European banks in the 21st century – are their business models sustainable?

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Introduction

The motivation of our research

》 Assessing the characteristics of European Banks' business models (BBMs) and the drivers of their relative performance

What's new in our paper

》 Probabilistic identification of BBMs on a dataset of 77 European banks

》 Identification through Supervised Learning of homogeneous Peer Groups (PGs) of Banks according to EBA categorisation

》 Quantitative analysis

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Key results

》Three BBMs operating in Europe: Retail, Investment and Diversified banks

》 Retail banks were the best performers before the onset of the Sovereign Debt Crisis; after 2010 business strategies hardly account for any significant difference in profitability

》Retail banks with sizable cross-border activities showed slightly higher profitability levels in most recent years (2014 – '15)

》Economic growth, the yield curve and sovereign default risk are the main drivers of Retail banks' profitability

》Credit quality is the main bank-specific driver of banks' RoA

》There is some evidence that banks benefit from holding more capital
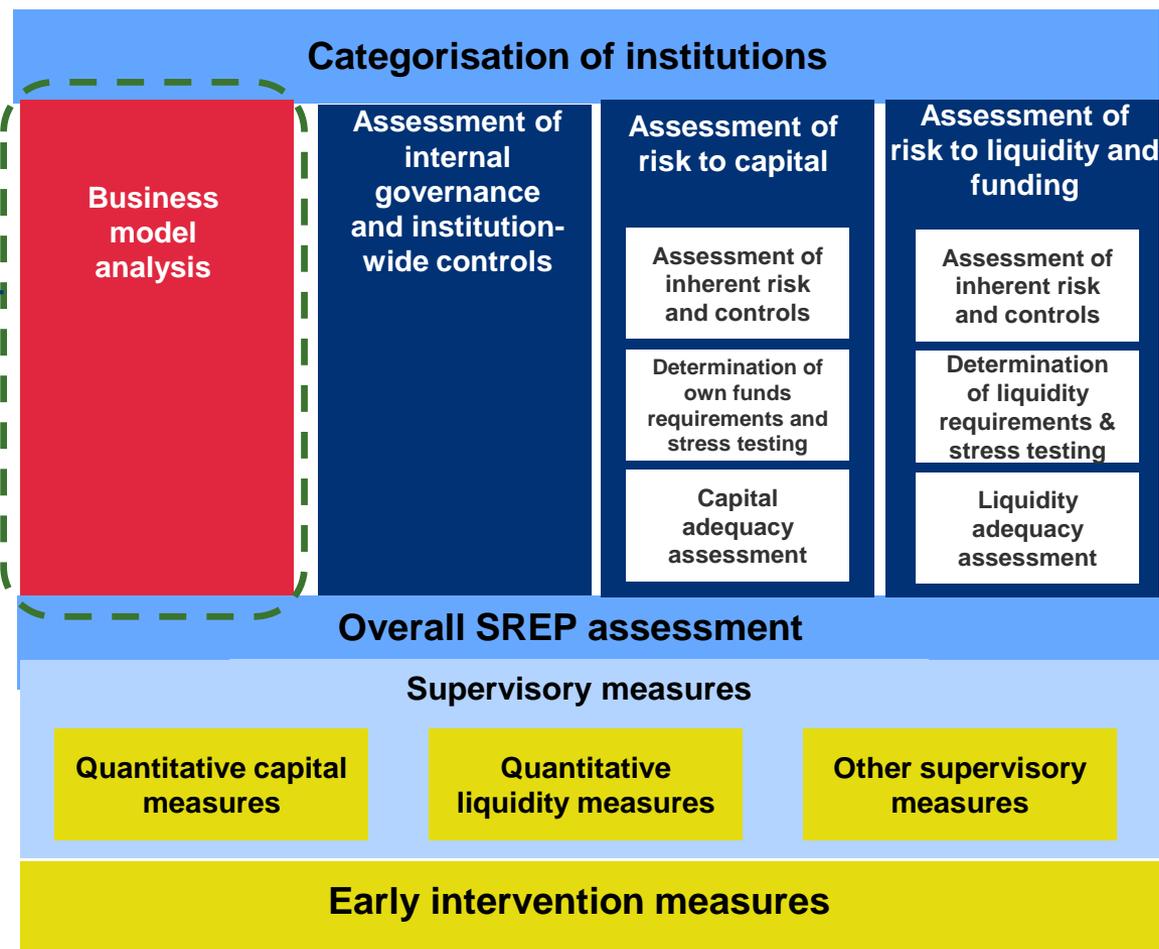
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> **Regulatory framework**

> **Literature review**

> **Data and methodology**
- **Dataset analysis**
- **Identification of Bank Business Models**
- **Identification of Peer Groups**
- **Performance analysis**

> **Results**

> **Conclusions and open issues for further research**

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Regulatory framework

Overview of the common SREP framework

- Business model analysis (BMA) is one of the four evalution areas of the SREP

- BMA aims at assessing bank's ability to achieve satisfactory profits in a 12-month and at least 3-year horizon

Categorisation of institutions

Business model analysis	Assessment of internal governance and institution-wide controls	Assessment of risk to capital	Assessment of risk to liquidity and funding
		Assessment of inherent risk and controls	Assessment of inherent risk and controls
		Determination of own funds requirements and stress testing	Determination of liquidity requirements & stress testing
		Capital adequacy assessment	Liquidity adequacy assessment

Overall SREP assessment

Supervisory measures

Quantitative capital measures	Quantitative liquidity measures	Other supervisory measures

Early intervention measures

source: EBA, guidelines on common procedure and methodologies, 19 December 2014

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Regulatory framework

SREP categorisation of institutions

Category 1
- Global systemically important institutions (G-SIIs)
- Other systemically important institutions (O-SIIs)

Category 2
- Other medium and large institutions that
  - Operate domestically or with sizable cross-border activities
  - Operating in several business lines, including non-banking activities
  - Offering credit and financial products to retail and corporate customers
  - Specialised institutions with significant market shares in their lines of business

Category 3
- Other small to medium institutions
  - Operating domestically or with non-significant cross-border operations
  - Operating in a limited number of business lines
  - Offering predominantly credit products to retail and corporate customers including non-banking activities with a limited number of financial products
  - Specialised institutions with less significant market shares in their lines of business

Category 4
- Other institutions

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Bank Business models identification

Literature review (1/2)

❯ **Roengptya et al (2014)**

- ❯❯ +200 individual banks from 34 countries

- ❯❯ Cluster analysis on balance sheet ratios (loans, traded securities, deposits, wholesale debt, interbank activity)

- ❯❯ Three Business models: Retail-funded; Wholesale funded; Trading

❯ **Ayadi and De Groen (2015)**

- ❯❯ +2000 European banks and subsidiaries

- ❯❯ Cluster analysis on balance sheet indicators (loans to customers and banks, trading assets and derivatives, debt liabilities)

- ❯❯ Five Business models: Focused Retail, Diversified Retail (Type I and Type II); Wholesale Banks; Investment Banks.

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Bank Business models identification

Literature review (2/2)

> **ECB (2016)**

>> +100 significant institutions supervised by the SSM

>> Cluster analysis based on: RWA (or size); net fee and commission income as a share of operating income; customer funding and interbank funding as a share of total liabilities; trading assets and domestic exposure as a share to total assets

>> Seven Bank Business Models: larger and more retail-oriented banks are generally associated with lower default risk

> **Bonaccorsi di Patti et al (2016)**

>> +100 European individual banks under the supervision of SSM

>> Identification approach relying on criteria concerning: specialization; size; core business; share of cross border exposure.

>> Eight Business models: Lending banks (high loan to assets); Diversified banks (large and small banks with lower incidence of traditional banking); Network banks (hubs for small local banks); Public and Development banks (banks with a public interest purpose).
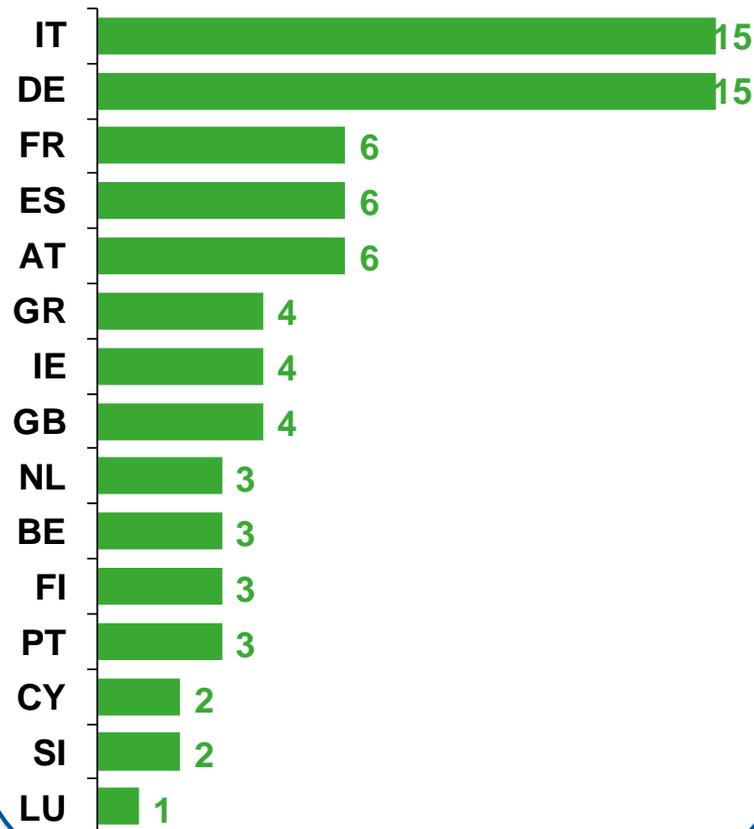
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Data and methodology

Dataset analysis

77 banking groups

Country	Count
IT	15
DE	15
FR	6
ES	6
AT	6
GR	4
IE	4
GB	4
NL	3
BE	3
FI	3
PT	3
CY	2
SI	2
LU	1

❯ We used publicly **consolidated data** provided by SNL for 73 banking groups from 14 countries in the Euro Area – accounting for around 80% of the EMU's total banking assets - plus 4 UK banking groups

❯ Almost **55% of SSM supervised** banks

❯ The sample covers the period **from 2006 to 2015**

❯ For Peer Groups identification we used:

  ❯❯ FSB's list of G-SIBs

  ❯❯ Operating income across different business lines, as reported in the segment performance analysis of banks' annual reports

  ❯❯ Counterparties' credit risk exposure

  ❯❯ Data from EBA/ECB stress test: credit risk exposure in the home country and exposure of the bank to sectors other than retail and corporate

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Data and methodology

Identification strategy of Bank Business Models and Peer Groups

> We assume no prior knowledge on the actual number and composition of BBMs operating in Europe at an aggregate level

> Bank Business Models identification with **Unsupervised Learning**

> EBA guidelines provides a categorisation of institutions in terms of
> > Systemic relevance
> > Dimension
> > Cross-border activity
> > Complexity

> At a microeconomic level, we assume that knowledge about characteristics of individual banks is available to the researcher

> Peer Groups identification with **Supervised Learning**

	Business model 1	**Business model 2**	**Business model 3**
Category 1	Peer Group 1	Peer Group 2	…
Category 2			
Category 3			
Category 4			

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Data and methodology

Identification of Bank Business Models

Deterministic (Hierarchical) clustering: progressively aggregate homogeneous groups of banks

» Euclidean distance to measure similarity of banks in terms of their balance sheet indicators

» Ward's method implemented by the Lance-Williams algorithm

» Stopping rule (i.e. optimal number of BBMs) obtained from hypothesis testing conducted on 30 different test statistics specified on homogeneity within the cluster and heterogeneity among clusters

Probabilistic (Fuzzy) clustering: estimation of the probability distribution that a bank belongs to the BBM identified with deterministic clustering

» Fuzzy c-means algorithm (FCM) : minimization of the expected squared distance between observations and cluster centers for a given degree of fuzziness (uncertainty)

» For each bank the FCM returns the probability of observing a BBM conditional to a specific bank, i.e. $\hat{p}(BM_i|B_j)$

» We then derive the probability of observing a bank for a given BBM, i.e. $\hat{p}(B_j|BM_i) = \dfrac{\hat{p}(BM_i|B_j)p(B_j)}{p(BM_i)}$

» If FMC is performed on a yearly basis, the expected KPI of BBM i at time t is given by $\widehat{KPI_{i,t}} = \sum_j KPI_{j,t}\hat{p}(B_j|BM_i)$

Data and methodology

Identification of Peer Groups

Key-nearest neighbour (KNN): identifies homogenous groups of banks for each BBM

» Starting point: a classification (set of labels) based on the categorization provided by EBA Guidelines

» Training banks: a set of banks with known membership to a specific PG

» Test banks: banks to be classified

» KNN classifies on the basis of a majority rule: a bank belongs to the PG containing the majority of closer training peers according to a distance measure (Euclidean)

» Similarity computed in terms of:

    » Business and organizational complexity

    » Cross border exposure

    » Specialization

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Data and methodology

Identification of Peer Groups

Systemic relevance

> As defined by the **Financial Stability Board**

>> FSB's list of G-SIBs as of November 2015

Business and Organizational Complexity

> Combination of two **Herfindal** indices:

>> **HCBL index**: concentration of **operating income** across different business lines; data from banks' annual report
>> **HCCR index**: concentration of **counterparties' credit risk** exposure as a percentage of total credit risk
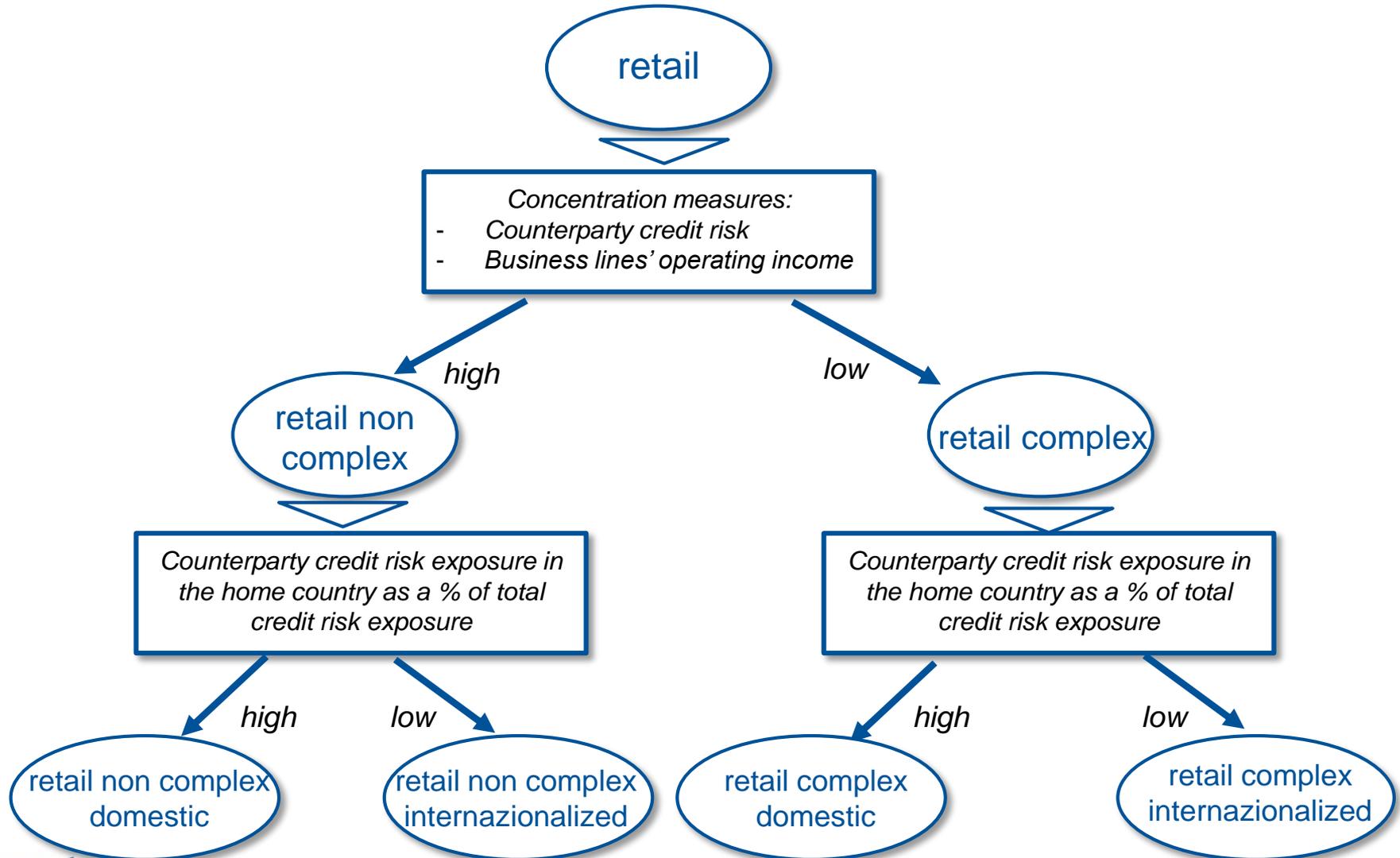
Cross border exposure

> Measured by the ratio of **credit risk exposure in the home country** as a percentage of total credit risk exposure

>> Data from the EBA/ECB stress test

Specialization

> Measured by the **exposure of the bank to sectors other than retail and corporate**

>> Data from the EBA/ECB stress test

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Data and methodology

Peer Groups of Retail banks

retail

Concentration measures:
- Counterparty credit risk
- Business lines' operating income

high → retail non complex

low → retail complex

retail non complex:
Counterparty credit risk exposure in the home country as a % of total credit risk exposure

high → retail non complex domestic

low → retail non complex internazionalized

retail complex:
Counterparty credit risk exposure in the home country as a % of total credit risk exposure

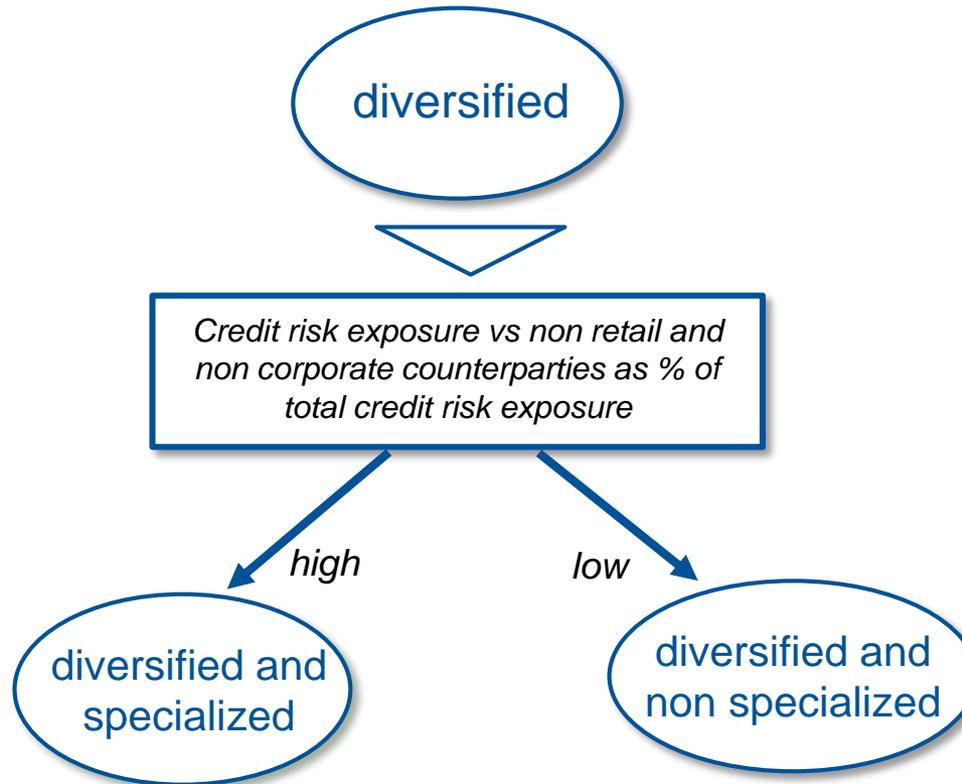high → retail complex domestic

low → retail complex internazionalized

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Data and methodology

Peer Groups of Diversified banks

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Data and methodology

Performance Analysis – panel data regressions

$$KPI_{i,t} = \alpha + \sum_{g} \beta_g\, D_{i,t,g} + \gamma GDP_{c,t} + \epsilon_{i,t}$$

> Pooling panel regressions with BBM-specific dummy variables
> Aimed at assessing relative performance of different BBMs / PGs, after controlling for country-specific factors (e.g. GDP growth)
> Estimated on two different subsamples: 2006-2010 and 2011-2014

> Dynamic panel regressions
> Aimed at assessing the relevant factors affecting BBMs and PGs performance
> Controlling for common, country and bank-specific factors

$$KPI_{i,t} = \alpha + \mu_i + \phi KPI_{i,t-1} + \beta X_{i,t} + \gamma K_{c,t} + \delta Z_t + \epsilon_{i,t}$$

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Results

Three Bank Business Models identified in Europe

Bank business models in 2015

retail — investment — diversified
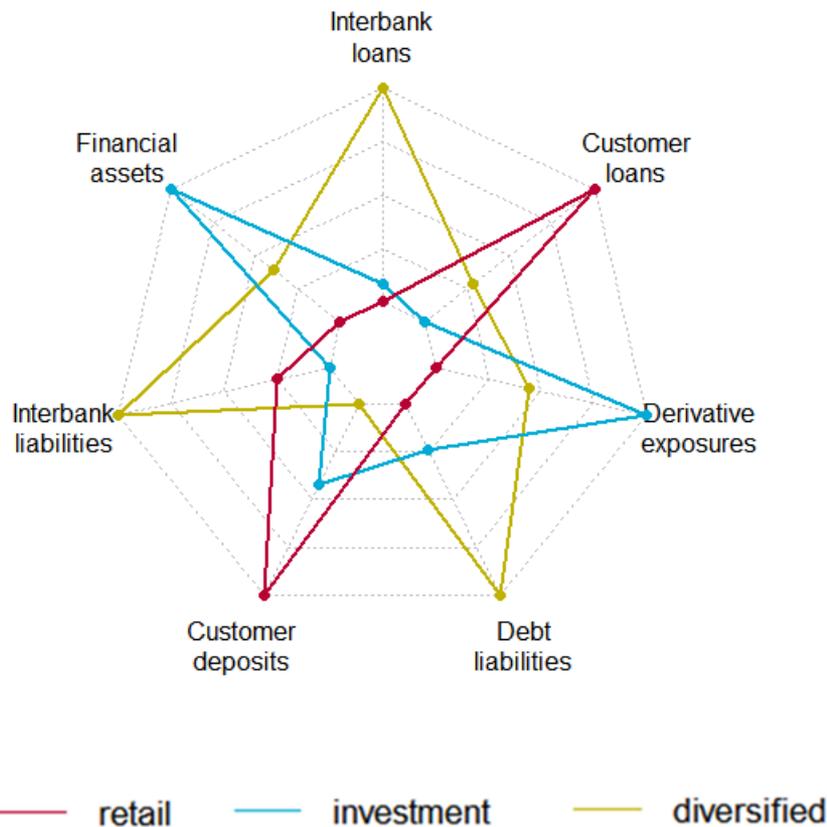
Share of BBMs across countries in 2015
% of bank total assets

retail ■ investment ■ diversified
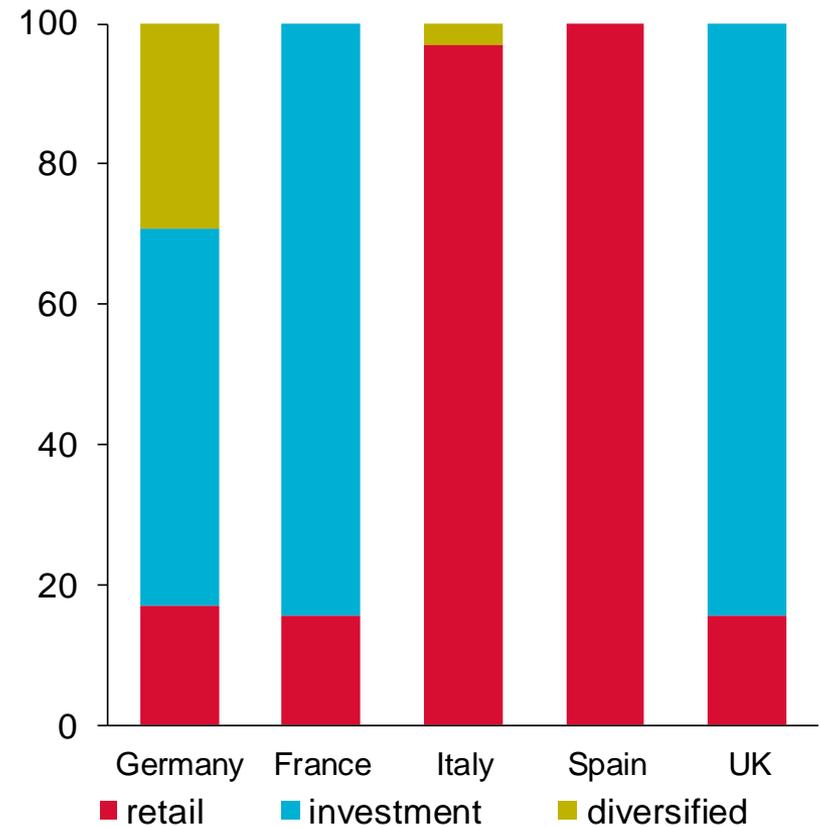
source: Prometeia calculations on balance sheet data
note: the radar plots the median value of each balance sheet indicator across all banks belonging to that cluster (BBMs), standardised across different BBMs

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Results

Retail banks are the prevailing BM in Italy throughout the sample period

Bank business models identified for Italian banks

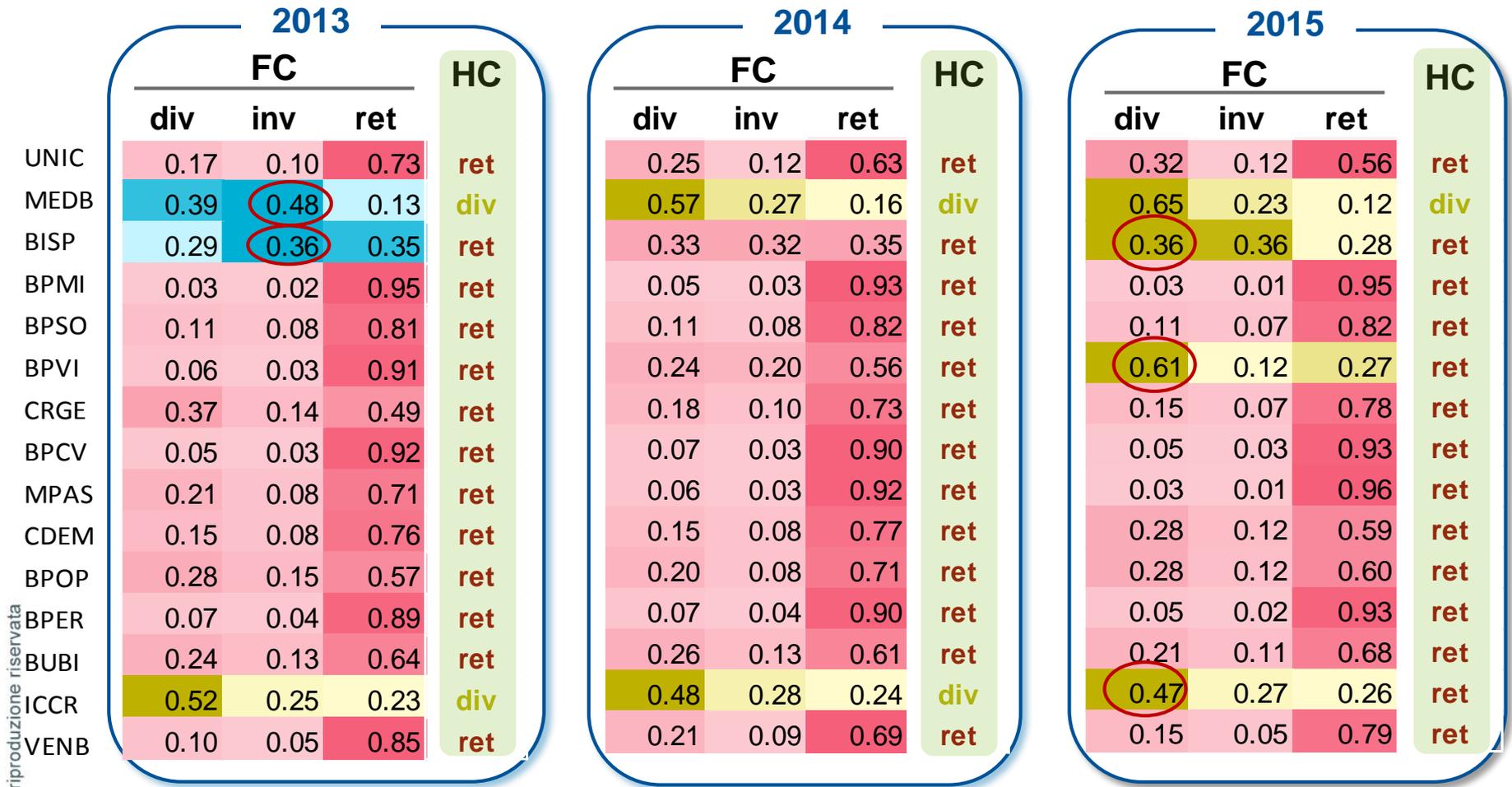|	2006	2010	2014	2015	prevailing*
UniCredit SpA	inv	ret	ret	ret	ret
Mediobanca	inv	inv	div	div	inv
Intesa Sanpaolo SpA	ret	ret	ret	div	ret
Banca Popolare di Milano Scarl	ret	ret	ret	ret	ret
Banca Popolare di Sondrio SCpA	ret	ret	ret	ret	ret
Banca Popolare di Vicenza SpA	ret	ret	ret	div	ret
Banca Carige SpA	ret	ret	ret	ret	ret
Credito Valtellinese SC	ret	ret	ret	ret	ret
Banca Monte dei Paschi di Siena SpA	ret	ret	ret	ret	ret
Credito Emiliano SpA	ret	div	ret	ret	ret
Banco Popolare Società Cooperativa	ret	ret	ret	ret	ret
Banca popolare dell'Emilia Romagna SC	ret	ret	ret	ret	ret
Unione di Banche Italiane SpA	ret	ret	ret	ret	ret
Iccrea Holding SpA	div	div	div	div	div
Veneto Banca SpA	ret	ret	ret	ret	ret

*prevailing over the period 2006-2015

Note: each bank is attributed to the business model with the highest probability,

Source: SNL, Prometeia calculations.

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Results

Fuzzy clustering vs deterministic (hard) clustering - Italian banks

2013

	FC			HC
	div	inv	ret	
UNIC	0.17	0.10	0.73	ret
MEDB	0.39	0.48	0.13	div
BISP	0.29	0.36	0.35	ret
BPMI	0.03	0.02	0.95	ret
BPSO	0.11	0.08	0.81	ret
BPVI	0.06	0.03	0.91	ret
CRGE	0.37	0.14	0.49	ret
BPCV	0.05	0.03	0.92	ret
MPAS	0.21	0.08	0.71	ret
CDEM	0.15	0.08	0.76	ret
BPOP	0.28	0.15	0.57	ret
BPER	0.07	0.04	0.89	ret
BUBI	0.24	0.13	0.64	ret
ICCR	0.52	0.25	0.23	div
VENB	0.10	0.05	0.85	ret

2014

	FC			HC
	div	inv	ret	
UNIC	0.25	0.12	0.63	ret
MEDB	0.57	0.27	0.16	div
BISP	0.33	0.32	0.35	ret
BPMI	0.05	0.03	0.93	ret
BPSO	0.11	0.08	0.82	ret
BPVI	0.24	0.20	0.56	ret
CRGE	0.18	0.10	0.73	ret
BPCV	0.07	0.03	0.90	ret
MPAS	0.06	0.03	0.92	ret
CDEM	0.15	0.08	0.77	ret
BPOP	0.20	0.08	0.71	ret
BPER	0.07	0.04	0.90	ret
BUBI	0.26	0.13	0.61	ret
ICCR	0.48	0.28	0.24	div
VENB	0.21	0.09	0.69	ret

2015

	FC			HC
	div	inv	ret	
UNIC	0.32	0.12	0.56	ret
MEDB	0.65	0.23	0.12	div
BISP	0.36	0.36	0.28	ret
BPMI	0.03	0.01	0.95	ret
BPSO	0.11	0.07	0.82	ret
BPVI	0.61	0.12	0.27	ret
CRGE	0.15	0.07	0.78	ret
BPCV	0.05	0.03	0.93	ret
MPAS	0.03	0.01	0.96	ret
CDEM	0.28	0.12	0.59	ret
BPOP	0.28	0.12	0.60	ret
BPER	0.05	0.02	0.93	ret
BUBI	0.21	0.11	0.68	ret
ICCR	0.47	0.27	0.26	ret
VENB	0.15	0.05	0.79	ret

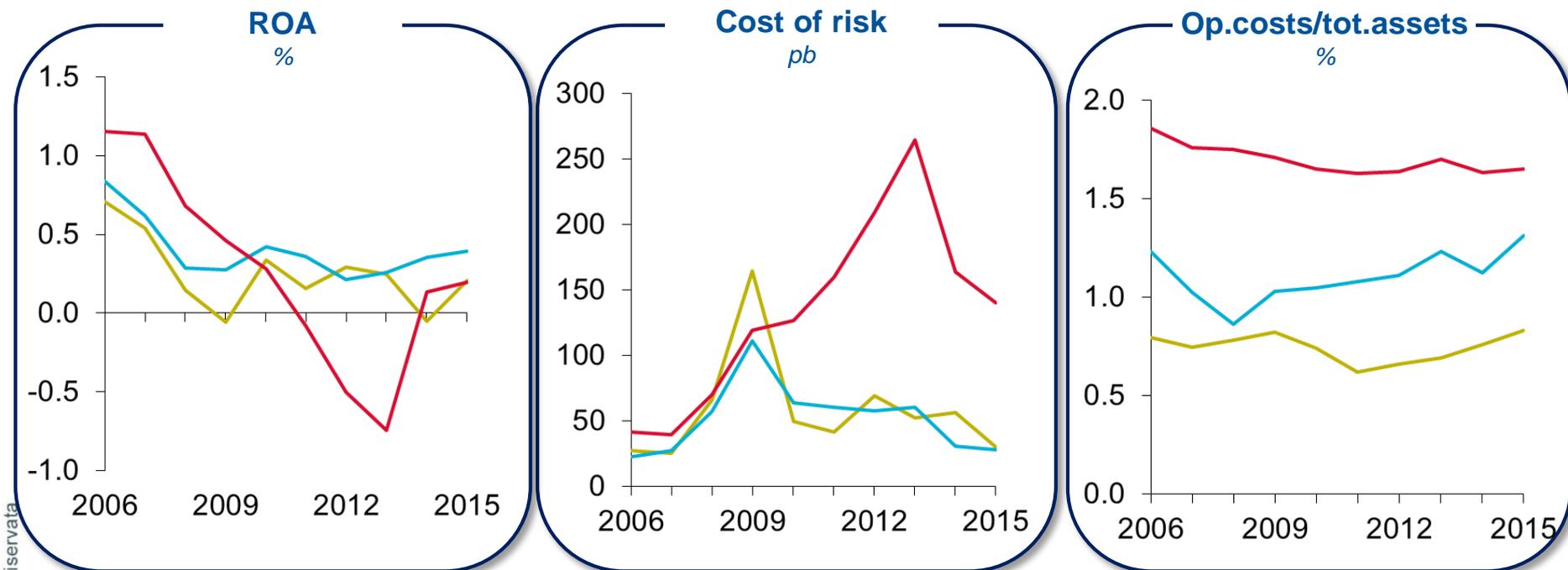cluster with higher probability: ■ retail ■ investment ■ diversified

⬭ cluster with higher probability ≠ result of hard clustering

Source: SNL, Prometeia calculations.

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Results

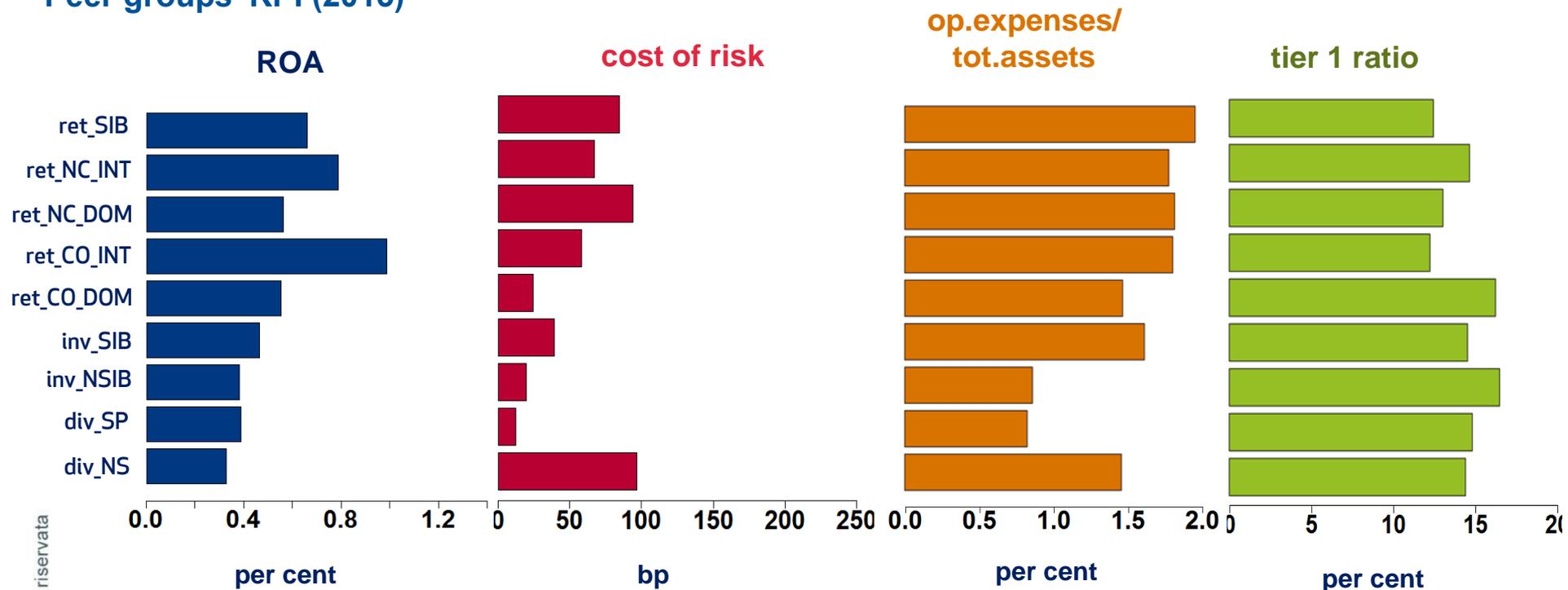## KPI analysis: retail banks have suffered the most during the crisis

ROA (%), Cost of risk (pb), Op.costs/tot.assets (%) — diversified, investment, retail (2006–2015)

Source: SNL, Prometeia calculations.

Results

Retail internationalized banks were the best performers in 2014-15
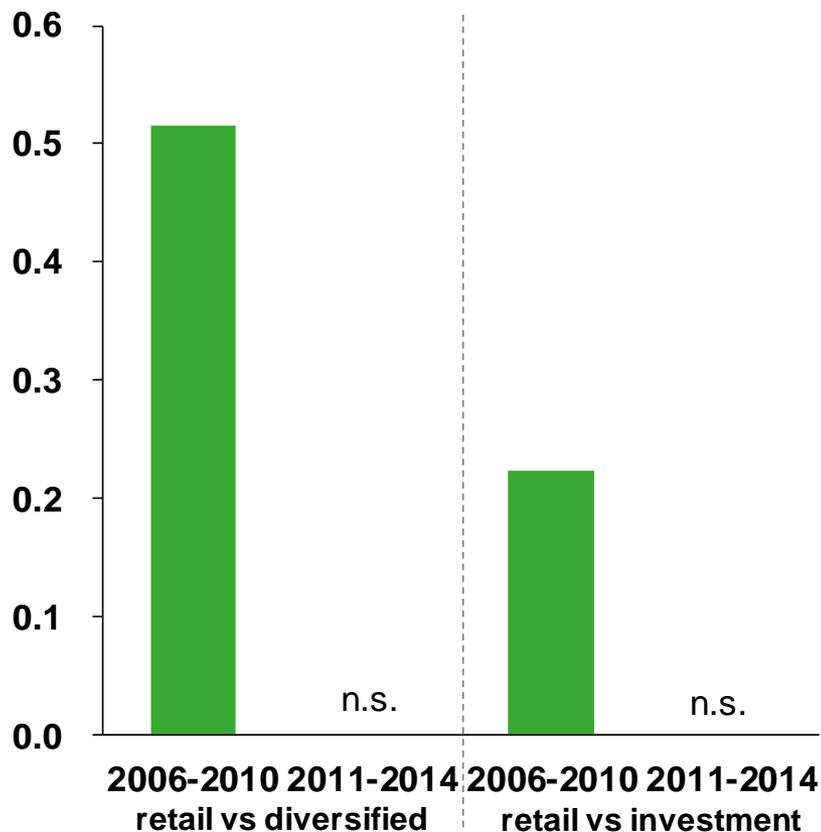
Peer groups' KPI (2015)

ROA — per cent

cost of risk — bp

op.expenses/tot.assets — per cent

tier 1 ratio — per cent

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Results

After 2010 business strategy does not account for differences in RoAs

Difference in ROA across BBMs, pooled regressions*
% values

> Retail banks were the best performers before the financial crisis

> After 2010, different business strategies, when considered at an aggregate level, hardly account for any significant difference in banks' profitability

> Country factors (summarized by economic growth) appear sufficient in explaining heterogeneity in banks' RoAs after 2010

Source: SNL, Prometeia calculations.

*Equation: $\text{RoA}_{i,t} = \alpha + \sum_g \beta_g\, D_{i,t,g} + \gamma \text{GDP}_{c,t} + \epsilon_{i,t}$, where $\text{RoA}_i^{(t)}$ is bank's i RoA in year t; $D_{i,g}^{(t)}$ is a vector of dummy variables assuming value equal to 1 when bank i belongs to group g (that is, to a specific BBM/PG); $\text{GDP}_c^{(t)}$ is country c's real GDP annual growth. The graph shows the differences between the coefficients of the dummy variables associated to different BBMs, if significant.

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Results

The macro-financial drivers of Retail banks' RoA

ROA sensitivity to a contemporaneous increase of 1 p.p. of the specified variable - % values
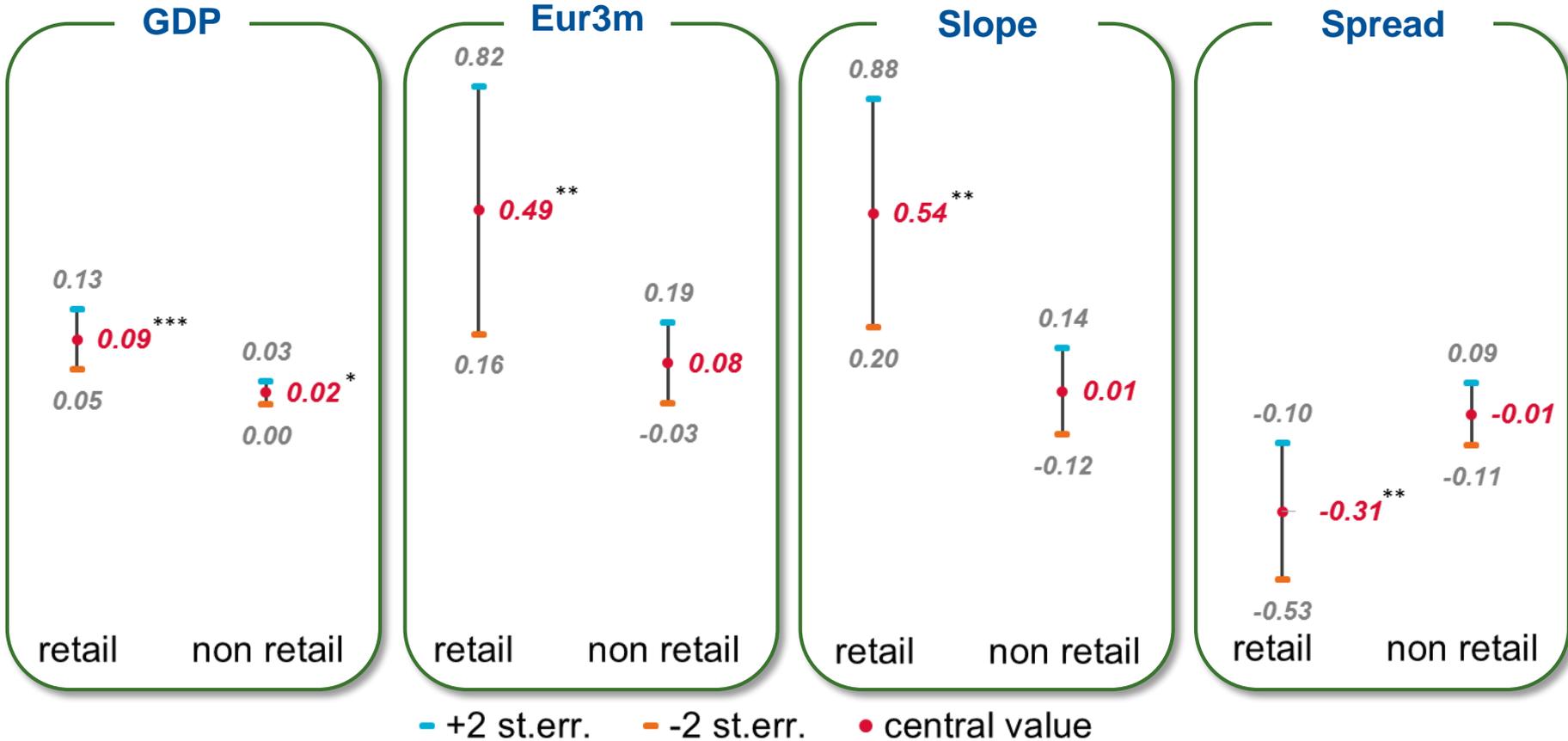
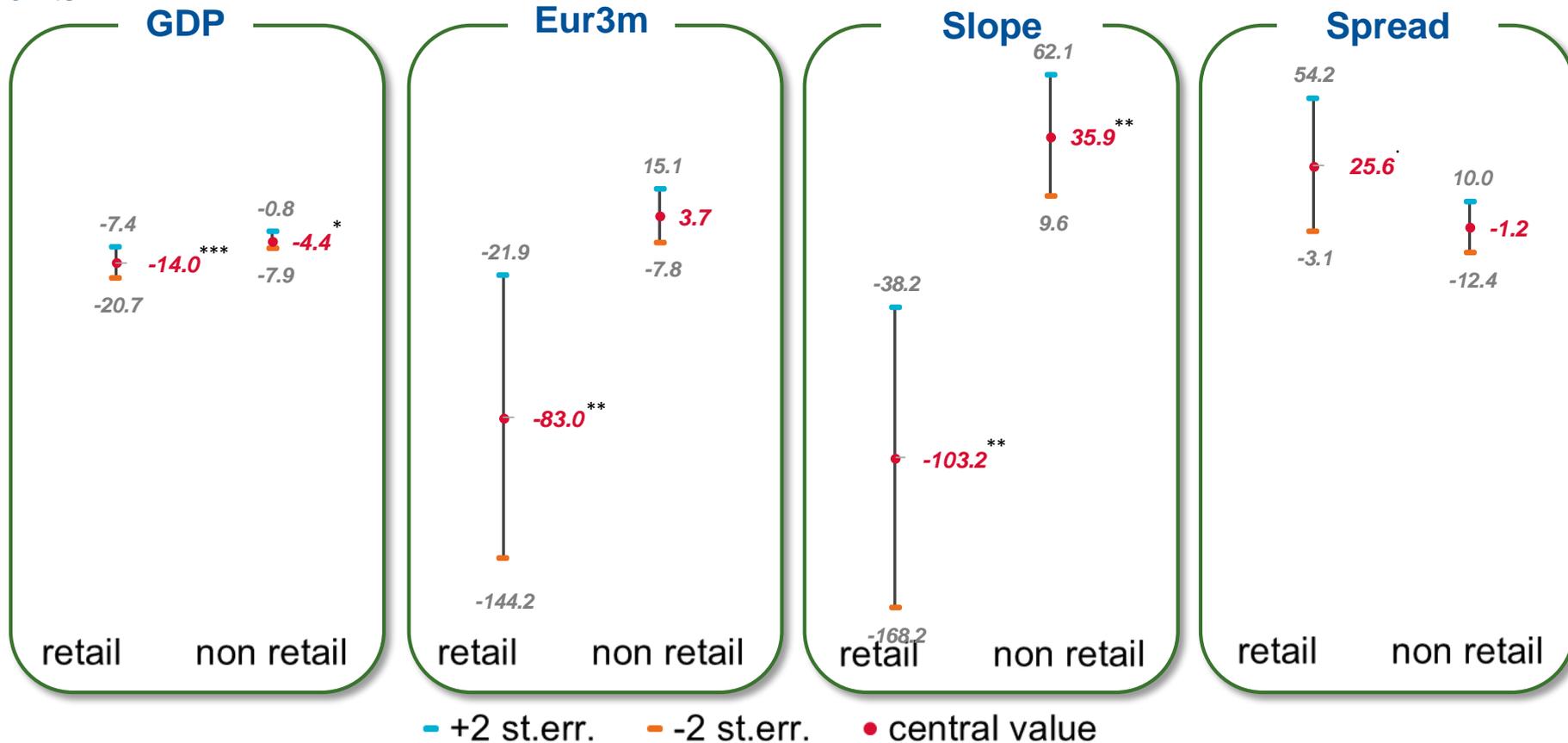Note: Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Source: Prometeia calculations on SNL data. Dynamic panel regressions on business models ROA – 2014 data.

Note: non retail banks include diversified and investment banks. Slope is defined as 10-year IRS – 3-month euribor, spread is calculated as 10-year government bond yield – 10-year IRS.

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Results

Counterintuitive relationship between credit quality and the yield curve

Cost of risk sensitivity to a contemporaneous increase of 1 p.p. of the specified variable – basis points

- +2 st.err.   - -2 st.err.   • central value

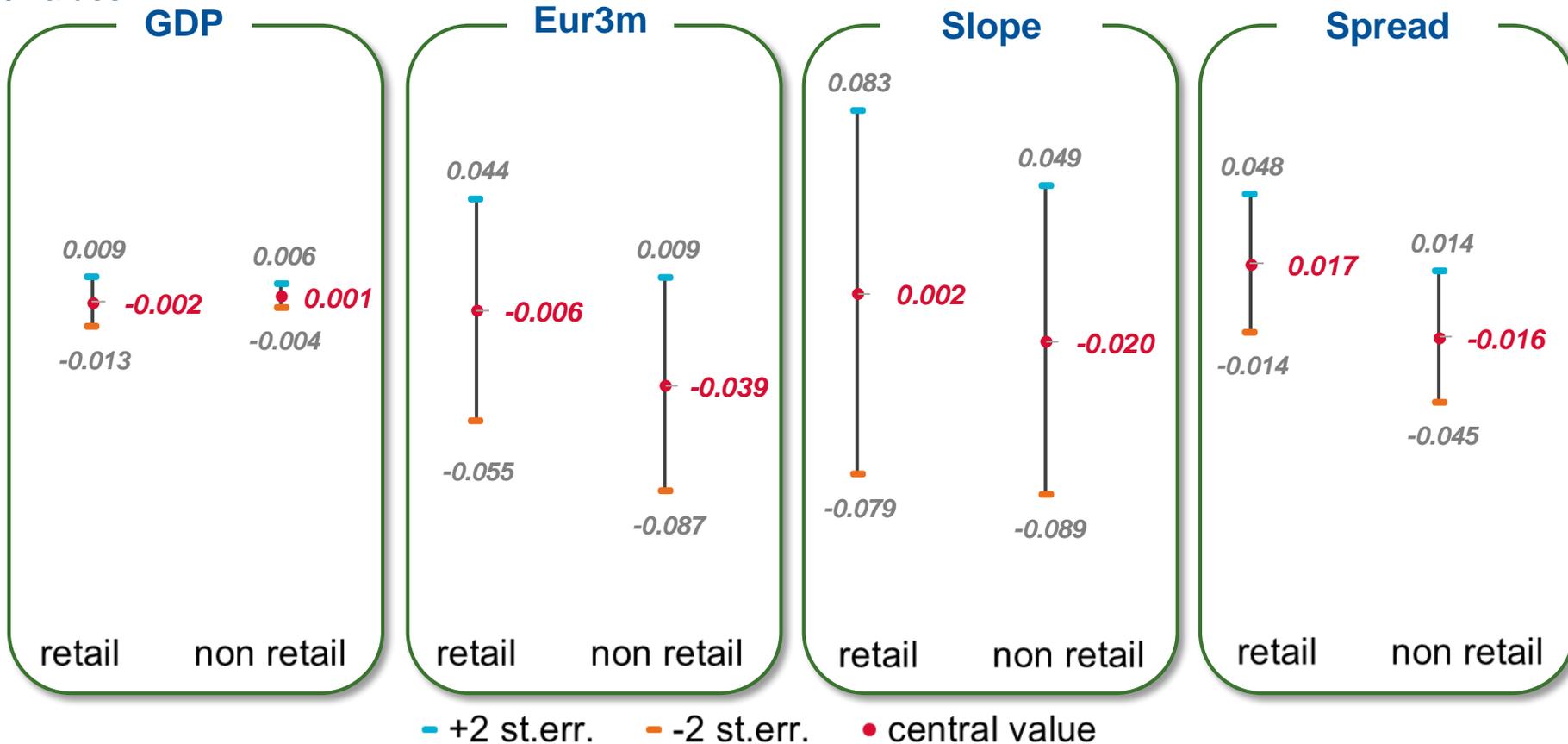Note: Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Source: Prometeia calculations on SNL data. Dynamic panel regressions on business models ROA – 2014 data.

Note: non retail banks include diversified and investment banks. Slope is defined as 10-year IRS – 3-month euribor, spread is calculated as 10-year government bond yield – 10-year IRS.

Results

Operating costs do not seem to be related to any macro risk factor

Op.cost/tot.assets sensitivity to a contemporaneous increase of 1 p.p. of the specified variable – % values

- +2 st.err.   - -2 st.err.   • central value

Note: Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Source: Prometeia calculations on SNL data. Dynamic panel regressions on business models ROA – 2014 data.

Note: non retail banks include diversified and investment banks. Slope is defined as 10-year IRS – 3-month euribor, spread is calculated as 10-year government bond yield – 10-year IRS.

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Conclusions and open issues for further research

Possible applications of our methodology

❯ Benchmarking analysis and performance assessment

  » Performance comparison with other members of a bank's peer group

  » Useful information on areas of strength and weakness in terms of profitability, risk, efficiency, and other performance indicators

  » Assessment of the viability of business models to different macroeconomic and financial market conditions

Open issues for further research

❯ Model validation

  » To test our PG classification across alternative supervised (machine) learning algorithms

❯ Forecasting

  » To develop a forecasting tool to assess the bank's ability to generate adequate profitability compared to its peers, and other business models/peer groups, as a function of the risk factors identified in our panel data framework

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