A Crash Course on the Euro Crisis

Markus K. Brunnermeier & Ricardo Reis
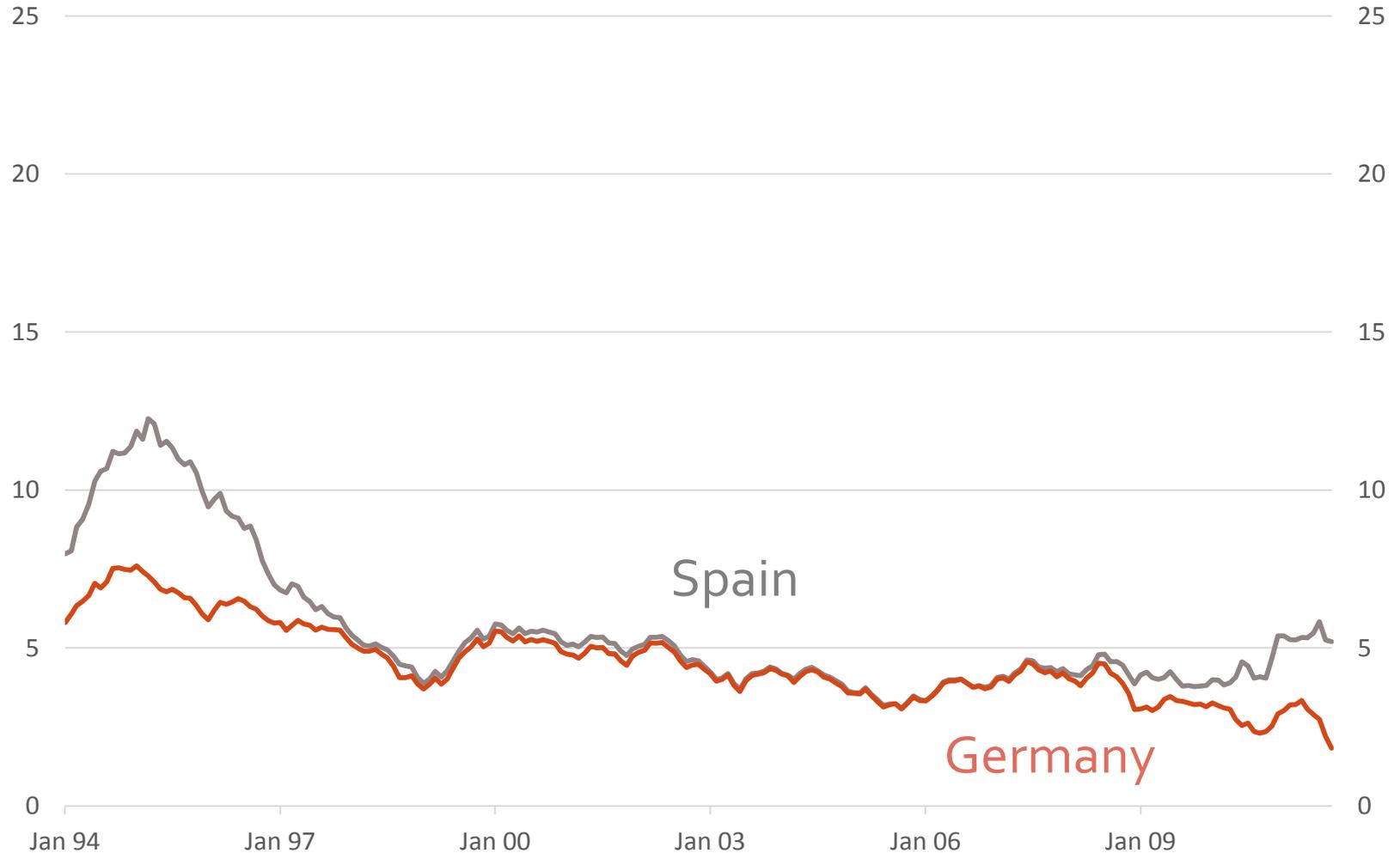
Overview

- Introduction of Euro
  - Decline in sovereign spreads
  - Capital inflows
    1. To low TFP growth sectors
       - Housing, non-tradable sector, not export sector
    2. Via banks – whole sale funding
- Crisis – "Macro-finance perspective"
  - Financial Instability: Amplification and multiple equilibria
    - Liquidity spiral, deflationary spiral, (redenomination risk)
  - ECB's Target 2 – replacing private flows
- Game of chicken between ECB and 17 fiscal authorities ⇒ strategic delay (war of attrition)
- Diabolic loop between fiscal and banking risk
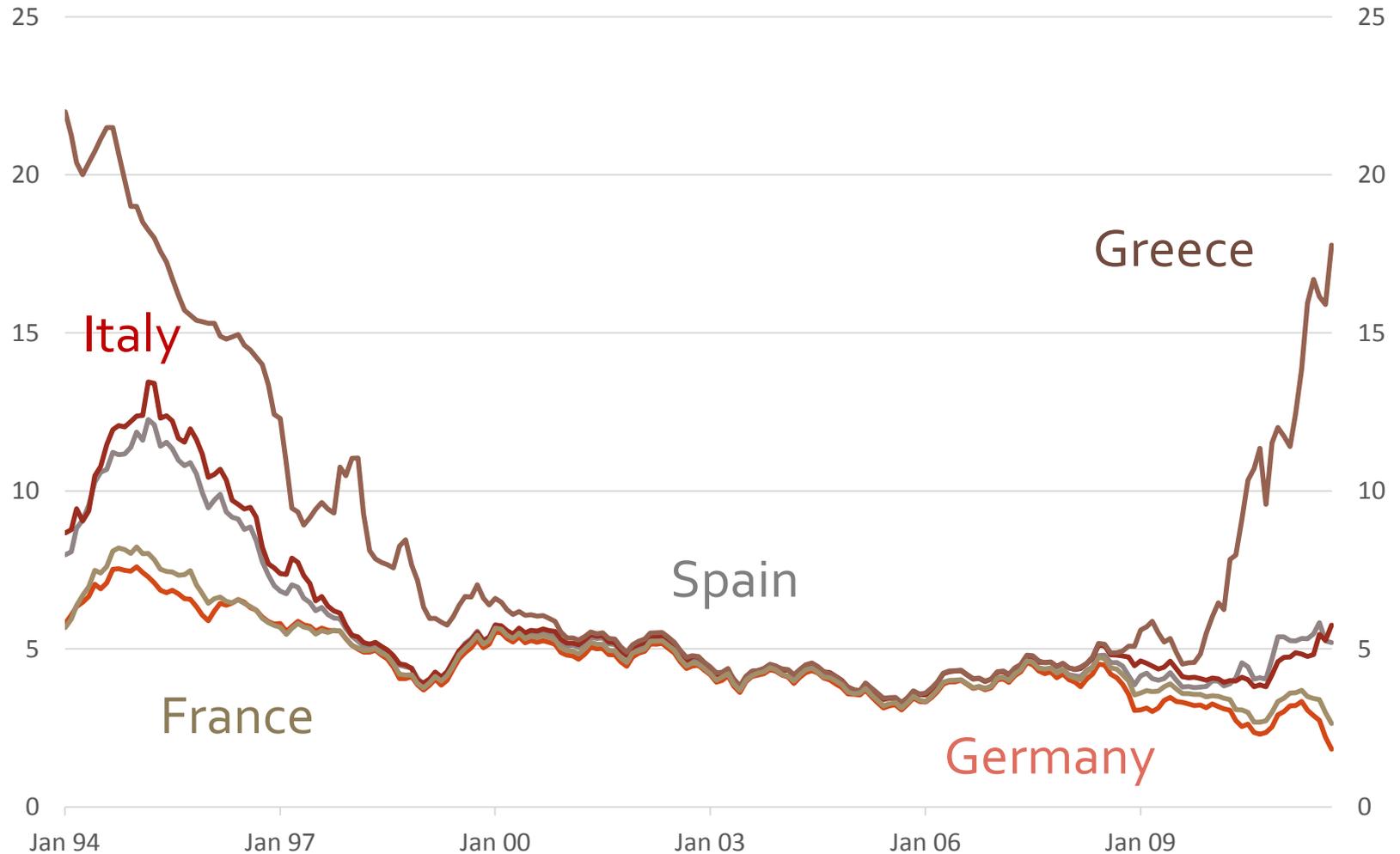
Sovereign debt yield (10 year)

Par %-Yield

Spain

Germany

Source: Eurostat

Sovereign debt yield (10 year)

Par %-Yield

Greece

Italy

Spain

France

Germany

25

20

15

10

5

0

Jan 94   Jan 97   Jan 00   Jan 03   Jan 06   Jan 09

Source: Eurostat

Reasons

- Elimination of exchange rate and inflation risk
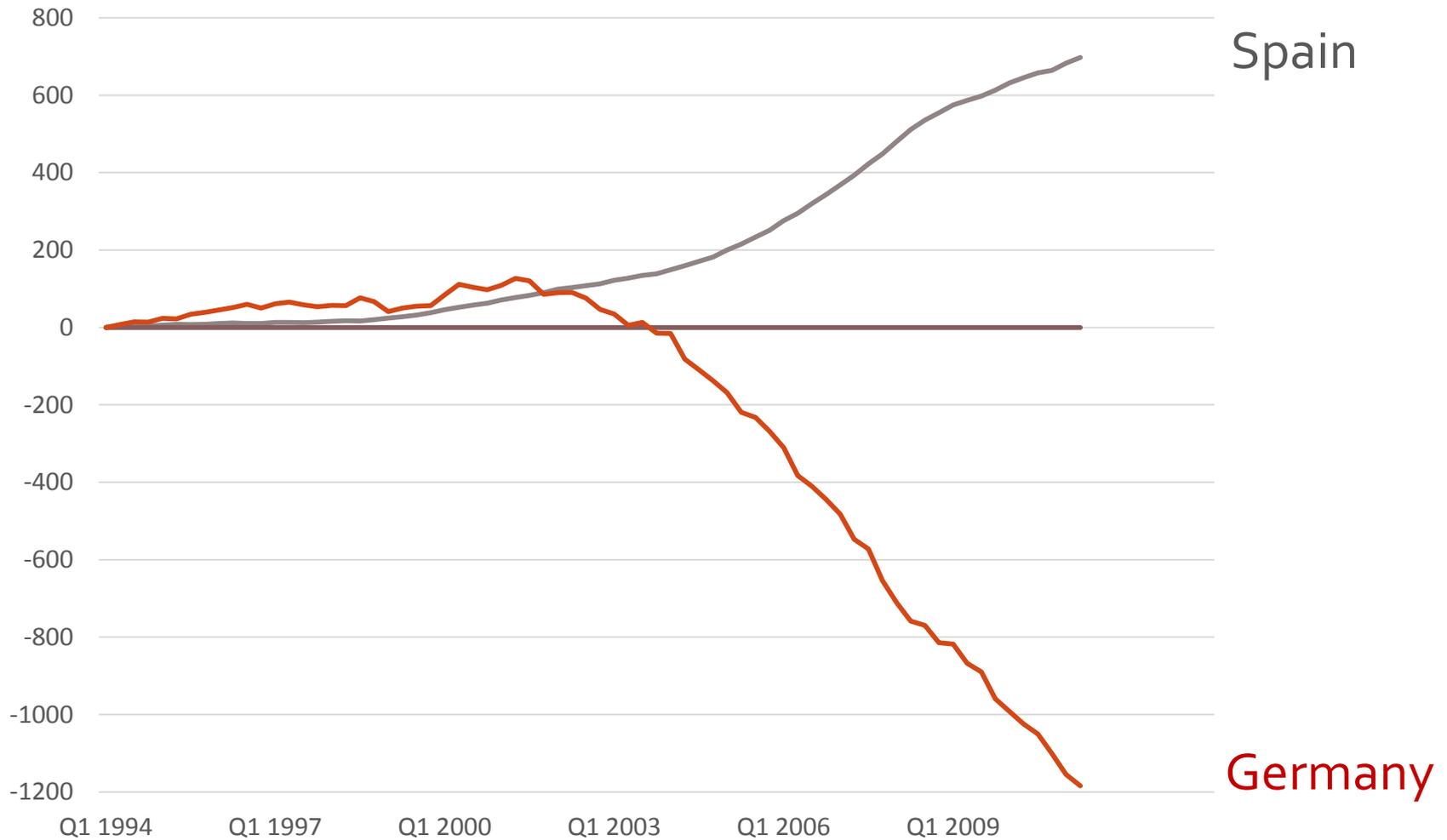
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- Basel: zero risk weight
- ECB common haircut rule

- Sovereign debt should be risky
  - Maastricht Treaty: No bailout clause
                            No ECB bond purchases
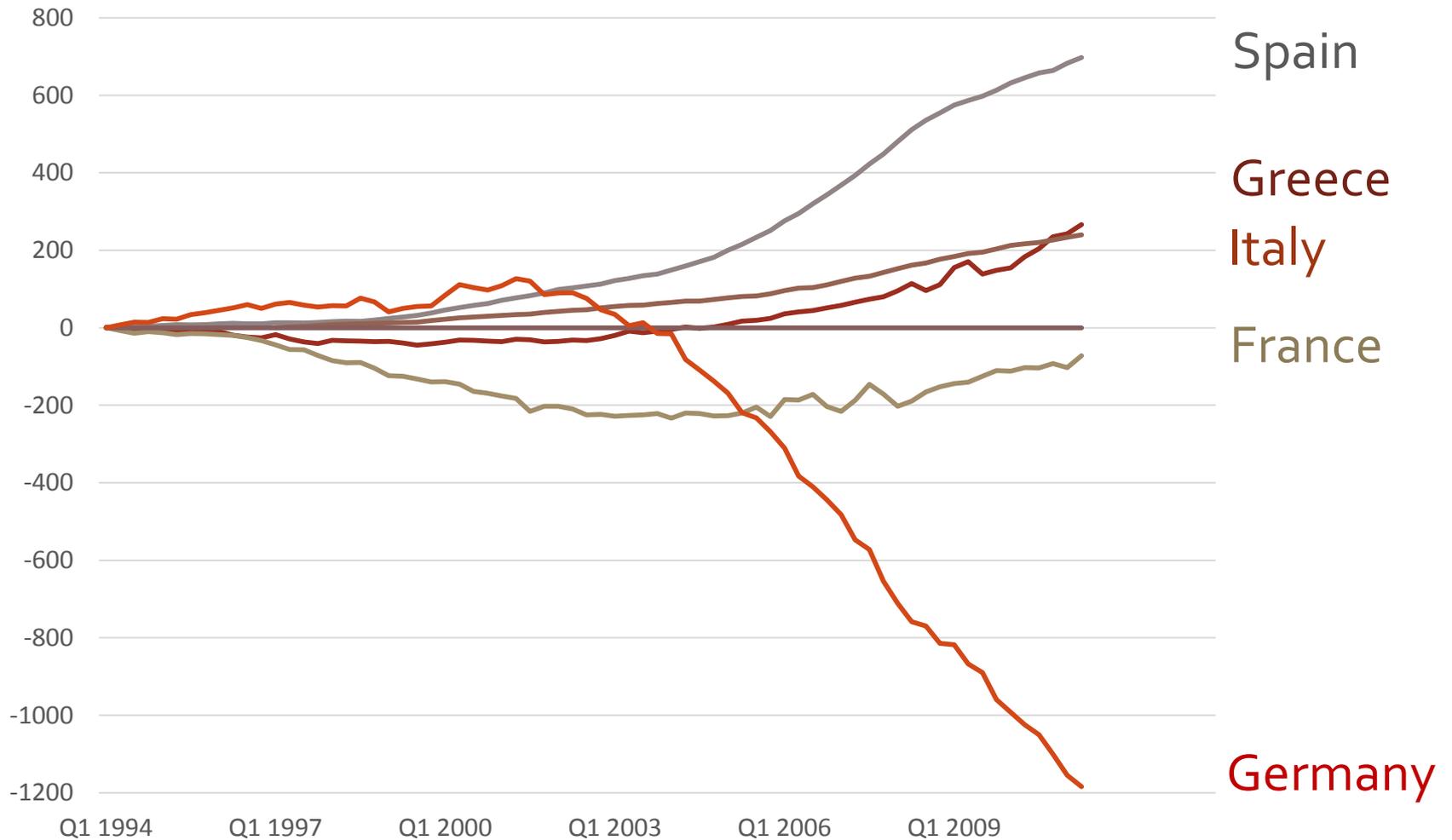 - Interest difference should act as disciplinary force

Inconsistency

Accumulated Net Capital Inflows

€ Billion

Spain

Germany

Q1 1994 Q1 1997 Q1 2000 Q1 2003 Q1 2006 Q1 2009

Source: Eurostat

Accumulated Net Capital Inflows

€ Billion

Source: Eurostat

Inflows into low TFP growth sectors

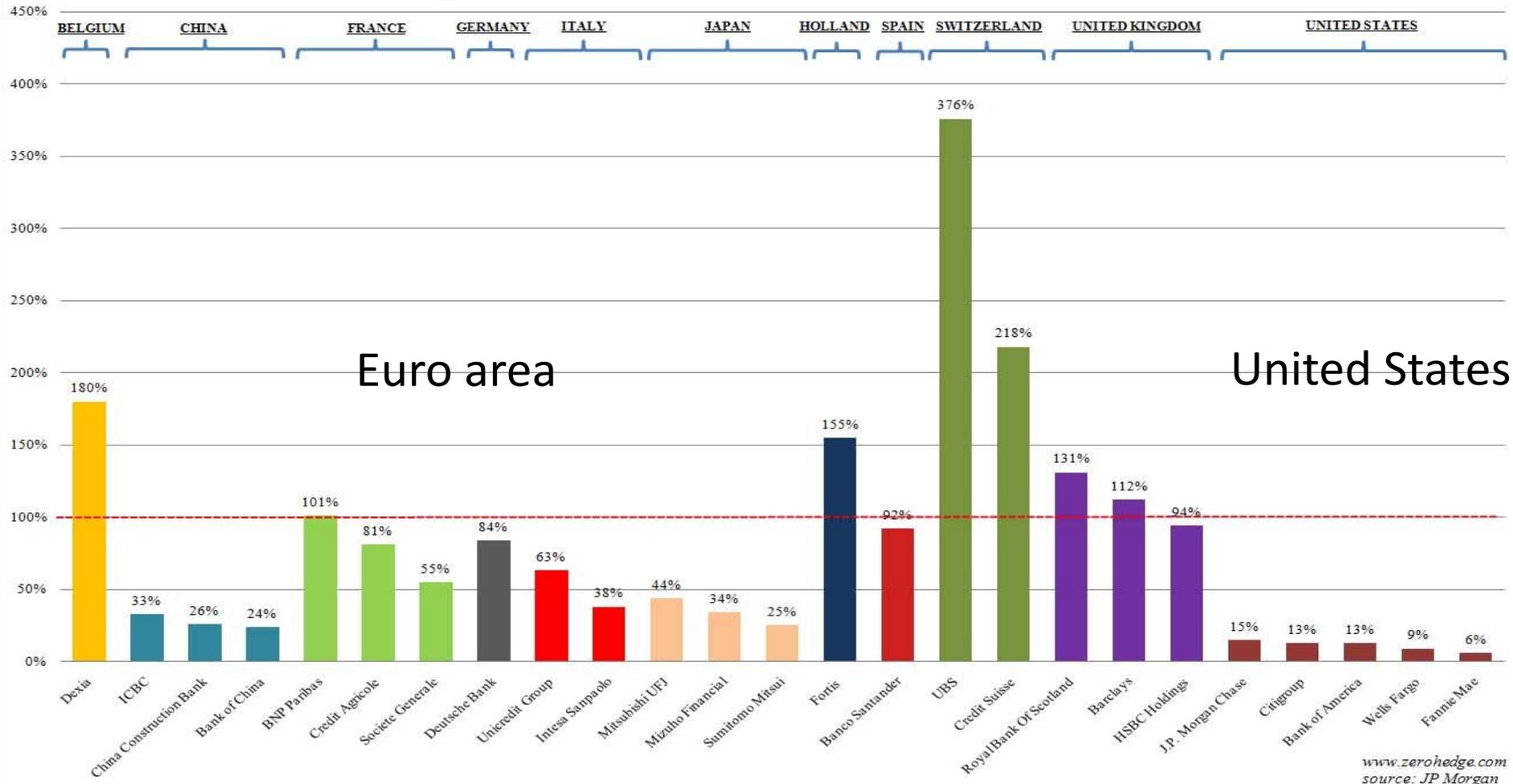|	REAL GDP	⊖	Labor	⊕	Capital	⊕	TFP
🇺🇸	3,1%		0,9%		1,5%		1,2%
🇪🇺	2,2%		0,6%		1,2%		0,4%
🇪🇸	3,6%		2,3%		1,9%		-0,7%

1 Para EU-15 los datos son del período 1995 – 2005 y sólo incluye países para los que el efecto multifactorial puede ser calculado: AUT, BEL, DNK, ESP, FIN, FRA, GER, ITA, NLD & UK
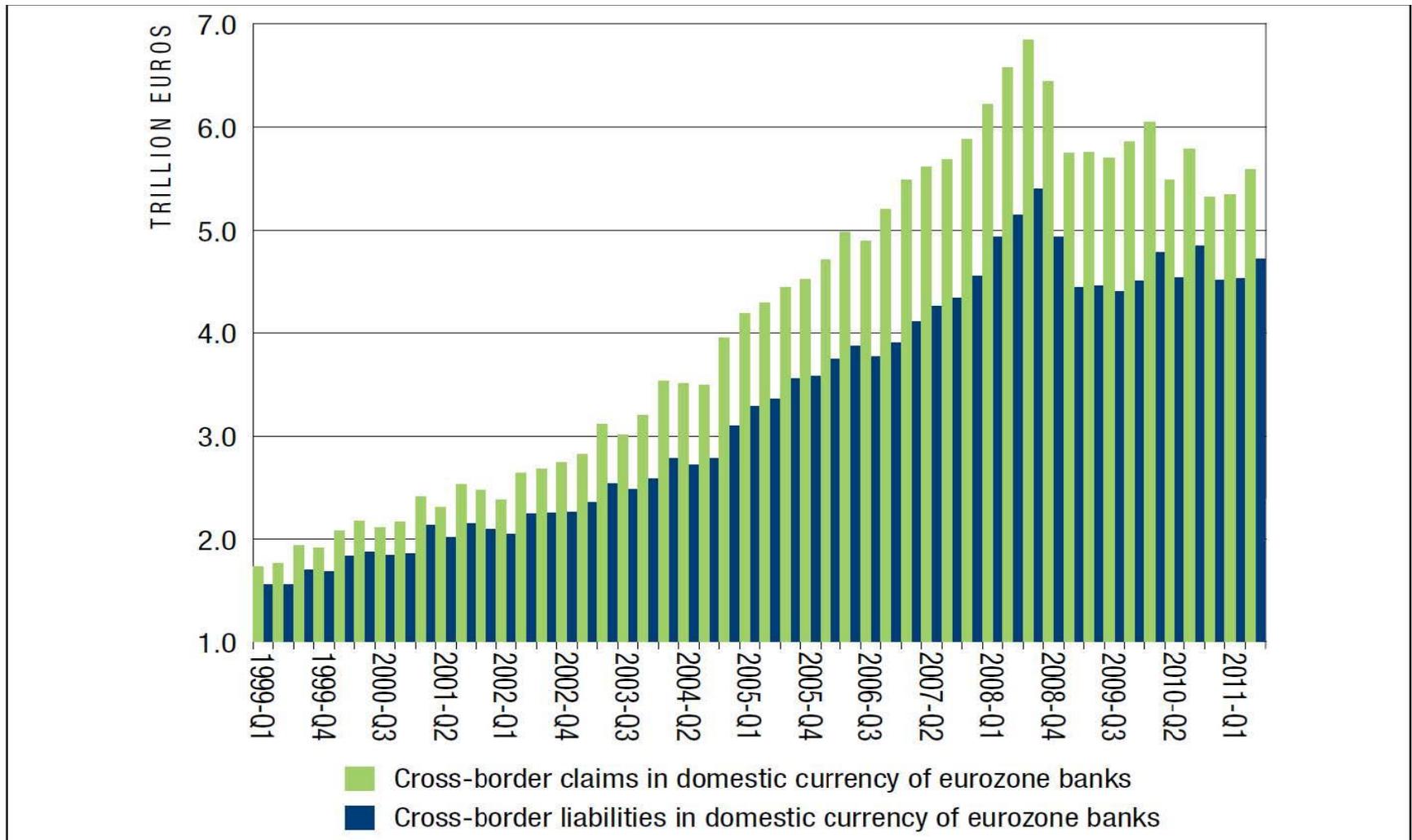
FUENTE: EU KLEMS

Funding via banks

- Large fraction of funding
- Large relative to GDP

Top 25 Global Banks: Total Assets To Home Country GDP

Country groupings: BELGIUM, CHINA, FRANCE, GERMANY, ITALY, JAPAN, HOLLAND, SPAIN, SWITZERLAND, UNITED KINGDOM, UNITED STATES

Euro area | United States

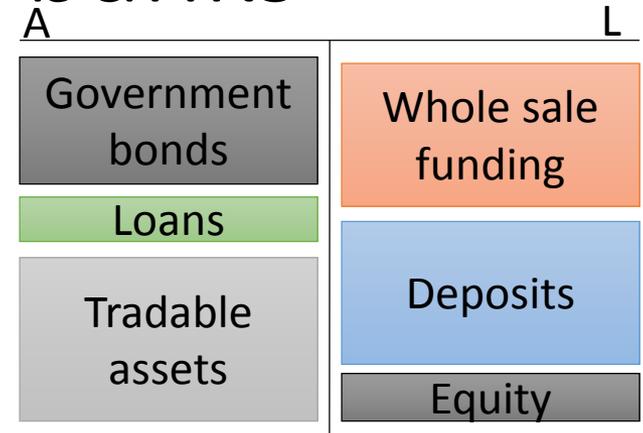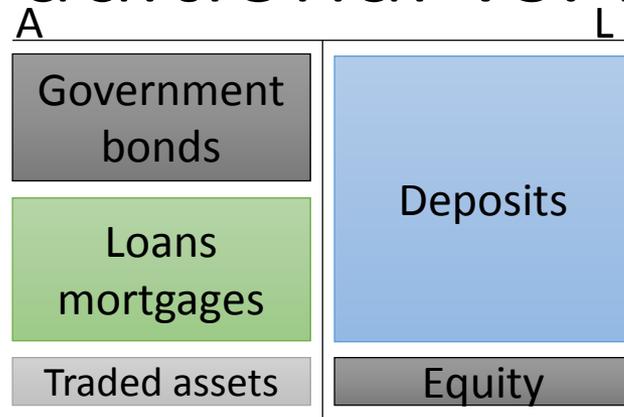| Bank	Value
Dexia	180%
ICBC	33%
China Construction Bank	26%
Bank of China	24%
BNP Paribas	101%
Credit Agricole	81%
Societe Generale	55%
Deutsche Bank	84%
Unicredit Group	63%
Intesa Sanpaolo	38%
Mitsubishi UFJ	44%
Mizuho Financial	34%
Sumitomo Mitsui	25%
Fortis	155%
Banco Santander	92%
UBS	376%
Credit Suisse	218%
Royal Bank Of Scotland	131%
Barclays	112%
HSBC Holdings	94%
J.P. Morgan Chase	15%
Citigroup	13%
Bank of America	13%
Wells Fargo	9%
Fannie Mae	6%

www.zerohedge.com
source: JP Morgan

Cross-border assets & liabilities of Euro area banks

Cross-border claims in domestic currency of eurozone banks

Cross-border liabilities in domestic currency of eurozone banks

Source: Bank for International Settlements, Locational Banking Statistics, Table 5A

Growth rate!

Traditional vs. modern banks

A		L	
Government bonds	Deposits		
Loans mortgages			
Traded assets	Equity		

A		L	
Government bonds	Whole sale funding		
Loans	Deposits		
Tradable assets			
	Equity		

- Loans/mortgages are securitized and made "tradable"

- Whole sale funding
 - Interbank market (foreign)
  - Money market funds (also from US)

Traditional vs. modern banks

A		L
Government bonds	Deposits	
Loans mortgages		
Traded assets	Equity	

A		L
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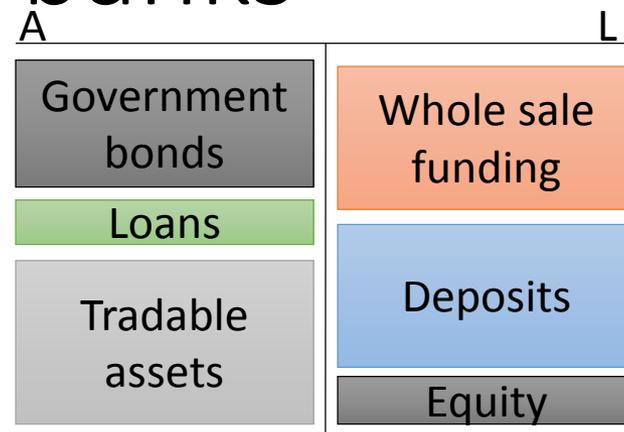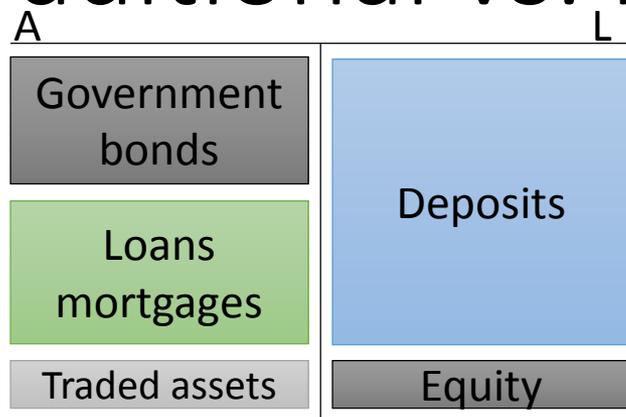
- **Bank run**
  a la Diamond-Dybvig
  - … but inertia
    also due to demand deposit insurance

- **Whole sale funding liq. risk**
  like in Brunnermeier-Pedersen
  - Short-term
    No inertia   *Essentially senior*
  - Collateralized

- **Fire-sales of tradable assets**

- **Risk shifting towards depositors (insurance)**

Interbank Market

Run-up in liquidity mismatch

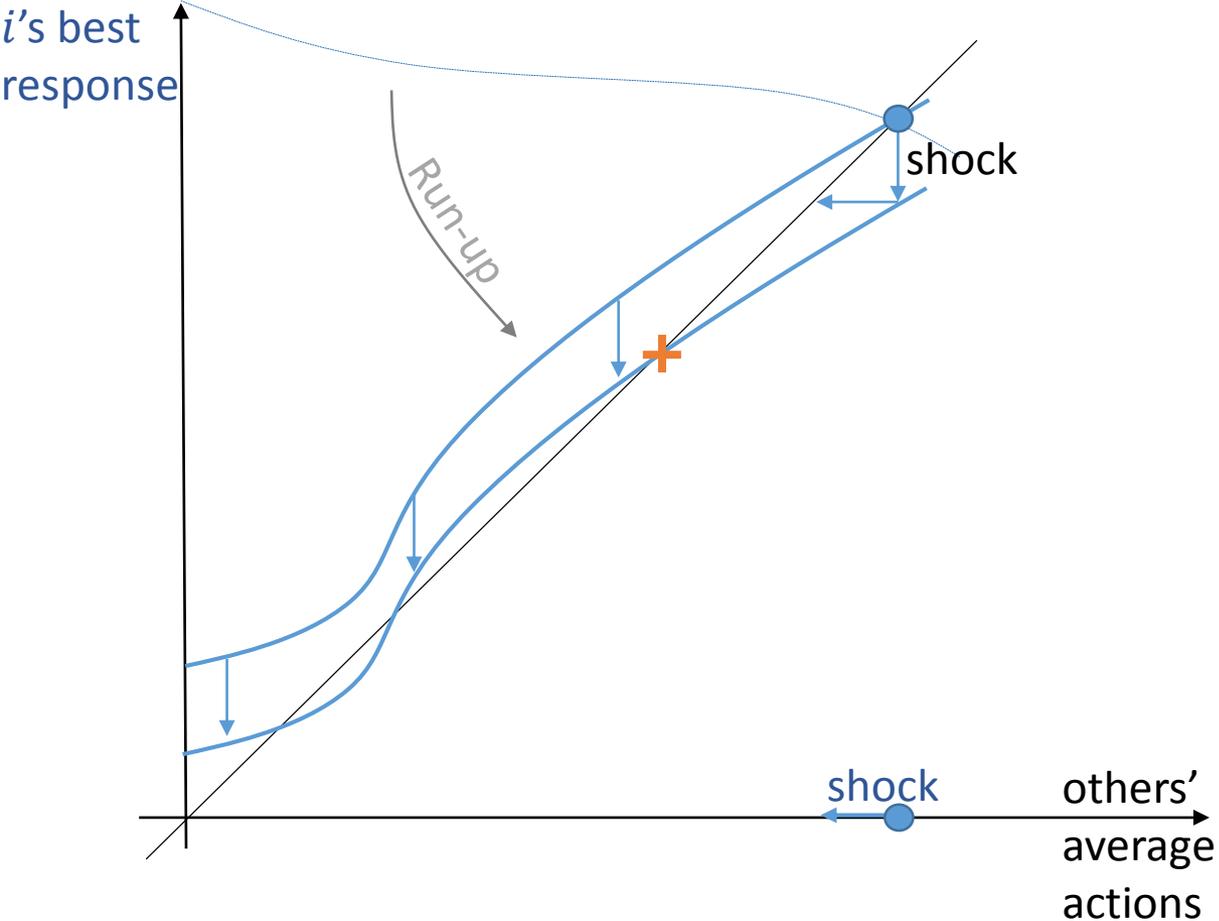*i*'s best response

shock

others' average actions
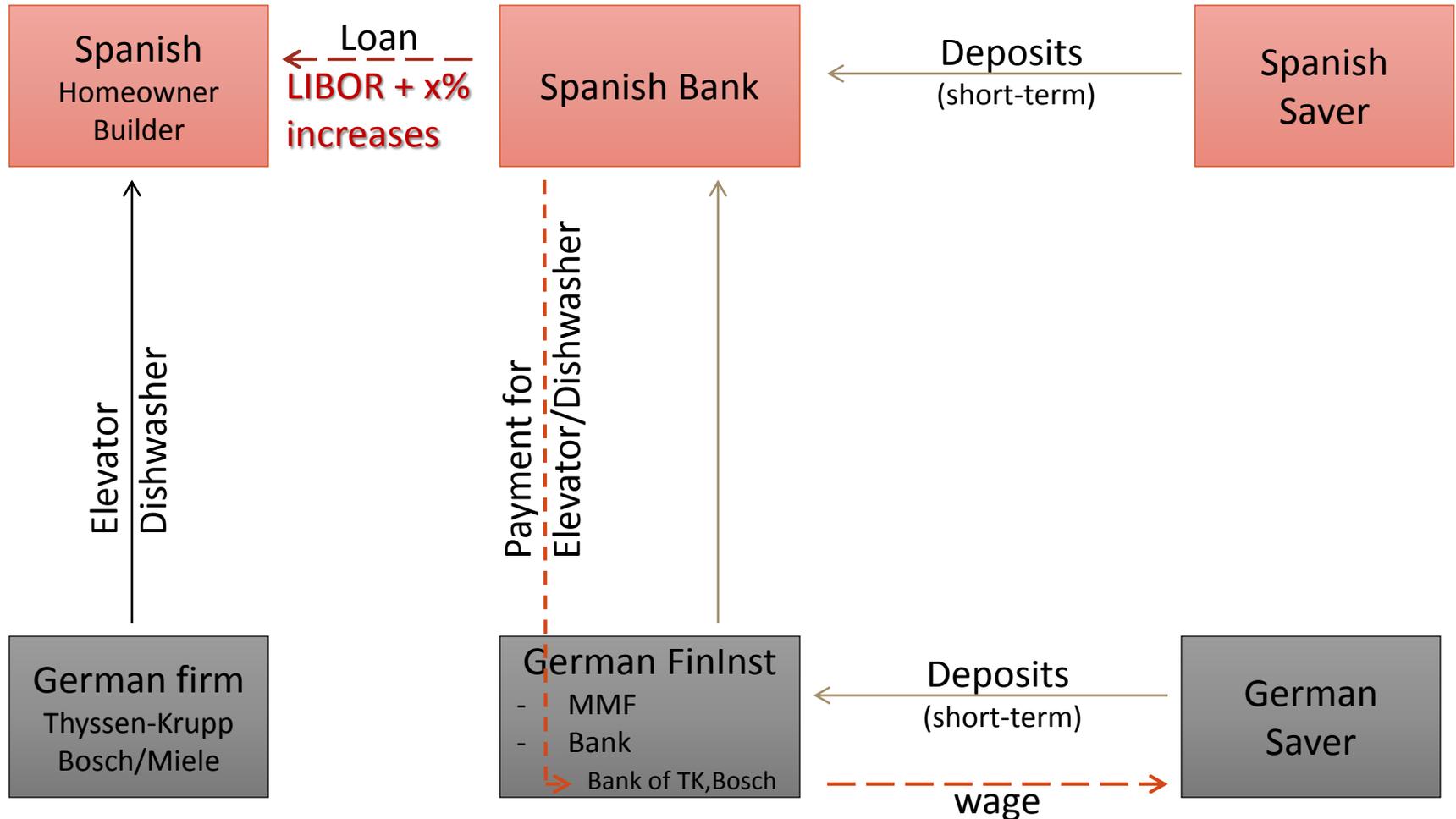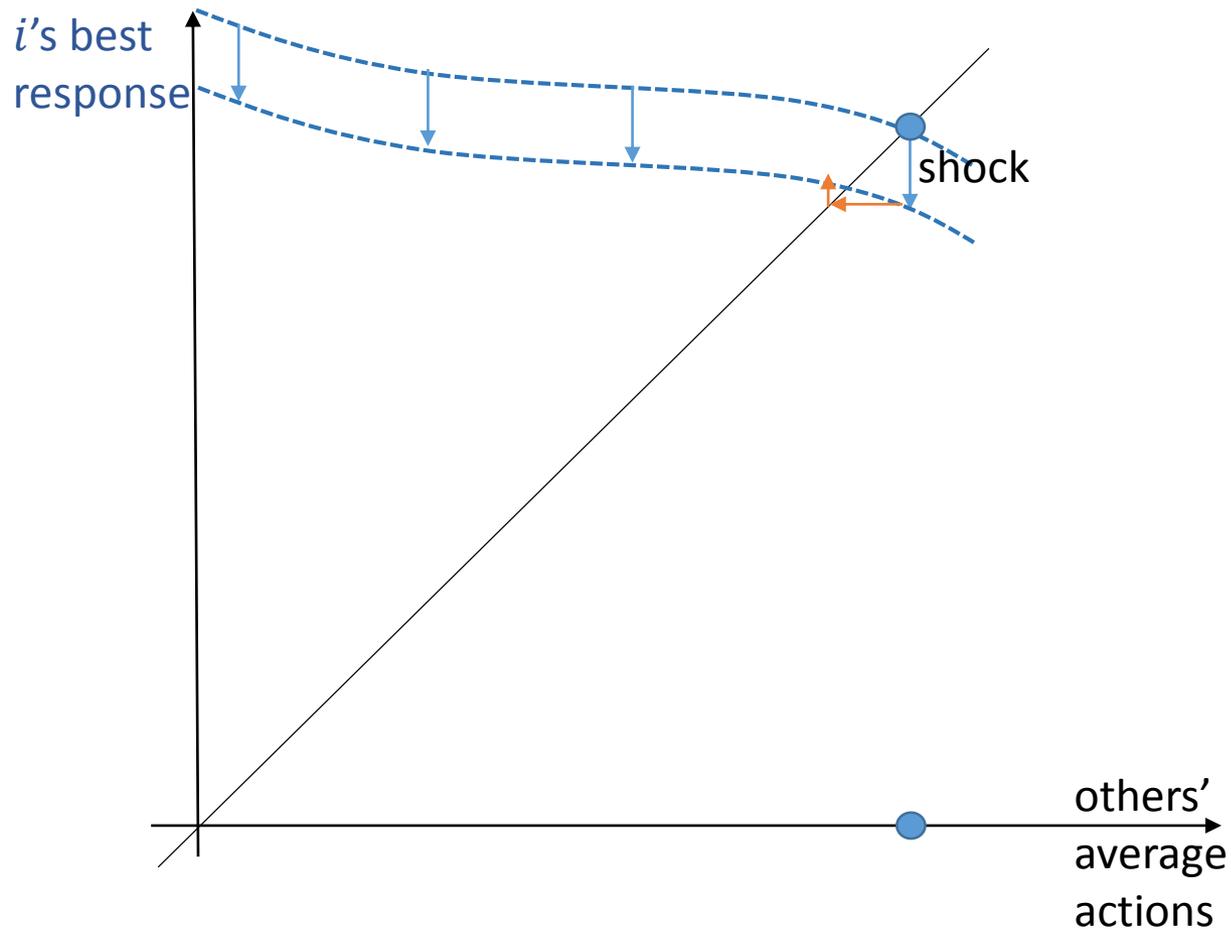
General mechanism

Run-up in liquidity mismatch

i's best response

Run-up

shock

others' average actions
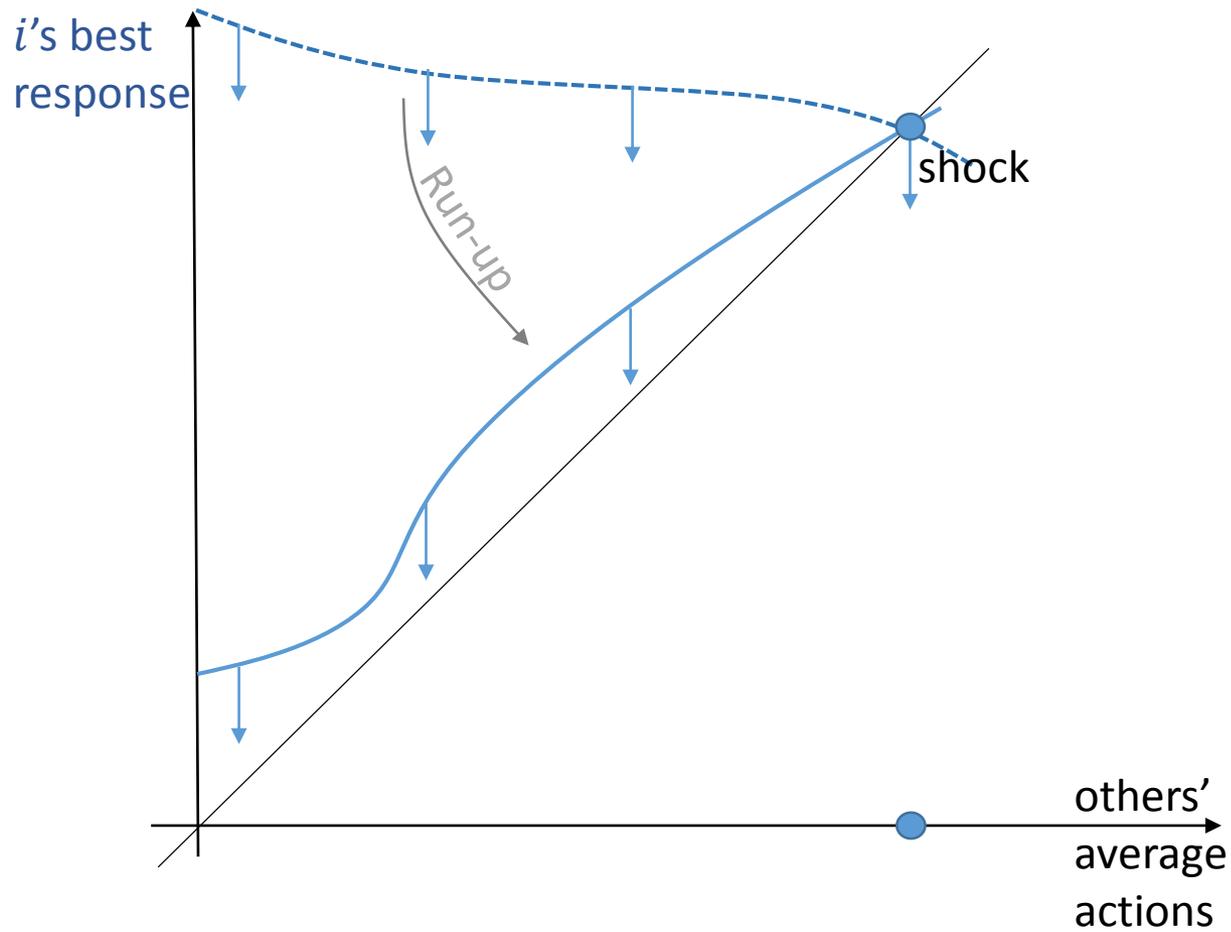
General mechanism

Shock after the run-up

General mechanism

2ⁿᵈ, 3ʳᵈ round effects: Amplification

General mechanism

2nd, 3rd round effects: Amplification
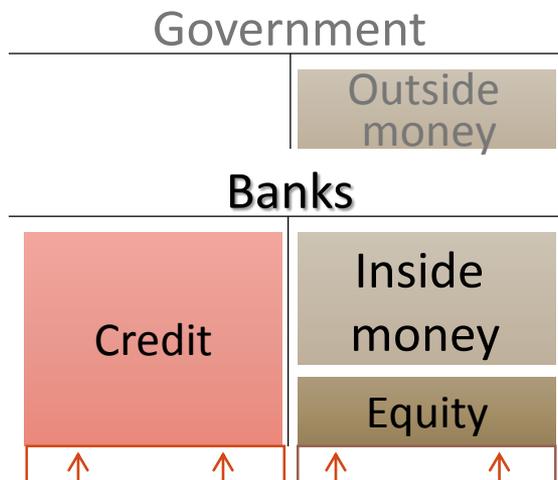# Multiplicity
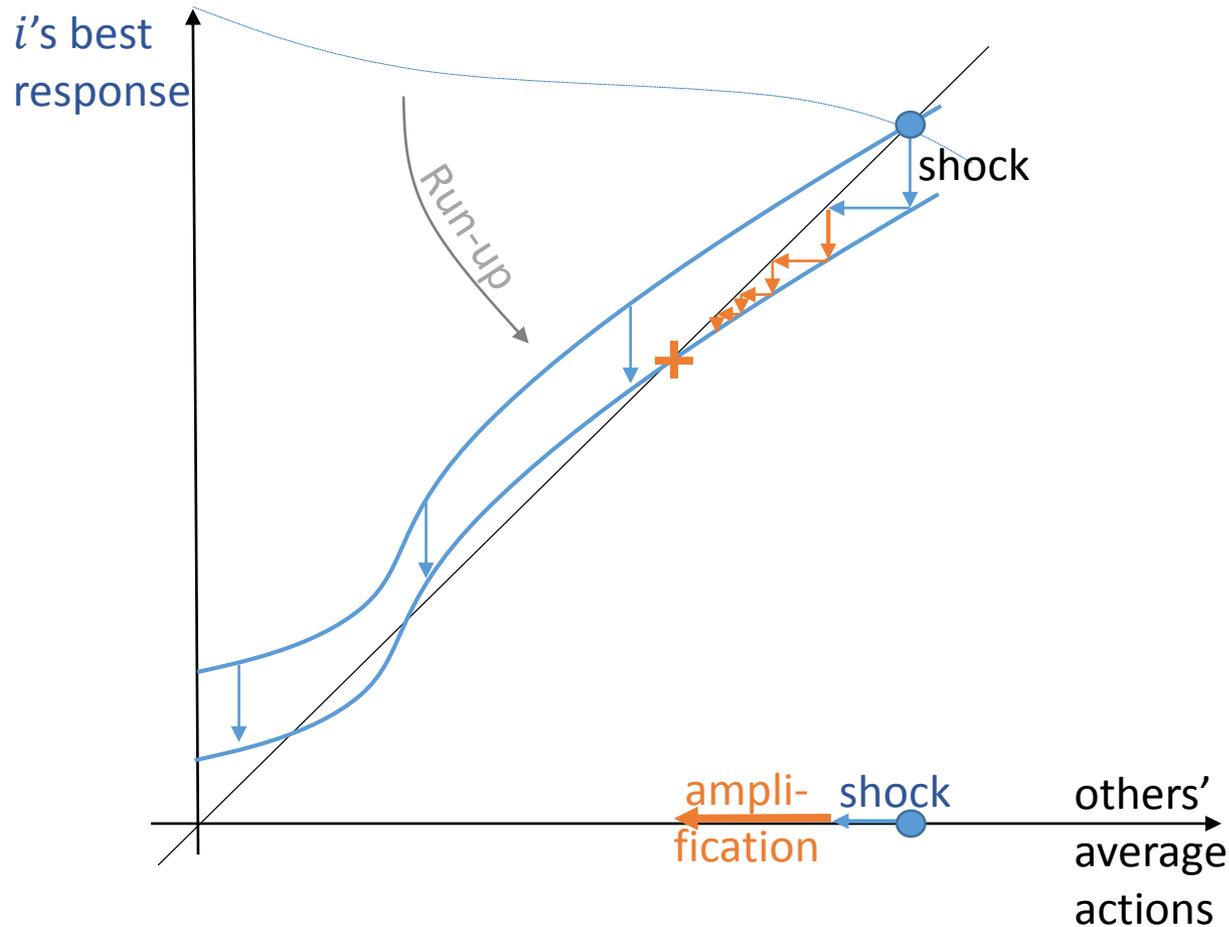


General
mechanism

Spirals & capital stops

- Liquidity spiral and fire-sales
  - Loss spiral
  - Margin/haircut/LTV spiral
- Deflationary spiral
- Redenomination spiral

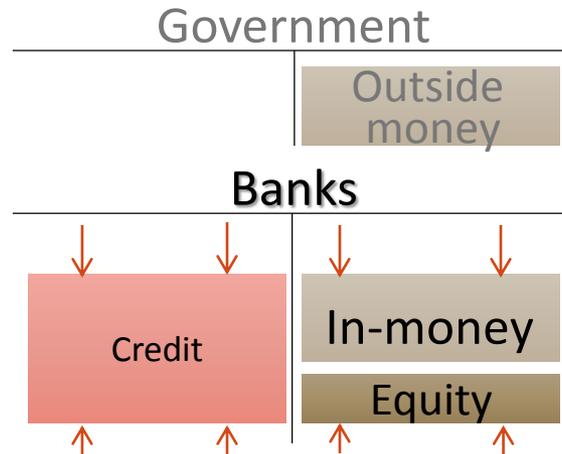- Along whole intermediation chain
- Including real sector (housing etc.)

1. Shock Impairs Assets – 1ˢᵗ of 4 Steps

Government

Outside
money

Banks

Credit

Inside
money

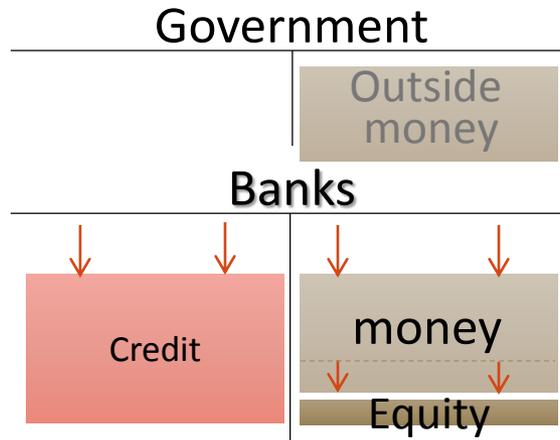Equity

2. Shrink Balance Sheet: Sell off of Assets
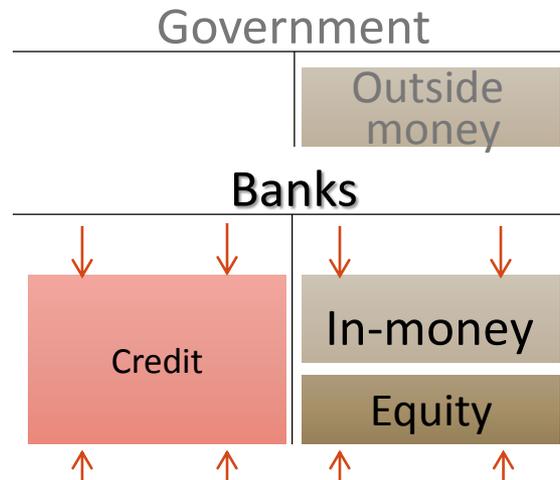
3. Liquidity Spiral: Sell off of Assets

"Self-defeating deleveraging"
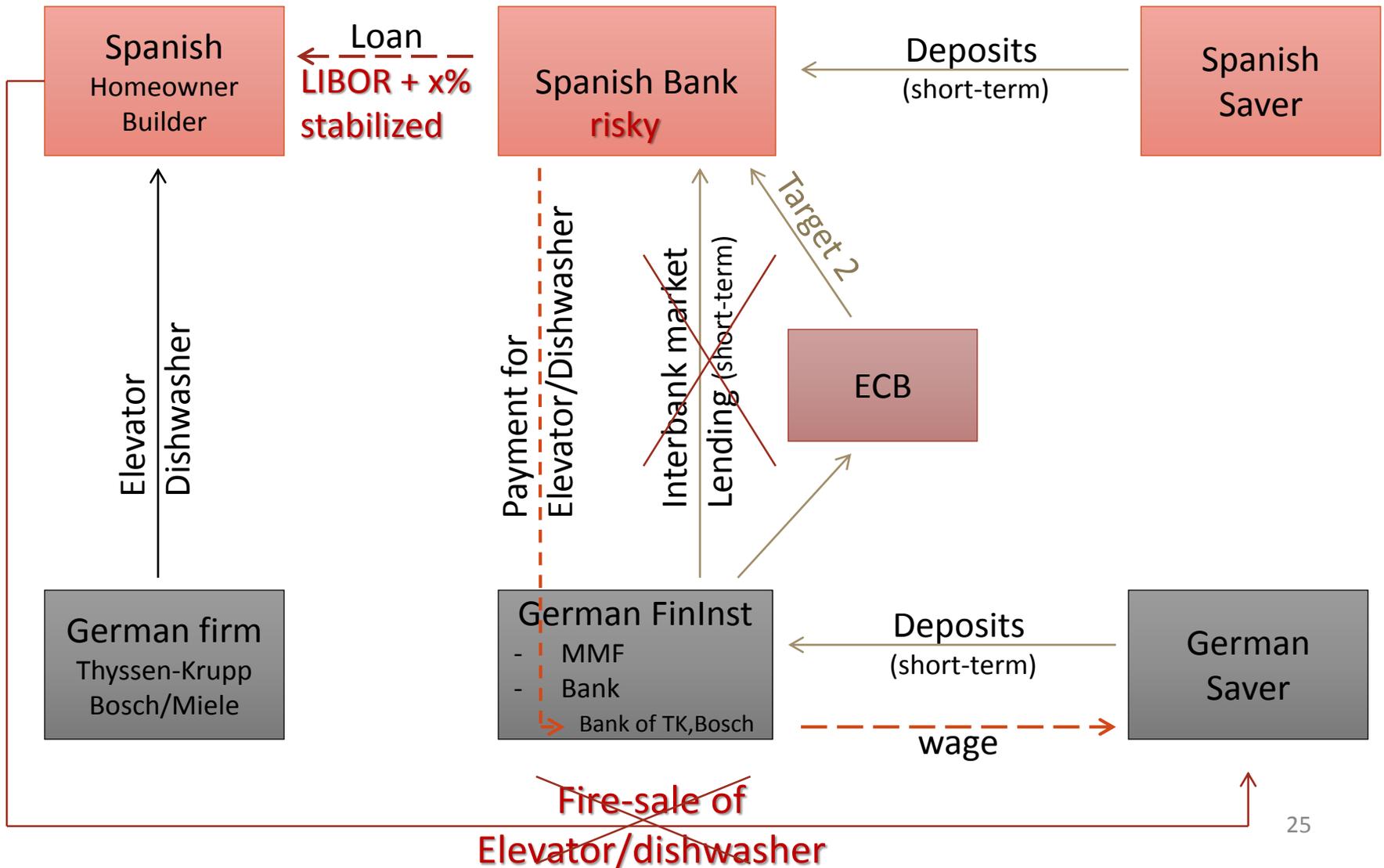
4. Deflation Spiral: Value of Liabilities ↑

Government

Outside money

Banks

Credit

money

Equity

See "I Theory of Money"

Interbank Market

Spanish Homeowner Builder

Loan
LIBOR + x% increases

Spanish Bank

Deposits
(short-term)

Spanish Saver

Elevator
Dishwasher

Payment for
Elevator/Dishwasher

Interbank market
Lending (short-term)

Losses accumulate

German firm
Thyssen-Krupp
Bosch/Miele

German FinInst
- MMF
- Bank
  Bank of TK,Bosch

Deposits
(short-term)

German Saver

wage

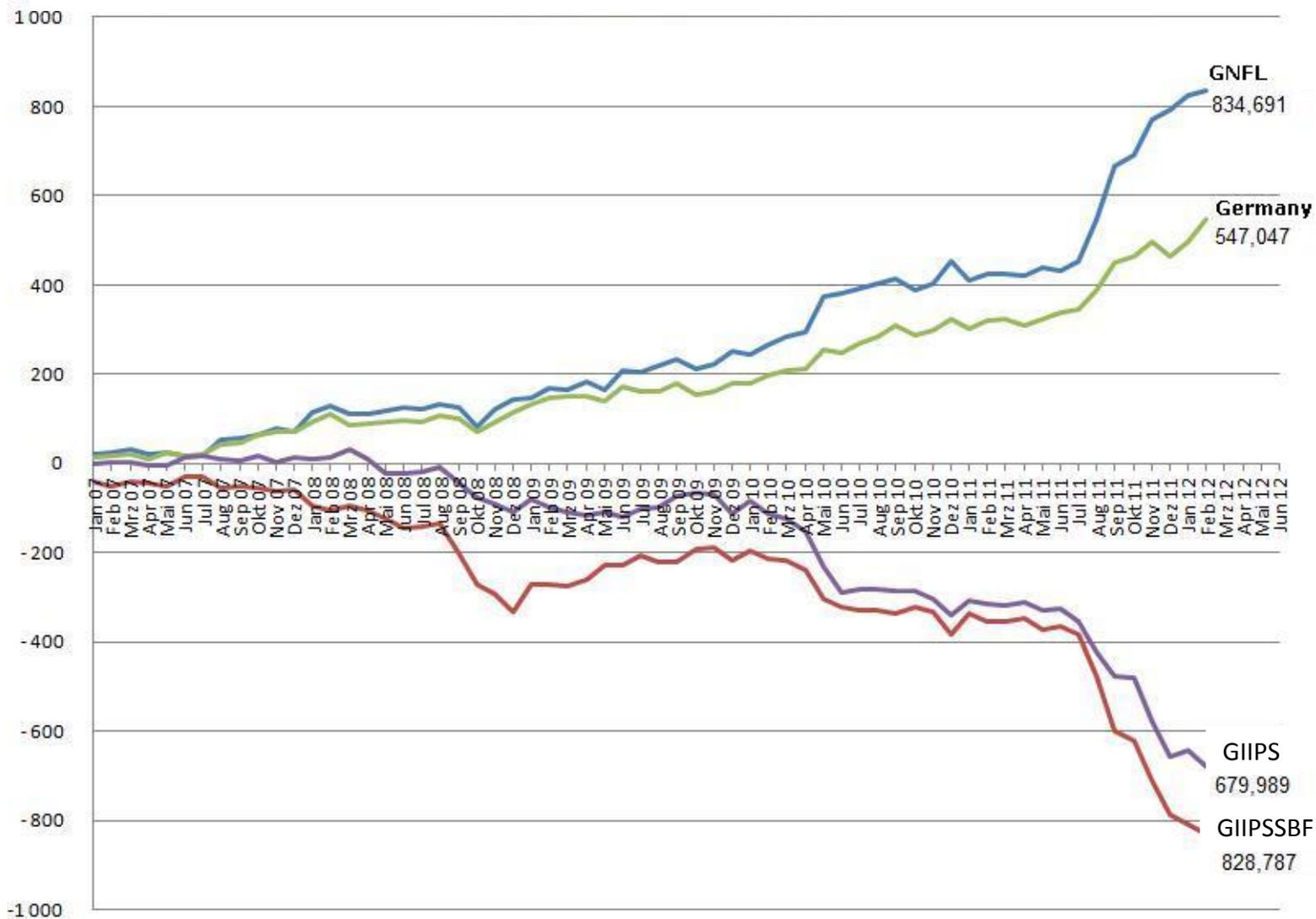Fire-sale of
Elevator/dishwasher
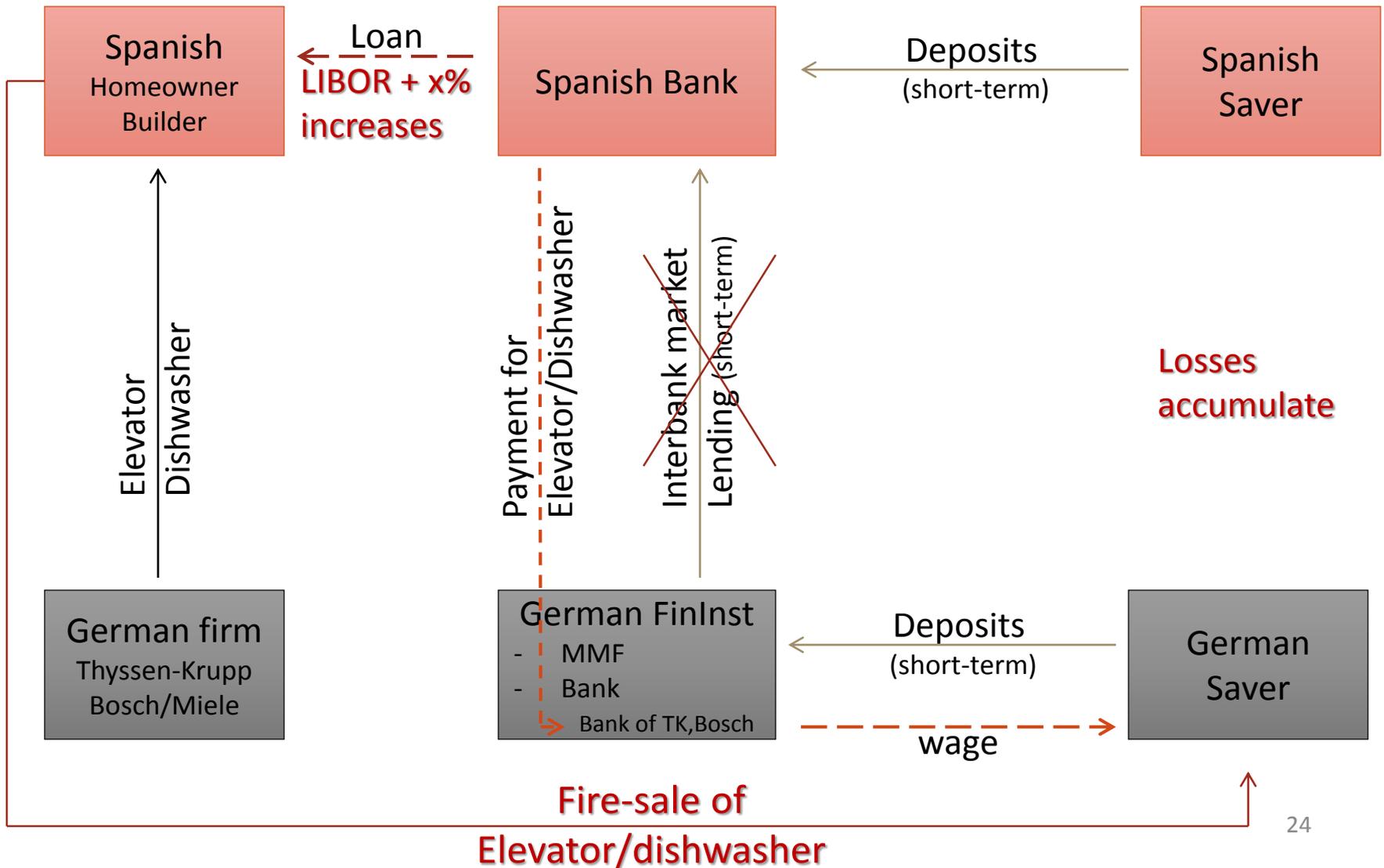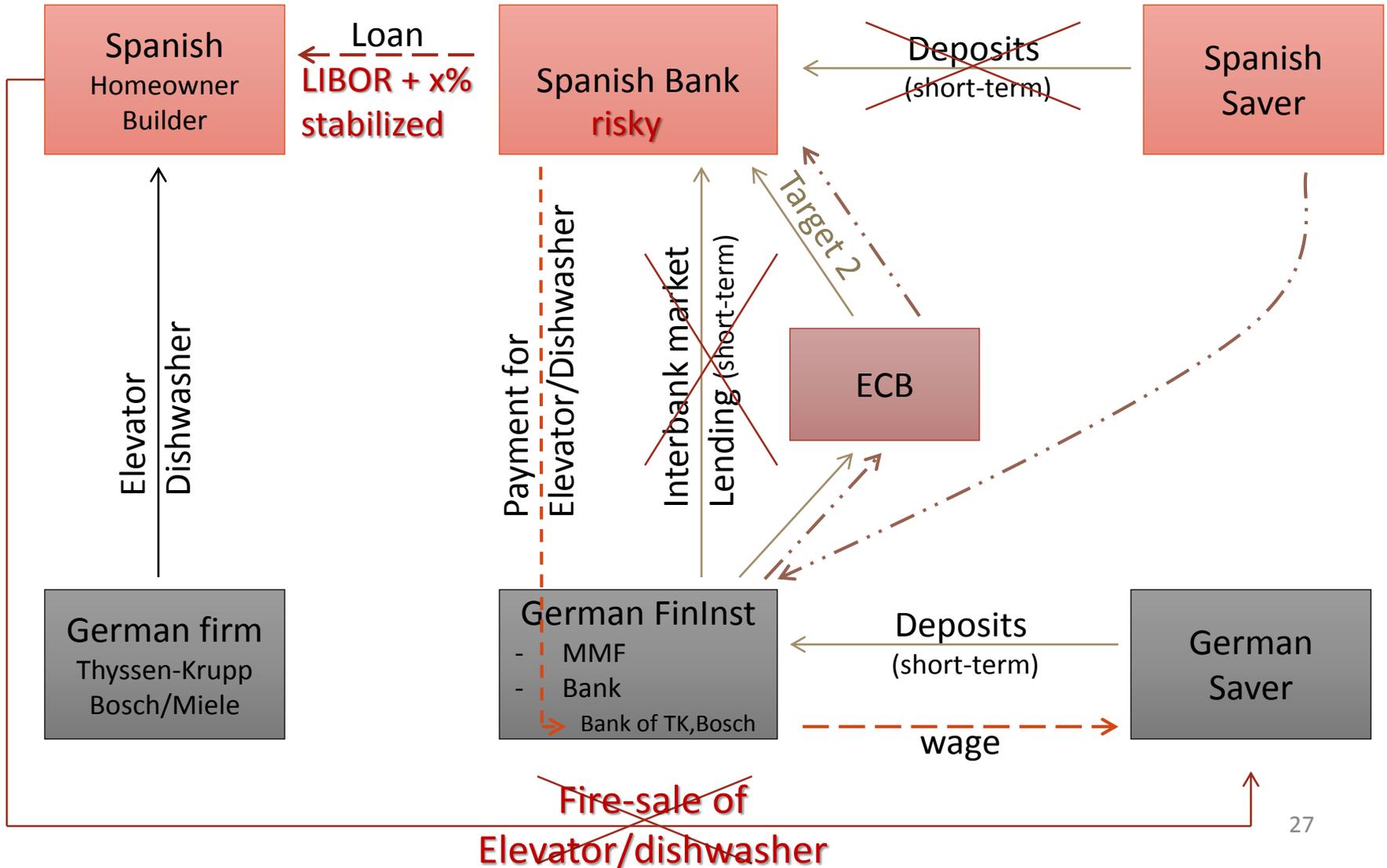
ECB assumes Tail Risk

Target 2 claims & liabilities

Adding Convertibility Risk

Liquidity vs. Solvency

- Pure Liquidity problem   multiplicity
  - ECB intervention does not lead to losses
    - Just ensures that we remain in good equilibrium

- Possible solvency problem   amplification
  - Who absorbs the losses? $\Rightarrow$ Game of chicken
    - Undoes initial shock to avoid amplification
      - Initial shock size = loss to be absorbed

2nd, 3rd round effects: Amplification Multiplicity
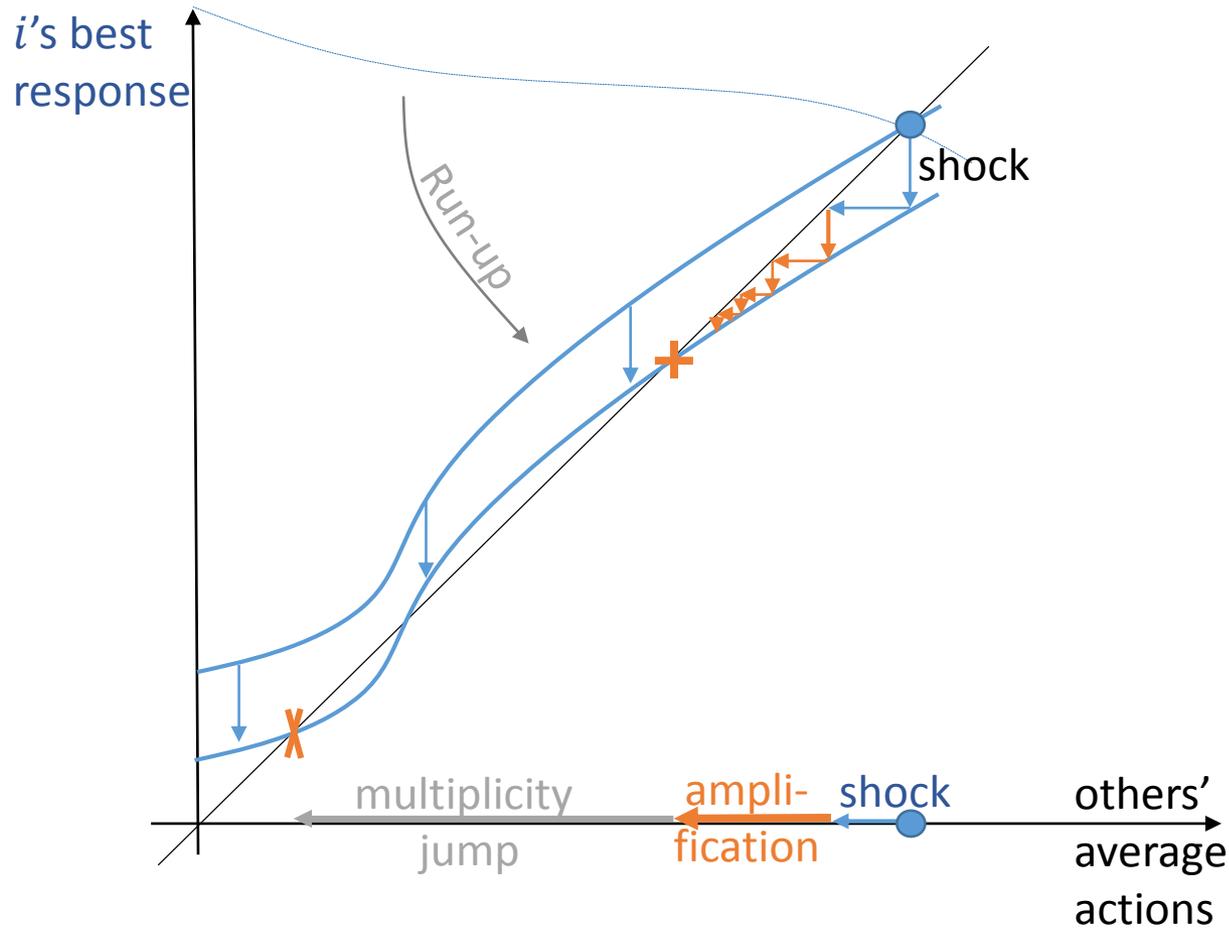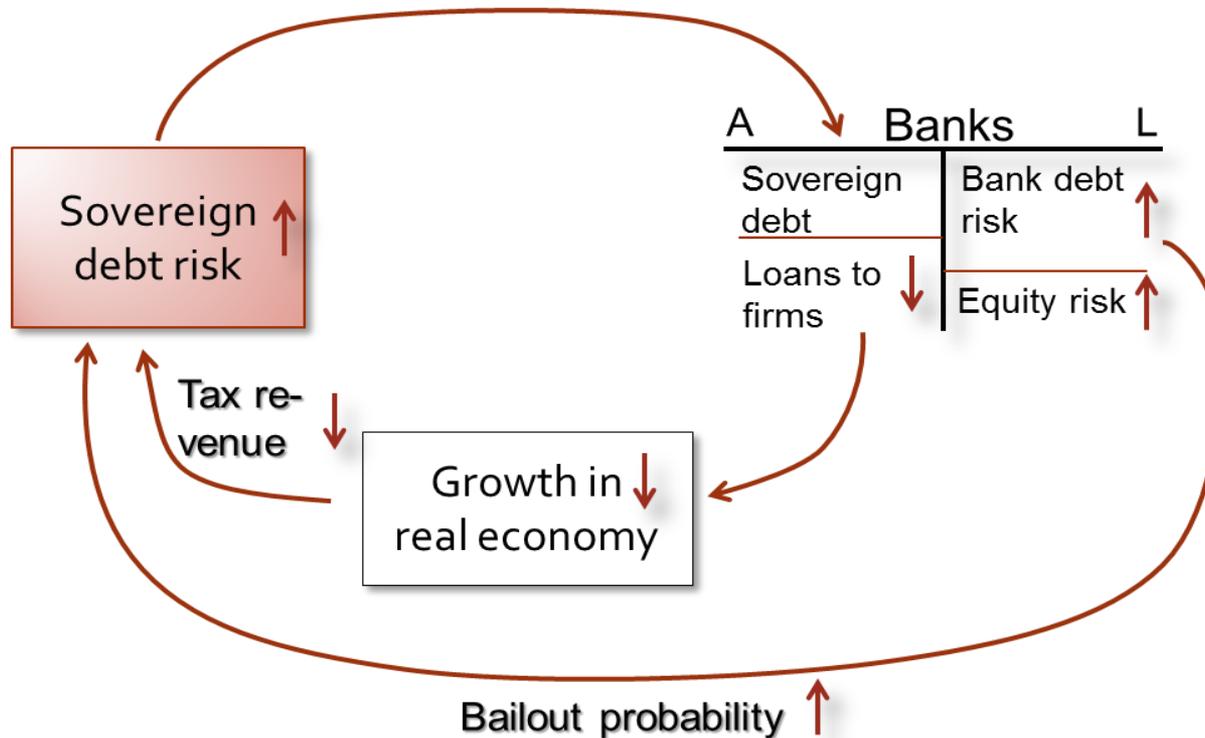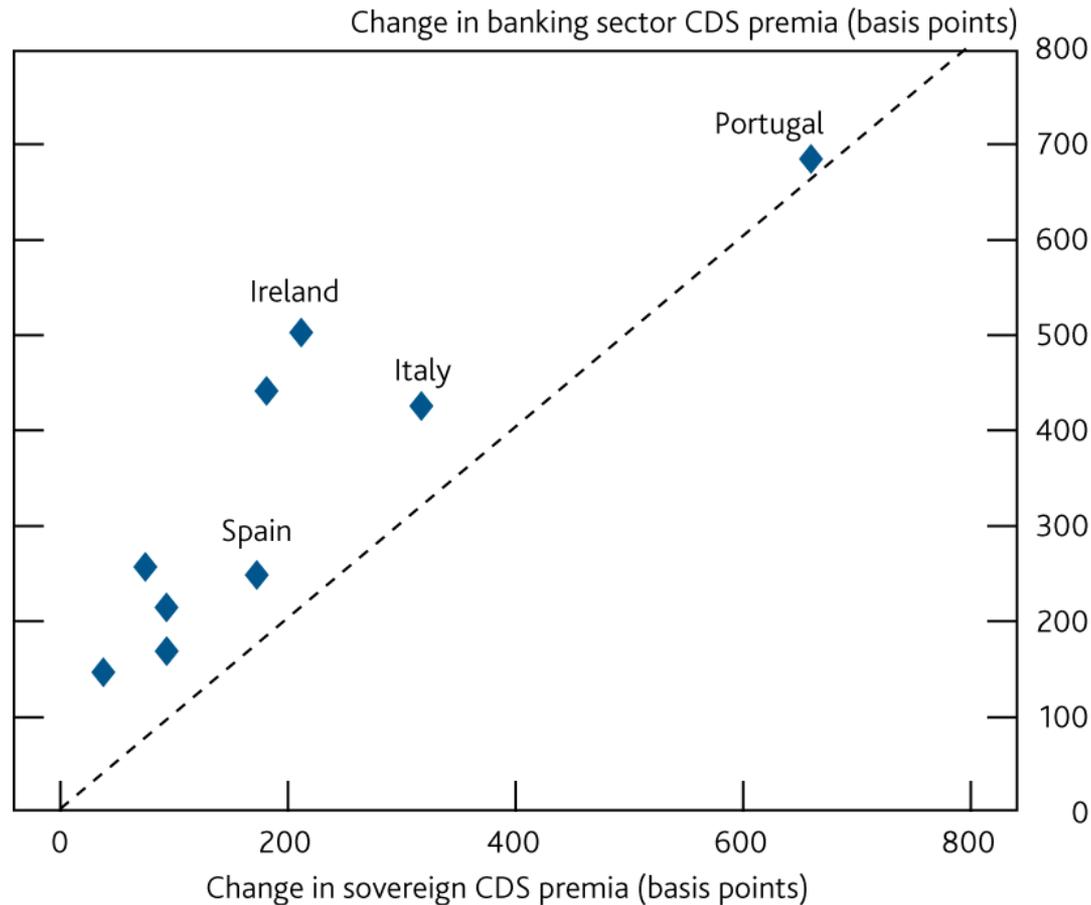
Game of Chicken

- Game between central bank
  - Central bank: assume losses and inflate way out
  - Fiscal authorities (17):   assume losses and raise taxes
- Game among governments

- Answer:
  - clear rules to assign losses!
  - No discretion (flexibility is bad)

Diabolic Loop

Changes in Sovereign & Banking CDS

Sources: Capital IQ, Markit Group Limited, Thomson Reuters Datastream and Bank calculations.

(a) The change is measured from 22 November 2010 to 22 November 2011.
(b) The other countries included, in addition to those labelled on the chart, are Austria, Belgium, France, Germany and the Netherlands.
(c) Banking sector CDS premia are asset-weighted.
(d) Five-year senior CDS premia

Overview

- …

- Losses in the system

- Postponing the day of reckoning – increasing losses
  - What's a timing game?
  - Single player decision (when to live up to losses)
  - Multiple player game

- Rules vs. Discretion (Commitment vs. Flexibility)
  - German vs. French economic traditions
    - Federal vs. centralized system

Losses are Realized by Nature – Inaction

- Day of reckoning (loss realization) with prob. π in t

$$\pi \diagup \quad L_t$$
$$\pi \diagup \quad L_t(1+g)$$
$$\pi \diagup \quad L_t(1+g)^2$$
$$\cdots$$
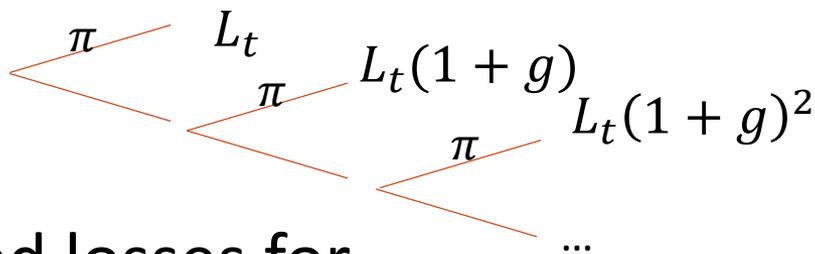
- Expected losses for

$$\mathcal{L} = \pi L + (1-\pi)\pi L(1+g) + (1-\pi)^2 \pi L(1+g)^2 + \cdots$$

$$\mathcal{L} = \frac{\pi L}{1 - (1-\pi)(1+g)} > L$$

- Recall: sum of geometric raw

$$a + aq + aq^2 + aq^3 + \cdots = \frac{a}{1-q}$$

Single Decision Maker

- Can move realization (day of reckoning) forward
  - π probability that losses are realized automatically
  - p_t extra probability triggered by decision maker

  - Total probability $\pi + (1-\pi)p_t =: P_t$

- Expected losses
  - Same formula, if all $p_t = p$,
    simply replace π with P

- Set $p_t = 1$, assume losses right away, then $\mathcal{L} = L$

$$\mathcal{L} = \frac{P}{1-(1-P)(1+g)}L \geq L$$

Two Decision Makers – War of Attrition

- Two players decide when to exit   - "Timing Game"

Payoff		
Assume losses first at t	"chicken" – full loss	L_t
Assume losses together at t	half loss	$L_t/2$
Assume losses last	no loss	0

- James Dean "game of chicken" – notice the difference
  - https://www.youtube.com/watch?v=u7hZ9jKrwvo

Two Decision Makers – War of Attrition

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- Timing Games: An overview

	Losses shrink	Losses grow
First mover advantage	Preemption game	
Last mover advantage		War of attrition

| Dynamic all-pay auction:	Dutch auction	English auction

Two Decision Makers – War of Attrition

Strategies	Expected Losses		Deviation/Best Response
Both assume loss at $t = 0$	$L/2$	$L/2$	Wait one round more
Both assume loss at any t	Losses/2 grow*		Wait one round more
Both wait forever	$\mathcal{L}/2$	$\mathcal{L}/2$	Much more expensive!

$$* \ \pi L/2 \sum_{\tau}^{t}[(1-\pi)(1+g)]^{\tau}$$

- Optimal timing
  - If it doesn't work for any time t (including $t = \infty$)
  - Randomize
    - Assume losses in each period with a certain probability p_t
      - Given that opponents uses probability q_t
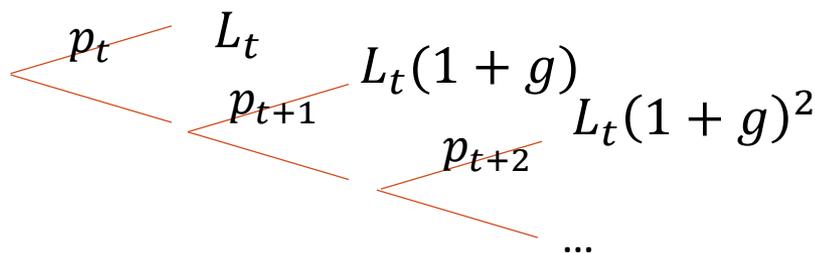
Provided that
- Natures does stop process
- Opponent doesn't assume loss

Expected Losses at t

Expected immediate loss

- $\mathcal{L}_t = p_t[L_t(1 - q_t/2)] +$

  $+(1 - p_t)\{q_t0 + (1 - q_t)[\pi L_t(1 + g) + (1 - \pi)\mathcal{L}_{t+1}]\}$
  - Linear in p_t

Expected future loss

Expected Losses at t

Expected immediate loss

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  $+(1 - p_t)\{q_t 0 + (1 - q_t)[\pi L_t(1 + g) + (1 - \pi)\mathcal{L}_{t+1}]\}$
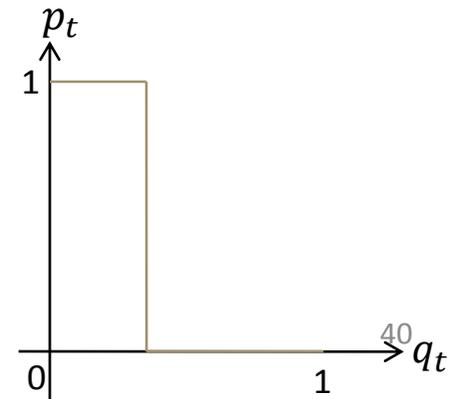
  - Linear in p_t

Expected future loss

| Immediate loss vs. expected future losses		Best Response
If $L_t(1 - q_t/2) < \{\dots\} \Leftrightarrow q_t > q_t^{threshold}$	$\Rightarrow$	Wait $\Leftrightarrow p_t = 0$
If $L_t(1 - q_t/2) = \{\dots\} \Leftrightarrow q_t = q_t^{threshold}$	$\Rightarrow$	any prob. $p_t \in [0,1]$
If $L_t(1 - q_t/2) > \{\dots\} \Leftrightarrow q_t < q_t^{threshold}$	$\Rightarrow$	Exit $\Leftrightarrow p_t = 1$

Expected Losses at t

Expected immediate loss

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Expected future loss

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If $L_t(1 - q_t/2) > \{\dots\} \Leftrightarrow q_t < q_t^{threshold}$	$\Rightarrow$	Exit $\quad \Leftrightarrow p_t = 1$

- $q_t^{threshold}$ depends on future $\mathcal{L}_{t+1}$
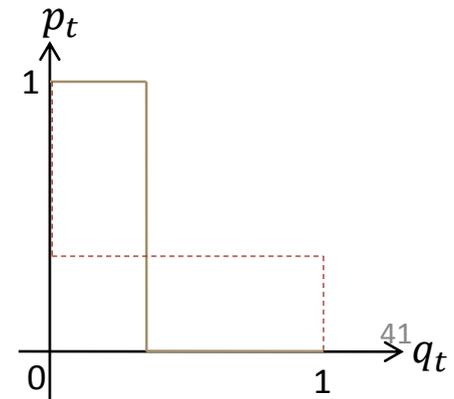
41

Stationary setting ... a "déjà vu world"

- $\mathcal{L}_t = p_t[L_t(1 - q_t/2)] +$
  $+(1 - p_t)\{q_t 0 + (1 - q_t)[\pi L_t(1 + g) + (1 - \pi)\mathcal{L}_{t+1}]\}$

- $\mathcal{L}_{t+1} = (1 + g)\mathcal{L}_t$
  - if $p_t = p$ and $q_t = q$ stay the same over time
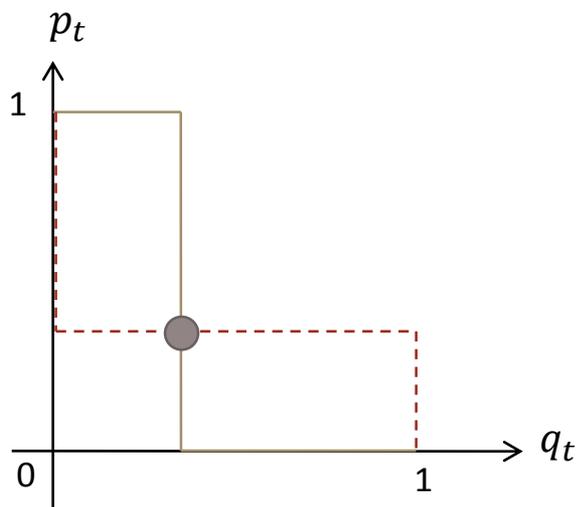
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- $\mathcal{L}_{t+1} = (1 + g)\mathcal{L}_t$
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- Yields
$$\mathcal{L}_t = \frac{p(1 - q/2) + (1 - p)(1 - q)\pi(1 + g)}{1 - (1 - p)(1 - q)(1 - \pi)(1 + g)} L_t \geq L_t$$
$$= \frac{expected\ loss\ in\ next\ round}{1 - expected\ growth\ rate\ of\ losses}$$
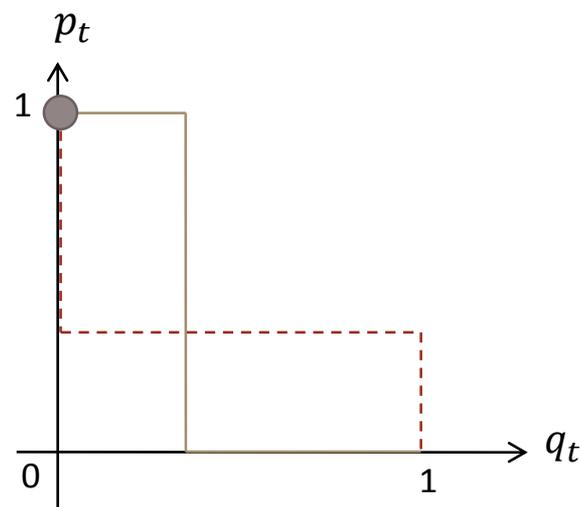
Opponent Faces Same Problem

- Nash equilibrium – where best responses cross

- $L_t(1 - q/2) = \{(1 - q)[\pi L_t(1 + g) + (1 - \pi)\mathcal{L}_{t+1}]\}$
- $L_t(1 - p/2) = \{(1 - p)[\pi L_t(1 + g) + (1 - \pi)\mathcal{L}_{t+1}]\}$
  - 2 equations, 2 unknowns q, p

Commitment to be "crazy" – winning strategy

- Opponent commits to move "later" (no matter what the cost)
  - $q_t = 0 \ \forall t$

- Best response
  - $p_1 = 1$ assume losses right away

- Example
  - "burn ship" (Hernan Cortes when conquering Mexico)
  - Stackelberg leader

Today's Europe

- Game between central bank
  - Central bank: assume losses and inflate way out
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- Answer:
  - clear rules to assign losses!
  - No discretion (flexibility is bad)

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- Internal governance
- Postponing the day of reckoning – increasing losses
  - What's a timing game?
  - Single player decision (when to live up to losses)
  - Multiple player game
- Rules vs. Discretion (Commitment vs. Flexibility)
  - German vs. French economic traditions
    - Federal vs. centralized system

Rules vs. Discretion

- **Discretion**
  - Delay in assuming losses

- **Rules**
  - Can't be fine-tuned enough

- Extended model
  - Extra loss of κL_t for one party - other party still L_t
  - Ex-ante (when rule is set up) not clear which party suffers extra loss
 - Rule is coarse (independent of extra loss)

Rules vs. Discretion

- **Extended model:** Extra loss κL_t for one party - other party still L_t

- Discretion:
  - After it is known, analysis is similar to before … except
    - party with "extra loss" is more reluctant to assume loss (lower p).
    - other party becomes more willing
  - "extra loss" provides commitment and is a blessing
  - Overall expected delay goes down due to extra loss
    - Aside: if $\kappa \to \infty$ other party assumes loses right away

- Rule:
  - If losses are split, then **no delay** but total loss: $\frac{1}{2}L + \frac{1}{2}(1 + \kappa)L$

- **Tradeoff:** for large enough κ discretion is better
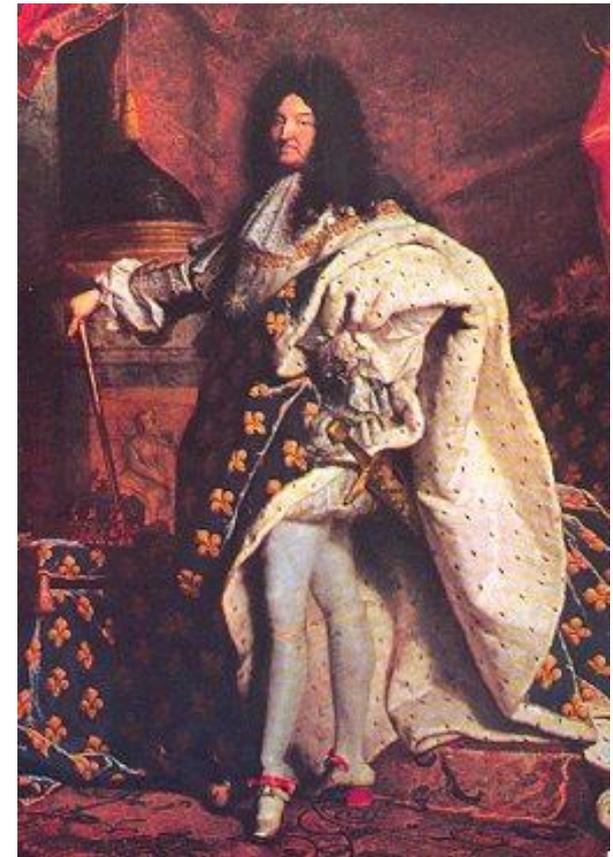
Federation vs. Centralized State

- Federation
  - Rule based system avoids many inefficient delays

- Centralized state
  - Discretion allows fine-tuned ex-post intervention
  - Single centralized player does not delay

Different Economic Traditions

- German Federation
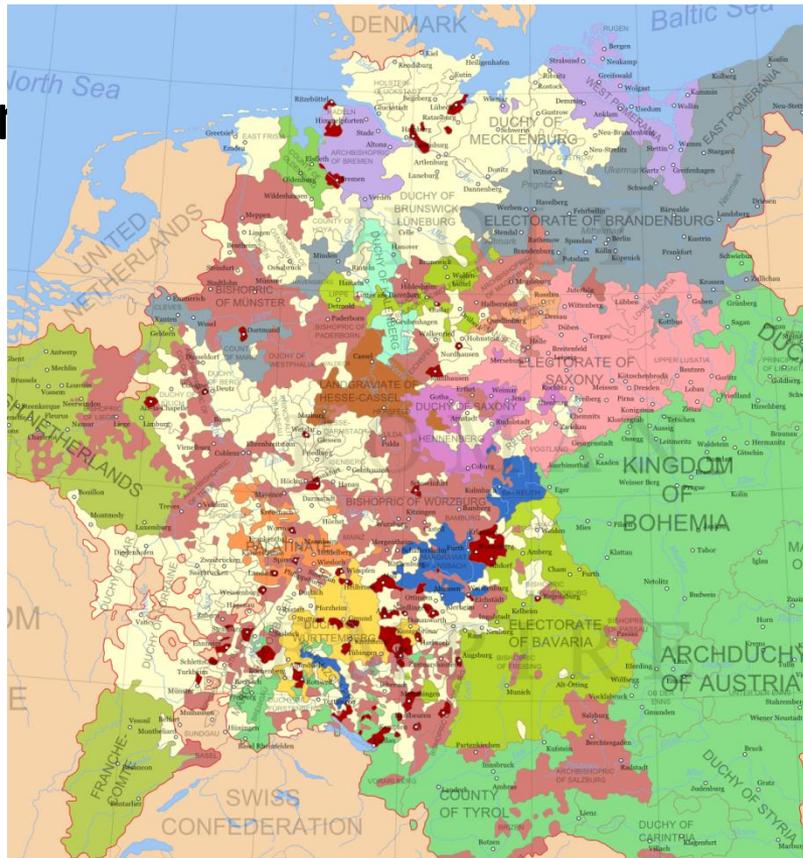
- French Absolutism/Centralism

- King Luis XIV, XV, XVI
  - 1643-1715, 1715-1774, 1774-1792 A.D.

Conclusion

- Introduction of Euro
  - Decline in sovereign spreads
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    1. To low TFP growth sectors
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    - Liquidity spiral, deflationary spiral, (redenomination risk)
  - ECB's Target 2 – replacing private flows
- Game of chicken between ECB and 17 fiscal authorities – ⇒ strategic delay (war of attrition)
- Diabolic loop between fiscal and banking risk