



EUROPEAN CENTRAL BANK

EUROSYSTEM

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Macroeprudential analysis and policy at the ECB

Risk Lab Conference

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- **Macroprudential policy as a new policy domain** to complement monetary policy and microprudential supervision
 - divergence in business and financial cycles: need separate set of tools (from MP) to prevent financial instability
 - MP instrument too broad and blunt to address sector- or country-(in MUs) risks to financial stability
 - Broaden the microprudential perspective: fallacy of composition; externalities
- **However, also a very complex policy field**: concept of macroprudential policy stance not easy to develop

Macroprudential policy: more complex

	Monetary	Macroprudential
Objective	Tangible; its reach is verifiable (price stability → below, but close to, 2%)	Less tangible; tail events less verifiable (financial stability)
Instruments	One or two (short-term interest rate; central bank balance sheet)	Many (price and quantity; activities and entities; banks and non-banks)
Analytical framework	Well-established (e.g. forecast targeting; experience with transmission channels)	Fledgling (e.g. stress testing, but transmission channels poorly understood)
Reaction function	Well-established , e.g. “constrained discretion”	“Guided” discretion (but elements of discretion not spelled out fully)
Institutional setting	Simple : central bank	Complex : plurality of authorities in the EU with different available tools

Sources of systemic risks are multidimensional

Multiple operational objectives:

- a) Resilience of the financial system
- b) Smoothing the financial cycle

Multiple intermediate objectives:

1. Mitigate / prevent excessive credit growth and leverage
2. Mitigate / prevent excessive maturity mismatch and market illiquidity
3. Limit direct and indirect exposure concentration
4. Limit the systemic impact of misaligned incentives
5. Strengthen the resilience of financial market infrastructures

(see ESRB Recommendation 2013)

1. Policy stance – **Macroprudential instruments**

	Time dimension	Cross-sectional dimension
Capital	Counter-cyclical capital buffer (CCyB) Sectoral capital requirements Sectoral risk weights	Capital conservation buffer Leverage ratio SIFI surcharges Systemic Risk buffer (SRB)
Assets	Loan-to-value (LTV) caps Loan-to-income (LTI) caps Debt-to-income (DTI) caps	Large exposure measures Concentration limits
Liquidity	Time-varying liquidity ratios Time-varying limits on loan-to-deposit (LTD) ratio	Liquidity coverage ratio (LCR) Net stable funding ratio (NSFR) Minimum haircuts on repos / securities lending

Macroprudential policy in the SSM area: shared responsibility between ECB and the national authorities (SSMR, Art. 5)

- a) ECB can object to national authorities' measures
- b) ECB can “top up” national authorities' measures

Rational:

1. Counteract inaction bias
2. Take into account spillover effects within SSM area
3. Ensure level playing field in the Banking Union
4. Ensure consistency and coordination of national policies

Risk areas

Instruments

Cyclical systemic risks

CCyB

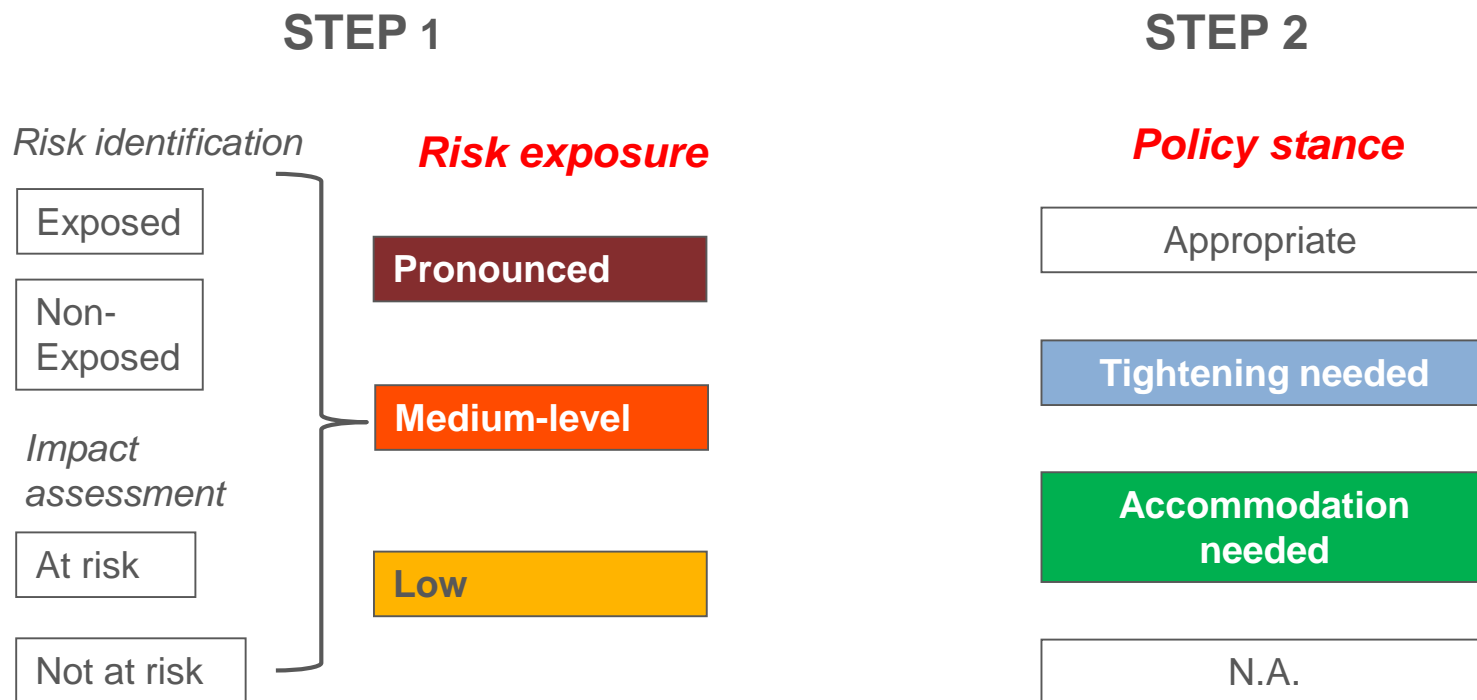
**Sector-specific risks,
with a focus on real
estate markets**

Risk-weights, borrower-
based measures (LTV, LTI
etc.)

Structural systemic risks

G-SII/O-SII buffers, SRB,
LE limits, funding/liquidity

1. General approach – From risk assessment to policy stance

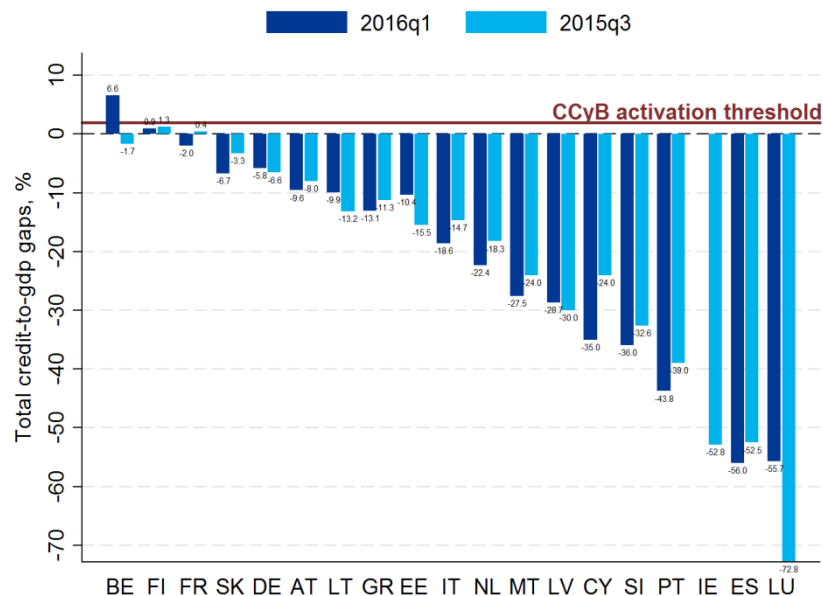


- **Step 1:** Combines **risk identification** process (scoreboards, early warning models) with country-specific scenario-based **impact assessment** (top-down stress test)
- **Step 2:** Taking as a starting point the overall risk assessment from Step 1, identify policy actions, assess macroprudential policies in different jurisdictions and evaluate whether the current **policy stance** is appropriate (model-based cost-benefit analysis)

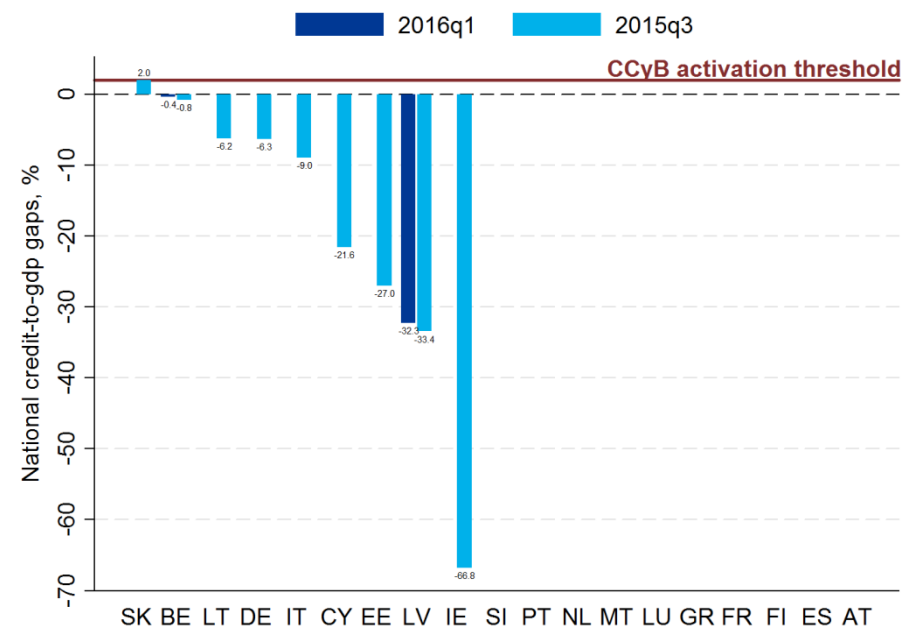
2. Cyclical risks – standardized and national credit gaps

- CRD IV: total credit-to-GDP gap: national authorities have to report the standardized measure of the credit-to-GDP gap when setting the CCyB but may use also additional indicators
- Credit gaps (i) are only a simple measure of financial cycle, (ii) and in the current situation may be biased downward (past credit excesses are reflected in the trend)

Total credit-to-GDP gaps across countries



National credit gaps

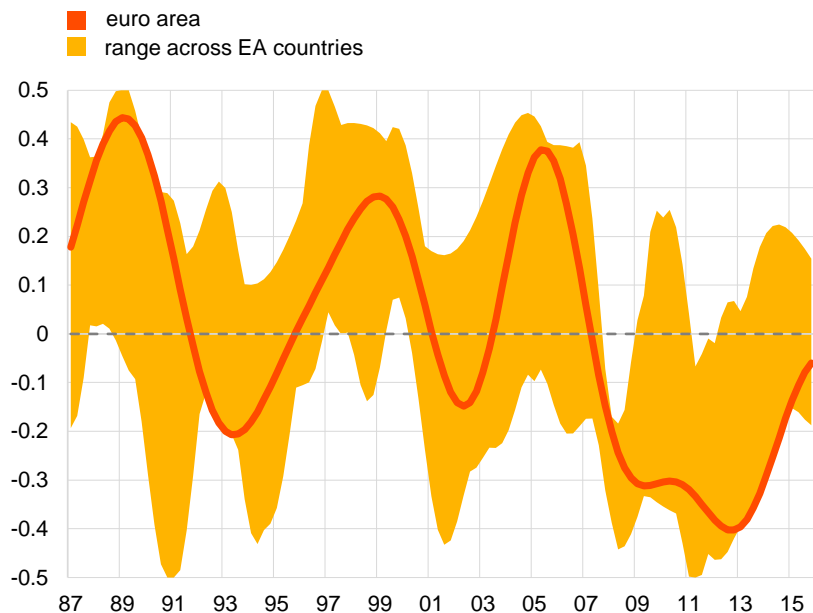


2. Cyclical risks – Financial cycle measurement

- More complete picture is granted by the composite measures of financial cycles
- These measures exploit cyclical co-movement in financial variables, with cycle durations generally exceeding those commonly associated with business cycles (below based on Schüler, Hiebert and Peltonen (2016))

EA financial cycle and country dispersion

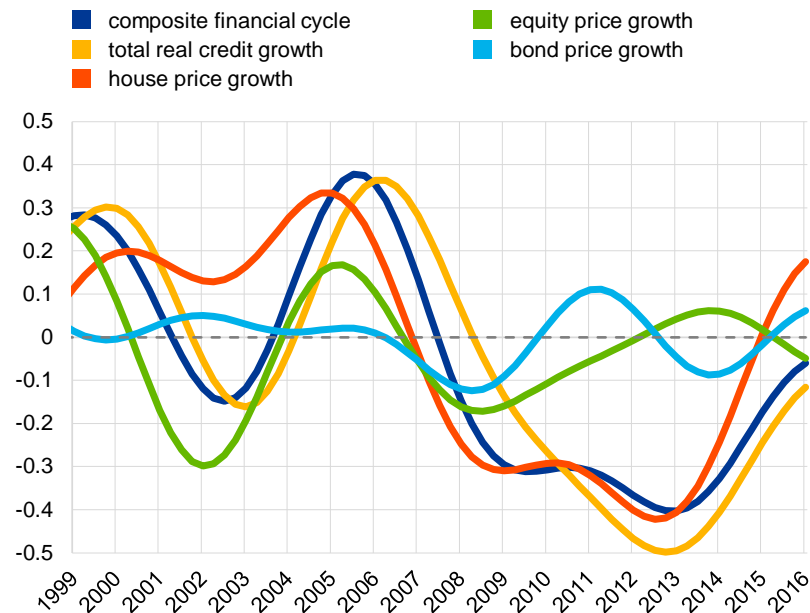
(deviation from historical median)



Note: Latest observations: Q1 2016

EA financial cycle components

(deviation from historical median)



Note: Latest observations: Q1 2016

2. Cyclical risks – A set of early warning models

- Univariate signaling: one indicator above threshold e.g. bank credit-to-GDP
- Logit early warning model: including credit and RRE prices
- Random forest: 38 indicators

Credit indicators				
	Bank credit-to-GDP gap	Real bank credit annual growth rate	Basel credit-to-GDP gap	Real total credit annual growth rate
	2016q1	2016q1	2016q1	2016q1
Latest value	-0.4	3.9	-2.0	1.0
Previous value	-0.6	3.5	0.4	2.4

Asset price indicators				
	Residential property price overvaluation measure	Residential property price-to-income ratio	Real residential property price average 3-year growth rate	Real equity price average 3-year growth rate
	2016q1	2016q1	2016q1	2016q2
Latest value	9.0	121.4	-1.4	5.5
Previous value	8.5	121.0	-2.0	6.1

Multivariate models					
	Bank Early Warning Model	Logit Model	Random Forest	Bivariate Signalling	
	2016q3	2016q1	2016Q2	Bank credit/GDP gap	Real equity price growth (2years)
				2016Q1	
Latest value	10.8	11.0	2.7	-0.4	1.1
Previous value	11.6	13.5	2.1	-0.6	7.1

Conditional crisis probability > 40 %
 Conditional crisis probability > 35 %
 Conditional crisis probability > 30 %
 Conditional crisis probability > 25 %
 Conditional crisis probability > 20 %
 Conditional crisis probability > 15 %

Notes: The colour coding is based on the conditional probability that a banking crisis could materialise with the next 12 to 5 quarters, upon a crisis signal being issued. This conditional probability depends on the specific signalling threshold that is being breached. In general, a higher preference for not missing vulnerable states leads to a lower signalling threshold and more false alarms being issued, which is usually associated with a lower conditional crisis probability. For each indicator or model, five different signalling thresholds are applied based on preference parameters ranging between 0.7 (strong preference for not missing crises) and 0.3 (strong preference for not issuing false alarms).

2. Cyclical risks – Scoreboard

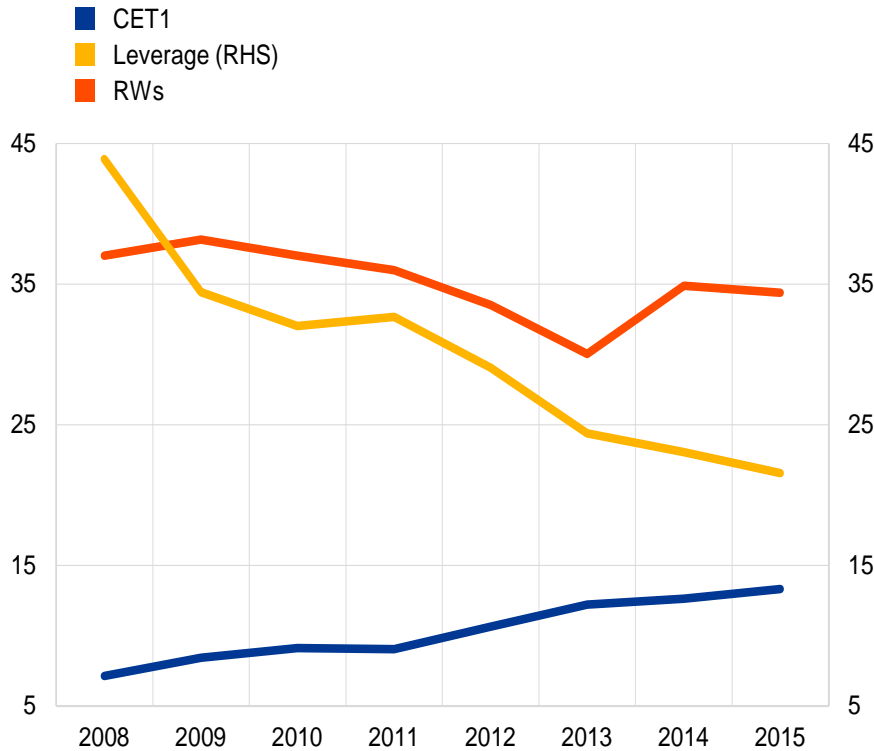
- 11 indicators (4 EWMs, Output gap, NFC + HH perspective)

Country	Aggregate indicators					NFC indicators			HH indicators			Summary measures	
	Total credit to NFPS, % of GDP, 3-year av. change	Real bank credit growth, 3-year av., %	Real res. property price growth, 3-year av., %	Real equity price growth, 3-year av., %	Probability from trivariate EWM, %	Consolidated NFC debt, % of GDP, y-on-y change	Adjusted MFI credit to NFCs, 12m growth, %	Composite NFC lending spread to 3m EURIBOR, %	HH debt, % of GDP, y-on-y change	Adjusted MFI loans to HH, 12m growth, %	Composite HH lending spread to 3m EURIBOR, %	Composite I: Average rating across indicators	Composite II: Average standardized indicator
1		Orange	Orange				Dark Red			Dark Red		Orange	Orange
2		Orange	Dark Red		Dark Red		Orange	Orange	Orange	Orange	Orange	Orange	Orange
3	Dark Red	Orange		Orange	Orange	Dark Red	Orange			Orange		Orange	Orange
4			Orange										
5													
6			Dark Red		Orange								Orange
7	Orange	Orange	Dark Red	Orange	Orange		Dark Red		Orange	Orange		Orange	Orange
8	Orange				Orange		Orange	Orange		Orange			Orange
9			Orange										
10													
11			Orange		Orange					Orange			Orange
12	Orange	Dark Red	Orange	Dark Red	Dark Red		Orange		Dark Red	Dark Red	Dark Red	Dark Red	Orange
13			Orange	Orange	Orange			Orange					
14	Orange			Orange	Orange	Orange	Orange		Orange		Dark Red	Orange	Orange
15													
16	Dark Red												
17			Orange										
18									Orange				
19			Dark Red	Dark Red	Dark Red								

2. Cyclical risks – Risk taking by banks

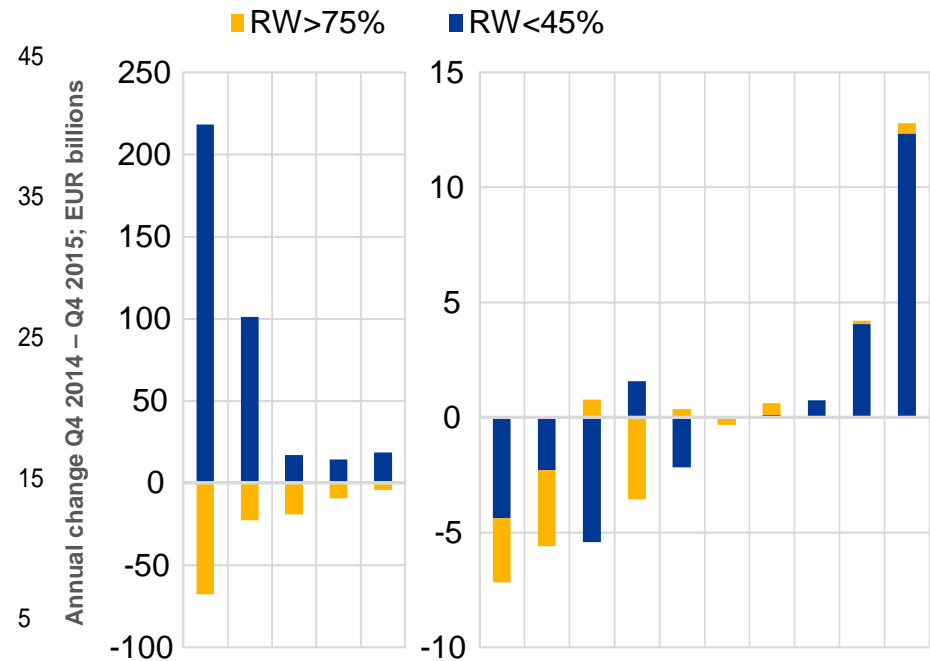
- Important to look at risk taking behavior by banks

Capital ratio, leverage and risk weights for significant banks



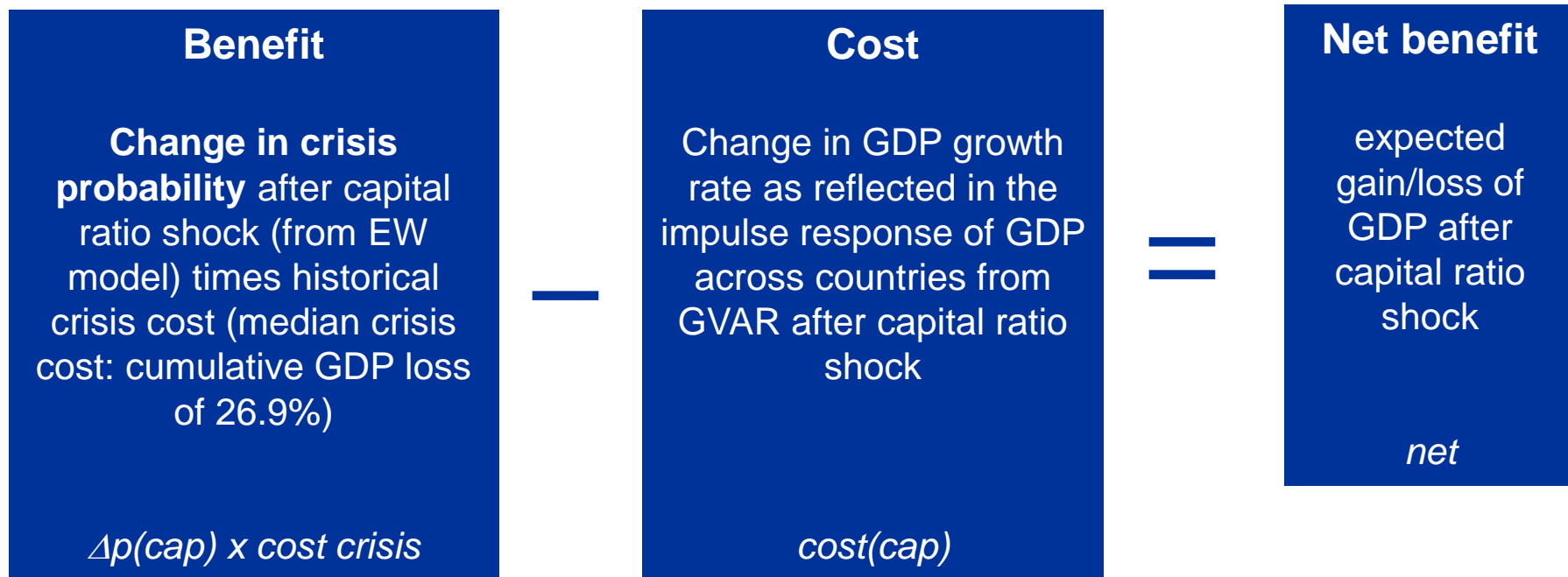
Breakdown of assets by risk weight and by obligor grade categories for IRB reporting institutions

Annual change (2015 Q4 – 2014 Q4; EUR billions)



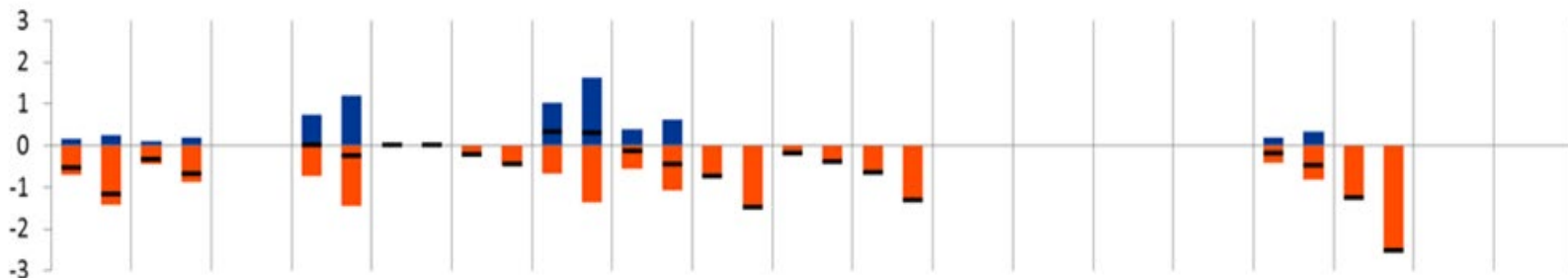
Net benefits of capital increases using probability of (rare) crisis

Behn, Gross and Peltonen (2016): integration of early warning & global vector autoregressive models



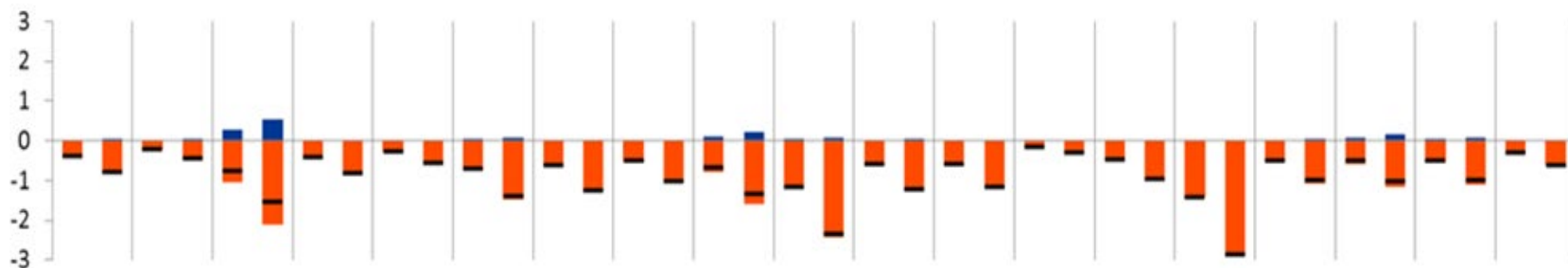
2. Cyclical risks – Cost-benefit analysis of CCyB setting

Assessment based on EW-GVAR model (Behn-Gross-Peltonen, 2015)



y-axis: expected output gain or loss in percent of GDP. Benefits (blue bars), costs under the assumption that in order to increase capital to RWA ratio banks would correspondingly reduce credit provision (red bars) and net benefits (black markers) for CCyB increase of 50 and 100 bps, respectively.

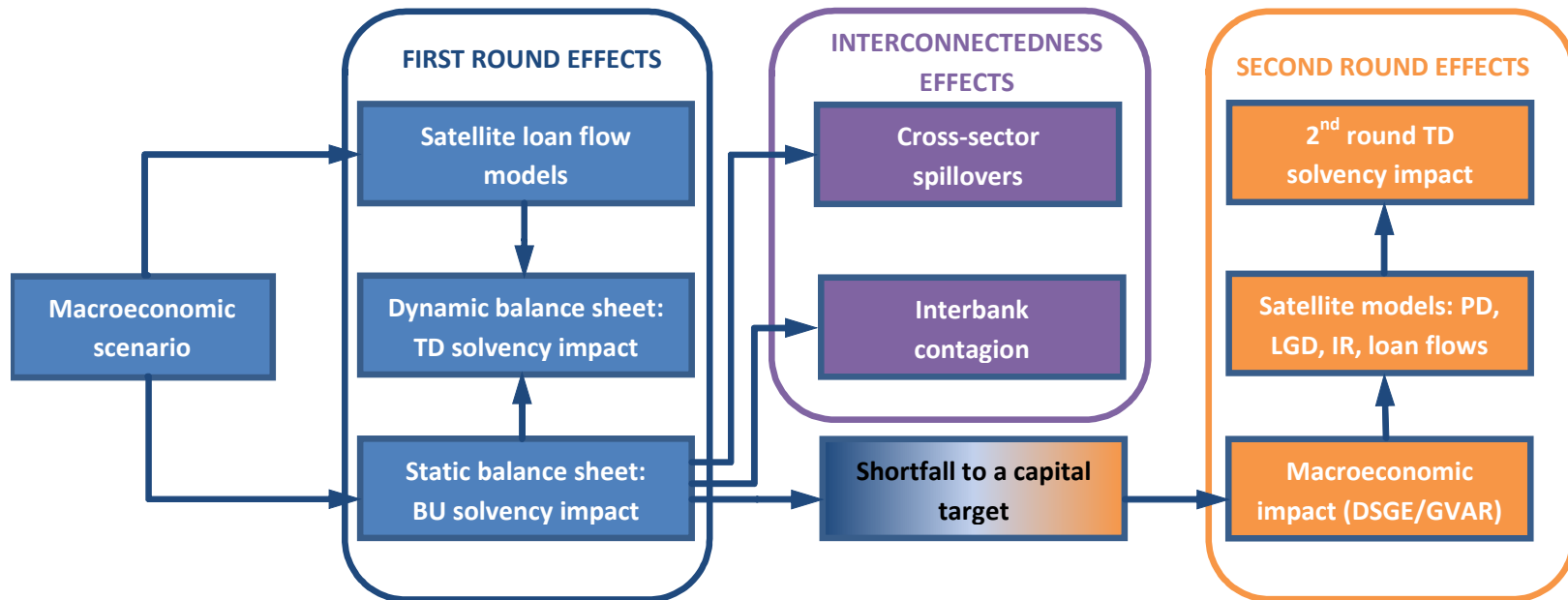
Assessment based on DSGE model (Darracq-Kok-Rodriguez, 2011)



y-axis: expected output gain or loss in percent of GDP. benefits (blue bars), costs under the assumption that in order to increase capital to RWA ratio banks would correspondingly reduce credit provision (red bars) and net benefits (black markers) for CCyB rates of 50 and 100 bps, respectively.

2. Cyclical risks – Macroprudential stress-test toolkit for CCyB setting

- **The macroprudential extension of stress tests** (ECB Macroprudential Bulletin, October 2016)



- **CCyB setting:**
- Develop a (counter-cyclical) adverse scenario and set the CCyB so that capital ratio does not fall below a pre-determined threshold
- **Alternative:** cost-benefit analysis using macroprudential ST tool

Net benefits of CCyB using macroprudential stress testing

Benefit

**Lower capital shortfalls
in downturn leading to
more robust credit
provision and smaller
GDP decline**

**[+ change in probability
of downturn x GDP
decline in downturn]**

—

Cost

**Lower GDP growth rate
as banks build buffers
partly by reducing credit
provisions**

=

Net benefit

**expected
gain/loss of
GDP after
introduction of
CCyB**

- **Task Force for Operationalising Macroprudential Research:** applying state-of-the-art models to policy questions
- **New model of co-operation:** common methodologies, country-level model development, centralised (SSM) use of information
- Extending the toolbox to limit model risks in taking decisions

- **Work Stream 1:** Net benefits of CCyB derived from a closed-economy **DSGE model with 3 layers of default (3D)** calibrated at the country level
- **Work Stream 2:** Net benefits, and distributional effects of CCyB derived from a structural **factor augmented VAR** with bank-level information estimated at a country level

Overview: from risk assessment to policy stance

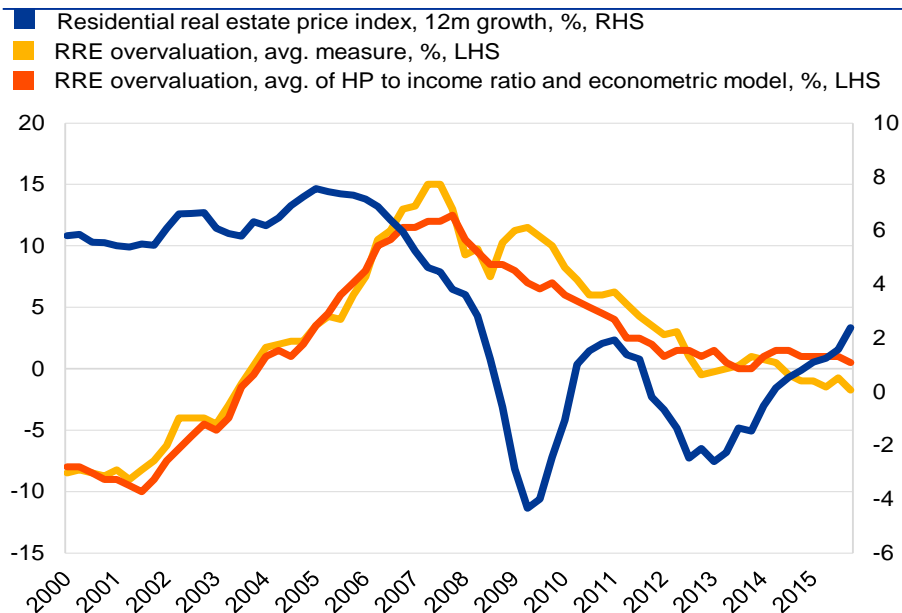
- First screening: scoreboard analysis of vulnerabilities, including measures of price overvaluation
 - Price indicators and volumes
 - Households indicators: is households' leverage growing? Are credit standards getting too soft?
- Banks' indicators on exposures to real estate
- Stress test assessment: how **resilient** is the banking system when there is an inversion of the housing cycle?
 - Use overvaluation measures to construct adverse scenario

3. Residential real estate imbalances – overall risk assessment

Looking at the overall picture: price and volumes developments in the SSM area

Residential real estate annual price growth and valuations

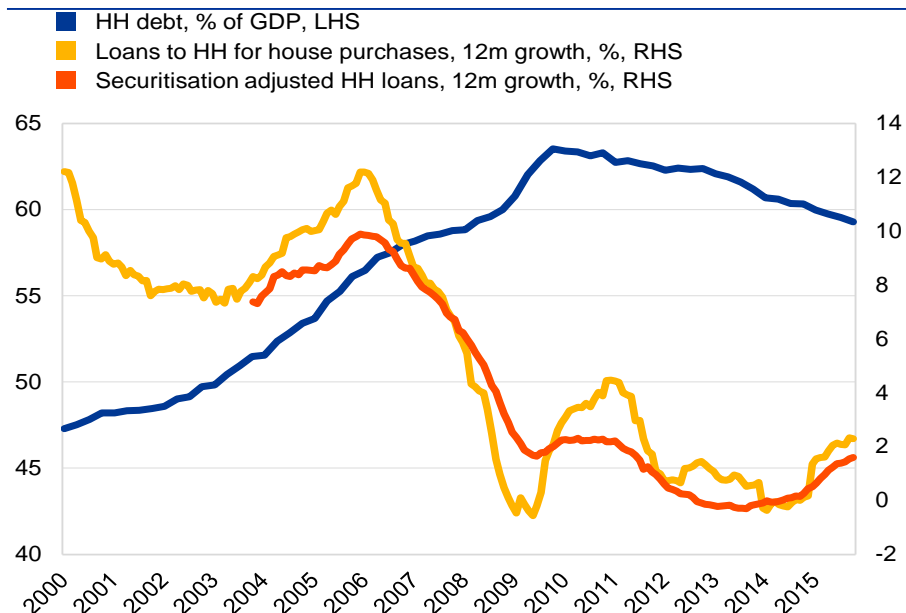
Percentages; average 3-year growth rate of real RRE prices



Sources: ECB and ECB calculations. “Average valuation measure” (yellow line) stems from the average of four valuation indicators, including (i) price to income, (ii) price to rent, (iii) standard valuation model and (iv) asset pricing model.

Loans to households for house purchases, securitisation adjusted loans and household debt to GDP

Percentages



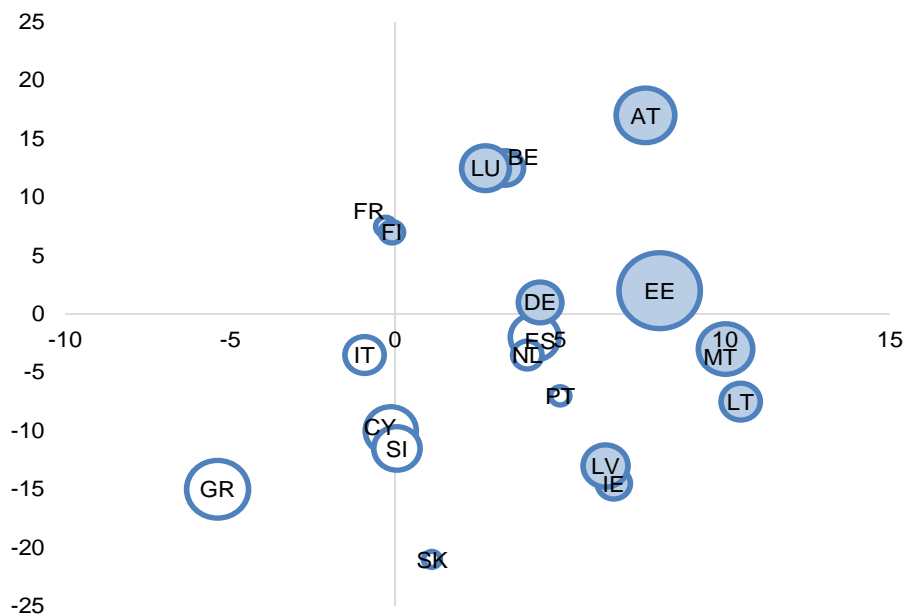
Sources: ECB and ECB calculations.

3. Residential real estate imbalances – overall risk assessment

... but large variability of across countries in real estate markets

Residential real estate annual price growth and valuations

Percentages; x-axis: RRE price growth; y-axis: over/under-valuation; bubble size = change of RRE prices since Q1 2011 (empty bubble = negative developments)

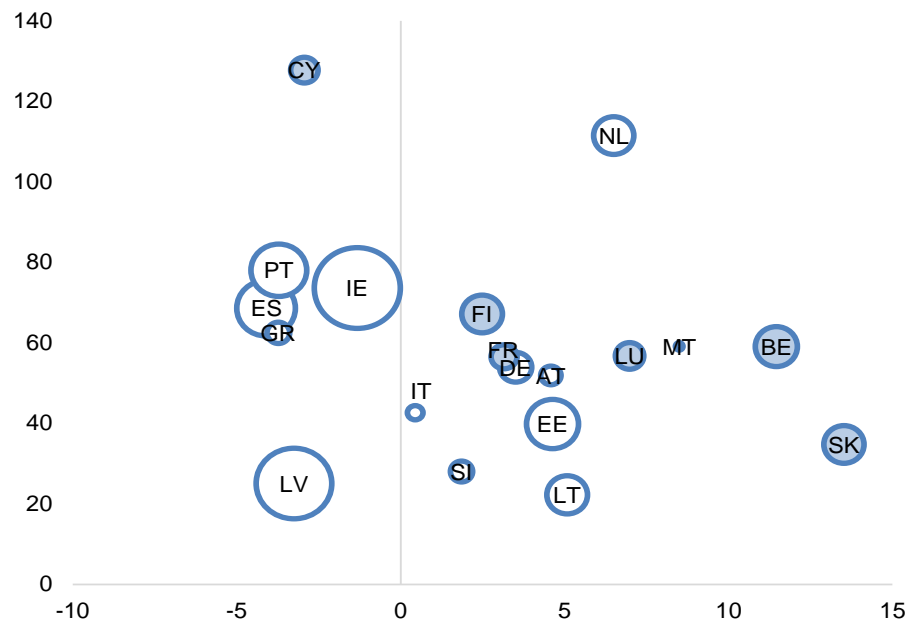


Sources: ECB and ECB calculations.

Note: The overvaluation measure (y-axis) stems from the average of two valuation indicators, (i) price to income and (ii) standard valuation model.

Loans to households for house purchases and household debt to GDP

Percentages; x-axis: annual growth loans to HH for house purchases; y-axis: HH debt as percent of GDP; bubble size = change of HH debt to GDP since Q1 2011 (empty bubble = negative developments)



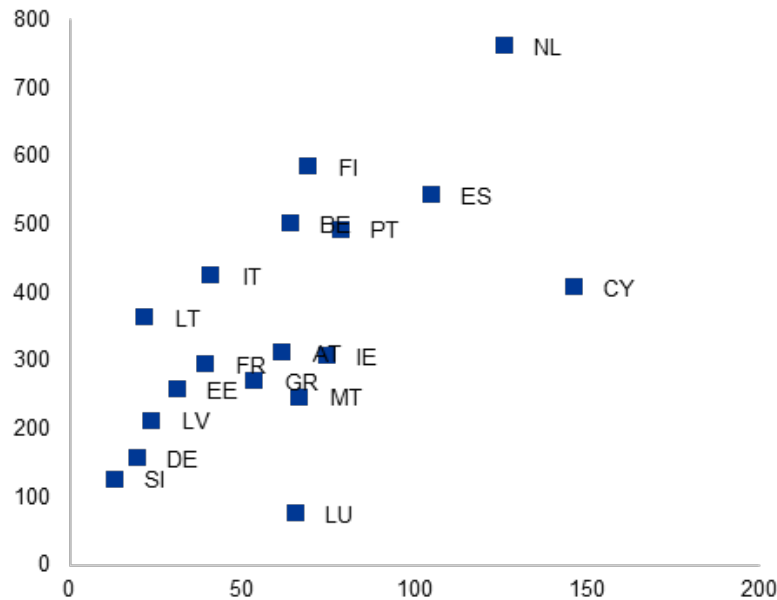
Sources: ECB and ECB calculations.

3. Residential real estate imbalances – overall risk assessment

Exposure and resilience of banking sectors to adverse RRE developments

Mortgage and other real estate loans in relation to GDP and bank capital

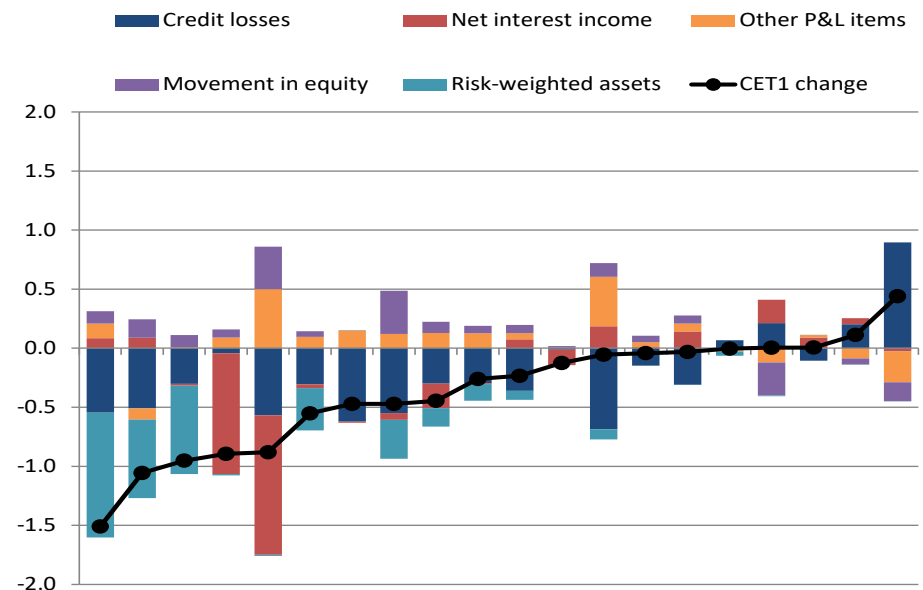
X-axis: Loans for house purchases and lending for real estate activities over GDP in p.p., y-axis: loans for house purchases and lending for real estate activities over CET1 in p.p.



Sources: ECB and ECB calculations.

Impact of the property market stress on bank CET1 ratios

(percentage points)



Sources: ECB and ECB calculations.

Policy assessment based on:

- Status of the housing cycle:
 - **Expanding phase:** forward looking policy actions to address potential problems in credit developments
 - **Close to peak:** emphasize cost-benefit balance of the policy stance
- Evaluation of enacted policies
- Sources of risk:
 - Banking system's leverage and resilience
 - Household sector's vulnerabilities

3. Residential real estate imbalances – **appropriateness of instruments**

Vulnerability	Degree of effectiveness of instruments
Excessive-Leverage of households	High: borrower-based measures Low: capital-based measures (indirect effect)
Risk taking/excessive leverage of banks	High: Capital based measures Low: borrower based measures (higher, in the case of expanding cycle)

Policy evaluation is particularly complex:

- Quantitative analysis not just for banks' but also for **households'** resilience
- Heterogeneity is a relevant aspect:
 - Availability of micro-data from credit registry/households surveys is key
- Task Force for Operationalising Macroprudential Research:
 - assessment of LTV, LTI and DSTI using DSGE model with 3 layers of default (3D) calibrated at a country level
 - effects of borrower-based measures using micro-information (along the lines of Kelly, McCann and O' Tool; 2016)

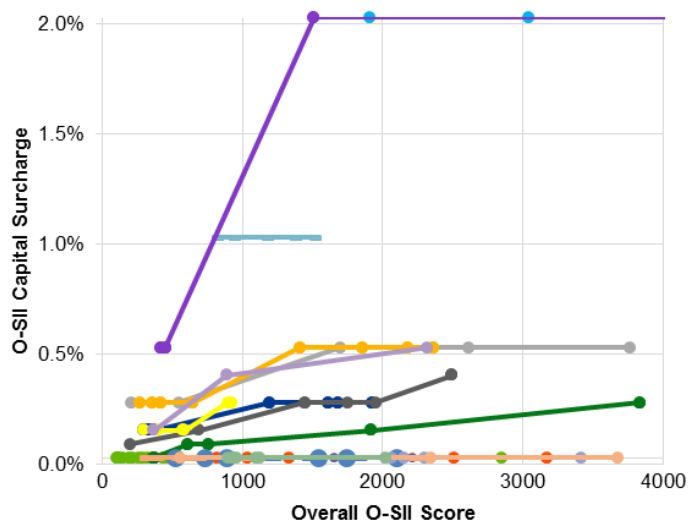
4. Structural risk – Overview

- **Structural risks:** TBTF, other structural features (e.g. interconnectedness, concentration, degree of openness, dependency on wholesale funding ...)
- **The CRR/CRD IV** capital buffers to address non-cyclical systemic risk:
 - Buffers on individual systemic institutions, i.e. G-SIIs and O-SIIs
 - Systemic Risk Buffer (SRB) to take into account other risks characterizing the aggregate structure of national banking systems
- **G-SIIs framework:** identification and calibration of the capital surcharges follows the recommendation of the Basel Committee (BCBS, 2014)
- **O-SII framework:** the EBA guidelines establish a two-step procedure
 - In the first step, the relevant authorities should calculate a score for each relevant entity
 - In the second step a supervisory assessment can be applied (no specific calibration required)

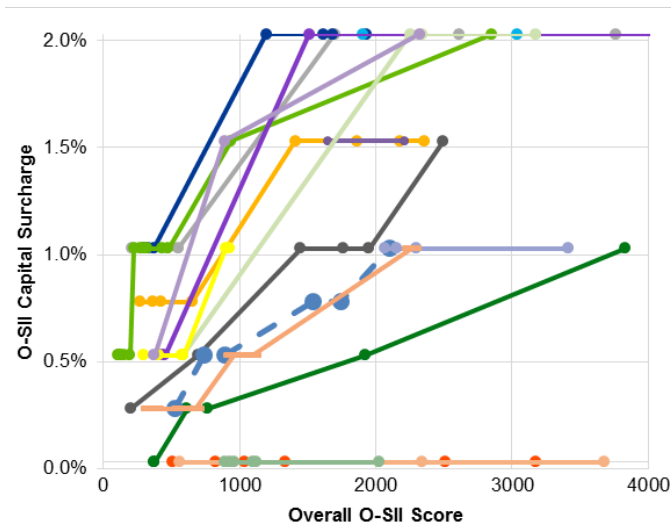
4. Structural risk – O-SII buffers

- SSM countries have applied a variety of methodologies to calibrate OSII buffers
- While some heterogeneity is justified by national specificities, some common criteria are needed
- ECB: minimum floor based on EBA scores
- Further work on calibration, e.g. how to take into account impact of failure or impairment of a bank

Relationship between O-SII calibration and overall score in 2016



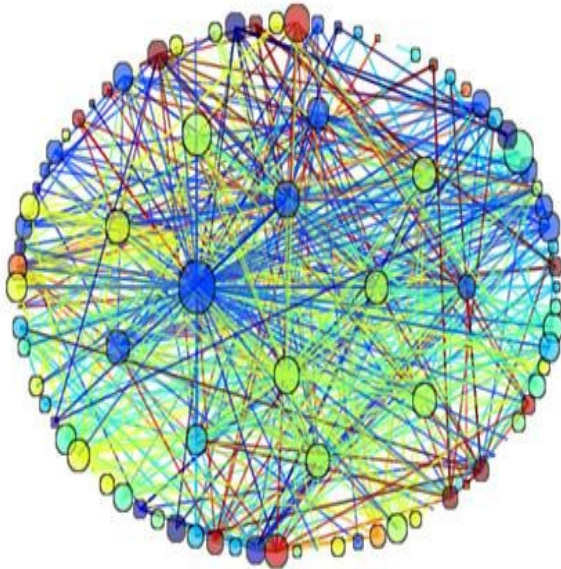
Relationship between O-SII calibration and overall score at the final stage of implementation



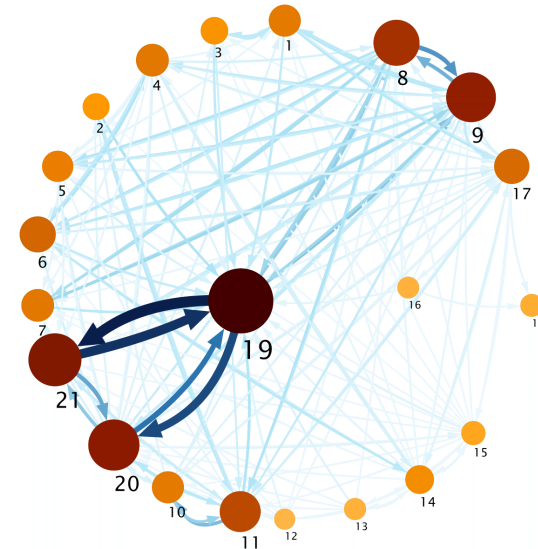
4. Structural risk – interconnectedness by direct and common exposures

- Risk stemming from the interconnectedness of the financial and banking system may be only partially captured by the G-SII and O-SII framework

Interbank network based on large exposure reporting



Interbank network based on common exposures



Sources: Corep 27-29.

Note: Node size is proportional to exposure size. The nodes are located on three "circles": the inner circle is with nodes that have a degree higher than 50, the middle ring for degree 25 to 50 and the outer ring for nodes with degrees below 25. The colours represent national banking sectors.

The 50 major SSM banks as in their network of overlapping portfolios (SHS data 2014Q4). Bank 20 suffers most portfolio losses and is the less resilient bank; its losses are mostly influenced by banks 2 and 7-10 when they sell mark-to-market assets at fire sales.

5. Conclusions

- Building up a concept for the macroprudential policy stance is complex
- The ECB is developing a suite of models and tools to identify risks, evaluate their impact and calibrate policy measures
- In the absence of established analytical framework and with only limited empirical evidence, research and peer learning is particularly important
- Substantial research is in particular needed to address the main challenges:
 - uncertainty about key transmission mechanisms
 - heterogeneity (also) due to interconnectedness
 - interactions among different instruments
 - interactions with other policies