Expectations vs. Fundamentals-based Bank Runs:

When should bailouts be permitted?

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The question

- Is it desirable to restrict policy makers from engaging in bailouts?
  - heated debate on this issue
  - important implications for policy reform

- Dodd-Frank Act prohibits some types of actions taken 2008-9
  - example: places new restrictions on the Fed's ability to lend
  - and on the ability of the Treasury and FDIC to guarantee the debt of financial institutions

Q: What types of actions should/should not be prohibited?

- what principle(s) should guide these decisions?

A proposed answer

- Lacker (2008) proposes a simple rule to guide these decisions:

  "Researchers have found it useful to distinguish between what I'll call 'fundamental' and 'non-fundamental' runs. . . .

  This distinction is important because the two types of runs have very different policy implications.

  Preventing a non-fundamental run avoids the cost of unnecessary early asset liquidation, and in some models can rationalize government or central bank intervention.

  In contrast, in the case of runs driven by fundamentals, the liquidation inefficiencies are largely unavoidable and government support interferes with market discipline and distorts market prices."

In other words

- Intervention may be useful when runs are caused by expectations (i.e., "sunspots" or multiple equilibria)
  - in particular, may eliminate bad equilibria
  - think of deposit insurance in the Diamond-Dybvig (1983) model

- But intervention is harmful when runs are caused by fundamentals (i.e., the inevitable response to a real shock)
  - policy maker's actions should be restricted in this case

Q: Is this a good rule?

- is expectations vs. fundamentals the key issue?
- what other factors may be important?

What we do

- Construct a banking model in which runs may be either:

  (i) non-fundamental (depend on realization of a sunspot variable), or

  (ii) fundamental (the inevitable result of a real shock)

- Study equilibrium under two policy regimes:

  (a) no policy intervention is allowed in a crisis

  (b) policy maker intervenes at will (provides bailouts; no commitment)

Ask: Which regime generates higher welfare?

- does the answer depend on (i) vs. (ii)?
- what other principle(s) should guide the decision?

Results

- Model identifies a fundamental tradeoff between two forces:
  - intervention distorts **incentives**
  - but also offers **insurance**

- Desirability of allowing intervention depends on which force dominates
  - if incentive distortion can be corrected through regulation

    $\Rightarrow$ allowing intervention is always desirable
  - if regulation is imperfect and the insurance benefit is small

    $\Rightarrow$ always better to prohibit intervention

- In general: intervention is desirable if regulation is sufficiently effective
  - precise cutoff depends on cause (expectations or fundamentals)
  - but the same tradeoff appears in both cases

Related Literature

- Growing literature on the effects/desirability of intervention, bailouts
- Settings with fundamental shocks where intervention is bad:
  - Farhi & Tirole (2013), Chari & Kehoe (2013)
- Setting with self-fulfilling runs where intervention may be desirable:
  - Diamond & Dybvig (1983), Chang & Velasco (2000), Cooper & Kempf (2013), Keister (2014)
- A few papers with fundamental shocks where intervention may be good
  - Gale & Vives (2002), Bianchi (2013)
  - but benefits of bailouts are related to contracting frictions
- Here: study crises driven by expectations or fundamentals within a common framework

Outline

- The model
- Equilibrium with no intervention
- Equilibrium when intervention is allowed
- Results and some examples
- Concluding remarks

The model

- $t = 0, 1, 2$

- Continuum of depositors, $i \in [0, 1]$

  – utility

$$u\left(c_1^i + \omega_i c_2^i\right) + \delta v\left(g\right) \qquad \text{(CRRA)}$$

$$\text{where } \omega_i = \left\{ \begin{array}{c} 0 \\ 1 \end{array} \right\} \text{ means the depositor is } \left\{ \begin{array}{l} \text{impatient} \\ \text{patient} \end{array} \right\}$$

  – c_t^i is private consumption, g is a public good

  – δ measures the weight of the public good in utility

- Type is revealed at $t = 1$; private information

  – $\pi \in \{\pi_L, \pi_H\}$ = probability of being impatient for each depositor

Technologies

- Depositors have endowments at $t = 0$

- Goods invested at $t = 0$ yield $\left\{ \begin{array}{c} 1 \\ R > 1 \end{array} \right\}$ at $t = \left\{ \begin{array}{c} 1 \\ 2 \end{array} \right\}$

  - usual incentive to pool resources for insurance purposes

- Public good can be created using private goods as inputs at $t = 1$

  - one unit of private good creates one unit of public good (for simplicity)

- Benevolent policy maker can tax deposits at $t = 1$

- Investment technology is operated in a central location (a **bank**)
  - agents deposit at $t = 0$, withdraw at $t = 1$ or $t = 2$

- Withdrawals occur sequentially
  - depositors are physically isolated, arrive at the bank one at a time (as in Wallace, 1988, others)

- Bank operates to maximize depositors' expected utility
  - no restrictions on the payments it can make (as in Green & Lin, 2003, Peck & Shell, 2003, Andolfatto, Nosal & Wallace, 2007, etc.)
  - cannot commit to future actions (as in Ennis & Keister, 2009)
    - payment to each depositor is chosen when she withdraws

Monitoring

- Policy maker can monitor a fraction $\sigma \in [0, 1]$ of withdrawals
  - observes the amount received by the depositor
  - can confiscate some of these goods, if desired
    - any proceeds are rebated to all banks lump sum
  - no commitment: confiscation decision made at the moment

- Monitoring represents a range of regulatory/supervisory activities
  - restrictions on interest rates or on short-term liabilities (e.g., LCR)
  - $\sigma = 1 \Rightarrow$ regulation and supervision are very effective
    ($\approx$ policy maker runs the bank)
  - $\sigma < 1 \approx$ banks can use new legal structures to avoid regulation

Uncertainty

- In addition to idiosyncratic uncertainty (about preference type ω_i), two types of **aggregate** uncertainty are resolved at $t = 1$

(i) Fraction of the population that is impatient (fundamental)

- $\pi \in \{\pi_L, \pi_H\}$
- prob$[\pi_H]$ is relatively small

(ii) A sunspot variable (non-fundamental)

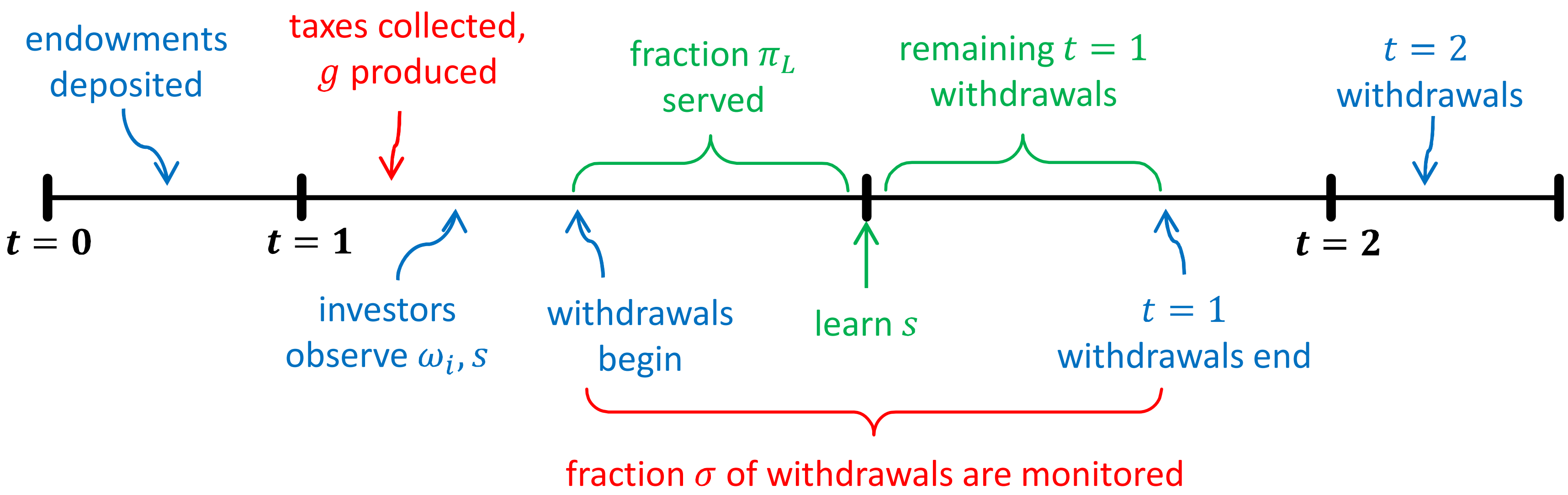
- realization is either α or β; equally likely (for this talk)

- Aggregate state is $s \in S = \{L, H\} \times \{\alpha, \beta\}$
  - depositors observe s at beginning of $t = 1$
  - banks, policy maker make inferences from flow of withdrawals

Policy regime 1: No intervention

- Policy maker collects taxes, produces g at beginning of $t = 1$
  - before state is realized and before withdrawals begin

- Afterward, additional fiscal policy is prohibited



Strategies and allocations

- Each depositor chooses a withdrawal strategy

$$y_i : \Omega \times S \to \{1, 2\}$$

- Bank chooses payments $c : [0,1] \to R^2_+$ subject to constraints
  - given y, solve bank's problem in three steps:

(1) After π_L withdrawals, bank learns state and run stops. Bank j solves

$$V\left(\psi_s^j; \widehat{\pi}_s\right) \equiv \max \ (1-\pi_L)\left(\widehat{\pi}_s u\left(c_{1s}^j\right) + (1-\widehat{\pi}_s)\, u\left(c_{2s}^j\right)\right)$$

s.t.

$$(1-\pi_L)\left(\widehat{\pi}_s c_{1s}^j + (1-\widehat{\pi}_s)\frac{c_{2s}^j}{R}\right) \leq \psi_s^j$$

FOC:

$$u'\left(c_{1s}^j\right) = Ru'\left(c_{2s}^j\right) = \mu_s^j.$$

Strategies and allocations (2)

(2) First π_L withdrawals – unmonitored – receive c_1^j :

$$\pi_L (1-\sigma) u \left(c_1^j\right) + \sum_{s \in S} q_s V \left(1 - \tau - \pi_L \left(\sigma \tilde{c}_1^j + (1-\sigma) c_1^j\right); \widehat{\pi}_s\right)$$

– FOC:

$$u' \left(c_1^j\right) = \sum_{s \in S} q_s \mu_s^j$$

(3) First π_L withdrawals - monitored – receive $\tilde{c}_1$:

$$\pi_L \sigma u (\tilde{c}_1) + \sum_{s \in S} q_s V (1 - \tau - \pi_L (\sigma \tilde{c}_1 + (1-\sigma) c_1); \widehat{\pi}_s)$$

– FOC:

$$u' (\tilde{c}_1) = \sum_{s \in S} q_s \mu_s$$

Result: $\tilde{c}_1 (y) = c_1^j (y)$ for all y, j $\Rightarrow$ regulation is not binding

Strategies and allocations (3)

- Fiscal policy: tax rate τ is chosen to maximize

$$\pi_L u(c_1(\tau)) + \sum_{s\in S} q_s V\left(1 - \tau - \pi_L c_1(\tau); \widehat{\pi}_s\right) + \delta v(\tau)$$

  – FOC reduces to: $$\delta v'(\tau) = \sum_{s\in S} q_s \mu_s$$

- Best response by banks and policy maker to y is summarized by

$$\mathbf{c}^{NI}(y) \equiv \left(c_1, \tilde{c}_1, \{c_{1s}, c_{2s}\}_{s\in S}, g\right).$$

Equilibrium

- y^* such that y_i^* is a best response to y_{-i}^* and $\mathbf{c}^{NI}(y^*)$ for all i

Fragility

- An economy is defined by parameters $e = (u, v, \delta, R, \pi_L, \pi_H, q, \sigma)$

- Each economy falls into one of three categories:

  – weakly fragile: there exists an equilibrium where depositors run in state H_β but not in H_α

    (non-fundamental runs; driven by expectations)

  – strongly fragile: depositors run in state H in every equilibrium

    (fundamental runs)

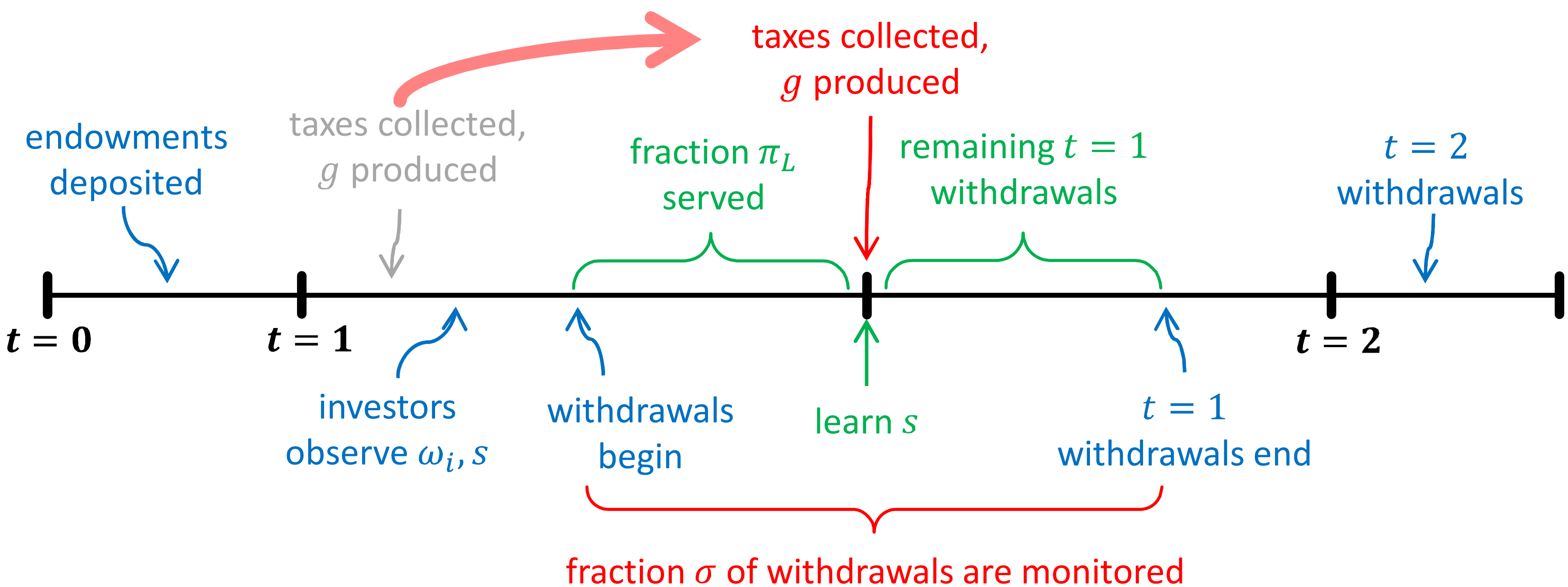
  – not fragile: if depositors do not run in any state in any equilibrium

    (bank runs do not occur)

Q: When should intervention be allowed?

Policy regime 2: Intervention permitted

- Policy maker collects taxes after learning the state (and after some withdrawals have occurred)
  - if $\pi = \pi_H$, can **intervene** by setting intermediary-specific taxes
  - can interpret $\tau - \tau_s^j$ as a "bailout"
  - intermediaries in worse financial shape will receive a larger bailout



Banking allocation (given y)

(1) After π_L withdrawals, same as before

(2) First π_L withdrawals – unmonitored:

$$\pi_L (1-\sigma) u\left(c_1^j\right) + \sum_{s=L} q_s V\left(1-\tau-\pi_L\left(\sigma\tilde{c}_1^j + (1-\sigma) c_1^j\right); \widehat{\pi}_s\right) + \sum_{s=H} q_s V\left(1-\tau-\pi_L \bar{c}_1; \widehat{\pi}_s\right)$$

– FOC:

$$u'\left(c_1^j\right) = \sum_{s=L} q_s \mu_s^j$$

(3) First π_L withdrawals - monitored:

$$u'\left(\tilde{c}_1\right) = \sum_{s\in S} q_s \mu_s$$

Result: $\tilde{c}_1(y) < c_1^j(y)$ for all $y, j \quad \Rightarrow \quad$ regulation is binding

Cost and benefit of intervention

- Cost: removes banks' incentive to provision for bad states

<u>before</u> <u>now</u>

$$u'\left(c_1^j\right) = \sum_{s \in S} q_s \mu_s^j \qquad u'\left(c_1^j\right) = \sum_{s = L} q_s \mu_s^j$$

$\longrightarrow$ distorted incentives (partially corrected through monitoring)

- Benefit: public good can be state-dependent

<u>before</u> <u>now</u>

$$\delta v'(g) = \sum_{s \in S} q_s \mu_s \qquad \delta v'(g_s) = \mu_s \ \ \forall s$$

$\longrightarrow$ improved risk sharing

How does intervention affect fragility?

Proposition: Equilibrium fragility is (weakly) decreasing in σ

- "Decreasing": strongly fragile $\rightarrow$ weakly fragile $\rightarrow$ not fragile

- Regulation lowers $t = 1$ payoffs for monitored depositors and raises $t = 2$ payoffs

$\Rightarrow$ waiting to withdraw becomes more attractive

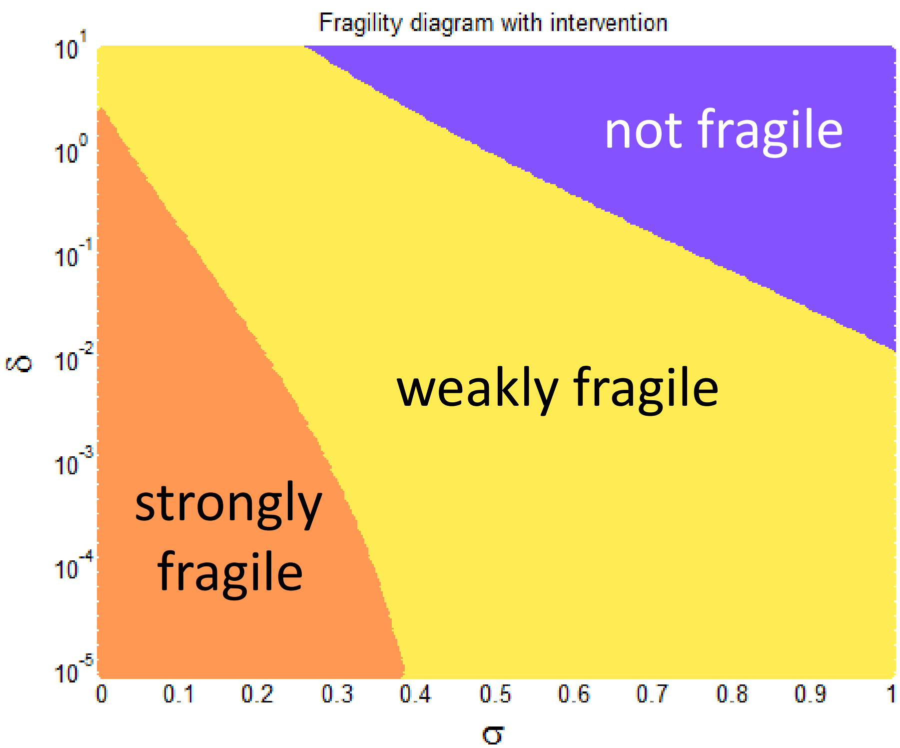
Proposition: There exists $\bar{\sigma} < 1$ such that $\sigma > \bar{\sigma}$ implies fragility is (weakly) decreasing in δ

- Larger δ implies a larger public sector, larger bailout payments

$\Rightarrow$ waiting becomes more attractive **if** supervision is good enough

An example

- $R = 1.05$, $\pi_L = 0.45$, $\pi_H = 0.55$, $q_H = 0.04, \gamma = 4$
  - look at different values of (δ, σ)
- Under no intervention, economy is weakly fragile (for all δ, σ)
- With intervention:



Comparing policy regimes

Desirability of allowing intervention depends on insurance vs. incentives

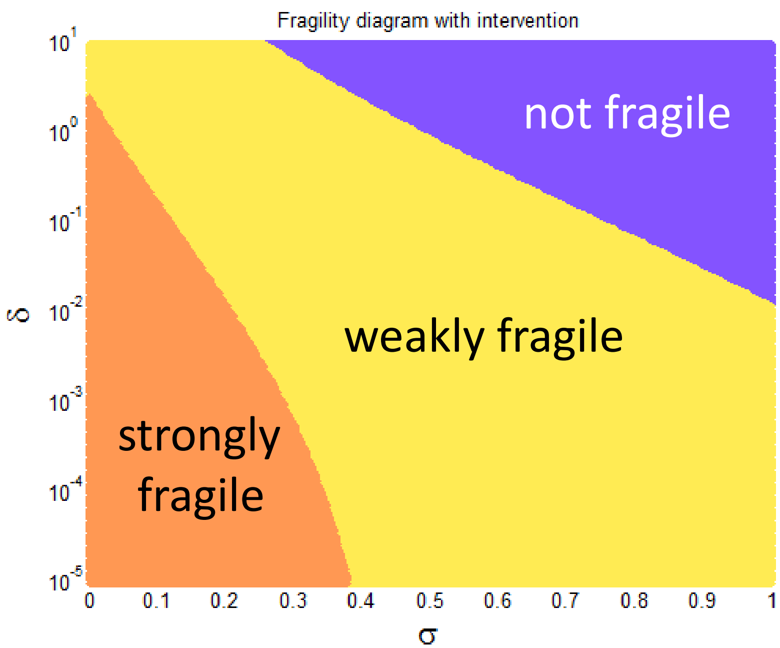
Proposition: If $\delta > 0$, there exists $\bar{\sigma} < 1$ such that $\sigma > \bar{\sigma}$ implies allowing intervention strictly increases equilibrium welfare

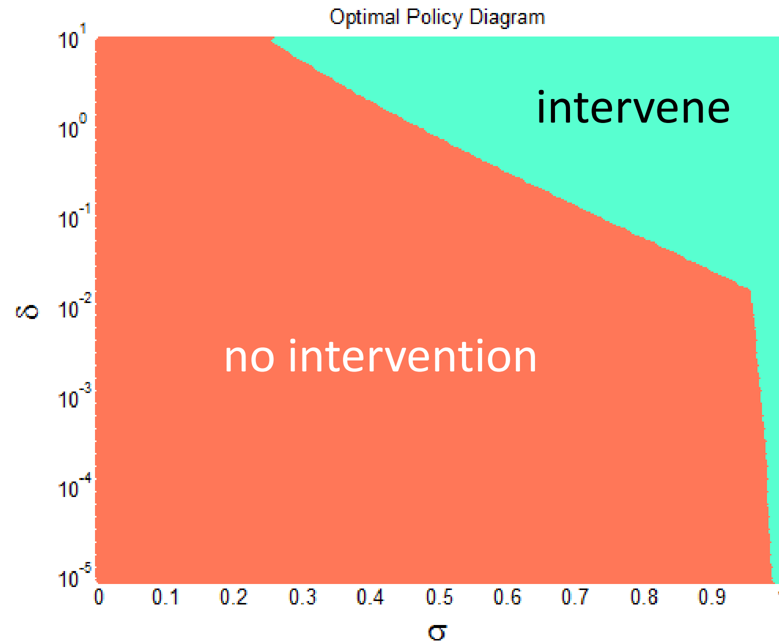
- regulation is very effective $\Rightarrow$ insurance effect dominates

Proposition: For any economy with $\delta = 0$ and $\sigma < 1$, allowing intervention strictly decreases equilibrium welfare.

- no scope for risk sharing $\Rightarrow$ incentive effect dominates

- Example from before (weakly fragile with no intervention)

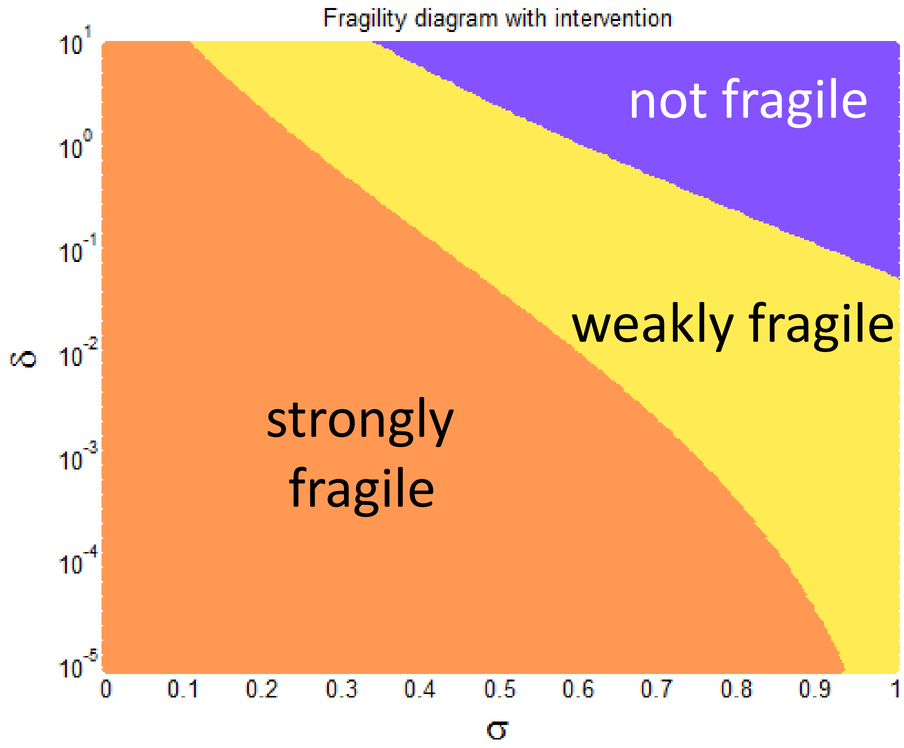




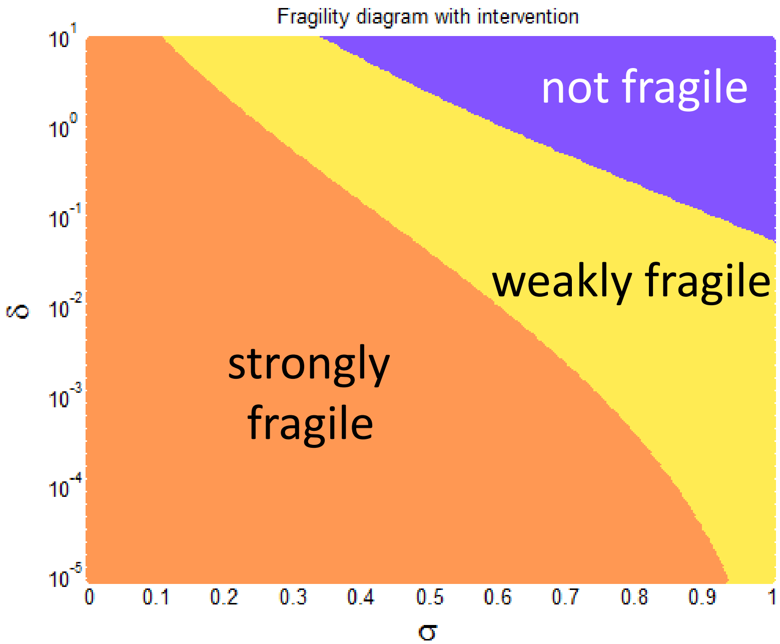
- Intervention is desirable in this example if:
  - it eliminates the run equilibrium (˜Lacker)
  - **or** σ is very high

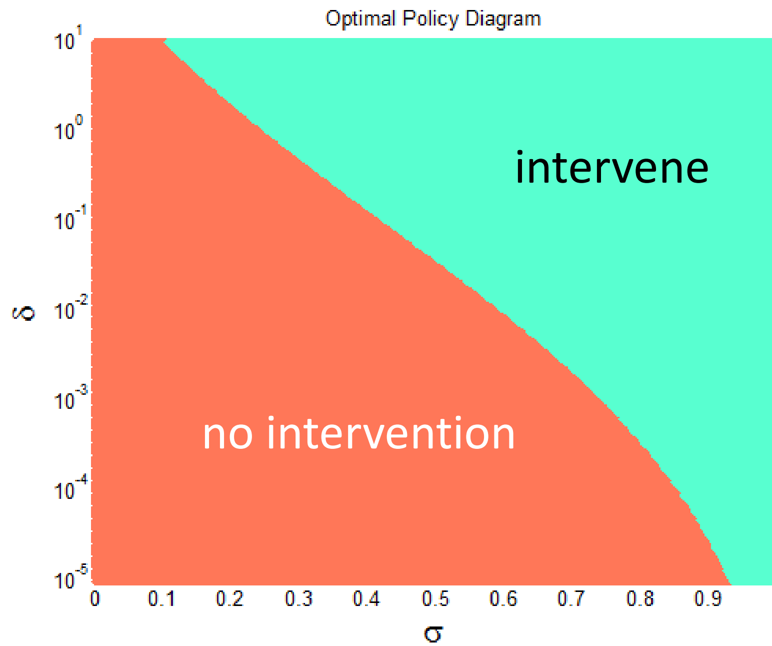
Example 2

- $\pi_H = 0.65$ instead of 0.55 (larger fundamental shock)
- Under no intervention, economy is now strongly fragile
- With intervention:



- Optimal policy:

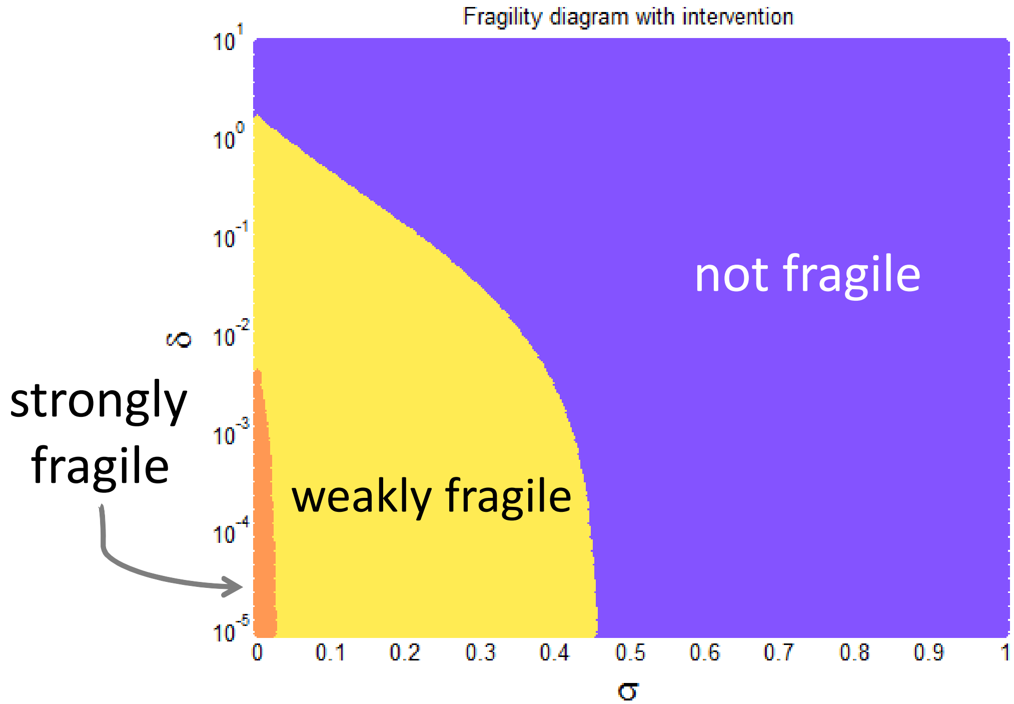




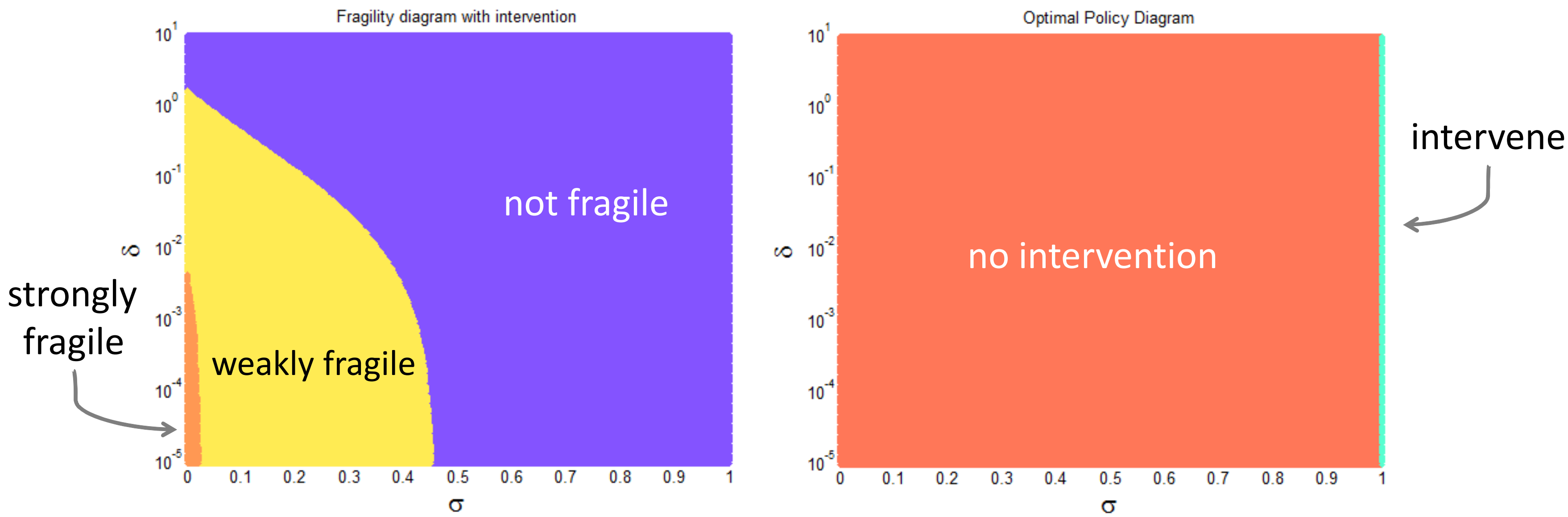
- Here: intervention is desirable if it **introduces** a better equilibrium
  - with no intervention, run is “fundamental”
  - still want to intervene if doing so changes y

Example 3

- $\pi_H = 0.55$ again and $\gamma = 2$
- Under no intervention, economy is <u>not fragile</u>
- With intervention: "policy-induced fragility"



- Optimal policy:



- In this example: no scope for improving y^*

- Results say intervention is desirable if σ is high enough
  - but it must be *very* high

Summary

Q: When should intervention be allowed/prohibited?

A: Think about two things

(1) allocation of resources holding withdrawal behavior fixed

(2) equilibrium withdrawal behavior

- For both components, key issue is **incentives vs. insurance** (rather than expectations vs. fundamentals)

- If regulation is effective enough, allowing intervention is optimal
  - improves risk-sharing
  - may eliminate bad equilibria **or** introduce good equilibria

- If regulation is ineffective and/or insurance benefit is small:
  - better to prohibit intervention

Conclusion

- Long-running debate about the causes of financial panics
- Some view it as the inevitable consequence of the *fundamental* shock
  - Gorton (1988), Allen and Gale (1998), etc.
- Others emphasize the importance of self-fulfilling *expectations*
  - Kindleberger (1978), Diamond & Dybvig (1983), etc.
  - shock could be anything that affects expectations (sunspots)
- Difficult to determine empirically which view is more accurate
  - theories predict observationally similar outcomes; Ennis (2003)

Q: Do we need to determine what causes a banking panic ...

[*in particular, the role of self-fulfilling beliefs*]

... in order to do effective policy analysis?

- Argue: in many cases, the answer is likely 'no'
  - the same types of policies are desirable in both cases

- Focus here: the desirability of restricting intervention
  - key issue in our model is insurance vs. incentives, not expectations vs. fundamentals
  - may illustrate a more general idea