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

Source: Eurostat
Sovereign debt yield (10 year)

Source: Eurostat
Reasons

• Elimination of exchange rate and inflation risk

+ • 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
Accumulated Net Capital Inflows

€ Billion

Source: Eurostat
Accumulated Net Capital Inflows

€ Billion

Source: Eurostat
Inflows into low TFP growth sectors

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
Cross-border assets & liabilities of Euro area banks

Source: Bank for International Settlements, Locational Banking Statistics, Table 5A
Traditional vs. modern banks

- Loans/mortgages are securitized and made “tradable”
- Whole sale funding
  - Interbank market (foreign)
  - Money market funds (also from US)
### Traditional vs. Modern Banks

<table>
<thead>
<tr>
<th>Traditional Banks</th>
<th>Modern Banks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government bonds</td>
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</tr>
<tr>
<td>Loans/mortgages</td>
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</tr>
<tr>
<td>Traded assets</td>
<td>Tradable assets</td>
</tr>
<tr>
<td>Equity</td>
<td>Deposits</td>
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</table>

- **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
  - Collateralized

- Fire-sales of tradable assets
- Risk shifting towards depositors (insurance)
Interbank Market

Spanish Homeowner Builder

Loan LIBOR + x% increases

→

Spanish Bank

Payment for Elevator/Dishwasher

→

German FinInst
- MMF
- Bank of TK, Bosch

→

Deposits (short-term)

→

German Saver

Deposits (short-term)

←

Elevator
Dishwasher

German firm
Thyssen-Krupp Bosch/Miele

→

Bank of TK, Bosch

→

Wage
Run-up in liquidity mismatch

General mechanism
Run-up in liquidity mismatch

General mechanism

i’s best response

Run-up

shock

others’ average actions
Shock after the run-up

General mechanism
2\textsuperscript{nd}, 3\textsuperscript{rd} round effects: Amplification

\textit{i}'s best response

General mechanism
2\textsuperscript{nd}, 3\textsuperscript{rd} 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

Government

Outside money

Banks

Credit

In-money

Equity
3. Liquidity Spiral: Sell off of Assets

Government

Outside money

Banks

Credit

In-money

Equity

“Self-defeating deleveraging”
4. Deflation Spiral: Value of Liabilities

See “I Theory of Money”
Interbank Market

Spanish Homeowner Builder

Loan
LIBOR + x% increases

Spanish Bank

German firm
Thyssen-Krupp Bosch/Miele

Elevator

Dishwasher

German FinInst
- MMF
- Bank
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Payment for Elevator/Dishwasher

Interbank market
Lending (short-term)

Fire-sale of Elevator/dishwasher

Deposits (short-term)

Spanish Saver

German Saver

Losses accumulate

Payment for Elevator/Dishwasher

Deposits (short-term)

wage
ECB assumes Tail Risk

- **Spanish Homeowner Builder**
  - Loan LIBOR + x% stabilized

- **Spanish Bank**
  - Risky

  - Payment for Elevator/Dishwasher

- **German FinInst**
  - MMF
  - Bank
  - Bank of TK, Bosch

- **ECB**

- **German Saver**

- **Fire-sale of Elevator/dishwasher**
Target 2 claims & liabilities

- Germany: 547,047
- GIIPS: 679,989
- GIIPSSBF: 828,787
Adding Convertibility Risk

Spanish Homeowner Builder

Loan LIBOR + x% stabilized

Spanish Bank risky

Payment for Elevator/Dishwasher

Interbank market Lending (short-term)

German FinInst
- MMF
- Bank
  - Bank of TK, Bosch

Fire-sale of Elevator/dishwasher

German Saver

ECB

Deposits (short-term)

Target 2

Spanish Saver

German firm
Thyssen-Krupp Bosch/Miele

Elevator
Dishwasher

Short-term Deposits

Interbank market Lending (short-term)

Deposits (short-term)

Wage
Liquidity vs. Solvency

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

• Possible solvency problem
  • Who absorbs the losses? \Rightarrow \text{Game of chicken}
  • Undoes initial shock to avoid amplification
  • Initial shock size = loss to be absorbed
2\textsuperscript{nd}, 3\textsuperscript{rd} round effects: Amplification Multiplicity

General mechanism
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

Sovereign debt risk → Tax revenue → Growth in real economy → Bailout probability → A

Banks

Sovereign debt → Loans to firms

Banks

Bank debt risk → Equity risk

L
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. $\pi$ in $t$

- $L_t \leftarrow \pi$
- $L_t(1 + g) \leftarrow \pi$
- $L_t(1 + g)^2 \leftarrow \pi$

• Expected losses for

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

• 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
  • $\pi$ 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 $\pi$ with $P$

• Set $p_t = 1$, assume losses right away, then $L = L$
Two Decision Makers – War of Attrition

• Two players decide when to exit – “Timing Game”

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• James Dean “game of chicken” – notice the difference
  - [https://www.youtube.com/watch?v=u7hZ9jKrwvo](https://www.youtube.com/watch?v=u7hZ9jKrwvo)
Two Decision Makers – War of Attrition

- **“Timing Game”**

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- **Timing Games: An overview**

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<td>Dutch auction</td>
<td>Preemption game</td>
<td>War of attrition</td>
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Two Decision Makers – War of Attrition

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<tr>
<th>Strategies</th>
<th>Expected Losses</th>
<th>Deviation/Best Response</th>
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<tr>
<td>Both assume loss <strong>at t = 0</strong></td>
<td>$L/2$</td>
<td>Wait one round more</td>
</tr>
<tr>
<td>Both assume loss <strong>at any t</strong></td>
<td>Losses/2 grow*</td>
<td>Wait one round more</td>
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<tr>
<td>Both wait <strong>forever</strong></td>
<td>$L/2$</td>
<td>Much more expensive!</td>
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* $\pi L/2 \sum_{\tau=1}^{\infty} [(1 - \pi)(1 + g)]^\tau$

- **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 $q_t$
  
\[
\begin{align*}
  p_t & \quad L_t \\
  p_{t+1} & \quad L_t(1 + g) \\
  p_{t+2} & \quad L_t(1 + g)^2 \\
  \vdots
\end{align*}
\]

Provided that
- Natures does stop process
- Opponent doesn’t assume loss
Expected Losses at $t$

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

- Linear in $p_t$

- Expected future loss
Expected Losses at $t$

- **Expected immediate loss**
  \[
  \mathcal{L}_t = p_t [L_t (1 - q_t/2)] +
  + (1 - p_t) \left\{ q_t 0 + (1 - q_t) [\pi L_t (1 + g) + (1 - \pi) \mathcal{L}_{t+1}] \right\}
  \]

- **Linear in $p_t$**

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Expected Losses at $t$

• $\mathcal{L}_t = p_t [L_t(1 - q_t/2)] + (1 - p_t)\{q_t0 + (1 - q_t)[\pi L_t(1 + g) + (1 - \pi)\mathcal{L}_{t+1}]\}$

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

Expected future loss

Immediate loss vs. expected future losses
Stationary setting ... a “déjà vu world”

• \( \mathcal{L}_t = p_t[L_t(1 - q_t/2)] + \)
  \( + (1 - p_t)\{q_t0 + (1 - q_t)[\pi L_t(1 + g) + (1 - \pi)\mathcal{L}_{t+1}]\} \)

• \( \mathcal{L}_{t+1} = (1 + g)\mathcal{L}_t \)
  • if \( p_t = p \) and \( q_t = q \) stay the same over time
Stationary setting ... a “déjà vu world”

\[ L_t = p_t [L_t (1 - q_t/2)] + \]
\[ + (1 - p_t)\{q_t 0 + (1 - q_t)[\pi L_t (1 + g) + (1 - \pi)L_{t+1}]\}\]

\[ L_{t+1} = (1 + g)L_t \]
• if \( p_t = p \) and \( q_t = q \) stay the same over time

Yields
\[ L_t = \frac{p(1 - q/2) + (1 - p)(1 - q)\pi(1 + g)}{1 - (1 - p)(1 - q)(1 - \pi)(1 + g)} \]
\[ L_t \geq L_t \]

expected loss in next round
\[ 1 - \text{expected growth rate of losses} \]
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
  • Fiscal authorities (17): assume losses and raise taxes

• Game among governments

• Answer:
  • clear rules to assign losses!
  • No discretion (flexibility is bad)
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• Losses in the system
• Internal governance
• Postponing the day of reckoning – increasing losses
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• **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 $\kappa L_t$ 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 $\kappa L_t$ 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 $\kappa \rightarrow \infty$ 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 $\kappa$ 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 Louis XIV, XV, XVI
    - 1643-1715, 1715-1774, 1774-1792 A.D.
Conclusion

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