

# Deposit Insurance without Commitment: Wall St. vs. Main St.

Russell Cooper\*    Hubert Kempf\*\*

\*European University Institute and University of Texas at Austin

\*\*Banque de France and Paris School of Economics

May 2011

# Outline

- 1 Motivation
- 2 Planner's Problem
- 3 Decentralization
- 4 Systemic Runs and DI: Timing
  - Optimal Taxes Ex Post
  - Taxes Set Ex Ante: Type Independent
  - Taxes Set Ex Ante: Type Dependent
- 5 Partial Runs
- 6 Preventing Runs
- 7 Conclusions



## Deposit Insurance in Theory

- assumed to be credible
- avoids runs equilibrium

## Deposit Insurance in Practice

- Prevalent in various forms around the globe
- But commitment assumed in theory is less clear
  - UK: Northern Rock (partial coverage and caps)
  - US: redesign of program mid-crisis
  - EMU: how is DI financed?
  - China: 1980s and current regulations
  - bailouts of non-bank intermediaries in many countries
- **Question:** in the absence of commitment, will DI (an *ex post* bailout) be provided?

## Deposit Insurance in Theory

- assumed to be credible
- avoids runs equilibrium

## Deposit Insurance in Practice

- Prevalent in various forms around the globe
- But commitment assumed in theory is less clear
  - UK: Northern Rock (partial coverage and caps)
  - US: redesign of program mid-crisis
  - EMU: how is DI financed?
  - China: 1980s and current regulations
  - bailouts of non-bank intermediaries in many countries
- **Question:** in the absence of commitment, will DI (an *ex post* bailout) be provided?

## Deposit Insurance in Theory

- assumed to be credible
- avoids runs equilibrium

## Deposit Insurance in Practice

- Prevalent in various forms around the globe
- But commitment assumed in theory is less clear
  - UK: Northern Rock (partial coverage and caps)
  - US: redesign of program mid-crisis
  - EMU: how is DI financed?
  - China: 1980s and current regulations
  - bailouts of non-bank intermediaries in many countries
- **Question:** in the absence of commitment, will DI (an *ex post* bailout) be provided?

## Deposit Insurance in Theory

- assumed to be credible
- avoids runs equilibrium

## Deposit Insurance in Practice

- Prevalent in various forms around the globe
- But commitment assumed in theory is less clear
  - UK: Northern Rock (partial coverage and caps)
  - US: redesign of program mid-crisis
  - EMU: how is DI financed?
  - China: 1980s and current regulations
  - bailouts of non-bank intermediaries in many countries
- **Question:** in the absence of commitment, will DI (an *ex post* bailout) be provided?

# Study Using

- Diamond-Dybvig model
- **heterogeneity** in endowments across households
- Wall St. vs. Main St. tension through claims on entire financial system
- redistribution through the provision of deposit insurance relative to tax contributions
- steps of analysis
  - characterize optimal deposit contract (planner and decentralized)
  - ask if there is a *expectations driven* bank-run (systemic or not) under the optimal allocation
  - if yes, determine if deposit insurance will be provided *ex post*
  - study this for progressively less flexible taxation systems



# Households

- $t = 0, 1, 2$ .
- type  $\alpha^0$  endowment of single good:  $(\alpha^0, \bar{\alpha}, 0)$
- $f(\cdot)$  is pdf,  $F(\cdot)$  is cdf
- preferences
  - early consumer:  $u(c^0) + v(c^E)$
  - late consumer:  $u(c^0) + v(c^L)$
  - $u(\cdot)$  and  $v(\cdot)$  are strictly increasing and strictly concave
  - $\pi \in (0, 1)$ : fraction early, independent of endowment type

# Technology

- one period technology: return of 1
- two-period technology:
  - return of  $R > 1$
  - return of  $\varepsilon$  if liquidated early

Table: Technology

	period 0	period 1	period 2
liquid	-1	1	1
illiquid	-1	$\varepsilon$	R

# Optimal Allocation

- endowment types are known, tastes are not
- choose:  $(d(\alpha^0), x^E(\alpha^0), x^L(\alpha^0))$  and  $\phi$
- objective function:

$$\int \omega(\alpha^0)[u(\alpha^0 - d(\alpha^0)) + \pi v(\bar{\alpha} + x^E(\alpha^0)) + (1 - \pi)v(\bar{\alpha} + x^L(\alpha^0))] f(\alpha^0) d\alpha^0. \quad (1)$$

- resource constraints

$$\phi D = \pi \int x^E(\alpha^0) f(\alpha^0) d\alpha^0 \quad (2)$$

$$(1 - \phi)DR = (1 - \pi) \int x^L(\alpha^0) f(\alpha^0) d\alpha^0 \quad (3)$$

- welfare weights:  $\omega(\alpha^0)$
- ignore prospect of run

# FOCs: insurance and redistribution

$$\omega(\alpha^0)u'(\alpha^0 - d(\alpha^0)) = \lambda \quad (4)$$

$$v'(\bar{\alpha} + x^E(\alpha^0)) = Rv'(\bar{\alpha} + x^L(\alpha^0)) \quad (5)$$

and

$$v'(\bar{\alpha} + x^E(\alpha^0)) = u'(\alpha^0 - d(\alpha^0)) \quad (6)$$

for all  $\alpha^0$ .

# Runs

- truth-telling is a Nash Equilibrium:  $c^L(\alpha^0) > c^E(\alpha^0)$
- bank run is an equilibrium too:
  - $\pi < 1$  is sufficient if  $\varepsilon$  is near 0
  - $\phi D = \pi \int x^E(\alpha^0) f(\alpha^0) d\alpha^0 < \int x^E(\alpha^0) f(\alpha^0) d\alpha^0$
  - not enough resources to meet demands for **all** households
  - some households served, others are not  
 $\zeta v(\bar{\alpha} + x^E(\alpha^0)) + (1 - \zeta)v(\bar{\alpha})$
- how does the planner respond to a run?

# Runs

- truth-telling is a Nash Equilibrium:  $c^L(\alpha^0) > c^E(\alpha^0)$
- bank run is an equilibrium too:
  - $\pi < 1$  is sufficient if  $\varepsilon$  is near 0
  - $\phi D = \pi \int x^E(\alpha^0) f(\alpha^0) d\alpha^0 < \int x^E(\alpha^0) f(\alpha^0) d\alpha^0$
  - not enough resources to meet demands for **all** households
  - some households served, others are not
$$\zeta v(\bar{\alpha} + x^E(\alpha^0)) + (1 - \zeta)v(\bar{\alpha})$$
- how does the planner respond to a run?



Figure: Responding to a Run

# Responses to a Run: Haircut

## Proposition

*Given a bank run, the planner has an incentive to reallocate consumption relative to the outcome under sequential service.*

- Objective:

$$\int \omega(\alpha^0)[\pi + \nu(\alpha^0)(1 - \pi)][v(\bar{\alpha} + \bar{x}^E(\alpha^0))]f(\alpha^0)d\alpha^0 + \int \omega(\alpha^0)[(1 - \nu(\alpha^0))(1 - \pi)][v(\bar{\alpha} + \bar{x}^L(\alpha^0))]f(\alpha^0)d\alpha^0 \quad (7)$$

where  $\nu(\alpha^0)$  of type  $\alpha^0$  late consumers announce early

- period 1 resource constraint:

$$\int [\pi + \nu(\alpha^0)(1 - \pi)]\bar{x}^E(\alpha^0)f(\alpha^0)d\alpha^0 = \phi D - S + \epsilon L. \quad (8)$$

- period 2 resource constraint:

$$((1 - \pi) \int (1 - \nu(\alpha^0))\bar{x}^L(\alpha^0)f(\alpha^0)d\alpha^0) = (\phi D - L)R + S. \quad (9)$$

- $S = 0$  and  $L \geq 0$  imply

$$v'(\bar{\alpha} + \bar{x}^E(\alpha^0)) = \frac{R}{\epsilon} v'(\bar{\alpha} + \bar{x}^L(\alpha^0)). \quad (10)$$

- risk sharing and reallocation across types, dominates sequential service



# Does this intervention prevent a run?

## Corollary

*In the allocation characterized in Proposition 1, there is no bank run.*

- $c^L(\alpha^0) > c^E(\alpha^0)$
- illiquid investment remains intact to fund late consumers
- commitment not needed
- but not quite deposit insurance

# Optimal Contract

- banks: max HH utility st feasibility and zero expected profit
- contract is  $\alpha^0$  specific
- Household optimization

$$\max_d u(\alpha^0 - d) + \pi v(\bar{\alpha} + r^1(\alpha^0)d) + (1 - \pi)v(\bar{\alpha} + r^2(\alpha^0)d) \quad (11)$$

- Bank constraints for all  $\alpha^0$

$$r^1(\alpha^0)\pi d(\alpha^0) + r^2(\alpha^0)(1 - \pi)d(\alpha^0) = \phi(\alpha^0)d(\alpha^0) + (1 - \phi(\alpha^0))d(\alpha^0)R; \quad (12)$$

and

$$\phi(\alpha^0)d(\alpha^0) \geq r^1(\alpha^0)d(\alpha^0)\pi, \quad (1 - \phi(\alpha^0))d(\alpha^0)R \geq r^2(\alpha^0)(1 - \pi)d(\alpha^0). \quad (13)$$

# Timing

- sequential service of households in period 1
- bank exhausts liquid assets
- $\varepsilon$  is near zero
- contacts government: will you provide DI?
- look at expected utilities with and without DI
- discuss prevention of runs below

- welfare with DI

$$W^{DI} = \int \omega(\alpha^0) v(\bar{\alpha} + \chi(\alpha^0) - T(\alpha^0)) f(\alpha^0) d\alpha^0 \quad (14)$$

- welfare without DI

$$W^{NI} = \int \omega(\alpha^0) [\zeta v(\bar{\alpha} + \chi(\alpha^0)) + (1 - \zeta) v(\bar{\alpha})] f(\alpha^0) d\alpha^0 \quad (15)$$

- $\chi(\alpha^0) \equiv r^1(\alpha^0)d(\alpha^0)$  is total owed under deposit contract
- $\zeta$  is the probability of getting served
- $T(\alpha^0)$  is type specific tax
- when is  $\Delta \equiv W^{DI} - W^{NI}$  positive?

$$\Delta = \int \omega(\alpha^0) \underbrace{[v(\chi(\alpha^0) + \bar{\alpha} - T(\alpha^0)) - v(\chi(\alpha^0) + \bar{\alpha} - \bar{T})]}_{\text{Redistribution through taxes}} f(\alpha^0) d\alpha^0 +$$

$$\int \omega(\alpha^0) \underbrace{[v(\chi(\alpha^0) + \bar{\alpha} - \bar{T}) - v(\zeta\chi(\alpha^0) + \bar{\alpha})]}_{\text{Redistribution through Deposit Insurance}} f(\alpha^0) d(\alpha^0) +$$

$$\int \omega(\alpha^0) \underbrace{[v(\zeta\chi(\alpha^0) + \bar{\alpha}) - \zeta v(\chi(\alpha^0) + \bar{\alpha}) - (1 - \zeta)v(\bar{\alpha})]}_{\text{Insurance gains to DI}} f(\alpha^0) d\alpha^0$$

where  $\bar{T} = \int T(\alpha^0) f(\alpha^0) d\alpha^0$ .

# Role of Heterogeneity

## Proposition

If  $F(\alpha^0)$  is degenerate,  $v(c)$  is strictly concave, then the government **will** have an incentive to provide deposit insurance.

## Note:

- Diamond-Dybvig case
- $F(\alpha^0)$  degenerate could reflect optimal reallocation in period 0

## Study Effects of Heterogeneity by:

- *ex post* optimal taxes
- *ex ante* taxes
- progressively weaken optimality of tax system to study redistribution costs

# Role of Heterogeneity

## Proposition

If  $F(\alpha^0)$  is degenerate,  $v(c)$  is strictly concave, then the government **will** have an incentive to provide deposit insurance.

## Note:

- Diamond-Dybvig case
- $F(\alpha^0)$  degenerate could reflect optimal reallocation in period 0

## Study Effects of Heterogeneity by:

- *ex post* optimal taxes
- *ex ante* taxes
- progressively weaken optimality of tax system to study redistribution costs

# Ex Post Optimal Taxes

$W^{DI}$  as the solution to an optimal tax problem:

$$W^{DI} = \max_{T(\alpha^0)} \int \omega(\alpha^0) v(\chi(\alpha^0) + \bar{\alpha} - T(\alpha^0)) f(\alpha^0) d\alpha^0 \quad (16)$$

## Proposition

*If  $T(\alpha^0)$  solves the optimization problem (16), then deposit insurance is always provided.*

- with optimal reallocation, no conflict with insurance provision
- like the optimal haircut of the planner
- **set tax structure to fund DI along with its provision**



## Ex Ante Lump Sum Taxes: Example

- two types
- $\alpha^0 = 3$  for poor,  $\alpha^0 = 5$  for rich
- 50% rich
- solve for equilibrium
- check if DI will be provided ex post
- depends on: risk aversion, welfare weight, distribution of endowments

# Risk Aversion as a Basis for Commitment

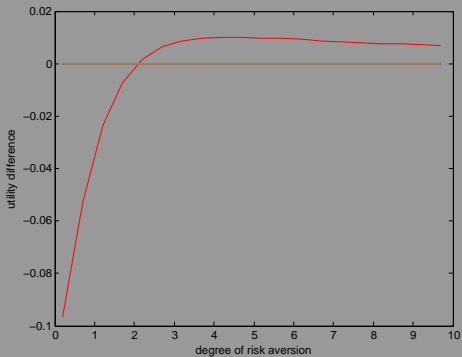


Figure: Effects of Risk Aversion

# Endowment MPS Reduces Commitment Value

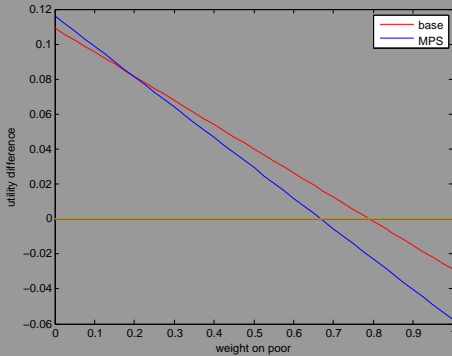


Figure: MPS on Endowment Distribution

# Restricted Contract

$$r^1(\alpha^0) = r, r^2(\alpha^0) = r^2$$

## Proposition

*If households are not too risk averse and  $\omega(\alpha^0)$  is strictly decreasing in  $\alpha^0$ , then a government **will not** have an incentive to provide deposit insurance.*

KEY: explore limit of risk neutrality where redistribution is costly when weights are declining.

# Ex ante Taxes

- redistribution through DI reflects deposit claims and tax liabilities
- all else the same, a tax schedule which redistributes more, reduces welfare

## Proposition

*Compare two tax schedules,  $T(\cdot)$  and  $\tilde{T}(\cdot)$ . If  $\tilde{T}(\cdot)$  induces a MPS on consumption relative to  $T(\cdot)$  then  $\Delta$  falls when we replace  $T(\cdot)$  with  $\tilde{T}(\cdot)$ .*

# Ex ante Taxes

- $c(\alpha^0) = (\bar{\alpha} + \chi(\alpha^0))^{(1-\tau)} \bar{T}^\tau$
- $\bar{T}^\tau$  balances the budget

## Proposition

*Compare two tax rates,  $\tau^L$  and  $\tau^H$  with  $\tau^H > \tau^L > 0$ , then  $\Delta$  is higher under the tax rate  $\tau^H$  compared to  $\tau^L$ .*

# Bank Specific Runs

- a fraction  $n$  of the households run on multiple symmetric banks
- probability of run is independent of type
- DI redistributes across types and groups (run, no run)

$$\Delta = \int \omega(\alpha^0) \{ n[v(c^E(\alpha^0) - \bar{T}) - \zeta v(\bar{\alpha} + \chi(\alpha^0)) - (1 - \zeta)v(\bar{\alpha})] + (1 - n)[v(c^E(\alpha^0) - \bar{T}) - v(c^E(\alpha^0))] \} f(\alpha^0) d\alpha^0. \quad (17)$$

- first term captures insurance gain plus redistribution to those at failed banks (Wall St.)
- second term captures tax obligation of those at surviving banks (Main St.)

## Proposition

*If  $F(\alpha^0)$  is degenerate, then the gains from deposit insurance are positive for any  $n$ .*

If  $F(\alpha^0)$  is not degenerate, two forms of redistribution interact.



## Proposition

*If  $F(\alpha^0)$  is degenerate, then the gains from deposit insurance are positive for any  $n$ .*

If  $F(\alpha^0)$  is not degenerate, two forms of redistribution interact.

# Computed Example: Partial Runs

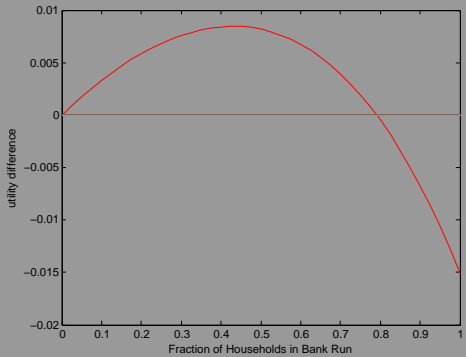


Figure: Partial Runs

# Does DI Prevent Runs?

NO

- bank liquidates to meet depositor demands
- DI redistributes what is left to “early consumers”

YES

- provision of DI involves optimal liquidation
- implement haircut allocation of planner
- late consumption exceeds early consumption: no incentive to run

# Does DI Prevent Runs?

NO

- bank liquidates to meet depositor demands
- DI redistributes what is left to “early consumers”

YES

- provision of DI involves optimal liquidation
- implement haircut allocation of planner
- late consumption exceeds early consumption: no incentive to run

# Conclusions

- DI will be provided *ex post* if insurance gains dominate
- DI will not be provided if it redistributes consumption away from favored types
- To consider:
  - cap on DI: effects on monitoring, is it credible?
  - interbank loans
  - too big to fail
  - monetary financing of DI
  - DI in a MU
  - reputation effects of bailout
  - model of political pressure