Interest Rate Trap

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Outline

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- The interest rate trap
- What's new

The model
- Banks in liquidity transformation
- Dynamic constrained efficiency
- Central bank as lender of last resort

The low interest rate trap
- Dynamic consistent equilibrium
- Dynamic inefficiency and liquidity rules

Conclusion

Interest rate trap

- "*The low rates introduced ... from 2002-2004 created momentum in house prices that soon became the rationale for crazy lending.... by the time risk-taking and asset price inflation again take off, it may be too late for the Fed to turn it back*..." (Rajan, 2010);
- Borio & Zhu (2008): "*changes in the financial system and in regulation had a profound impact on the relation between central bank policy and risk taking incentives of financial intermediaries, changing the way monetary policy affects the real side of the economy*..." – risk taking channel;
- Fed (2011) "*anticipates that economic conditions... are likely to warrant exceptionally low levels for the federal funds rate at least for two years*...";
- Interest rate trap: low rate for crisis resolution $\longrightarrow$ too low for too long time $\longrightarrow$ next crisis...

The outline

- Endogenous model to explain the banks' response to monetary policy, or, "risk-taking channel"
  - Allen et al. (2011): "constrained efficiency" in crisis resolution;
  - But: why is there crisis?
- Dynamic approach to test time consistency
  - Freixas et al. (2011): "first best" rules;
  - Unfortunately, not credible in dynamic context;
- Concentrate on banks' role in liquidity transformation
  - Central bank as lender of last resort;
  - Diamond & Rajan (2011) type resolution doesn't work;
- To maintain financial stability, regulatory rule such as LCR is not *supplement* to monetary policy, but itself a *pillar*.

Structure of the model

Baseline model with risk-neutral agents and real contracts. Banks' role in liquidity transformation

Investors	Entrepreneurs
Unit endowment at t, can be stored or invested in projects Investors want to consume at $t + 1$	$R_1 > 1$: Safe project, realized early at $t + 1$ $R_2 > R_1$: Risky project, may be delayed until $t + 2$, with probability $1 - p$

Competitive Banks
Technology: Expertise to collect $0 < \gamma < 1$ from projects' return
Fragile structure: Banks offer deposit contracts as commitment device not to abuse their collection skills
Cost: Risk of bank runs with inefficient liquidation $0 < c < 1$ before $t + 1$

Agents preference, & technology

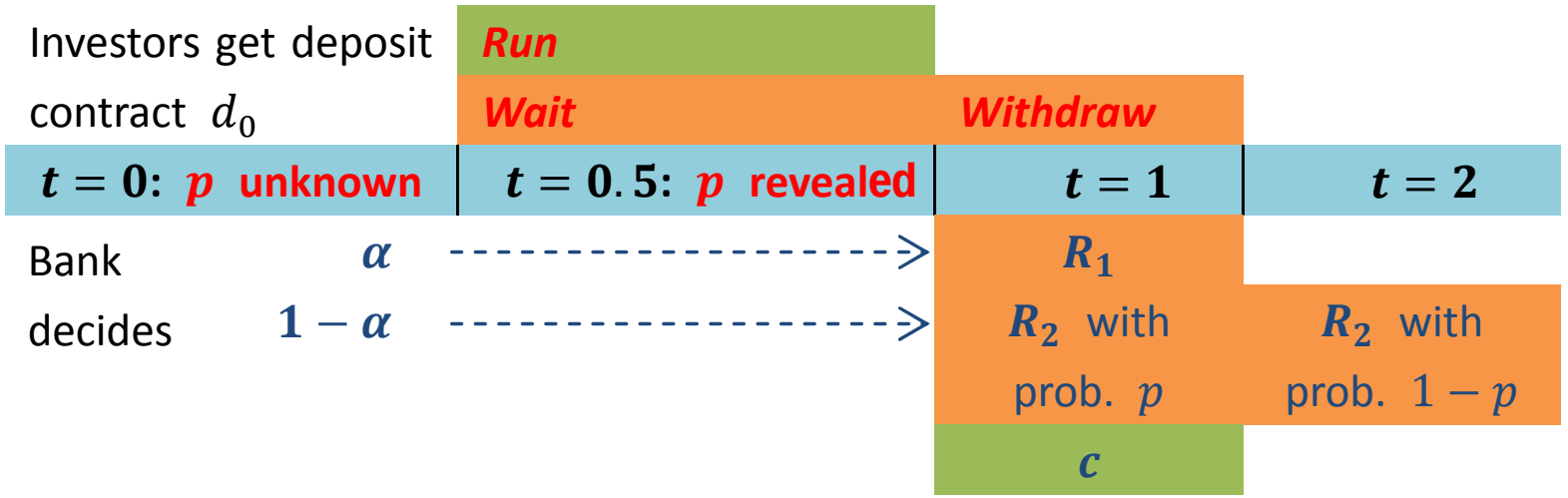
- Investors and firm entrepreneurs from overlapping generations, infinitely lived banks;
- Banks: expertise to collect $0 < \gamma < 1$ from projects' return;
- Generation t investors, live for 2 periods
  - Born with unit endowment at t, deposit in the banks;
  - Observe signal of bank return at $t + 0.5$, run or wait;
  - If not run, withdraw and consume at $t + 1$, exit.

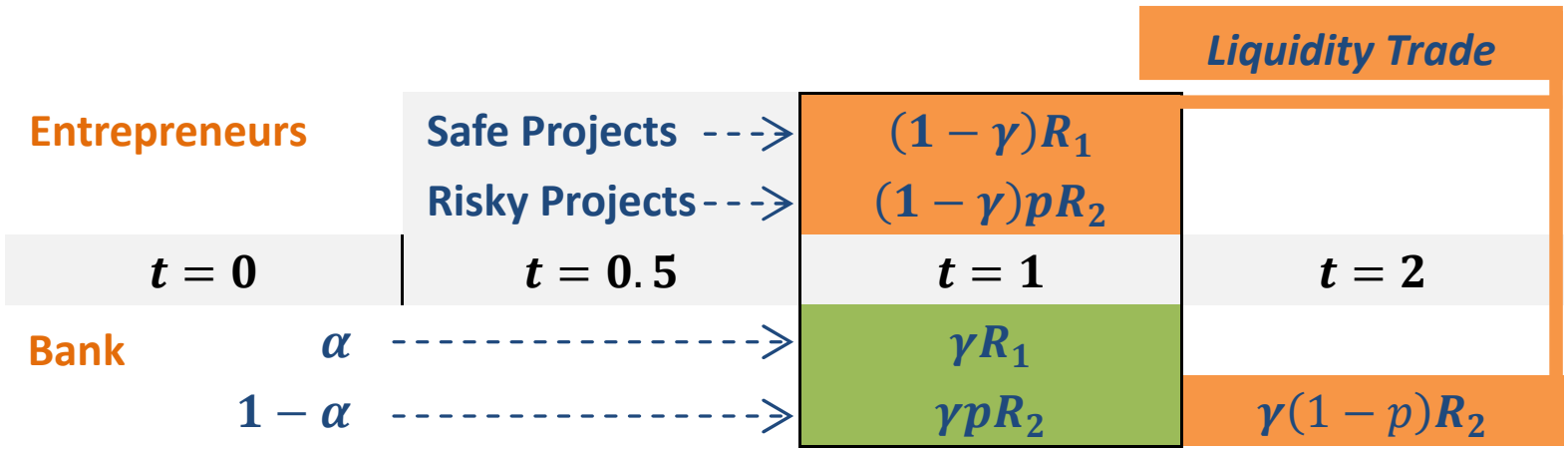
t	$t + 0.5$	$t + 1$	$t + 1.5$	$t + 2$
Gen. $t - 1$: Withdraw and consume				
Gen. t: Deposit in the banks	p_t gets revealed; decide whether to run	If no run, withdraw and consume		
		Gen. $t + 1$: Deposit in the banks	p_{t+1} gets revealed; decide whether to run	If no run, withdraw and consume
				Gen. $t + 2$: Deposit in the banks

Agents preference, & technology (cont'd)

- Generation t entrepreneurs, live for 3 periods, each running one project starting from t. Type of entrepreneurs distinguished by their projects:
  - Safe: return $R_1 > 1$ at $t+1$;
  - Risky: return $R_2 > R_1 > 1$ at $t+1$ with probability $p_t < 1$, or postponed to $t+2$
- Probability p_t are i.i.d., can take two values
  - Normal state p, with prob. $\pi \longrightarrow 1$;
  - Crisis state $\underline{p} < p$.
- Entrepreneurs are indifferent in the timing of consumption.

Timing: static version





Timing: dynamic version

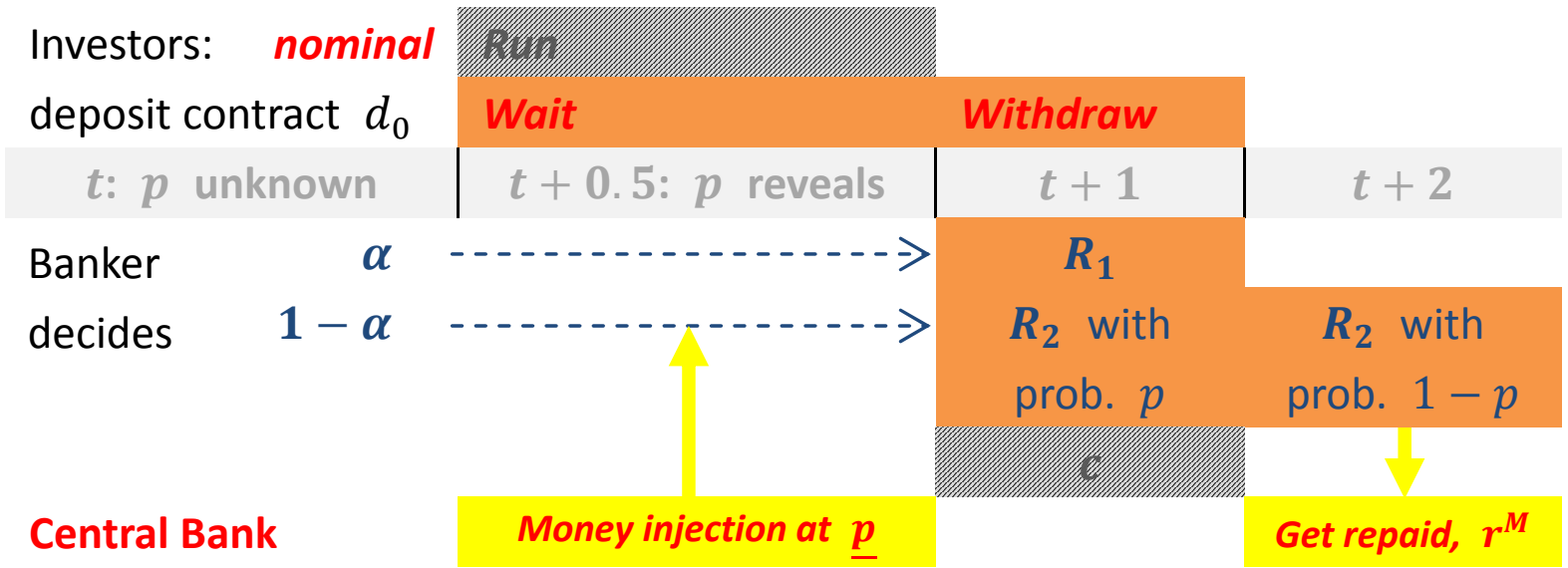
t	$t+0.5$	$t+1$	$t+1.5$	$t+2$
Banks: Collect late returns of proj. $t-2$; repay early gen. $t-2$ ent.; collect early returns of proj. $t-1$; liqudity trade with early gen. $t-1$ ent.; repay gen. $t-1$ investors; contract with gen. t investors; invest $(\alpha, 1-\alpha)$ on proj. t	If experience run, liquidate & exit; otherwise continue	Collect late returns of proj. $t-1$; repay early gen. $t-1$ ent.; collect early returns of proj. t; liquidity trade with early gen. t ent.; repay gen. t investors; contract with gen. $t+1$ investors; invest $(\alpha, 1-\alpha)$ on proj. $t+1$	If experience run, liquidate & exit; otherwise continue	Collect late returns of proj. t; repay early gen. t ent.; collect early returns of proj. $t+1$; liquidity trade with early gen. $t+1$ ent.; repay gen. $t+1$ investors; contract with gen. $t+2$ investors; invest $(\alpha, 1-\alpha)$ on proj. $t+2$
Entrepreneurs: Late proj. $t-2$ mature; early gen. $t-2$ ent. repaid; early proj. $t-1$ mature; gen. $t-1$'s liquidity trade with bank; get loans for proj. t	If experience run, all projects terminated; otherwise continue	Late proj. $t-1$ mature; early gen. $t-1$ ent. repaid; early proj. t mature; gen. t's liquidity trade with bank; loans for proj. $t+1$	If experience run, all projects terminated; otherwise continue	Late proj. t mature; early gen. t ent. repaid; early proj. $t+1$ mature; gen. $t+1$'s liquidity trade with bank; loans for proj. $t+2$

Market equilibrium

- The market equilibrium is featured by
  - Banks invest $\alpha^* = \frac{\gamma - p}{\gamma - p + (1-\gamma)\frac{R_1}{R_2}}$, maximizing investors' return; and this makes
  - Liquidity market rate $r = 1$, minimizing the intermediate borrowing cost;
  - Bank run happens when crisis state $\underline{p}$ gets revealed.
- The market equilibrium is constrained efficient since
  - Impossible to reshuffle resources between generations;
  - The costly bank run in the crisis implies loss in social welfare.

Nominal contract and role of central bank

- Nominal contract and money-in-the-market pricing
  - Price $= \dfrac{\text{real goods} + \text{fiat money}}{\text{real goods}}$;
- The role of central bank as lender of last resort
  - Inject fiat money in need, against collateral.

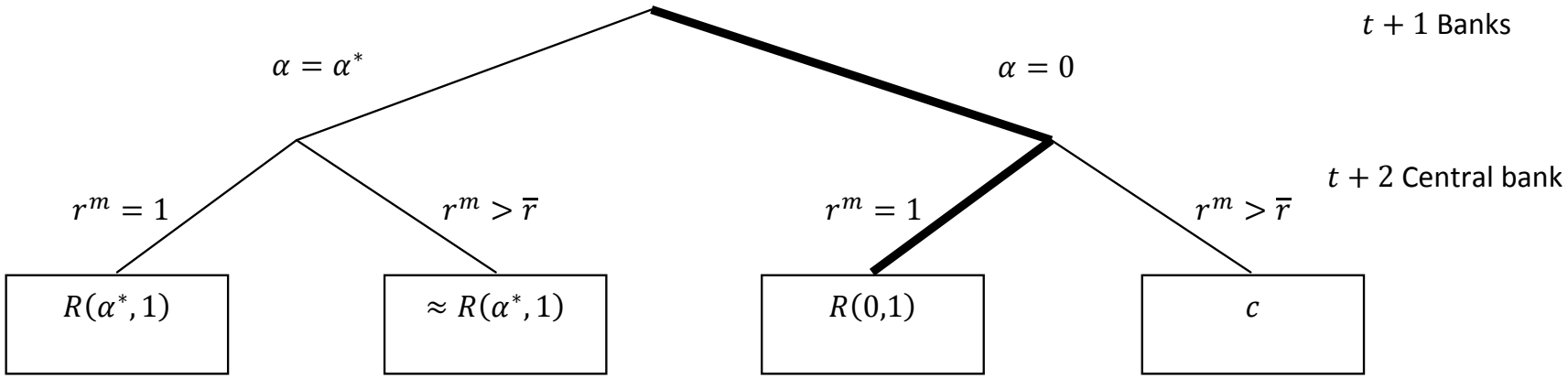


Nominal contract and role of central bank (cont'd)

- The central bank's monetary policy rule à la Freixas et al (2011):
  - In crisis state, lending fiat money at $r^m = 1$: crisis resolution via inflating the economy;
  - In normal state, keep $r^m > \overline{r}$ to deter free-riding on the cheap liquidity and induce efficient market solution;
- The result: Pareto improvement
  - Avoiding costly bank run by fulfilling the *nominal* contract, in line with Allen et al. (2011);
  - While the investors' *real* return is lower, they are still better off than bank run.
- Unfortunately, the policy is *dynamic* inconsistent!

The low interest rate trap

- Suppose a crisis at $t + 0.5$ so that $r^m_{t+1} = 1$
  - Central bank: $r^m_{t+2} > \bar{r}$ almost for sure;
  - What's the banks' response at $t + 1$?



Dynamic inefficiency and liquidity rule

- Unique dynamic *consistent* equilibrium is featured by
  - Central bank always keeps rate too low for too long time;
  - Banks always take excessive liquidity risk;
  - Investors always worse off in terms of *real* consumption;
  - Low interest rate trap is the unique dynamic consistent equilibrium!
- Lessons?
  - Systemic risk is already built in when monetary policy is lax, making it difficult to raise the rate again;
  - Monetary policy is dynamic inconsistent as financial stabilizer;
  - Policy analysis needs dynamic endogenous approach, taking into account the feedback from the economy;
  - Need ex ante liquidity regulation to fix the risk taking channel: liquidity coverage ratio α^*, etc.
- Next step: understanding liquidity requirements.

Liquidity rules in Basel III

- Liquidity coverage ratio (LCR) to address liquidity shock
  - Sufficient liquid assets to withstand a 30-day stressed funding scenario;
  - Unemcumbered, high quality liquid assets that can be converted to cash to meet liquidity demand;
  - $LCR = \frac{\text{Stock of high quality assets}}{\text{Net cash outflows over 30 days}} \geq 100\%$;
- Net stable funding ratio (NSFR) to address liquidity mismatch
  - Limit liquidity mismatch between assets and liabilities over a one-year horizon;
  - Reduce emphasis on short-term, whole sale funding;
  - Compare maturity profile and liquidity of assets to liabilities to ensure fundings are met with stable financing sources;
  - $NSFR = \frac{\text{Available stable funding}}{\text{Required stable funding}} \geq 100\%$;
- Principles for Sound Liquidity Risk Management and Supervision.

Liquidity rules and banks' strategies

- Liquidity transformation, maturity mismatch, and banks' liquidity management
  - "Finance as you go"
    - Return to capital market / borrow from investors when liquidity needs arise;
    - However, moral hazard / adverse selection $\longrightarrow$ market freeze in downturn;
  - "Liquidity hoarding"
    - Secure credit lines / hold liquid assets, etc.;
    - (In-)efficiency and procyclicality;
- Further research to understand
  - How liquidity requirements change the banks' behavior in liquidity management;
  - The role of lender of last resort policy, and how liquidity rules fix endogenous moral hazard problem.

Conclusion

- A model to understand the "risk-taking channel" of monetary policy
  - A finance model with some macro twist, focus on the banks' role in liquidity transformation;
  - To understand the impact of monetary policy on financial stability in an endogenous framework;
  - To understand the credibility of policy rules in the dynamic approach;
- Still much to do
  - To understand the concept of liquidity in the standard macroeconomic framework;
  - To understand the banks' response to liquidity requirements and the implication on systemic risk.