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

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

Agenda

- Introduction
- 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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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
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
Agenda

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Regulatory framework
Overview of the common SREP framework

- Business model analysis (BMA) is one of the four evaluation 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

Source: EBA, guidelines on common procedure and methodologies, 19 December 2014
## Regulatory framework

### SREP categorisation of institutions

<table>
<thead>
<tr>
<th>Category 1</th>
<th>Global systemically important institutions (G-SIIs)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Other systemically important institutions (O-SIIs)</td>
</tr>
</tbody>
</table>

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

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

<table>
<thead>
<tr>
<th>Category 4</th>
<th>Other institutions</th>
</tr>
</thead>
</table>
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European banks in the 21st century – are their business models sustainable?
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.
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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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.
## Data and methodology

### Identification strategy of Bank Business Models and Peer Groups

- EBA guidelines provide a categorisation of institutions in terms of Systemic relevance, Dimension, Cross-border activity, and Complexity.
- At a microeconomic level, we assume knowledge about characteristics of individual banks is available to the researcher.
- Peer Groups identification with **Supervised Learning**.
- 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**.

### Table: Business Models and Peer Groups

<table>
<thead>
<tr>
<th>Category</th>
<th>Business model 1</th>
<th>Business model 2</th>
<th>Business model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category 1</td>
<td>Peer Group 1</td>
<td>Peer Group 2</td>
<td>…</td>
</tr>
<tr>
<td>Category 2</td>
<td></td>
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<td>Category 3</td>
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<tr>
<td>Category 4</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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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. \( \hat{p}(B_j|BM_i) = \frac{\hat{p}(BM_i|B_j)p(B_j)}{p(BM_i)} \)
- If FMC is performed on a yearly basis, the expected KPI of BBM \( i \) at time \( t \) is given by \( \overline{KPI}_{i,t} = \sum_j KPI_{j,t} \hat{p}(B_j|BM_i) \)
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
## Data and methodology

### Identification of Peer Groups

<table>
<thead>
<tr>
<th>Systemic relevance</th>
<th>Business and Organizational Complexity</th>
</tr>
</thead>
<tbody>
<tr>
<td>As defined by the Financial Stability Board</td>
<td>Combination of two Herfindal indices:</td>
</tr>
<tr>
<td>» FSB’s list of G-SIBs as of November 2015</td>
<td>» HCBL index: concentration of operating income across different business lines; data from banks’ annual report</td>
</tr>
<tr>
<td></td>
<td>» HCCR index: concentration of counterparties’ credit risk exposure as a percentage of total credit risk</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cross border exposure</th>
<th>Specialization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measured by the ratio of credit risk exposure in the home country as a percentage of total credit risk exposure</td>
<td>Measured by the exposure of the bank to sectors other than retail and corporate</td>
</tr>
<tr>
<td>» Data from the EBA/ECB stress test</td>
<td>» Data from the EBA/ECB stress test</td>
</tr>
</tbody>
</table>
Data and methodology

Peer Groups of Retail banks

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

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

Retail non complex
- High
- Low

Retail complex
- High
- Low

Retail non complex domestic
- High
- Low

Retail complex domestic
- High
- Low

Retail non complex internazionalized
- High
- Low

Retail complex internazionalized
- High
- Low
Data and methodology

Peer Groups of Diversified banks

Credit risk exposure vs non retail and non corporate counterparties as % of total credit risk exposure

- diversified and specialized
- diversified and non specialized

high

low
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

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

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

Three Bank Business Models identified in Europe

Bank business models in 2015

Share of BBMs across countries in 2015
% of bank total assets

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

<table>
<thead>
<tr>
<th>Bank Name</th>
<th>2006</th>
<th>2010</th>
<th>2014</th>
<th>2015</th>
<th>prevailing*</th>
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<td>UniCredit SpA</td>
<td>inv</td>
<td>ret</td>
<td>ret</td>
<td>ret</td>
<td>ret</td>
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<tr>
<td>Mediobanca</td>
<td>inv</td>
<td>inv</td>
<td>div</td>
<td>div</td>
<td>inv</td>
</tr>
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<td>ret</td>
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<td>ret</td>
<td>ret</td>
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<td>ret</td>
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<tr>
<td>Banca Popolare di Sondrio SCpA</td>
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<td>ret</td>
<td>ret</td>
<td>ret</td>
<td>ret</td>
</tr>
<tr>
<td>Banca Popolare di Vicenza SpA</td>
<td>ret</td>
<td>ret</td>
<td>ret</td>
<td>div</td>
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<td>ret</td>
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<td>ret</td>
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<tr>
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<td>ret</td>
<td>ret</td>
<td>ret</td>
<td>ret</td>
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<tr>
<td>Banca Monte dei Paschi di Siena SpA</td>
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<td>ret</td>
<td>ret</td>
<td>ret</td>
<td>ret</td>
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<tr>
<td>Credito Emiliano SpA</td>
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<td>div</td>
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<tr>
<td>Banco Popolare Società Cooperativa</td>
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<tr>
<td>Banca popolare dell'Emilia Romagna SC</td>
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<tr>
<td>Unione di Banche Italiane SpA</td>
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<tr>
<td>Iccrea Holding SpA</td>
<td>div</td>
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<td>div</td>
<td>div</td>
<td>div</td>
</tr>
<tr>
<td>Veneto Banca SpA</td>
<td>ret</td>
<td>ret</td>
<td>ret</td>
<td>ret</td>
<td>ret</td>
</tr>
</tbody>
</table>

*prevailing over the period 2006-2015

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

Source: SNL, Prometeia calculations.
### Results

**Fuzzy clustering vs deterministic (hard) clustering - Italian banks**

<table>
<thead>
<tr>
<th>Year</th>
<th>FC</th>
<th>HC</th>
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</thead>
<tbody>
<tr>
<td></td>
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<tr>
<td>2013</td>
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<td>MEDB</td>
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<td>BISP</td>
<td>0.29</td>
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<tr>
<td></td>
<td>BPMI</td>
<td>0.03</td>
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<tr>
<td></td>
<td>BPSO</td>
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<td></td>
<td>BPVI</td>
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<tr>
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<tr>
<td></td>
<td>MPAS</td>
<td>0.21</td>
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<tr>
<td></td>
<td>CDEM</td>
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<tr>
<td></td>
<td>BPOP</td>
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<tr>
<td></td>
<td>BPER</td>
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<tr>
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<td>BUBI</td>
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<td></td>
<td>ICCR</td>
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<tr>
<td></td>
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<td>2014</td>
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<td></td>
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<td>VENB</td>
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<tr>
<td>2015</td>
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<td>0.47</td>
</tr>
<tr>
<td></td>
<td>VENB</td>
<td>0.15</td>
</tr>
</tbody>
</table>

Cluster with higher probability: **retail**, **investment**, **diversified**

Cluster with higher probability ≠ result of hard clustering

Source: SNL, Prometeia calculations.
Results

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

Source: SNL, Prometeia calculations.

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Results

Retail internationalized banks were the best performers in 2014-15

Peer groups’ KPI (2015)

- ROA
- Cost of risk
- Opexpenses/tot-assets
- Tier 1 ratio

Source: SNL, Prometeia calculations. Median values
Results

After 2010 business strategy does not account for differences in RoAs

Difference in ROA across BBMs, pooled regressions*

<table>
<thead>
<tr>
<th></th>
<th>2006-2010</th>
<th>2011-2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>retail vs diversified</td>
<td>n.s.</td>
<td>n.s.</td>
</tr>
<tr>
<td>retail vs investment</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

*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 $t$; $D_{i,t,g}$ 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.
Results
The macro-financial drivers of Retail banks’ RoA

ROA sensitivity to a contemporaneous increase of 1 p.p. of the specified variable - % values

<table>
<thead>
<tr>
<th>Variable</th>
<th>Retail</th>
<th>Non Retail</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eur3m</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slope</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spread</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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.
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

GDP

Eur3m

Slope

Spread

<table>
<thead>
<tr>
<th>Variable</th>
<th>Retail</th>
<th>Non Retail</th>
<th>Retail</th>
<th>Non Retail</th>
<th>Retail</th>
<th>Non Retail</th>
<th>Retail</th>
<th>Non Retail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of risk sensitivity</td>
<td>-7.4</td>
<td>-14.0***</td>
<td>-21.9</td>
<td>-83.0**</td>
<td>-38.2</td>
<td>-103.2**</td>
<td>-144.2</td>
<td>-168.2</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Variable</th>
<th>Retail</th>
<th>Non Retail</th>
<th>Slope</th>
<th>Spread</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP</td>
<td>0.009</td>
<td>-0.002</td>
<td>0.083</td>
<td>0.048</td>
</tr>
<tr>
<td>Eur3m</td>
<td>0.044</td>
<td>-0.006</td>
<td>0.009</td>
<td>0.017</td>
</tr>
<tr>
<td>Slope</td>
<td></td>
<td></td>
<td>0.049</td>
<td></td>
</tr>
<tr>
<td>Spread</td>
<td></td>
<td></td>
<td></td>
<td>0.014</td>
</tr>
</tbody>
</table>

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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Agenda

Introduction

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