Discussion of *"Bank Runs, Deposit Insurance, and Liquidity"* by Douglas W. Diamond and Philipp H. Dybvig

Co-Pierre Georg

University of Cape Town
and
Deutsche Bundesbank

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Motivation and main idea(s)

- Q: How can banks attract deposits, even though they are subject to runs?
- A: Bank deposit contracts can provide allocations superior to those of exchange markets
- Privately observed risks lead to demand for liquidity
- Multiple equilibria, with a bank-run equilibrium that causes real economic damage
- Deposit insurance by government can improve demand deposit contract

The Model - Core ingredients

- Banks provide **insurance** that allows agents to consume when they need to most
- Asymmetric information lies at the root of liquidity demand
- Three periods $T = 0, 1, 2$ and single homogenous good with constant returns **production technology** that yields output $R > 1$ in $T = 2$

$$\begin{array}{ccc} T = 0 & T = 1 & T = 2 \\ -1 & 0 & R \\ -1 & 1 & 0 \end{array}$$

The Model - Households

- Two types of households: fraction $t \in (0, 1)$ are early households that only care about consumption in $T = 1$, while fraction $1 - t$ are late households that only care about consumption in $T = 2$
- All households are identical in period 0 and face **privately observed** risk of being of early or late type $\rightarrow$ type is learned in period 1
- All agents have endowment of 1 and can (privately) store for consumption
- (State dependent) **Utility** of agents

$$U(c_1, c_2; \Theta) = \begin{cases} u(c_1) & \text{for early households in state } \Theta \\ \rho u(c_1 + c_2) & \text{for late households in state } \Theta \end{cases}$$

where $1 \geq \rho > R^{-1}$ and u satisfies usual conditions

Competitive Solution

- Agents hold assets directly and in each period there is a competitive market in claims on future goods
- In period $T = 0$ all agents are identical, establish the same trades and invest in production technology
- Prices are determined:
  - period 0 price of period 1 consumption is 1
  - period 0 and 1 price of period 2 consumption is R^{-1}
- With these prices, there are never any trades and agents can do no better than if they produce for their own consumption only:

$$c_1^e = 1 \quad , \quad c_2^e = c_1^l = 0 \quad , \quad c_2^l = R$$

Is the competitive solution optimal?

- If types were **publicly** observable in period 1, optimal insurance contracts for output sharing between early and late consumers can be written
- Optimal consumption $\{c_k^{i*}\}$ satisfies that those who can, delay consumption:

$$c_1^{l*} = c_2^{e*} = 0$$

- Marginal utility in line with marginal productivity:

$$u'(c_1^{e*}) = \rho R u'(c_2^{l*})$$

- Resource constraint:

$$tc_1^{e*} + [(1-t)c_2^{l*}/R] = 1$$

Banks can improve on competitive solution by offering insurance

- By assumption, $\rho R > 1$ and since relative risk aversion exceeds unity, optimal consumption levels satisfy:

$$c_1^{e*} > 1 \quad \text{and} \quad c_2^{l*} < R$$

$\Rightarrow$ competitive solution **not** optimal!

- Lack of observability of agents' types rules out complete market of Arrow-Debreu state-contingent claims

- **Banks** can provide the desired insurance by providing liquidity

Demand deposit contracts...

- Demand deposit contract gives each agent withdrawing in $T = 1$ fixed claim r_1 per unit deposited in $T = 0$
- Withdrawal requests are served sequentially in random order until bank runs out of assets $\rightarrow$ sequential service constraint
- Agents not withdrawing in $T = 1$ get equal pro-rata share in $T = 2$
- Period one payoff per unit deposit withdrawn:

$$V_1(f_j, r_1) = \begin{cases} r_1 & \text{if } f_j < r_1^{-1} \\ 0 & \text{if } f_j \geq r_1^{-1} \end{cases}$$

Demand deposit contracts...

- Period two payoff per unit deposit withdrawn:

$$V_2(f, r_1) = \max\{R(1 - r_1 f)/(1 - f), 0\}$$

where f_j is number of withdrawers' deposits serviced before agent j and f is the total amount of deposits withdrawn

- Let w_j be fraction of agent j's deposits he attempts to withdraw at $T = 1$. Consumption from deposit proceeds is thus:

$$w_j V_1(f_j, r_1)$$

- For late households, total consumption from deposit proceeds is given by:

$$w_j V_1(f_j, r_1) + (1 - w_j) V_2(f, r_1)$$

...can(!) achieve optimal risk sharing

- When $r_1 = c_1^{e*}$, it is an equilibrium for early agents to withdraw at $T = 1$ and for late agents to wait $\rightarrow$ **good equilibrium**
- A **bank-run equilibrium** is obtained when all agents are panicking and trying to withdraw at $T = 1$. If this is anticipated, all agents will prefer to withdraw prematurely
- For all $r_1 > 1$, runs are an equilibrium. For $r_1 = 1$, no improvement over the competitive equilibrium is achieved
- In bank-run equilibrium, all households receive a risky return of mean one, while storage yields safe return of mean one
- Bank-runs are inefficient as they interrupt all production at $T = 1$ while it is optimal for some to continue until $T = 2$

Suspension of convertibility can improve on demand deposit contracts

- Pure demand deposit contracts can achieve a full-information optimum, while bank-run equilibrium is worse than direct ownership of assets

- Suspension of convertibility can improve on demand deposit contracts

- After a fraction $\hat{f} < r_1^{-1}$ of all deposits have been withdrawn, the bank suspends convertibility:

$$V_1(f_j, r_1) = \begin{cases} r_1 & \text{if } f_j \leq \hat{f} \\ 0 & \text{if } f_j > \hat{f} \end{cases}$$

and

$$V_2(f, r_1) = \max\left\{ \frac{(1 - fr_1)R}{1 - f}, \frac{(1 - \hat{f} r_1)R}{1 - \hat{f}} \right\}$$

Suspension of convertibility can improve on demand deposit contracts

- Convertibility is suspended when $f_j = \hat{f}$ and no one else in line is allowed to withdraw at $T = 1$
- This contract can achieve optimal allocation
- Suspension of convertibility guarantees that it will never be profitable to participate in a bank run
- Contract works perfectly if “normal” volume of withdrawals t is known and not stochastic