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# Cross-Border Issues in Stress-Testing

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IMF Expert Forum on Advanced Techniques  
on Stress-Testing

Washington DC, 2-3 May 2006

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# Outline

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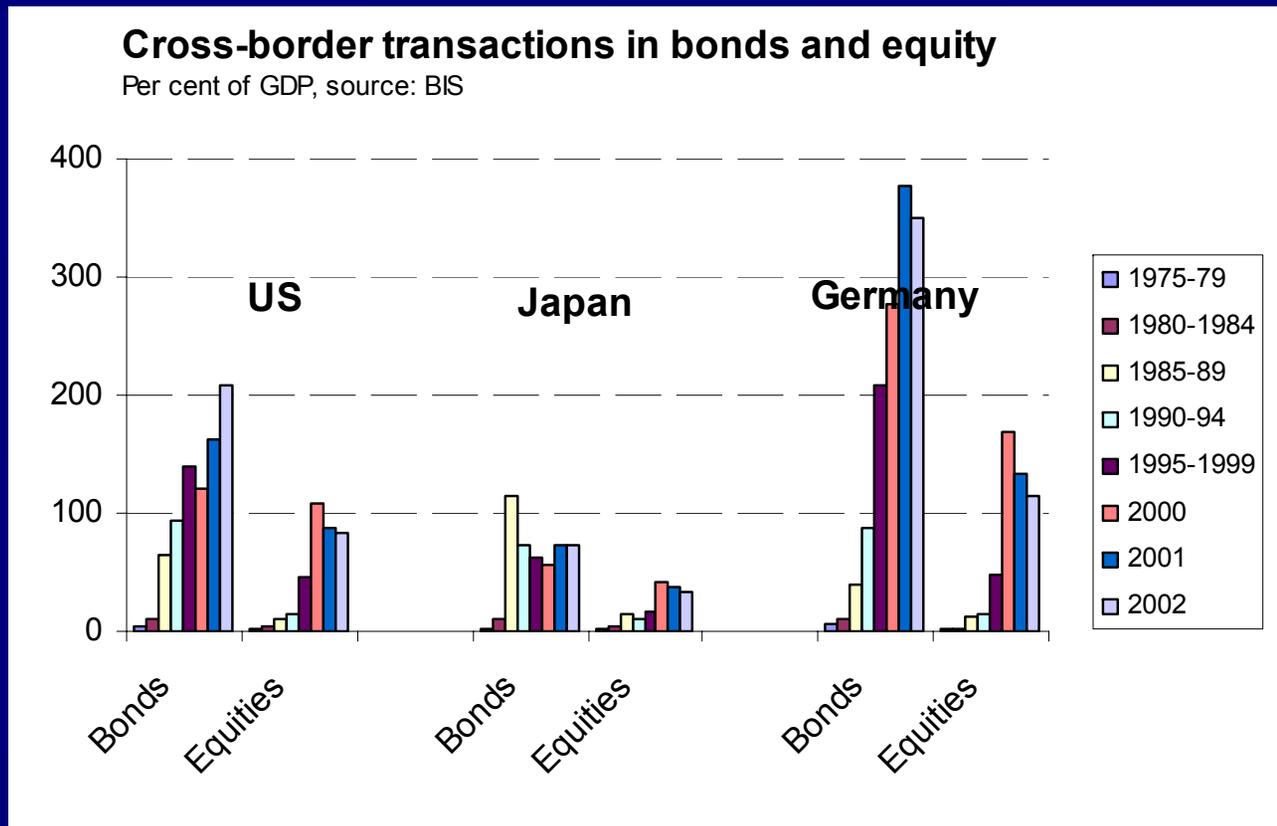
- **Cross-border issues**
  - **where do we stand**
  - **concepts and evidence of risks and contagion**
- **Macro stress-testing cross-border risks by DNB**
  - **scenarios**
  - **liquidity risk**
  - **group-wide approach**

# 1. Increased financial integration

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- **Internationalization financial markets**
- **Globalisation financial institutions**
- **Cross-border payments systems**
- **Consolidation exchanges and clearing and settlement systems**

# 2. Financial integration: evidence



# 3. CB risks in macro-prudential analysis

“there is still insufficient attention in many FSAPs to global and regional linkages” (IMF IEO, 2005)

Results of the IEO assessments of FSAP content <sup>1</sup>		
Criteria	Mean score (on scale of 1-4)	Percentage of ratings indicating some problems
<b>Extent of incorporation of regional /global risks into analysis</b>	<b>1.84</b>	<b>28</b>
Balance of development and stability issues	1.88	16
Integration of standard and codes in overall assessment	1.84	20
Coverage of overall financial sector	2	20
Clarity and candor of findings	1.88	12
Importance and consequence well explained	1.94	20
Clarity of recommendations	1.82	8
Usability of recommendations	1.96	16
Prioritisation of recommendations	2.46	44
Degree of alignment of FSAP and FSSA	1.42	0

<sup>1</sup> IEO assessors rated each of the FSAPs for the 25 countries in depth with respect to the above criteria. Each aspect was rated on a four point scale (with 1 being the highest). source: IMF

## 4. Cross-border risks and contagion

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### Concepts of systemic risk (De Bandt and Hartmann, 2000)

- idiosyncratic: domino effects from single failure
- systematic: simultaneous effects from widespread shock

### Cross-border propagation mechanisms

- direct contagion (cross-border balance sheet linkages: interbank contagion models)
- indirect contagion (exogenous global shock: global risk scenarios)

# 5. Direct contagion: evidence

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## Between institutions

- Research: support for interbank market as important contagion channel  
(Gropp and Vesala, 2004 / Hartmann et al, 2005)

## Within financial groups

- Joint Forum: LCFIs face cross-border liquidity risk
- Dutch bank: dry run revealed forex complication

## 6. Indirect contagion: historical evidence

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### Global financial system as mechanism for transmission and amplification of shocks

- Historical scenarios: 1987 stock market, 1994 bond market, 1998 emerging markets /LTCM, 2005 credit derivative market

### Typical features

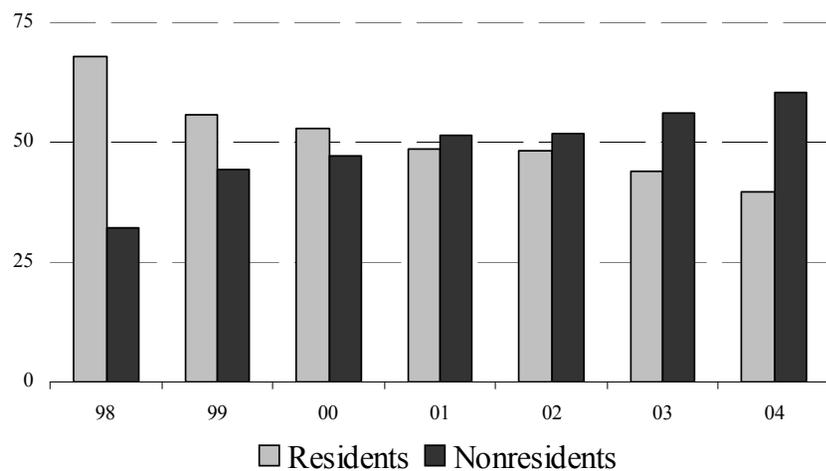
- Interaction global risk factors
- Key role liquidity (hard to internalise in micro stress-tests)

# 7. CB issues in the Netherlands

## Cross-border issues highly relevant

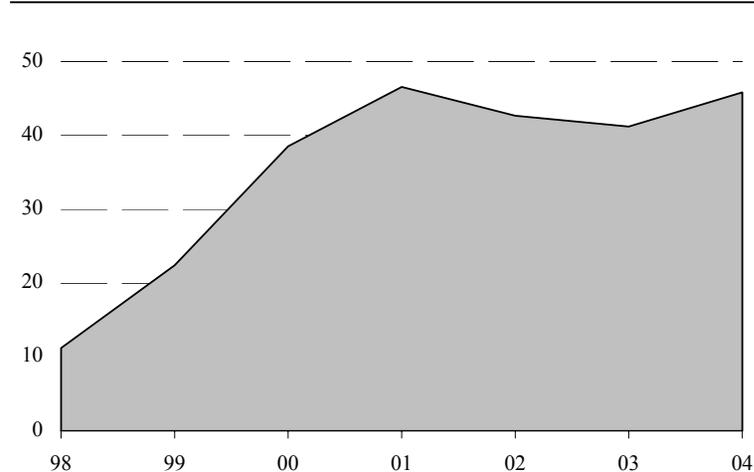
- small open economy
- internationally integrated financial system
- LCFIs and large institutional investors (IC, PF)

**Cross border assets insurance companies and pension funds**  
In percentage of total assets



Source: DNB.

**Dutch banks: non-Dutch contributions to profits**  
In percentage of total profits



Source: DNB.

# 8. DNB well positioned for CB issues

	Systemic stability	Prudential	Conduct of business	
			non-securities	securities
Banks	DNB		A	
Securities				
Insurance pensionfunds				

DNB = De Nederlandsche Bank  
AFM = Authority for Financial Markets

# 9. Macro stress-testing by DNB

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**DNB's macro stress-testing framework is combination of bottom-up and top-down methods**

- **Bottom-up**
  - regular exercise including banks, PF and IC
  - DNB designs scenarios and instructs institutions, they run their internal models, DNB aggregates the results
- **Top-down**
  - credit and interest rate risk of banks (reduced form models)
  - interbank risk (interbank contagion model)
  - market risks PF/IC (structural models)

# 10. Stress-testing cross-border issues

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## Three ways to address cross-border issues in stress-tests

- scenario design (systemic shock  $\Rightarrow$  indirect contagion)
- liquidity risk, key role (systemic and idiosyncratic shocks  $\Rightarrow$  indirect and direct contagion)
- group-wide approach

# 11. Global risk drivers in scenarios

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## Scenario analyses DNB

(Overview of Financial Stability in the Netherlands, OFS)

- **tool for macro-prudential monitoring**
- **hypothetical macro scenarios modelled by macro economic model**
- **global factors main risk drivers**
- **interaction of global risk factors over multi-year horizon**

# 12. CB transmission in macro scenarios

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**In the recent macro scenarios of DNB...**

- **Malaise**
- **Global correction**

**...the transmission to the domestic system mainly runs through international interest rate movements**

**Global correction scenario affects financial sector:**

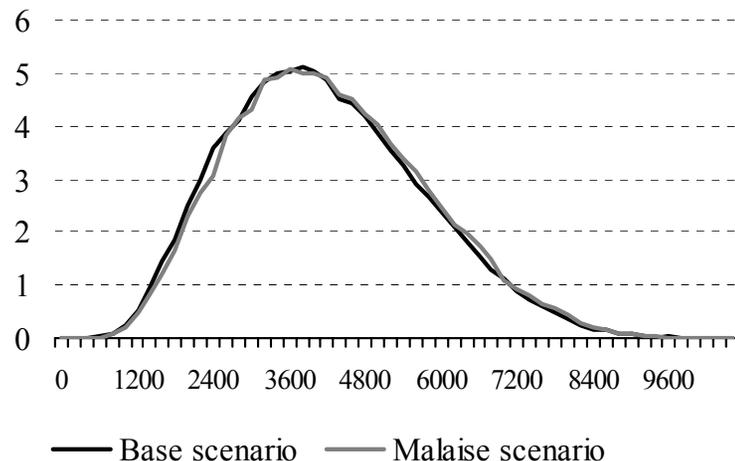
- **Financial contagion ⇒ market risk (worldwide rise of risk aversion, declining asset prices, currency losses on foreign assets)**
- **Transmission to economy by wealth effects and trading channel ⇒ credit risk**

# 13. Impact macro scenarios on banks

## Banks most vulnerable for global correction scenario (worldwide exposures)

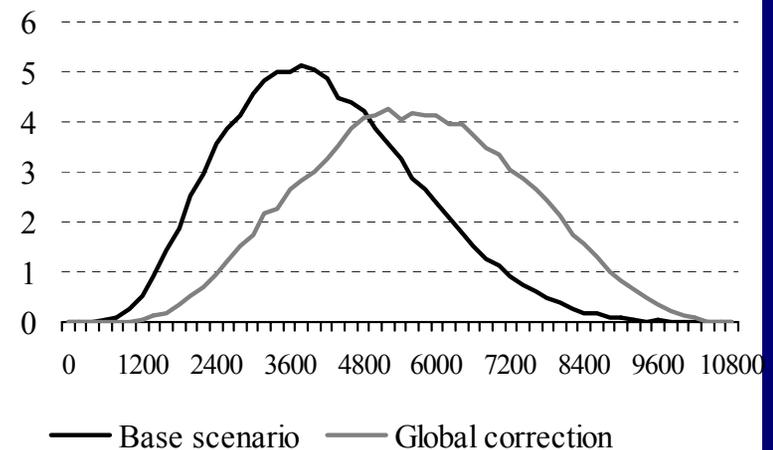
### European malaise: impact on total credit portfolio

Probability distribution of credit losses, horizon 3 yrs



### Global correction: impact on total credit portfolio

Probability distribution of credit losses, horizon 3 yrs

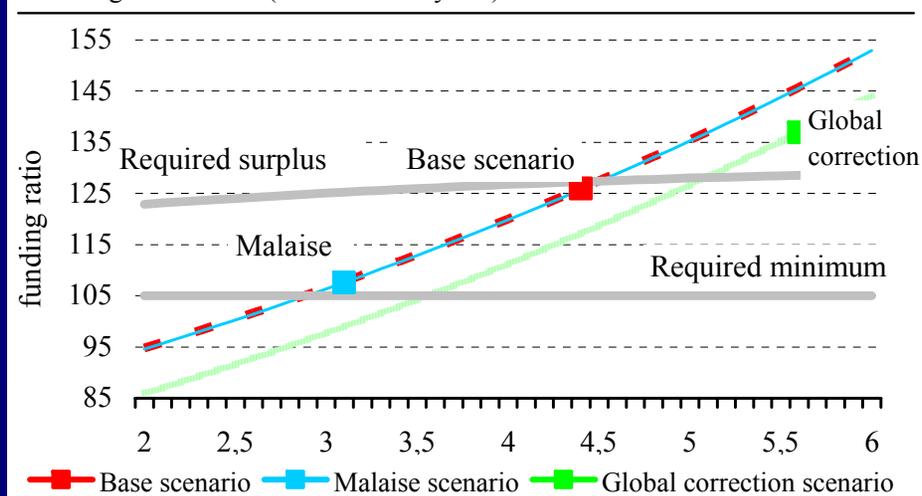


# 14. Impact macro scenarios on PF

IC, PF most vulnerable for European malaise scenario (interest rate sensitivity due to negative duration gap)

## Funding ratio of pension funds in scenarios

Funding ratio, per cent, with shocks in interest rate and stock price index according to scenarios (effects after 3 years)



Explanation: the lines "Malaise" and "Base scenario" nearly coincide and show that the impact of a positive stock market shock coincides in both scenarios. The line "Global correction" shows the impact of various interest rates at the negative stock market shock in this scenario. Source: DNB.

# 15. Liquidity risk in stress-testing

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**Liquidity risk hard to model...**

**...but key in systemic risk**

**Liquidity risk of banks addressed by**

- **scenarios for bottom-up stress-testing**
- **interbank contagion model**
- **liquidity supervision at the level of the institutions (also based on scenarios)**

# 16. Global liquidity scenario

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## Liquidity scenario in bottom-up stress-tests of DNB

### Market crisis (systemic shock)...

- drying up interbank market euro area
- shut down CD, CP market
- falling asset prices, rising interest rates and spreads

...options: outright sales of assets, posing additional collateral at central bank

### Indicators

- liq assets / liq liabilities ratio
- time to default

# 17. DNB interbank contagion model

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**DNB interbank model to test direct contagion of idiosyncratic shock (top-down)**

## **Conclusions simulation**

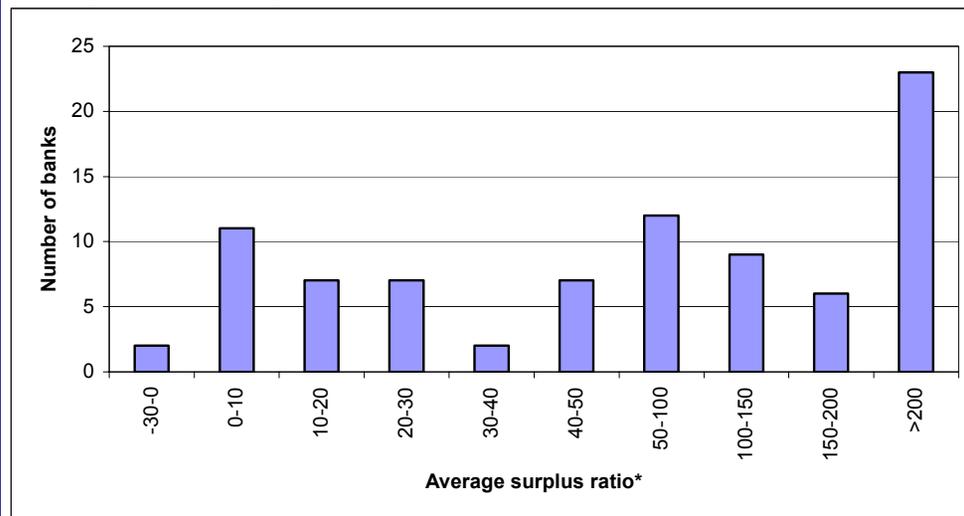
- **main risks for Dutch banks have cross-border nature (losses from foreign regions have stronger impact than failure of other Dutch banks). Due to global nature of banks exposures**
- **In particular foreign subsidiaries and/or branches are vulnerable to shocks originating in the parent company region**

# 18. Liquidity supervision

## DNB's liquidity risk supervision

- Stress-test based tool (scenario mix)
- fixed weights for hair cuts on assets and withdrawal rate of liabilities
- useful for macro prudential analysis

Liquidity position based on stressed conditions  
Monthly period Average surplus ratio



\* Average surplus as % of average liquidity requirement (average over the period 06/03 - 09/03)

# 19. Importance group-wide approach

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**Group-wide approach of stress-tests, covering both domestic and foreign activities (LCFIs with cross-border operations)...**

**...to capture risks and identify potential spill-overs among business areas within the group**

# 20. Group-wide approach DNB (1)

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## Liquidity supervision

- group-wide reporting of liquidity data, incl. material branches and subsidiaries abroad
- Inclusion of liquidity surpluses abroad only permitted if no liquidity deficit in foreign entity and if convertible currency

## Bottom-up stress-testing

- reporting break-down of results by business unit

# 21. Group-wide approach DNB (2)

## Top-down stress-testing

- modelling consolidated balance sheets
- separate credit risk models for domestic vs. total exposures

$$\lambda \left( \frac{LLP\_dom}{CRED\_dom} \right)_{i,t} = fixed\ effects_i + \beta_1 GDP\_NL_t + \beta_2 RL_t + \beta_3 \lambda(\overline{Defaultrate\_NL})_t$$

$$\lambda \left( \frac{LLP\_total}{CRED\_total} \right)_{i,t} = fixed\ effects_i + \beta_1 GDP\_EU_{i,t} + \beta_2 RL_{i,t} + \beta_3 \lambda(\overline{Defaultrate\_world})_t$$

## 22. Cross-border approach ESCB

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**ESCB/BSC/WGMA Task Force on Stress Testing**

*to explore ways to extend macro stress-tests with cross-border inter-linkages*

**Possibly by adding European dimension to national stress-tests**

# 23. Conclusions

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- **Cross-border risks important, but usually neglected in macro stress-tests**
- **Cross-border issues could be incorporated by:**
  - **scenario analyses**
  - **focus on liquidity**
  - **group-wide approach**

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