BANK FOR INTERNATIONAL SETTLEMENTS

Characterising the financial cycle and implications for stress testing

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* The views expressed here are my own and do not necessarily reflect those of the BIS.

Motivation and Objective

- Time vs cross sectional dimensions of systemic risk
- Macroeconomics needs to understand the financial cycle

- Establish the stylised facts
  - Data groundwork, no theory
- A reasonable quantification of the financial cycle

- Messages for macro stress testing
  - Medium-term cycles in credit and property prices
  - The role of indicators and non-linear relationships

Characterising the financial cycle: overview

- Two very different approaches:
  - A. Statistical frequency-based filtering (continuous)
  - B. Algorithmic dating of peaks and troughs (discrete)
- Common messages from panel of countries and series
- Analysis of individual series :
  - What are their cyclical properties?
- Combining series
  - Which series have a common pattern?
- A composite measure of the financial cycle:
  - Credit and property

Related work

- Burns and Mitchell (1946) : pioneers of bottom-up cycle characterisation
- Mendoza & Terrones (2008), Claessens et al (2011) dating approach
- Aitken et al (2011) filtering approach
- Schularick and Taylor (2009) , Detken and Smets (2004) , Goodhart and Hofmann (2008) on interactions between financial and real variables

Filtering approach

- Band-pass filter (Christiano and Fitzgerald (2003))
  - Annual growth rates (no drift)
  - Cumulated to create cycles in log-levels

- Decomposed in
  - Short term cycles: 5 to 32 quarters long
  - Medium term cycles: 32 to 120 quarters long

The ratio of medium to short cycle volatility

	AU	DE	GB	JP	NO	SE	US
Credit	**4.52**	**1.80**	**3.73**	**4.34**	**6.28**	**6.78**	**3.87**
Credit/GDP	**7.36**	**2.83**	**5.28**	**3.39**	**4.99**	**5.98**	**4.92**
House prices	1.75	**2.19**	**2.42**	3.05	2.21	**4.91**	**3.91**
Equity prices	1.72	1.40	1.77	2.14	1.30	1.42	1.41
AAP[2]	1.95	**3.94**	**2.56**	**3.36**	1.60	1.48	**1.75**
GDP	3.25	1.73	1.93	3.06	2.55	1.84	1.51

Credit and house prices are more volatile over the medium term

The ratio of medium cycle volatility pre- & post-1985

	AU	DE	GB	JP	NO	SE	US
Credit	**2.75**	**1.53**	**1.49**	0.85	**2.09**	**1.12**	**2.66**
Credit/GDP	**5.86**	**2.27**	**3.88**	0.99	**2.05**	**1.26**	**4.91**
House prices	**2.27**	**1.16**	**1.94**	0.49	**1.90**	**1.04**	**3.96**
Equity prices	0.43	**1.14**	0.51	**1.45**	0.65	**1.36**	**1.78**
AAP^2	**2.97**	0.68	0.48	0.56	**1.88**	**2.25**	**1.86**
GDP	0.34	**1.14**	**1.26**	0.84	**1.25**	**2.16**	0.93

Amplitude of financial variables increased post-liberalisation

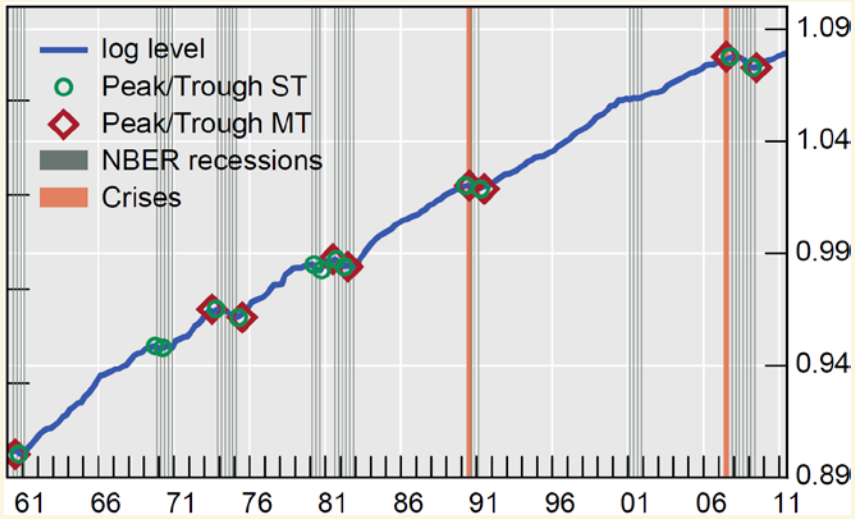
Turning point dating approach

- Bry-Boschan (1971) and Harding-Pagan (2002) algorithm

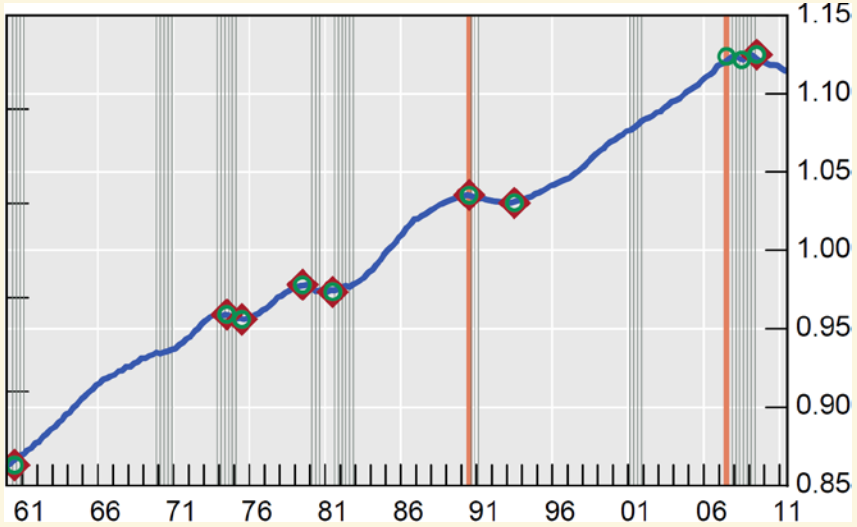
- Pick local minima and maxima
  - Window width
  - Censoring to guarantee minimum length of phase
- Make sure that min and max alternate

- Two parameterisations
  - Short term : min phase length 2 quarters
  - Medium term : min phase length 10 quarters

GDP


log level
Peak/Trough ST
Peak/Trough MT
NBER recessions
Crises
1.09
1.04
0.99
0.94
0.89
61
66
71
76
81
86
91
96
01
06
11

Credit


1.15
1.10
1.05
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61
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06
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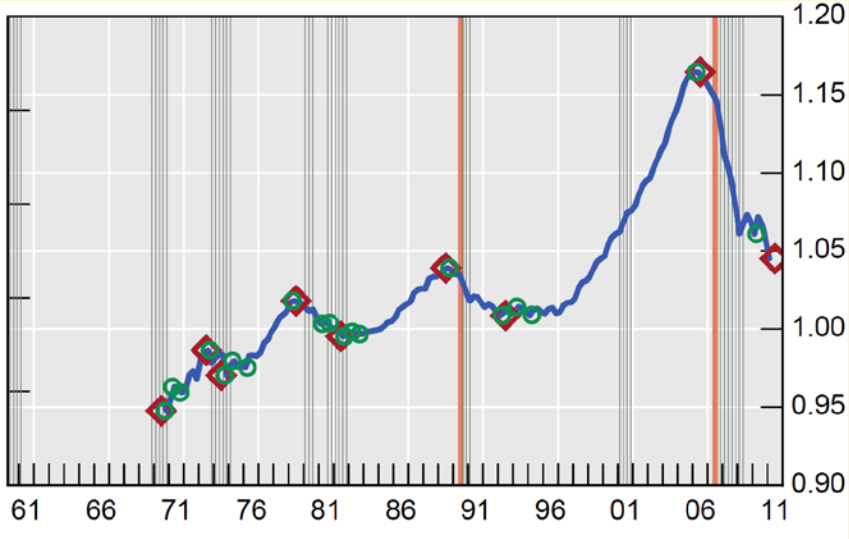
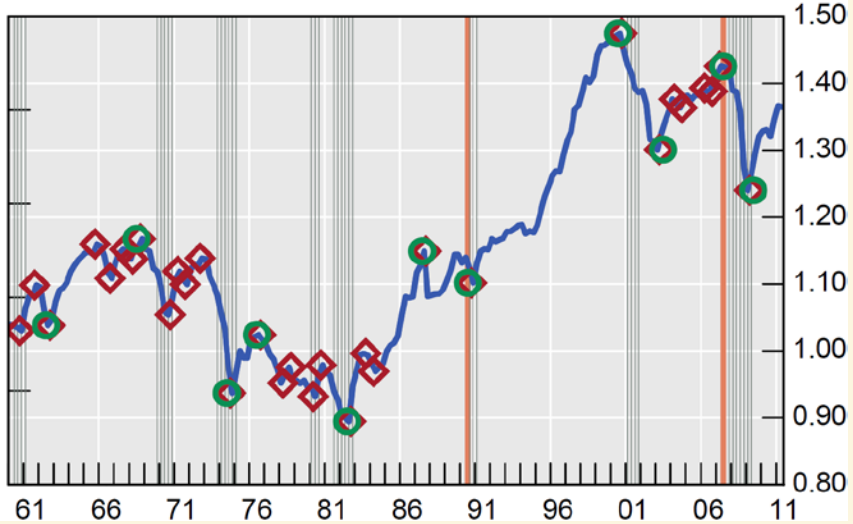
Property



Equity



Turning point analysis

	Amplitude[2]		Duration		
	Expansion	Contraction	Expansion	Contraction	Cycle[3]
Medium-term cycles	*In per cent*		*Number of quarters*		
Credit	140	–7	53	8	72
Credit/GDP	31	–8	27	13	41
House prices	48	–16	19	15	42
Equity prices	121	–48	20	12	38
AAP	57	–26	22	11	37
GDP	38	–3	48	5	44
Short-term cycles					
Credit	18	–3	10	3	13
Credit/GDP	8	–4	7	5	15
House prices	12	–6	7	6	16
Equity prices	36	–22	5	5	11
AAP	15	–11	6	5	13
GDP	15	–2	20	3	22

Turning point analysis and liberalisation

	Amplitude[2]		Duration		
	Expansion	Contraction	Expansion	Contraction	Cycle[3]
Pre-1985	*In per cent*		*Number of quarters*		
Credit	132	–7	48	6	22
Credit/GDP	31	–8	39	9	31
House prices	36	–14	17	14	25
Equity prices	86	–44	21	20	34
AAP	50	–19	21	12	28
GDP	37	–3	41	4	27
Post-1985					
Credit	149	–8	64	18	74
Credit/GDP	41	–9	20	16	49
House prices	94	–16	37	20	57
Equity prices	171	–49	19	10	40
AAP	74	–29	23	10	42
GDP	60	–3	63	5	48

Commonality in cycles of financial series

- Closer correlation of medium-term cycles in:
  - House prices and credit (60%) or credit/GDP (42%)
- Lower correlations of equity prices with the rest

- Harding-Pagan Concordance measure
  - % of time two series are in same phase

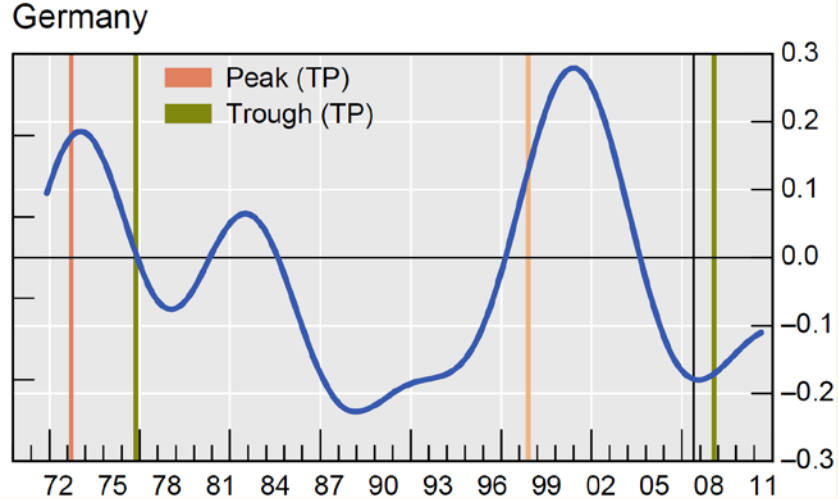
Concordance measures

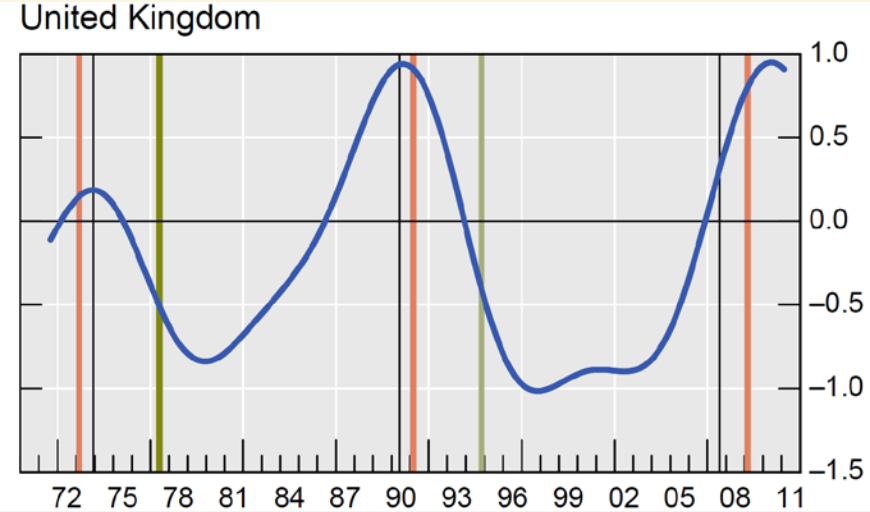
	Credit				Credit/GDP			House prices		Equity
	Credit/ GDP	HP	EQ	AAP	HP	EQ	AAP	EQ	AAP	AAP
AU	91	56	57	84	54	60	76	42	66	75
DE	89	59	49	62	63	42	54	29	58	67
GB	93	80	53	75	85	48	68	55	75	71
JP	77	86	80	81	77	59	76	78	96	82
NO	72	72	56	69	52	59	53	72	75	81
SE	73	76	62	51	72	58	46	57	66	78
US	93	79	54	73	71	47	73	66	80	68
Mean	*84*	*73*	*59*	*71*	*68*	*53*	*64*	*57*	*73*	*74*

Combining the series and methods

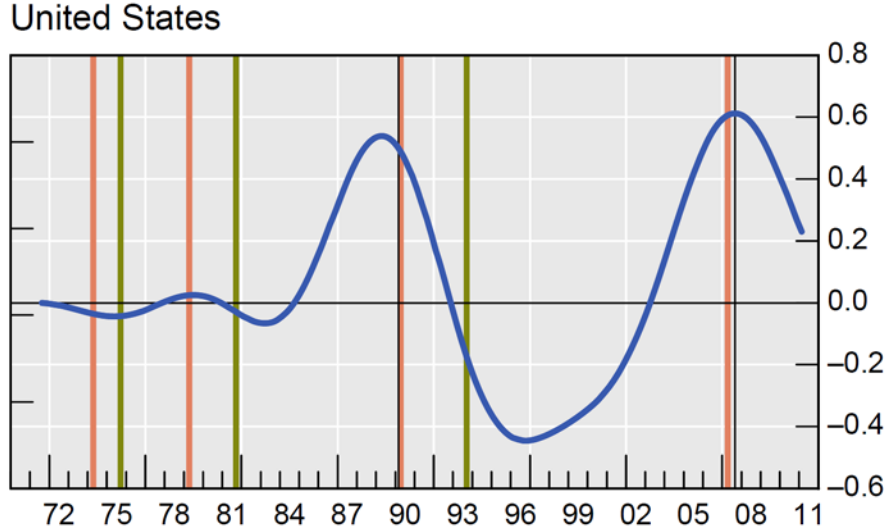
- Frequency filters:
  - Add the three medium term components of filtered series
- Dating points:
  - Create a continuous variables: the median distance of solo series from turning point
  - Combined peaks are local minima of median distance
  - Each series has peak within specified window
  - Peaks and troughs alternate

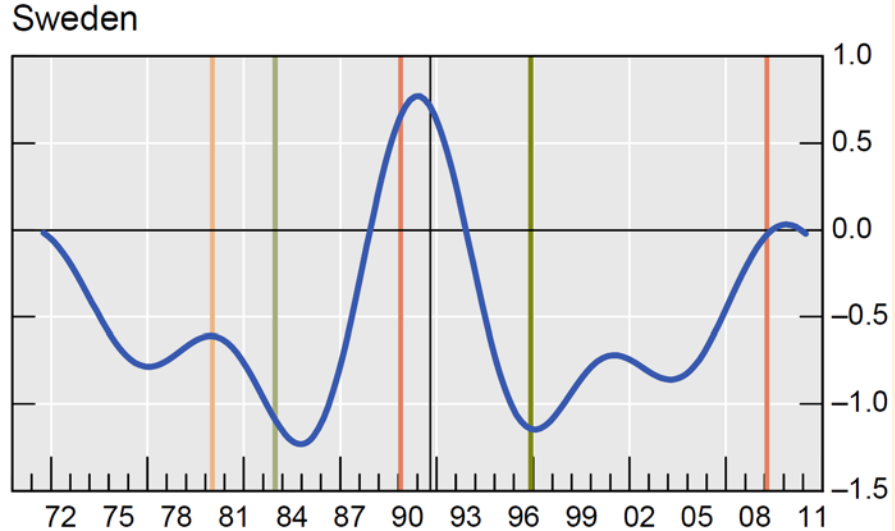
Combined series both approaches





Combined series both approaches



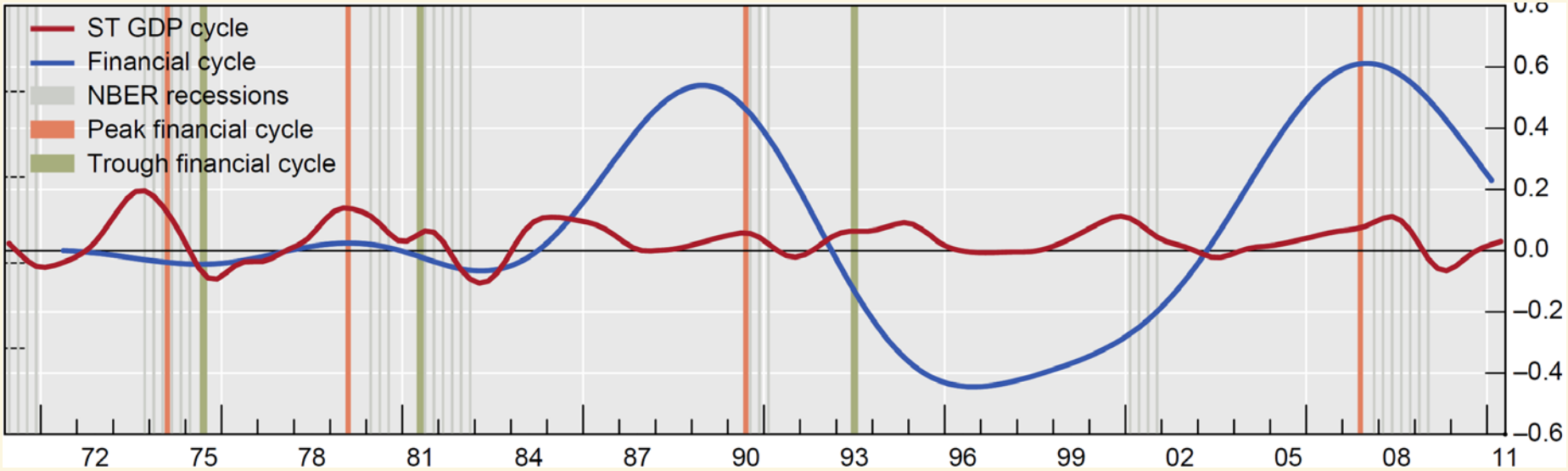


Peaks and crises

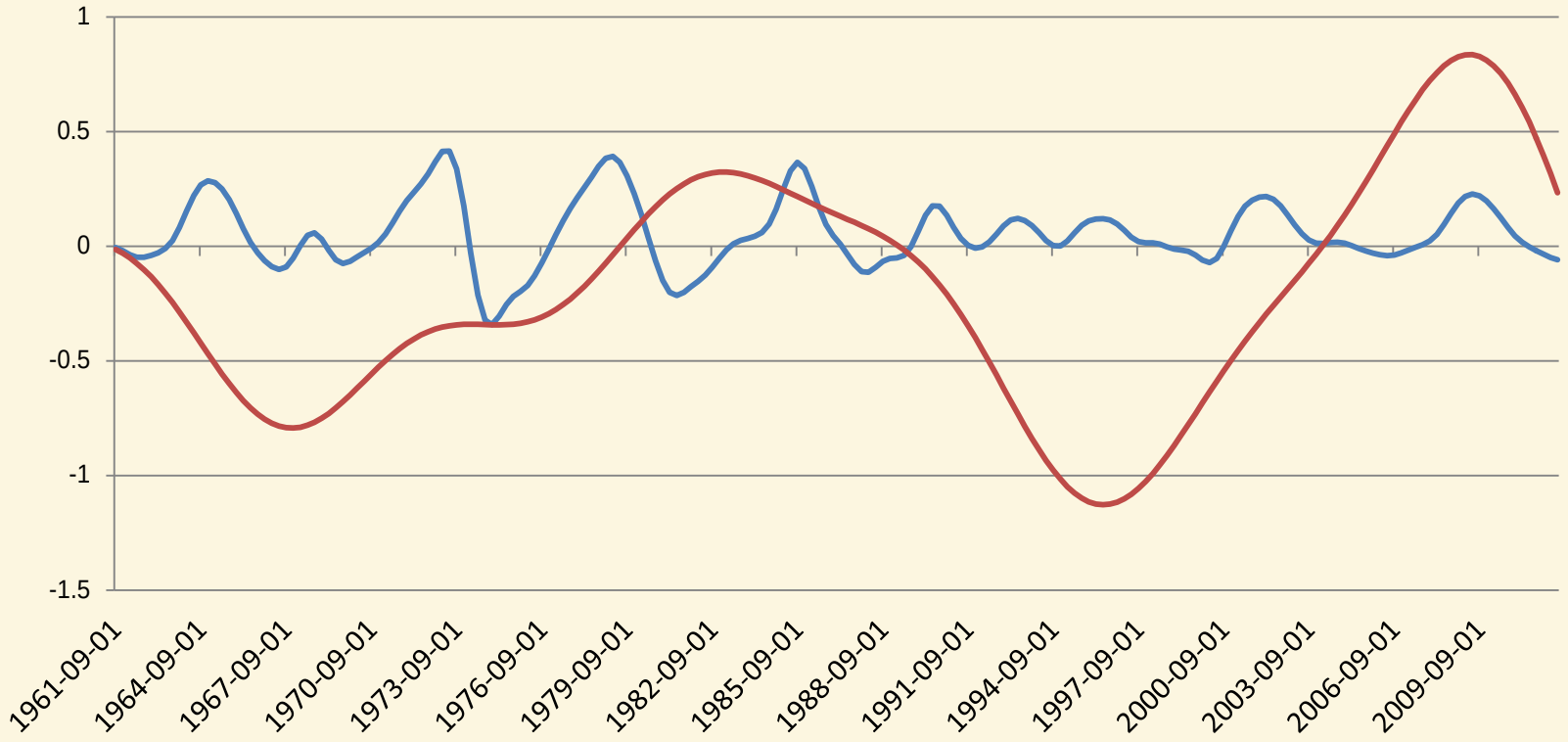
- More often than not, the two methods identify peaks within five quarters from each other
- Jointly identified peaks are often close to crises

	Date	Time to closest[1]			Cluster width[3]	Duration[4]
		Crises	Peak (filters)	Peak (TP)		
		Number of quarters				
Peaks identified by both methods that are close to a crisis[5]						
GB	2009 Q1	–6	5	0	10	72
SE	2009 Q1	–2	4	0	7	75
US	2007 Q3	0	0	0	12	68
JP	1992 Q2	2	–3	0	8	74
GB	1991 Q1	–3	–2	0	8	69
AU	1990 Q3	–3	–2	0	8	..
US	1990 Q3	–2	–5	0	5	44
SE	1990 Q2	5	3	0	1	38
NO	1989 Q3	5	–2	0	9	53
GB	1973 Q4	0	0	0	2	..
Peaks identified by both methods that are not close to a crisis[5]						
NO[2]	2009 Q2	–74	3	0	16	79
AU	2009 Q1	–77	1	0	6	74
DE[2]	1998 Q4	35	9	0	21	100
SE[2]	1980 Q4	43	–2	0	13	..
US	1979 Q3	42	–1	0	5	21
DE	1973 Q4	135	–1	0	0	..
JP	1973 Q4	76	–2	0	4	..

The financial and business cycles: US



Greece: the short and medium credit cycles



Summary of results

- The financial cycle looks like the medium-term component of credit and property prices
- This cycle seems to have strengthened and lengthened post-1985
- The cycle peaks align well with crises
- Recessions are worse when in financial cyclical downturn

What does this imply for macro stress testing?

Houston, we have a problem…

"The banking system's reported financial indicators are above minimum regulatory requirements and stress tests suggest that the system is resilient"

19 August 2008, IMF, *Iceland: Financial Stability Assessment – update*, p 5

- Quote typical of the tone in vulnerability assessments prior to the crisis

Five Propositions

I. Macro stress testing is a tool box, not a single tool

II. Beware of macro stress tests as early warning devices

III. Macro stress tests can greatly help in crisis management/resolution…

IV. …and their additional benefits should not be underestimated….

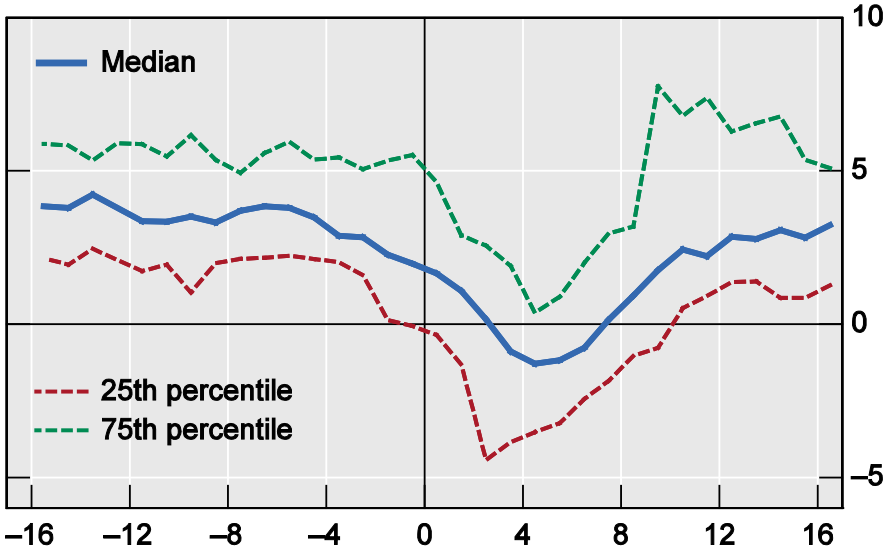
V. …but when you do them, do them right!

Beware of model limitations for early warning

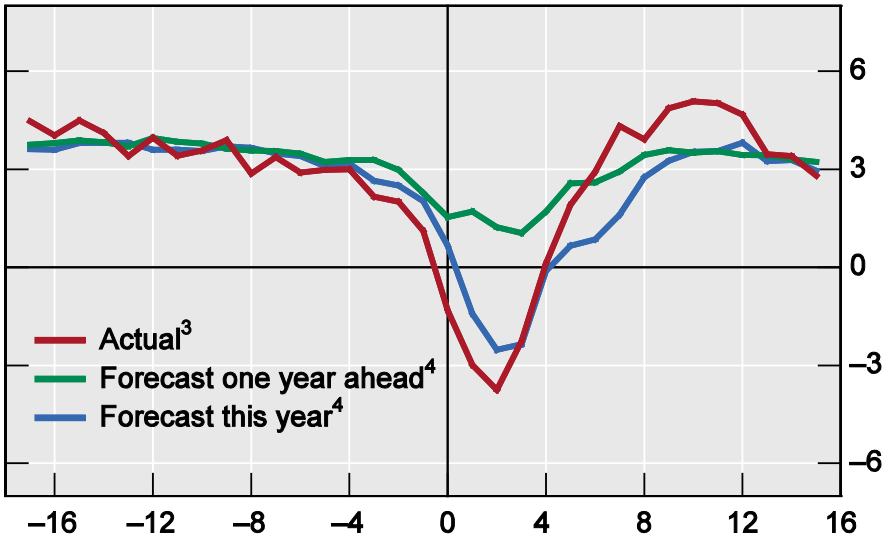
- Partial equilibrium exercises
- Likely sources of miss-specification (ie model risk for stress testing)
  - Log-linearity (macro model legacy)
  - Crises as “structural breaks”
- Models the antithesis of what financial stress is all about
  - Instability: *normal sized* shocks can cause *breakdown*
  - Estimation focuses on the average, not the tail

Crises are tail events with pronounced dynamics

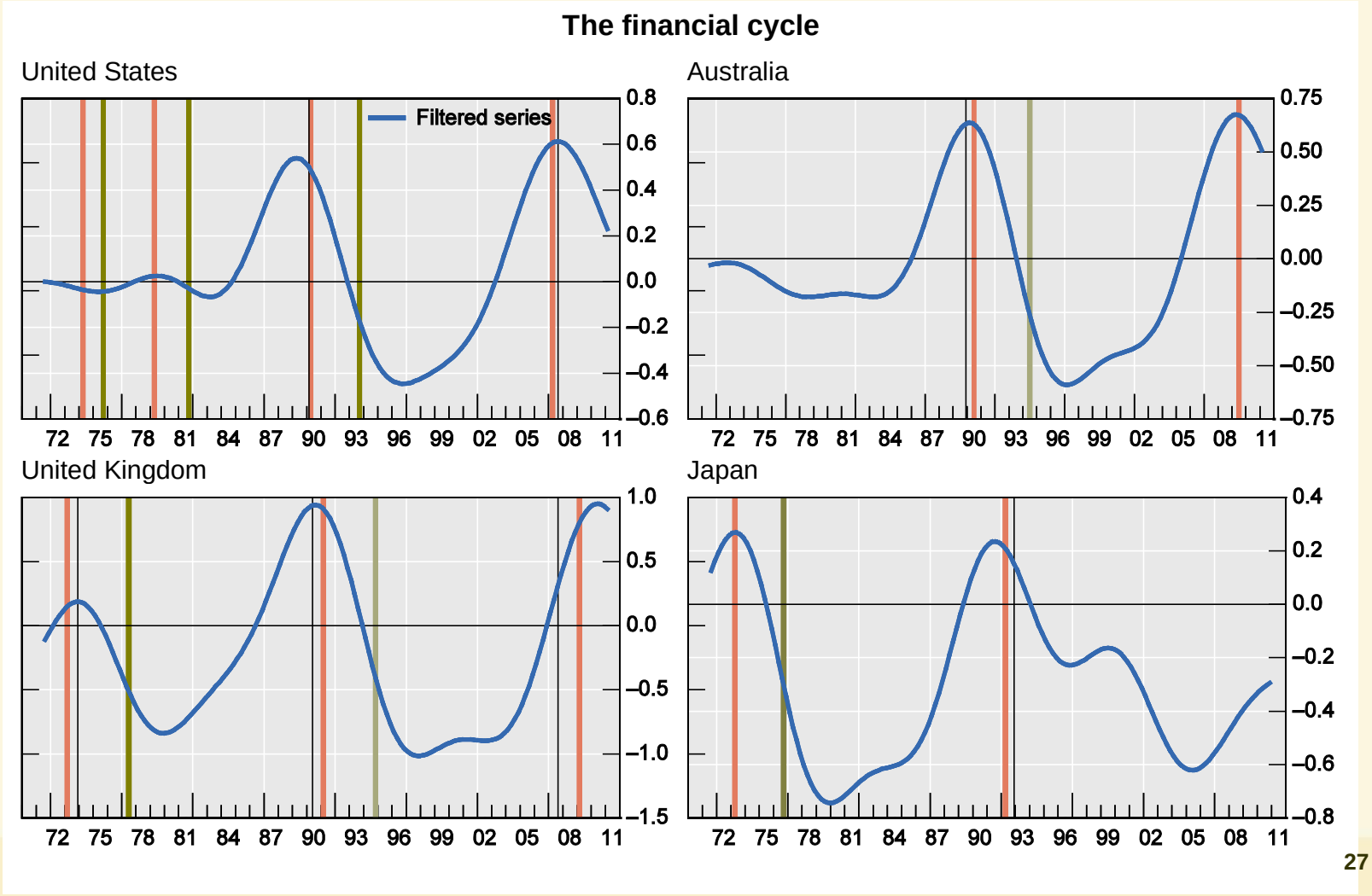
Distribution of real GDP growth[2]



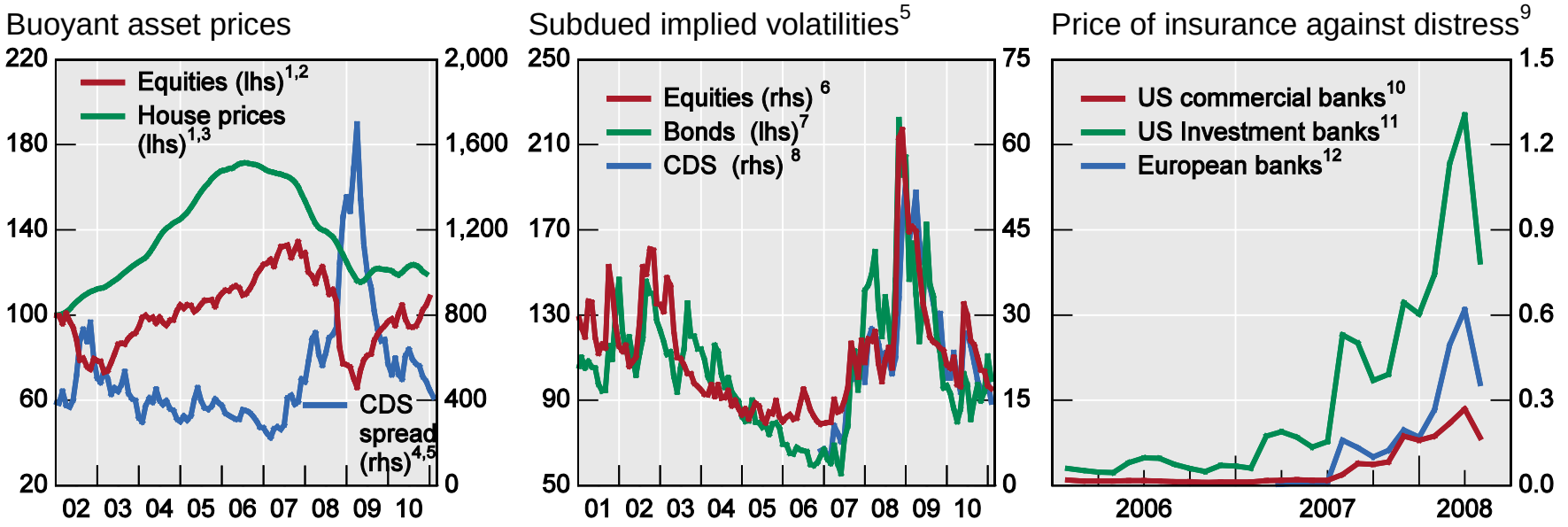
Actual and forecast real GDP growth



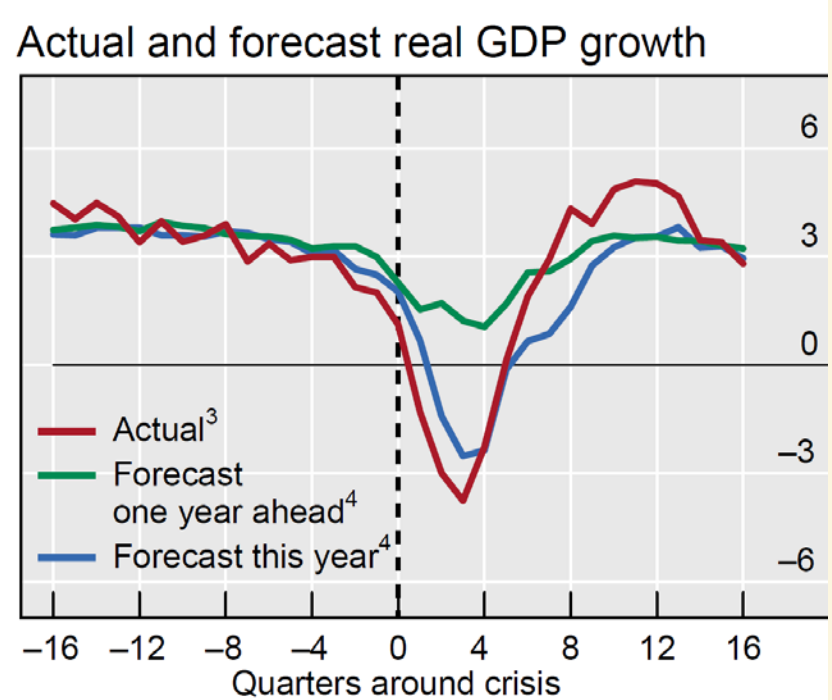
Crises emerge at the top of the financial cycle

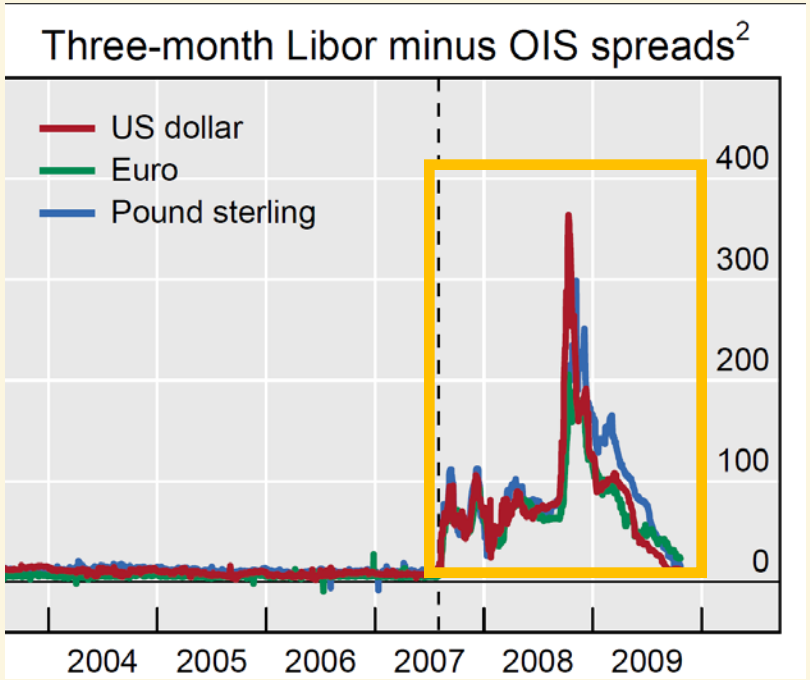


The context: the system appears strongest when it is most vulnerable (paradox of financial instability)



Reality can be brutal…





Beware of stress tests as early warning exercises

- Model limitations
  → shocks have to be large to get any effect
- Initial conditions (balance sheet strength and earnings capacity) perceived as benign
  → shocks have to be even larger
- Hubris is high and prudence is low
  → bias to argue that analysis is not plausible

- The deck is stacked against stress tests in good times

Macro stress tests can help in crisis resolution

- Hubris has given way to prudence
- Vulnerabilities have already crystallized
  - Key risk is known
  - Weak macro conditions allow history to be used for scenarios that are as severe as reality
- The important behavioural reactions that create non-linearities have already taken place

- In bad times the deck is stacked in favour of stress tests

A way forward?

- Enhance models
  - Focus on common exposures and common reactions rather than bilateral inter-linkages
- Add patches to model that can deal with non-linearities
- Use information from early warning indicators

Predicting banking crises

Table II.2

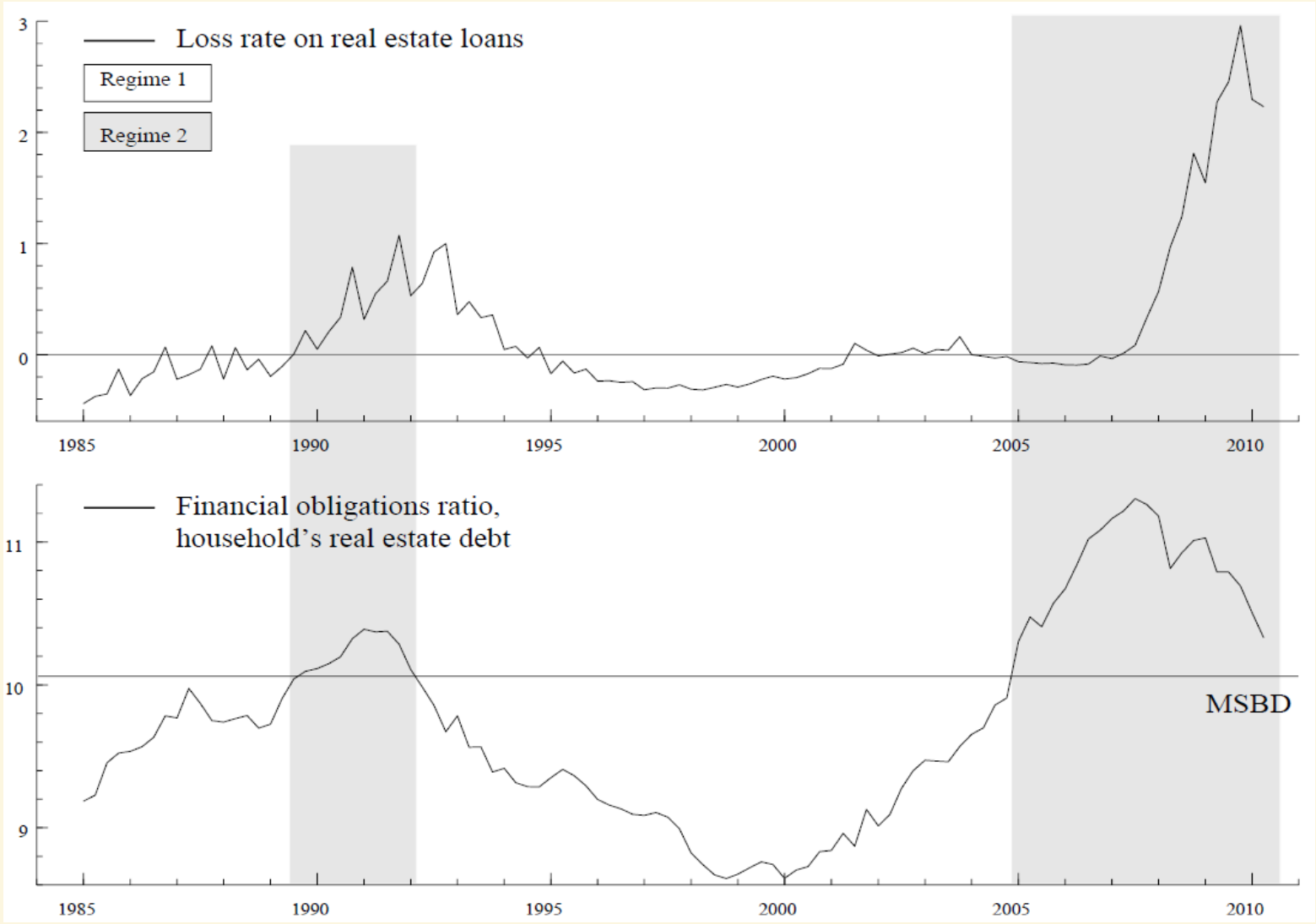
Composite indicators of banking distress, industrial countries

Horizon (years)	Credit (4) and asset price (40)		Credit (4) and exchange rate (4)		Credit (4) and (asset price (40) or exchange rate (20)[1])	
	Noise/ signal	% crises predicted	Noise/ signal	% crises predicted	Noise/ signal	% crises predicted
1	0.09	50	0.11	44	0.09	50
2	0.06	56	0.10	44	0.06	56
3	0.04	63	0.10	44	0.04	63

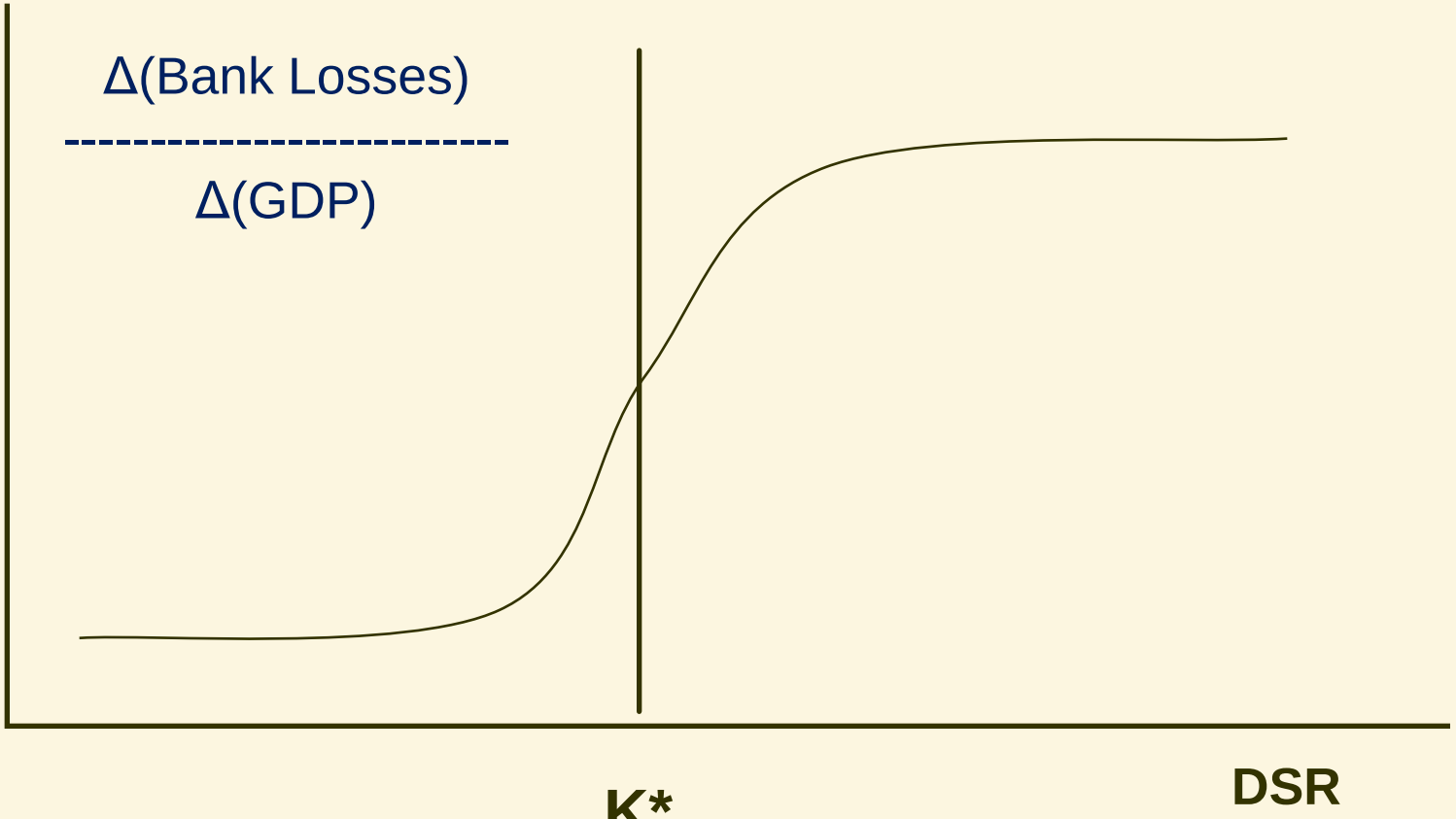
[1] Or higher.

Source: Borio and Lowe (2002b).

LOW *HIGH*


Loss rate on real estate loans
Regime 1
Regime 2
3
2
1
0
1985
1990
1995
2000
2005
2010
Financial obligations ratio,
household's real estate debt
11
10
9
MSBD
1985
1990
1995
2000
2005
2010

Sensitivity of bank write-downs to GDP



Juselius and Kim (2011)
Drehmann and Juselius (2012)

Important additional benefits

- They force a common language about financial stability
  - To break the compartmentalised view of key stakeholders (macroeconomists, finance specialist, risk managers or supervisors)
- Plus:
  - Improve toolbox for financial stability analysis
  - Improve data availability
  - Help benchmark risk management practices

→ Stress test as a …conversation piece

When you do them, do them right!

- Have the will to really stress the system
  - Should not feel to constrained by recent history
- Ensure buy-in by all stakeholders
  - Clear objectives and responsibilities for policymakers
  - Create incentives for market participants
- Do not undermine banks' own stress testing strategies
- Have a clear follow-up plan
  - In good times: how vulnerabilities could be addressed
  - In bad times: absolute targets for buffers and system-wide capital and liquidity backstops
- Always: communication is crucial

Thank you!

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