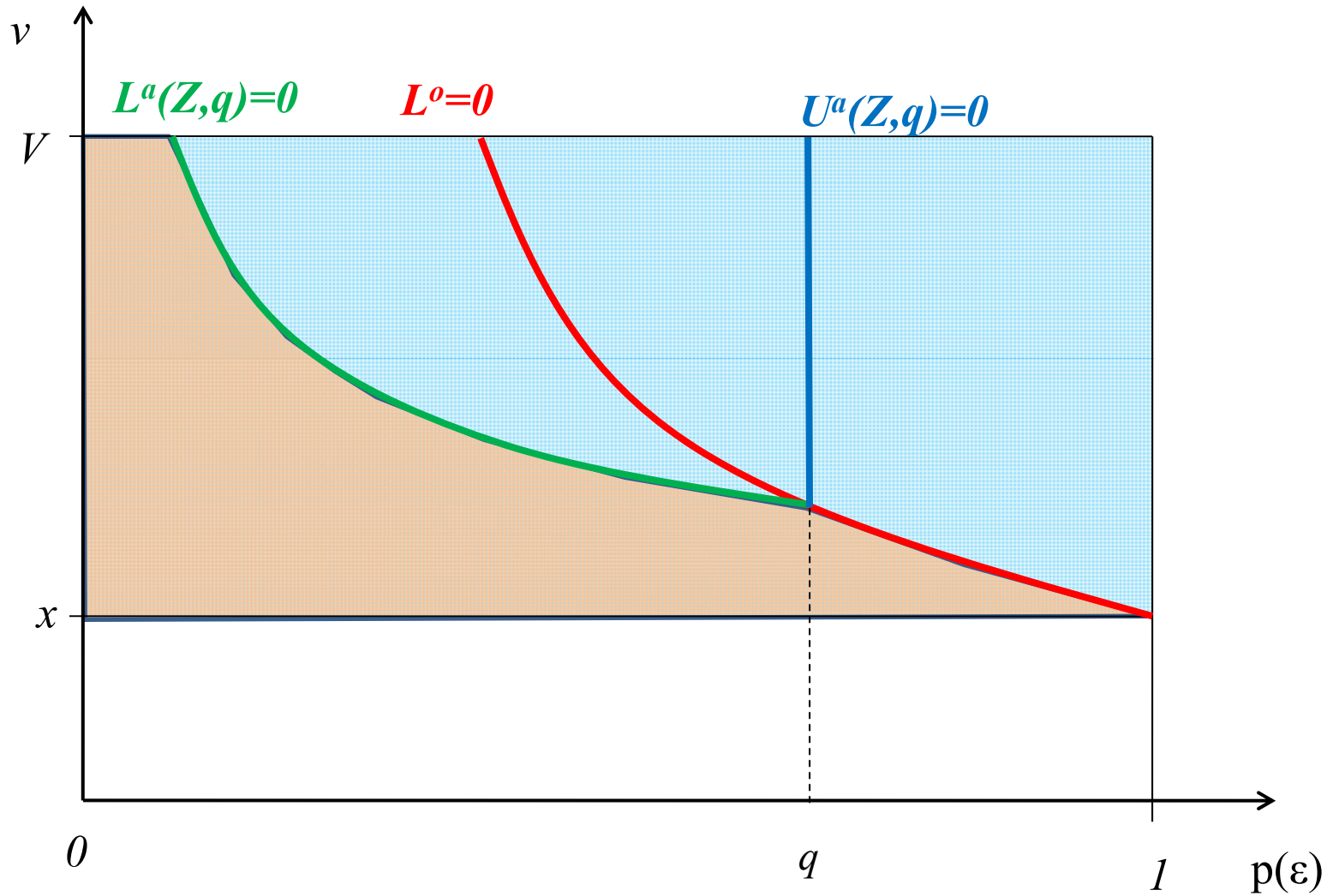


Fig 6: Asset Purchase at time 1

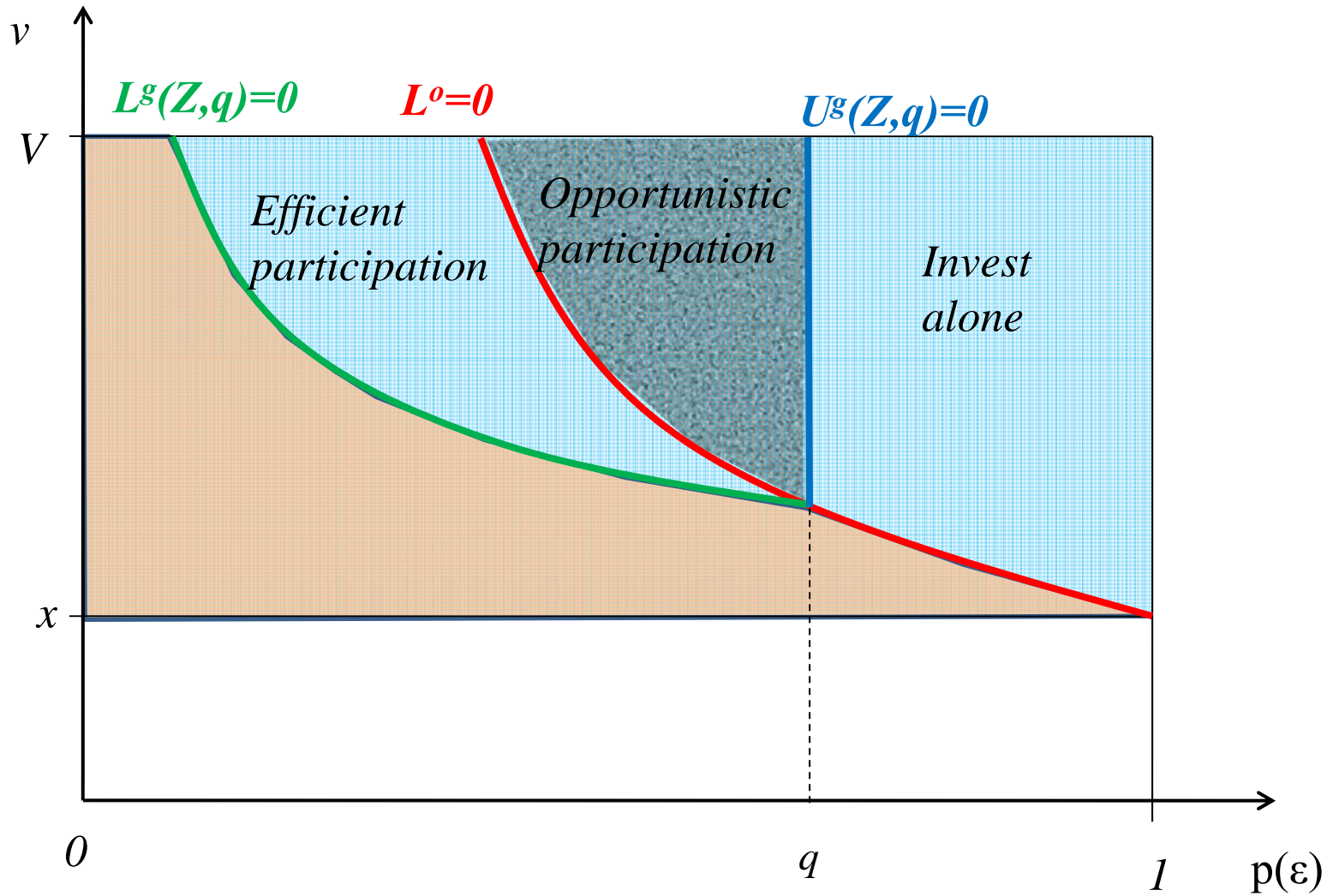
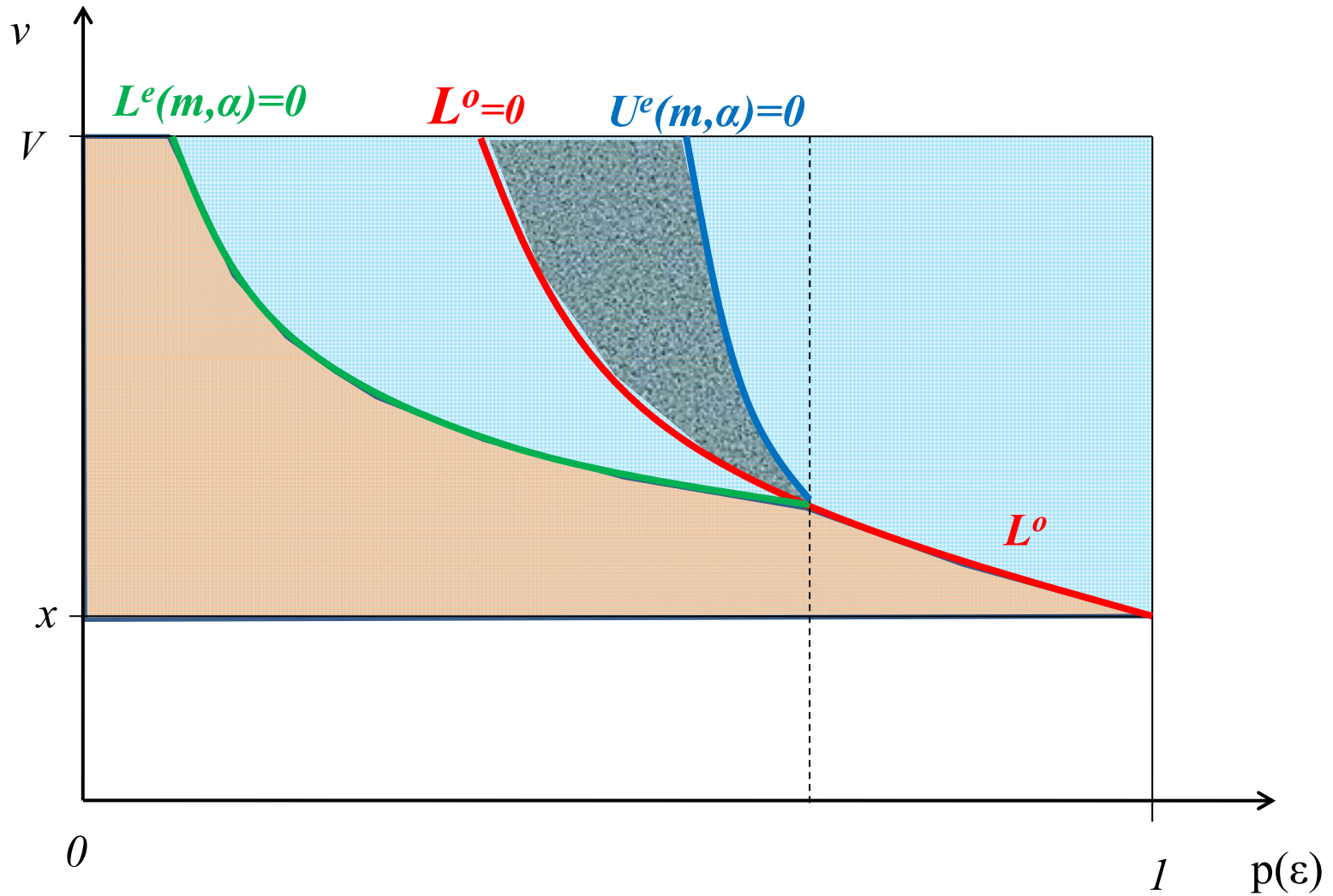


Figure 7: Equity injection at time 1



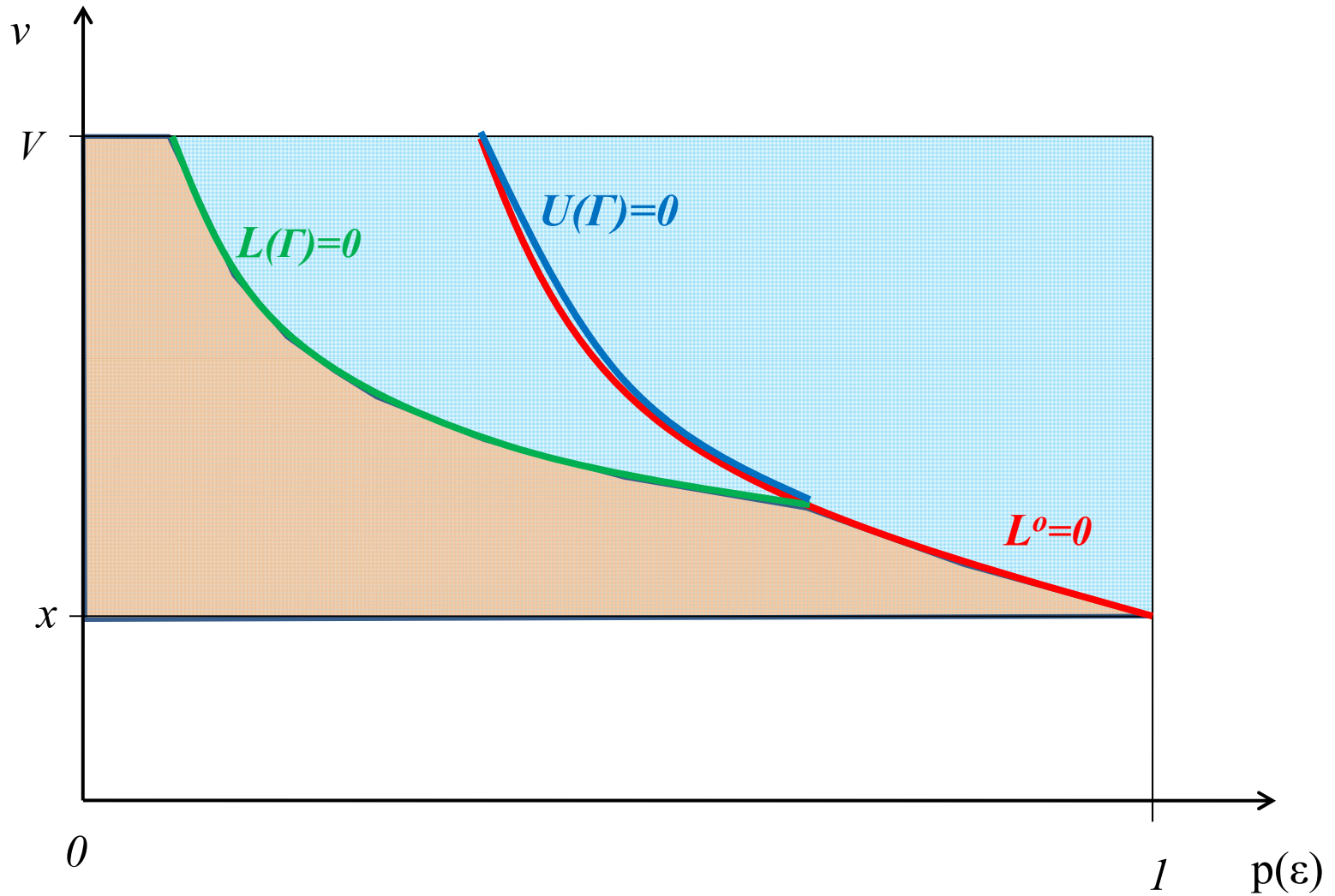
Efficient program

- Preferred stock with warrants at strike price $A - D$
- Payments to old shareholders

$$f(y^e) = \min(y^e, A - D) + \varepsilon \max(y^e - (A - D), 0)$$

- Full residual claimants up to value of old assets in good state
- ε residual claimants beyond
- Summary
 - Good for banks who are really constrained.
 - Implements allocation as if ε, v are observed by government
 - Also limits risk shifting
- Similar to U.S. bailouts under TARP

Figure 8: Efficient Mechanism



Conclusion

Summary

- Optimal bailouts extract rents from banks
 - Make banks pivotal (macroeconomic rents)
 - Ask for preferred stock and warrants (informational rents)
- Bailout costs
 - Can generate profit if macroeconomic rents are large
 - Otherwise trade-off less debt overhang with tax distortion

References

- Allen, F., S. Bhattacharya, R. Rajan, and A. Schoar (2008): “The Contributions of Stewart Myers to the Theory and Practice of Corporate Finance,” *Journal of Applied Corporate Finance*, 20, 8–19.
- Bernanke, B. (2009): “Financial Reform to Address Systemic Risk,” Speech at the Council on Foreign Relations.
- Diamond, D., S. Kaplan, A. Kashyap, R. Rajan, and R. Thaler (2008): “Fixing the Paulson Plan,” *Wall Street Journal*.
- Diamond, D. W., and R. G. Rajan (2009): “Fear of fire sales and the credit freeze,” NBER WP 14925.
- Fama, E. (2009): “Government Equity Capital for Financial Firms,” www.dimensional.com/famafrench.

- Farhi, E., and J. Tirole (2009): “Collective Moral Hazard, Maturity Mismatch and Systemic Bailouts,” Working Paper.
- Ivashina, V., and D. Scharfstein (2008): “Bank Lending During the Financial Crisis of 2008,” Harvard Business School Working Paper.
- Myers, S. C. (1977): “Determinants of Corporate Borrowing,” *Journal of Financial Economics*, 5, 147–175.
- Scharfstein, D., and J. Stein (2008): “This Bailout Doesn’t Pay Dividends,” *The New York Times*, October 21.
- Stiglitz, J. (2008): “We Aren’t Done Yet: Comments on the Financial Crisis and Bailout,” *The Economists’ Voice*, 5 (5).