# Economics of Banking Regulation

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# Outline

# Disclaimer

*(If they care about what I say,) the views expressed in this manuscript are those of the author's and should not be attributed to Norges Bank.*

# Prelude

*"Now it is true that banks are very unpopular at the moment, but this (banking regulation) seems very much like a case of robbing Peter to pay Paul." (The Economist, 20th July, 2011)*

# Why regulation?

Banking, as other industries, needs regulation on issues where free market cannot discipline itself, to

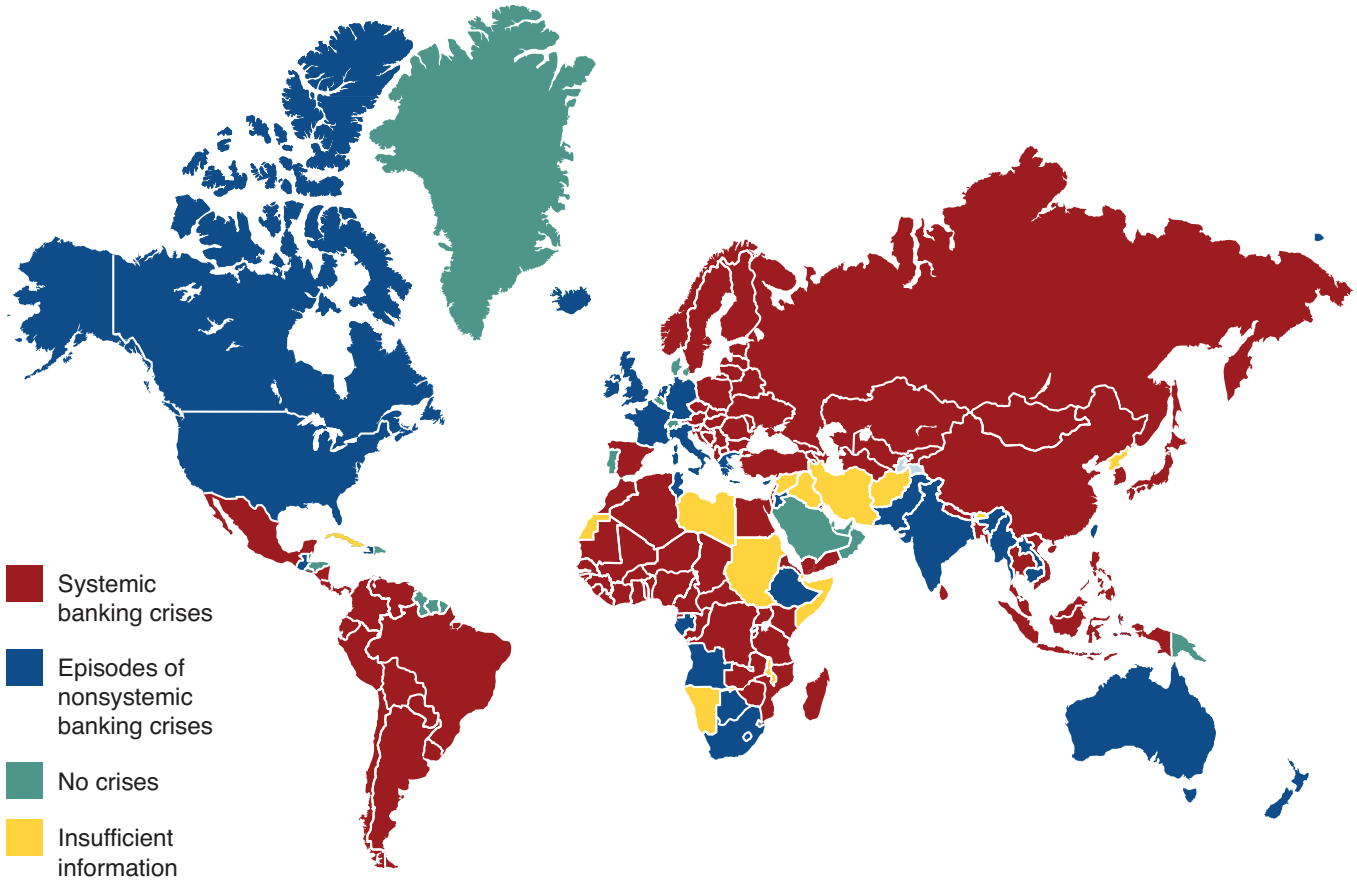
- Create and enforce *rules of the game*;
- Restrict *market power* and keep market competitive;
- Correct *externalities* or other *market failures* due to moral hazard and adverse selection;
- Protect the interests of *taxpayers*.

# What make banking regulation special?

Banking regulation is special, comparing with others like telecommunications:

- Focuses more on "*safety*" and less on "*price*";
- *Taxpayer* protection, rather than consumer protection, is more important motivation and benchmark in regulatory design;
- The outcome is a crucial *public good*: *financial stability*;
- It prevents the spillover to the real economy through *macro-finance linkages*, such as "*financial accelerator*".

# Banking crises since 1970



# Cost of bank bailout since 1980

| Country | Date | Cost as Percentage of GDP |
|---|---|---|
| | **1980–2007** | |
| Indonesia | 1997–2001 | 57 |
| Argentina | 1980–1982 | 55 |
| Thailand | 1997–2000 | 44 |
| Chile | 1981–1985 | 43 |
| Turkey | 2000–2001 | 32 |
| South Korea | 1997–1998 | 31 |
| Israel | 1977 | 30 |
| Ecuador | 1998–2002 | 22 |
| Mexico | 1994–1996 | 19 |
| China | 1998 | 18 |
| Malaysia | 1997–1999 | 16 |
| Philippines | 1997–2001 | 13 |
| Brazil | 1994–1998 | 13 |
| Finland | 1991–1995 | 13 |
| Argentina | 2001–2003 | 10 |
| Jordan | 1989–1991 | 10 |
| Hungary | 1991–1995 | 10 |
| Czech Republic | 1996–2000 | 7 |
| Sweden | 1991–1995 | 4 |
| United States | 1988 | 4 |
| Norway | 1991–1993 | 3 |
| | **2007–2009** | |
| Iceland | 2007–2009 | 13 |
| Ireland | 2007–2009 | 8 |
| Luxembourg | 2007–2009 | 8 |
| Netherlands | 2007–2009 | 7 |
| Belgium | 2007–2009 | 5 |
| United Kingdom | 2007–2009 | 5 |
| United States | 2007–2009 | 4 |
| Germany | 2007–2009 | 1 |

# Banking regulation: basic principles

- Banking regulation should be based on sound foundations
  - To address *well articulated problems*;
  - Using instruments working through well understood *mechanisms*;
- Banking regulation should target on *excessive* risk-taking while maintaining optimal *risk-sharing*;
- Regulatory policies should be *efficient*, or *incentive compatible*;
- Regulatory policies should be waterproof for *regulatory arbitrage*.

# Financial crises and evolution of banking regulation

- Financial crisis is the most important driving force of banking regulation. The first greatest output was to create central banks worldwide;
- The second greatest output is to create global standards for banking regulation, namely, **Basel Accord** since 1988
  - **Basel I** (1988): on *credit risks* and *risk-weight* of assets;
  - **Basel II** (2004): more refinements, but failed miserably in the crisis
    - **I**nternal **R**ating-**B**ased (IRB) approach – opportunities to *arbitrage*;
    - Generates more volatilities through *procyclical* rules;
  - **Basel III** (in progress).

# Reconstructing banking regulation

- Banking regulation needs to address **systemic risk**,
  - The risk or probability of breakdowns in an *entire* system, as opposed to breakdowns in individual parts;
  - Evidenced by *comovements* (*correlation*) among most or all the parts;
- Banking regulation needs to be **macroprudential** instead of microprudential, mitigating *systemic* risks instead of idiosyncratic risks;
- Banking regulation needs to be **countercyclical** instead of procyclical
  - Building up buffers and cushions in the boom in order to
  - Absorb shocks and losses in the bust.

# What's new in macroprudential regulation?

**The macro- and microprudential perspectives compared**

| | **Macroprudential** | **Microprudential** |
|---|---|---|
| Proximate objective | limit financial system-wide distress | limit distress of individual institutions |
| Ultimate objective | avoid output (GDP) costs | consumer (investor/depositor) protection |
| Model of risk | (in part) endogenous | exogenous |
| Correlations and common exposures across institutions | important | irrelevant |
| Calibration of prudential controls | in terms of system-wide distress; top-down | in terms of risks of individual institutions; bottom-up |

# Why is banking so unstable?

- Instability arising from bank runs has been presented in Diamond & Dybvig (1983)
  - **Maturity transformation**: one of the most important features in banking;
  - However, runs there are easily eliminated by deposit insurance, while
  - In reality banking is generally unstable — history shows that insurance did *not* make the system more stable;
- Why is banking still so unstable?
  - Moral hazard problem prevents full insurance;
  - Fragility may be *necessary* to descipline banks.

# Fragility and instability: a model

A simple model based on Diamond & Rajan (2001) and Cao & Illing (2011)

- Consider an economy extending over 3 periods, $t = 0, 1, 2$, with the following risk-neutral agents:
  - **Depositors**: born with unit endowment at $t = 0$, deposit in banks; at $t = 1$ withdraw, consume and die;
  - **Banks**: Bertrand competion in deposit market $\rightarrow$ zero profit;
  - **Entrepreneurs**: borrow from banks, produce, and repay loans.
- No asymmetric information.

# Technology

Two types of entrepreneurs, distinguished by the types of their projects:

- **Safe projects**: start at $t = 0$, return $R_1 > 1$ with certainty at $t = 1$;
- **Risky projects**: start at $t = 0$, return $R_2 > R_1$, however
  - With probability $p$, realize at $t = 1$, and $pR_2 < R_1$;
  - With probability $1 - p$, return *postponed* to $t = 2$.
- Banks would love to support only risky projects, while depositors prefer safe ones: **maturity mismatch**.

# Incomplete contract and desire for fragility

- Entrepreneurs have expertise on operating projects ("*inalienable human capital*"), while bankers only get $\gamma R_i$ ($\gamma > p$) if they operate themselves
  - Entrepreneurs would walk away if the return demanded by bankers is too high: a *credible* threat;
  - In equilibrium bankers collect $\gamma R_i$ from projects' return;
- However, depositors do not have such collection skills
  - Bankers have the power to renegotiate with depositors at $t = 1$;
  - Depositors exercise bank run as *commitment device*, preventing renegotiation: desire for fragility.

# Timing

At $t = 0$

- Banks decide their investment plan: share $\alpha$ on safe projects and $1 - \alpha$ on risky projects, and offer deposit contracts promising the return $d_0 > 1$ to depositors;

| **Assets** | **Liabilities** |
|---|---|
| $\alpha$ on safe projects | Deposits |
| $1 - \alpha$ on risky projects | |

# Timing (cont'd)

- At $t = \frac{1}{2}$
  - If depositors have doubt on bank's return, they can run on the bank — all projects have to be liquidated, with poor return $c < 1$;
- At $t = 1$
  - Banks collect early returns, and depositors withdraw $d_0$;
  - Banks may borrow from early entrepreneurs (those with safe projects and risky projects that return early) using *collateral*;
- At $t = 2$
  - Banks collect returns from late projects and repay early entrepreneurs.

# Timing (cont'd)

| **Timing of the model:** | | | **Early Projects** | **Late Projects** |
|---|---|---|---|---|
| $t = 0$ | | $t = 1/2$ | $t = 1$ | $t = 2$ |
| **Investors** deposit; | | | | |
| **Bank** | $\alpha$ | Type 1 projects → | $\boldsymbol{R_1}$ | |
| chooses | $1 - \alpha$ | Type 2 projects → | $\boldsymbol{R_2}$ | $\boldsymbol{R_2}$ |

# Debt roll-over and liquidity

- At $t = 1$ banks have
  - Collected return from early projects, $\gamma [\alpha R_1 + (1 - \alpha) pR_2]$;
  - Loans to the postponed projects, $\gamma (1 - \alpha) (1 - p) R_2$;
- Early entrepreneurs have $(1 - \gamma) [\alpha R_1 + (1 - \alpha) pR_2]$;
- To maximize deposit repayment to depositors, banks may borrow from early entrepreneurs, using postponed projects as collateral.

# Debt roll-over and liquidity (cont'd)

- Bank's balance sheet after $t = 1$

| **Assets** | **Liabilities** |
|---|---|
| Late risky projects | Debt to early entrepreneurs |

# Maturity transformation and liquidity risk

- Bank's optimal strategy boils down to its choice on $\alpha$, which leads to "just enough" collateral for debt roll-over

$$\alpha = \frac{\gamma - p}{\gamma - p + (1-\gamma)\frac{R_1}{R_2}};$$

- Depositor's return $d_0 = \gamma\left[\alpha R_1 + (1-\alpha) R_2\right] = \alpha R_1 + (1-\alpha) pR_2 = E[R] > \gamma R_1$;
  - Maturity transformation is *welfare improving*;
  - However, if there is anything wrong in debt roll-over, banks are exposed to **liquidity risk**.

# Maturity transformation and liquidity risk (cont'd)

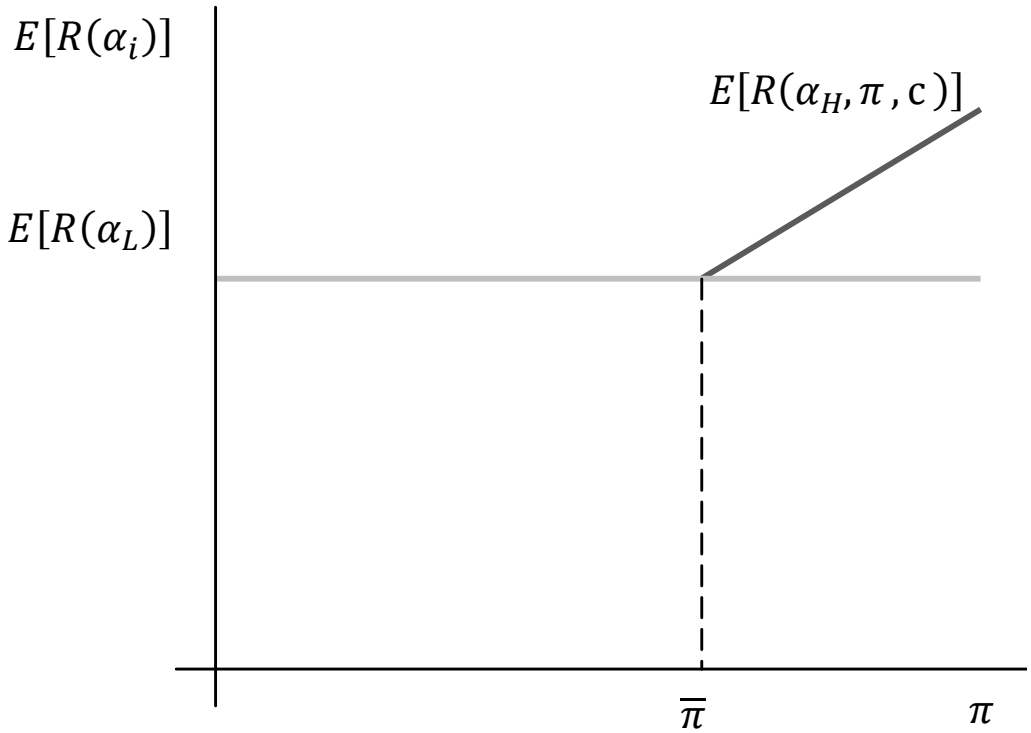
- Bank's liquidity risk comes from two sources
  - **Market liquidity**: on the *assets* side, the liquid assets that can be converted to cash without much discount ("haircut") when necessary — safe projects in this model;
  - **Funding liquidity**: on the *liabilities* side, the funding that a bank can raise without too high cost when it needs to roll over its debt — debt to the entrepreneurs in this model;
- A bank's liquidity changes over time: a liquid balance sheet can easily becomes illiquid under market stress.

# Liquidity risk under aggregate shock

- Now suppose there is uncertainty on $p$
  - $p$ can take two values, $0 < p_L < p_H < \gamma$;
  - $p$ is unknown at $t = 0$, and revealed at $t = \frac{1}{2}$. Probability of being $p_H$ is $\pi$;
- Consider two extreme cases
  - $\pi \to 1$, $\alpha_H = \frac{\gamma - p_H}{\gamma - p_H + (1-\gamma)\frac{R_1}{R_2}}$ and $d_0 = \alpha R_1 + (1-\alpha) p_H R_2 = E[R_H]$;
  - $\pi \to 0$, $\alpha_L = \frac{\gamma - p_L}{\gamma - p_L + (1-\gamma)\frac{R_1}{R_2}} > \alpha_H$ and $d_0 = \alpha R_1 + (1-\alpha) p_L R_2 = E[R_L]$;
  - What happens in between?

# Liquidity risk under aggregate shock (cont'd)

- Suppose $\pi$ goes down from 1, following $\alpha_H$
  - Depositor's return is $E[R_H]$ with probability $\pi$ and $c$ with $1-\pi$;
  - Bank sticks to $\alpha_H$ as long as $\pi E[R_H] + (1-\pi)c > E[R_L]$.



# The root of evils

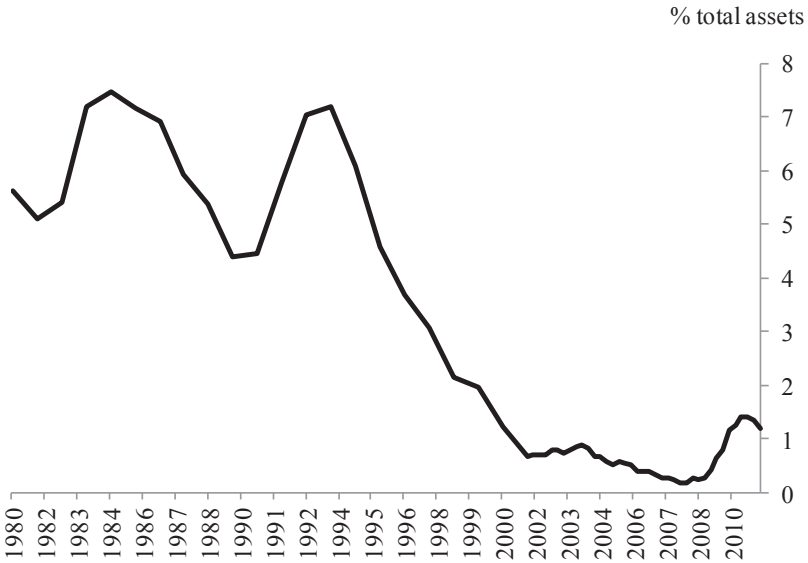
- *Principal-agent problems* and *limited liability* that encourage banks to take excessive risks, e.g., biased incentives from OPM (**O**ther **P**eople's **M**oney) instead of MOM (**M**y **O**wn **M**oney);
- *Externalities* that lead to inferior allocation of resources and risks
  - **Positive** externalities – taking the full cost while generating benefit to others – reduce necessary buffers in banking system, e.g., liquid assets holdings;
  - **Negative** externalities – taking the full benefit while cost partially borned by others – lead to excess risk-taking, e.g., interbank borrowing.

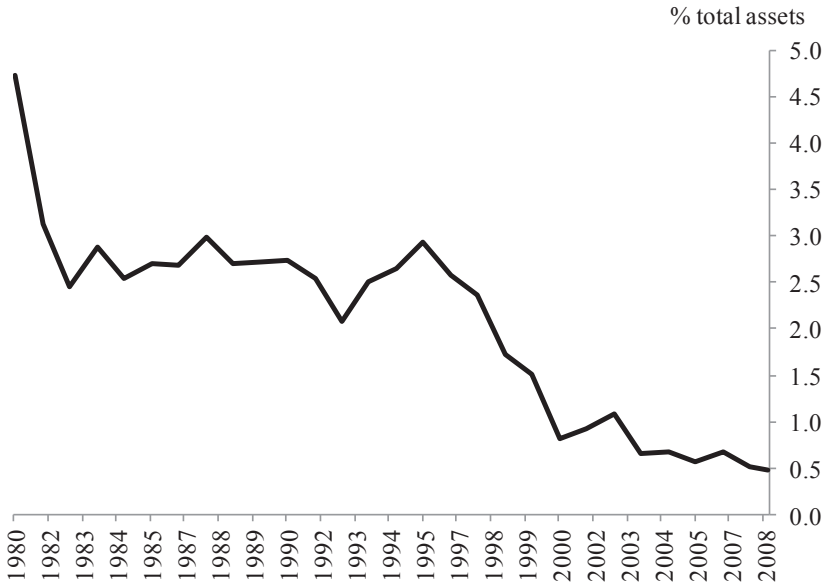
# Example: systemic liquidity shortages

- Banks need to hold some *liquid assets* – assets that can be easily converted to cash – in order to cushion demand shocks from depositors
  - There's *opportunity cost* in holding liquid assets, while
  - It benefits stressed banks through interbank lending;
- *Positive externality* $\rightarrow$ *systemic liquidity shortage* among banks.

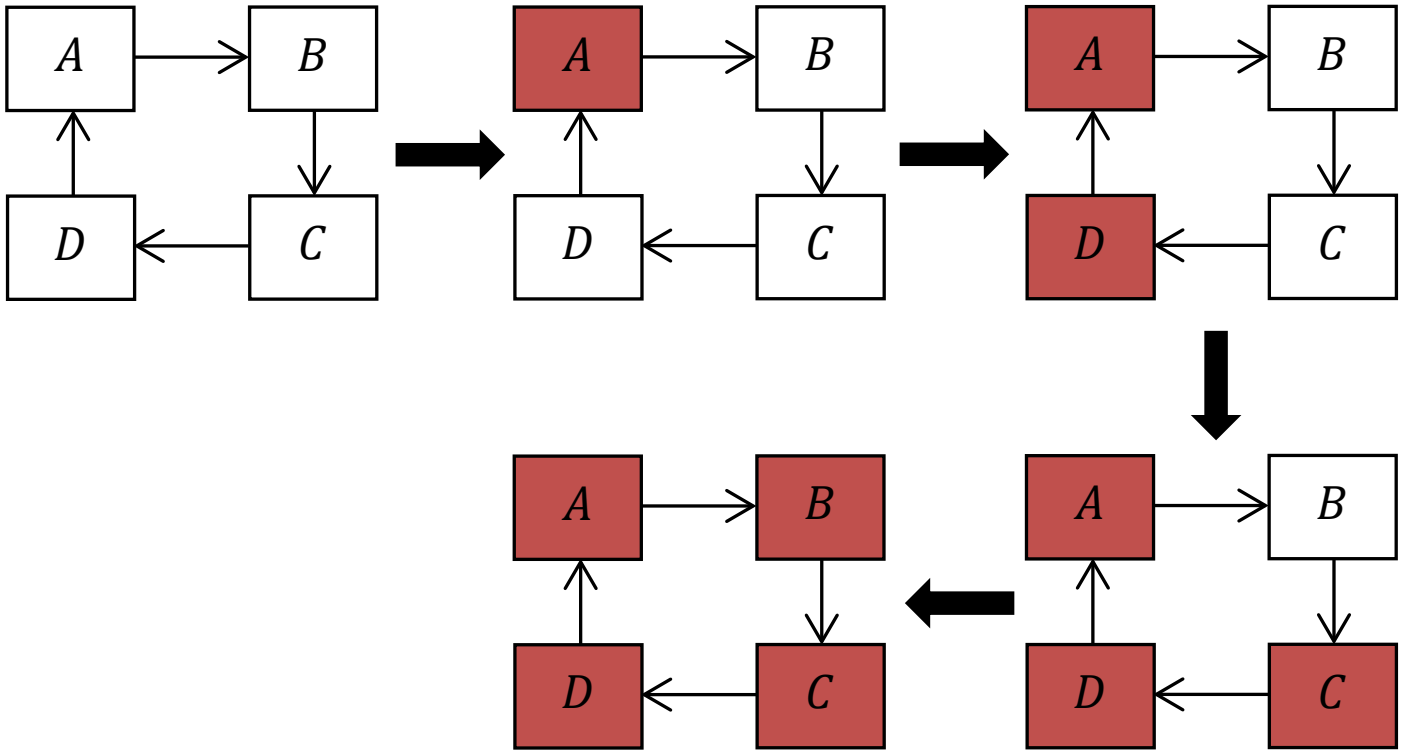
# Example: systemic liquidity shortages (cont'd)

- Liquid assets as share of banks' balance sheets: US & UK



# Example: network externality



# Example: network externality (cont'd)

- Interbank lending makes the banks a "*web of claims*", or *banking network*;
- One bank's failure leads to losses of connecting banks'; bank failure may further spread over the network – *contagion* or "*domino effect*";
- In good time banks make profit with borrowed money from other banks, while in bad time the connecting banks suffer from losses, too – *negative externality*;
- Too much reliance on interbank lending – "*too-interconnected-to-fail*".

# The devil in the details

- Financial history suggests the following *lead indicators* for systemic events:
  - "Capital Flow Bonanzas";
  - Waves of financial innovation;
  - Housing boom;
  - Financial liberalization;
  - After all, *credit growth* seems single best indicator for financial instability;
- Regulators need watch the indicators, while design rules to target sources of systemic risks.