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by Stefano Cosma, Riccardo Ferretti, Elisabetta Gualandri, Andrea Landi and Valeria Venturelli

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CEFIN – Centro Studi di Banca e Finanza www.cefin.unimore.it
Dipartimento di Economia Marco Biagi – Università di Modena e Reggio Emilia
Viale Jacopo Berengario 51, 41121 MODENA (Italy)
tel. 39-059.2056711 (Centralino) fax 39-059 205 6927

HOW DOES FINANCIAL MARKET EVALUATE BUSINESS MODELS? EVIDENCE FROM EUROPEAN BANKS

Stefano Cosma[a,c] – Riccardo Ferretti [b,c] – Elisabetta Gualandri [a,c] - Andrea Landi [a,c] – Valeria Venturelli [a,c,*]

Abstract This paper investigates the way in which the financial market defines and evaluates different business models/business mix, using a sample of listed European banking groups, with a total asset value greater than 50 billion US$, for the period 2006-2015. The main results suggest that non-interest components foster market valuation and that financial market seems to associate a better risk-return trade-off to non-banking fees compared to the banking ones. This evidence enables us to identify 3 clusters of European banking groups based on the main components of income. These findings have strategic implications both for bank managers, regulators and supervisors due to the impact of the crisis on banking business, bank profitability and riskiness and the new challenges they entail.

keywords: banking strategies; business mix; market-to book value; panel data; cluster analysis

JEL classification G20; G21

a Department of Economics 'Marco Biagi', University of Modena and Reggio Emilia, Modena, Italy

b Department of Communication and Economics, University of Modena and Reggio Emilia, Modena, Italy

c CEFIN, Centro Studi Banca e Finanza, University of Modena and Reggio Emilia, Modena, Italy

* Corresponding author: valeria.venturelli@unimore.it

1. Introduction

The paper addresses the question of strategic drivers in the banking sector and proposes an innovative approach that aims to understand how and by which measures the different bank business models (BMs) contribute to profitable bank strategies in terms of market evaluation.

The relevance of the topic is due to the impact of the crisis on banking business, bank profitability and riskiness. All these factors have determined new challenges facing banks and regulators.

From the managerial point of view, the crisis has caused a deep revision of banks' strategies and has enhanced their ability to change/adapt both their business mix and the market positioning in the different strategic areas they compete in.

In the years after the outbreak of the crisis, three main drivers have spurred a significant change of banks' strategic plans.

Firstly a new adverse economic context characterized by the combination of slow economic growth with historically low levels of interest rates. Both phenomena depress the perspectives of traditional bank intermediation in so far as they reduce and make riskier the lending activity and, at the same time, squeeze the profit margins on loans-deposits circuit.

Secondly, the re-regulation introduced in the wake of the crisis is determining strategic changes in business models to adapt balance–sheet structures to new regulatory requirements: liquidity, high-quality capital, more stable funding resources and bail-inable debt.

A third driver concerns the structural configuration of the main banking systems which affects the banks' ability to face the increasing technological innovation and its impact on products and distributive channels.

This Darwinian economic context opens to question of which banks are in a better position to emerge and, at the same time, which banks are going to become the victims of the much more competitive arena.

The business model analysis (BMA) has become the conceptual framework used by analysts and regulators in the attempt to individuate the main strategic bank behaviours and their implications in terms of competitiveness and future performance and stability.

As far as banking regulation and supervision are concerned, the interest is testified by the strong focus on BMA embedded in the Supervisory Review and Evaluation Process (SREP); it has also become a key area of the supervisory activity by the Single Supervisory Mechanism (SSM) in the Thematic Review in 2015 and 2016. BMA in banking supervision aims to reveal a bank's key vulnerabilities in the short run and the viability and sustainability of its strategic plans in the short and medium terms. The supervisory assessment not only regards the risks undertaken by each bank and therefore its vulnerability (idiosyncratic risk in a micro-prudential perspective) but also its contribution to systemic risk, in a macro-prudential perspective.

For financial analysts and investors the business model is an important element in the evaluation of banks' ability to create value. In a phase of high financial market volatility and relevant needs of equity capital, it is crucial to understand how the market assesses and evaluates a bank's process of restructuring and its changes of strategies and business mix. As a result, the market evaluation of the viability and sustainability of each bank's business model is an important

element in the management strategic choices that should be considered also as an analytical tool of banking supervisors.

A key issue in BMA is the identification of banks' business model types: which variables and typical characteristics should be considered? Can these variables be clustered into relative homogeneous groups so as to develop a peer analysis aimed at identifying the relative strengths and weaknesses of different business models?

In the last two decades, the business model has become a key managerial concept but still now there is not a widely accepted definition in the economic literature, mainly based on strategic management studies, and some limits and difficulties are evident when applied to the financial sector. Notwithstanding the plurality of definitions, there is consensus in believing that BM offers a useful holistic perspective for understanding not only what businesses do but also how they do it.

In our work we consider business models as the result both of portfolio choices and of strategic abilities to exploit the market positioning in order to create value in the different business areas. The portfolio choices find evidence in the different mix of strategic business areas (SBAs) which reflect how the "first level long-run strategies" (like differentiation, growth, diversification, internationalization) are translated into organizational features of different combinations of product/customers/resources to create and capture value. The strategic abilities embrace the managerial choices that pursue revenue enhancement, cost efficiency, risk management in the different business areas as to capture value from the adopted business mix.

The main research question of the paper concerns the way in which the market defines and evaluates different business models/business mix.

Respect to the previous works, our paper represents one of the first attempt to directly assess the risk/return implications of strategic drivers and of different product mixes implemented by the most relevant European banks. In this paper, we prefer capital market data (price to equity book value) to accounting data, because equity prices are forward-looking and hence better identifiers of prospective performances and risks associated with different strategic choices, and also of intangible values. We use an income composition approach, rather than a balance sheet approach, with a finer classification of the commissions and fees: Banking Commissions - that measure the income from banking and lending related services – and Market Commissions - that measure the income from securities, asset management, insurance and other financial services. Moreover, we use other strategic variables concerning "efficiency and risk strategies" like operating efficiency and risk factors.

These choices enable us to classify European banking groups on the values that the market attributes to the main components of income once we control for the effects on market value of other strategic variables. To our knowledge, this is one of the first study that identifies clusters on the basis of accounting variable adjusted for a market evaluation.

Our sample (proprietary data set) is made up of consolidated accounting data, for the period 2006-2105, of listed European banking groups with a total asset value greater than 50 billion US$ at 2015. The final dataset includes 432 bank-year observations corresponding to 45 bank holding companies (BHCs) belonging to 14 countries. We select 30 banks from 9 countries in the Euro area, accounting for around 70% of the EMU's total banking assets, plus 15 Non-EMU

banking groups. Italy and Spain account for the majority of banks in the sample, given the fragmentation of their banking system.

The main result is that non-interest components are the main determinants of the difference between accounting and market valuation. Disentangling the components of net fees and commission income reveals that financial market associates a better risk-return trade-off to non-banking fees and commissions, compared to the banking ones. Moreover, as expected, financial market negatively reacts to an increase in the level of operating expenses, of the cost of credit and of the degree of systemic risk. Our major empirical findings remain qualitatively unchanged even considering price to equity book value measured at different time interval.

These results have then been used in order to define the weight of the different business mixes at market value; this exercise enables us to identify 3 business models, using cluster analysis methodology. The different clusters do not show significant differences in terms of performance measure, with two principal exceptions. On one hand, risk return profile is higher for "Market oriented banks" while the probability of default, proxied by the Zscore, is higher for "Retail banks" group which encloses banks more linked to traditional banking business. The second cluster, "Retail diversified", stands between the other two groups.

The paper is structured as follows. Section 2 reviews the theoretical and empirical literature on Banking Business Model (BBM) by drawing on the main concepts adopted in the strategic management literature. Section 3 presents the econometric methodology and the data used. Section 4 describes the results. Finally, Section 5 concludes.

2. Literature Review

Evolving market conditions, technological innovations, regulatory changes, and current monetary policy stance challenge the sustainability of banks' business models. The business model question is increasingly grabbing the attention of bank managers, regulators, investors and financial analysts. The need to use the business model concept as a tool for analyzing the bank's performance and assessing its viability asks, first of all, for a clear understanding of what business model means, since the existing literature does not offer a uniform picture (Klang et al., 2014).

We start by drawing on the strategic management studies to deepen and specify the concepts of corporate strategy, business strategy and business model (Zott et al., 2011).

In the strategic management studies, strategy, recognised as the foundation of competitive advantage and value creation (Porter, 1996), involves two levels of execution: corporate (what) and business (how). Corporate strategy (Ansoff, 1965) delineates the amplitude and diversification of the company's business portfolio in terms of Strategic Business Areas (SBAs); it is the set of high-order (first level) long-run choices such as growth, size, governance structures, diversification, internationalization. It answers the question as to where we have to compete. Business strategy (second level) identifies how to achieve the competitive advantage in each SBA.

A systemic perspective positions the BM closely to the strategy. It can be defined as the concrete choices that derive from actual combination of corporate/business strategies (Mottura, 2011) and from the several involved activities and economic levers (price variables, control of

costs, customer segments, quality, distribution channels, relationship degree, technology, productive processes, etc.).

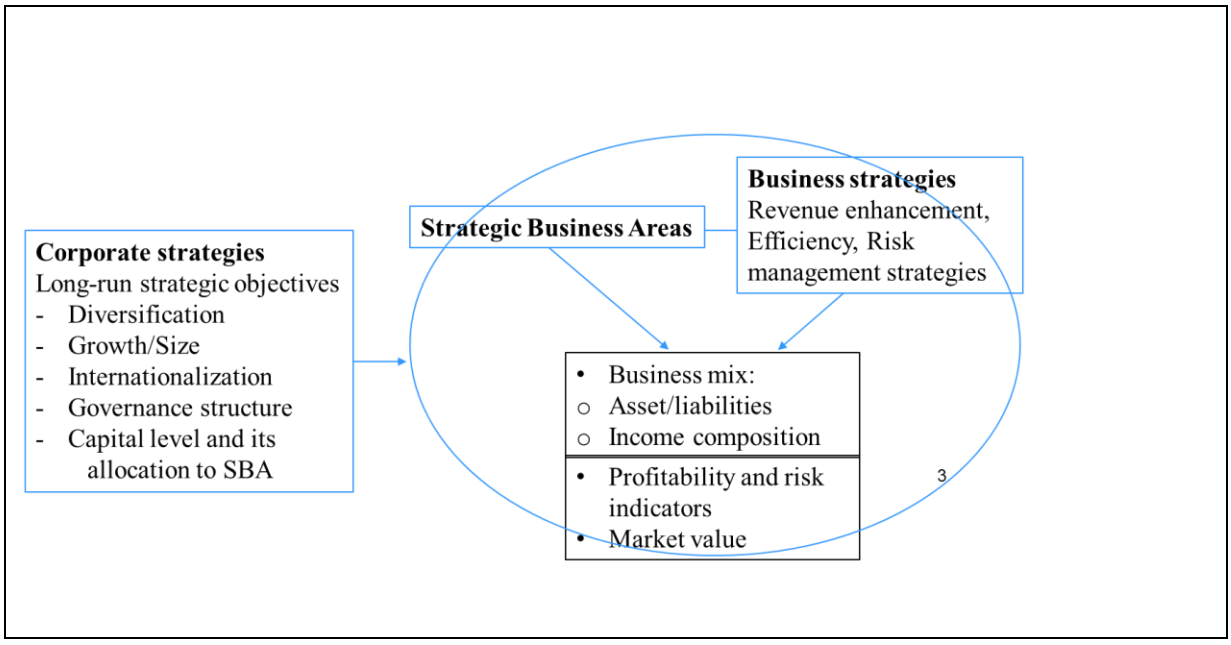
This approach provides the rationale for connecting the key company strategic choices to their main consequences. BM is the representation of a subset of key realized choices and of their main consequences, put in relationship by the theory. Choosing a particular BM (policies, assets and governance) means choosing a particular way to operate, to create and to capture value for the firm's stakeholders. Strategic choices set up the business model. Therefore, business model is not the strategy but is the direct result of a firm's realized strategy (Casadesus-Masanell and Ricart 2010).

This theoretical framework guides our review of the Banking Business Model (BBM) literature. In banking, corporate strategy (what) leads to SBAs choices reflected in the business mix (asset & liability composition and income composition), while business strategy (how) relates to the management of revenues, efficiency, and risk in each SBA. Business mix and business strategy are the components of the BM and the factors affecting performance indicators (profitability, risk levels, market value).

Both long-run and business strategies are affected by the macroeconomic, competitive and regulatory variables. These context variables have ex ante effects on bank strategies and their BM in so far as they condition the hypothesis the strategic plans are based on. Ex post they directly affect the way in which the business strategies reach the targeted results.

In Figure 1 we show the different strategic levels through which we represent the Business Model concept. This scheme allows us to classify the main contributions to BBM literature underlining how the different approaches focus on a different identification of strategic variables.

Fig. 1 Bank Business models' strategic components



A first classification of the literature concerns the different emphasis set on the identification of bank peer groups characterized by similar business models. Several studies follow the strategic group literature and aim at finding evidence of how banking industry can be classified into few different bank BMs that display different performance with respect to economic and financial context. This approach is based on a distinction of *what* the bank is doing (proxied by asset/liabilities and/or income composition), from *how* the bank is doing it (revenue enhancement, efficiency and risk management strategies), so that the BM concept overlaps with the business mix, whereas other strategic variables (revenues, efficiency, and risk strategies) are implicitly regarded and evaluated as outcomes of portfolio choices. This BM definition can lead to attribute to the business mix the performance results and obscure the role played by the ability of the bank in managing the single business area.

This approach can be traced down in Ayadi and de Groen (2015) and Ayadi et al. (2016) contributions. Following the pioneering work of Passmore (1985) and Amel and Rhoades (1988) these authors employ a two stage procedure for the BM analysis of European banks. The first step adopts the cluster analysis to identify the bank groups on the base of asset and liability composition. Then, they evaluate how the bank clusters perform with respect to a very broad set of indicators concerning both performance results and strategic behaviours like risk exposure, loan growth, internationalization. Roengpitya et al. (2014) use the cluster algorithm, along with the adoption of some judgmental criteria and balance sheet ratios to classify the BMs of a large sample of listed and non-listed banks from 34 countries.

De Meo et al. (2016) adopt an original fuzzy clustering technique based on a broad set of asset/liability mix indicators of listed and non-listed European banks (77 for 15 countries) for the period 2006-14. They individuate three main clusters of banks: Retail, Diversified, Investment banks. Then each group has been split according to four EBA classification criteria (systemic relevance, dimension, organizational complexity, cross border activity) considered by the authors as attributes of strategic choices.

The specificity of bank strategies is the focus of Mergaert and Vennet (2016) analysis. They define the BM in terms of the strategic variables that reflect the long-term choices of management (latent strategies) related to assets and liabilities composition, capitalization, income structure and bank's risk profile. The common variance of these variables are the factors that define two broad BBMs: retail and diversified. The authors underline the graduation of these models and use the common factor analysis to evaluate both how these long-run strategies are implemented and their impact on performance.

A different approach to the grouping of European bank is employed by Bonaccorsi et al. (2016). They classify 112 significant European banks following a step procedure based on *a priori* threshold values of balance sheet parameters like size, lending propensity, international credit exposure.

A second stream of the BM literature in banking relies on a wide definition of BM that combines corporate and business strategies with context variables. According to our scheme this approach has the merit of considering many strategic aspects of a BM even if these studies often fail to make a clear distinction between long-run strategies, business mix and business strategies. The primary aim of this approach is the identification of which BM variables affect the banks vulnerability, reflecting the supervisors' concerns for the consequences of bank strategies on default events. This approach characterizes the work of Altunbas et al. (2011) who use a broad

set of bank characteristics to individuate BMs. Three risk measures of a large sample of European and US banks are regressed on some groups of indicators, collected in the pre-crisis period that should denote different banks' BMs: asset, funding and income structure variables along with indicators like loan growth, capital ratio, total asset and a number of variables that account for major macroeconomic and institutional factors. Therefore their definition of BM includes business mix variables along with some other strategic variables concerning growth, capitalization and size. Köhler (2014) follows a similar approach relating the Z-logscore to some business mix and loan growth variables for a large sample of European banks. In Köhler (2015) the same risk indicator is regressed on two main business mix variables (non-interest income share and non-deposit funding as a fraction of total asset) and then integrated with many other control variables. The approach is similar to that adopted by Demirguc-Kunt and Huizinga (2010) for an international sample of 1,334 banks in 101 countries leading up to the 2008 financial crisis.

2.1. Novelty of our contribution

With respect to the current BM literature our paper presents some significant differences. Firstly, we estimate the performance of different banks' BMs in terms of market value instead of using accounting performance data. Following Baele et al. (2007) and Calomiris and Nissim (2014), we believe that equity prices are forward-looking and hence better identifiers of prospective profitability and risks of the different strategic choices. By taking into account the banks' intangible assets, associated to relationship banking and bank's reputation, the market analysts evaluate the qualitative information and the strategic drivers of specific bank performance (Chen et al., 2014).

Secondly, the estimation of the effect of BMs on banks' Price to book values is based on a definition of BM which includes the business mix variables (proxied by income components) and other strategic variables concerning "efficiency and risk strategies" like operating efficiency, risk behaviour (Beta and loan loss provisions). By keeping separated the business mix variables from the other ones, we estimate how the market evaluates the different business components and, as a second step, we use the estimated market value of these business components to individuate cluster of banks. The novelty of our approach is the classification of bank groups based on the values that the market attributes to the main components of income once we take into account the effects on market value of other strategic variables. To our knowledge, this is one of the first study that identify clusters on the basis of accounting variables adjusted for market value.

As already outlined, in our study the business mix is proxied by the income composition. We prefer the income approach to the balance sheet composition as the former captures in a finer way the important bank service activity. By focusing on a sample of large banks we are able to propose a finer classification of the net fees and commissions income. We distinguish the Banking Commissions, that measure the income from banking and lending related services, from the Market Commissions that measure the income from asset management, insurance and other financial services. We are aware that income variables reflect product/customer combinations but also incorporate the bank pricing policies. According to our scheme these policies should belong to the strategic variables that explain how the bank is effective and efficient in delivering products and values to customers. By taking into account the high level of price competition in the banking markets and the precious informative content of income variables (whose values reflect the different types of products and segment of customers) we

believe that the last ones are more suited to capture the contribution of business mix to the bank value.

3. Methodology and data

3.1. Data

The bank sample is made up of 45 banking groups belonging to fourteen European countries. The composition of the sample by country is provided in the appendix [Table A.1]. We have only considered consolidated data of listed European banking groups with a total asset value greater than 50 billion US$ at 2015.

Bank-level data come from the annual balance sheet. We exclude banks with missing data on basic accounting variables, including assets, loans, deposits, equity, interest income, non-interest income and commissions. We use the last ten years of data, 2006–2015. The starting date is 2006 because that is the first year when the different countries report accounting data based on IAS/IFRS. Stock price data are collected from Thomson Reuters Datastream.

The final dataset includes 432 bank-year observations corresponding, in the last year 2015 to 45 bank holding companies (BHCs) belonging to 14 countries. We select 30 banks from 9 countries in the Euro area, accounting for around 70% of the EMU's total banking assets[1], plus 15 Non-EMU banking groups. Italy and Spain account for the majority of banks in the sample, given the fragmentation of their banking system.

Differently from other studies (DeYoung and Roland, 2001; Chiorazzo et al., 2008) we analyze the bank BM using consolidated accounting data. This latter choice is of particular importance for several reasons: on the one hand banks tend to reserve the making of non traditional innovative activities to non-banking subsidiaries whose contribution can be more precisely evaluated if consolidated financial statements are available; moreover, financial holding company represents the relevant unit of observation for regulators on extremly important topic such as the level of systemic risk (Stiroh and Rumble, 2006).

3.2. Measure of banks' business mix

To determine the results of choices concerning bank business mix, asset-based measure and/or income-based indicator can be used. Ideally to measure the array of bank activities, detailed data on the degree to which each bank underwrites, operates mutual funds, insurance, etc. should be used. The available dataset do not provide information with this type of detailed information on the different type of activities engaged. So several authors construct revenue based measure that suffers some measurement problems (Laeven and Levine 2007). In fact, loans and in general more traditional activities can yield fee income; in this way the income-based measures that do not disentagle the different fee and commission components could overestimate the degree to which some lending institutions engage in non-lending activities. For instance, DeYoung and Rice (2004) show that payment services linked to traditional banking activities are the largest source of non-interest income for U.S. banks. Brighi and Venturelli (2014, 2016) find similar results for Italian BHCs.

[1] 2014 figures.

In line with our research question, we construct several business mix measures detailed in the remainder of the section.

The first type of business mix analysed is the one related to the diversification across different sources of income. Traditionally in literature (Stiroh, 2004, 2006a, 2006b; Lepetit et al., 2008) one way to capture the degree of diversification of bank activities is to consider the net interest income generated by traditional activities and non-interest income produced by non-traditional ones. To account for diversification between major activities, we consider on the one hand the ratio between net interest margin over equity book value (INT) and on the other the ratio between net commission and trading income over equity book value (NON).

The second set of indicators relate to the diversification between different sources of non interest income. Following the seminal work of DeYoung and Roland (2001), Stiroh (2004), Mercieca et al. (2007) and Lepetit et al. (2008) to allow for deeper insights, we have first of all to distinguish the principal components of non-interest income. Two main components have been identified: net fees and commission (COMM) on the one hand and the net results from trading activities (TRAD) on the other.

The third step is to verify the degree of diversification within the commission revenues. To mitigate the overestimation problem we disaggregate fee income in relation to the type of activities developed. In particular, we divide net fees and commission revenue along two principal dimensions:

- Banking Commissions (BANK), that comprise commission income from guaranties given, lending related, collection and payment services, services related to factoring, tax collection services, current accounts management and other services;
- Market Commissions (MKT), fee and commission revenue from credit derivatives, trading operations in financial instruments and foreign exchange, custody and administration of securities, underwriting operations, servicing related to securitization, placement of securities, financial structure consultancy service, fees from portfolio management services, depositary bank services, investment consultancy service and from the distribution of third party products and services;

To our purpose, the variable total net fees and commission income (COMM) is the sum of Banking and Market commission. This disaggregation enable us to identify a more precise measure of the traditional banking business. To this end, banking commission have been first of all added to net interest margin in order to define the variable ADJ_INT = INT + BANK.

All variables are computed as the fraction over the equity book value and trimmed at the 1% level.

3.3. Market based and accountancy performance measures

Market based performance is measured in terms of Price to book value (PBV). This indicator is used in the first part of the analysis when we evaluate how the market values the business mix and the other strategic variables.

Several alternative proxies of bank accountancy performance are employed when we compare the performance of the bank clusters: the return on average equity (ROAE) defined as the ratio of net profits to total average equity, the return on average assets (ROAA) defined as the ratio of net profits to total average assets. To adjust this last measure for risk (volatility), following

Stiroh (2004) and Chiorazzo et al. (2008) we compute the ratio between the annual ROA and its standard deviation calculated over the entire sample period. $SHROA_{i,t}$ indicates risk-adjusted returns, for the bank *i* in the year *t*. Analytically:

$$SHROA_{i,t} = \frac{ROA_{i,t}}{\sigma ROA_i}$$

Finally as in Stiroh (2004) we introduce a proxy for insolvency risk computed in terms of the Z-score. The Z-Score measures by how many standard deviations a firm is away from insolvency. A higher Z-Score indicates improved risk-adjusted performance; in other words, higher values of Z-score imply lower probabilities of failure. Analytically:

$$Z\text{-}score_{i,t} = \frac{\left(ROA_{i,t} + \frac{E_{i,t}}{TA_{i,t}} \right)}{\sigma ROA_i}$$

where E/TA is the equity-to-total asset ratio (equity capital divided by total assets).

3.4. Efficency,risk and other variables

To proxy bank's credit quality we use the ratio Loan loss provision over equity book value (LLP).

To measure the effect of efficiency on bank profitability (COST) we introduce in the analysis the ratio of operating expenses over book value. The variable operating expenses is computed as the sum between personnel expenses and other administrative expenses.

As a proxy for bank risk and leverage we use the variable Beta (BETA). The BETA of each bank is obtained by estimating, with the OLS method, the market model. More precisely, the BETA of bank *j* for the year *t* is estimated using daily returns in local currency of the bank *j* in year *t*. The returns of the market portfolio are those of the S & P 100 E GLOBAL - PRICE INDEX in Euros.

Processing the R^2 of these regressions, we also build another variable named INTERNATIONALIZATION. In detail, the INTERNATIONALIZATION index of bank *j* in year *t* is the difference between the R^2 of the market model of the bank *j* in year *t* and the average R^2 in year *t* computed for the entire sample of banks in the year. Higher values signal higher degree internationalization. Also this variable is employed when we compare the performance of the bank clusters.

To catch the effect of the financial and sovereign debt crisis two structural break dummies are introduced. To account for the consequences from financial crisis we insert a dummy variable CRISIS_FIN equals to one for the years 2008 and 2009 and equals to zero otherwise; to account for the consequences from government debt crisis we insert a dummy variable CRISIS_GOV equals to one for the years 2010, 2011 and 2012 and equals to zero. otherwise.

To control for the country effect, two country dummy variables are included in the analysis: EURO_CORE equals to one for France, Germany, Ireland, Belgium and Austria and equals to zero otherwise; EURO_NON_CORE equals to one for Spain, Italy and Portugal.

3.5. Empirical methodology

The approach is based on the panel data random effect model[2] between the market-to-book ratio (our dependent variable) and proxies for bank activities, which are based on measures derived from accounting variables. We are able to capture how a greater focus on the traditional business, captured by net interest income, for instance, affects the bank's market value.

We use the econometric models shown to examine the link between market performance and the business mix. In particular:

$$y_{i,t} = \alpha_{i,t} + \beta_1 INT_{i,t} + \beta_2 NON_{i,t} + \sum_{s=3}^{5} \beta_s \lambda_{i,t} + \varepsilon_{i,t} \quad (1)$$

$$y_{i,t} = \alpha_{i,t} + \beta_1 INT_{i,t} + \beta_2 COMM_{i,t} + \beta_3 TRAD_{i,t} + \sum_{s=4}^{6} \beta_s \lambda_{i,t} + \varepsilon_{i,t} \quad (2)$$

$$y_{i,t} = \alpha_{i,t} + \beta_1 INT_{i,t} + \beta_2 BANK_{i,t} + \beta_3 MKT_{i,t} + \beta_4 TRAD_{i,t} + \sum_{s=5}^{7} \beta_s \lambda_{i,t} + \varepsilon_{i,t} \quad (3)$$

$$y_{i,t} = \alpha_{i,t} + \beta_1 ADJ\_INT_{i,t} + \beta_2 MKT_{i,t} + \beta_3 TRAD_{i,t} + \sum_{s=4}^{6} \beta_s \lambda_{i,t} + \varepsilon_{i,t} \quad (4)$$

$$y_{i,t} = \alpha_{i,t} + \beta_1 ADJ\_INT_{i,t} + \beta_2 MKT_{i,t} + \beta_3 TRAD_{i,t} + \sum_{s=4}^{6} \beta_s \lambda_{i,t} + \sum_{s=7}^{8} \beta_s crisis_t + \varepsilon_{i,t} \quad (5)$$

$$y_{i,t} = \alpha_{i,t} + \beta_1 ADJ\_INT_{i,t} + \beta_2 MKT_{i,t} + \beta_3 TRAD_{i,t} + \sum_{s=4}^{6} \beta_s \lambda_{i,t} + \sum_{s=7}^{8} \beta_s crisis_t + \sum_{s=9}^{10} \beta_s country_i + \varepsilon_{i,t} \quad (6)$$

where *i* identifies the individual bank-observation belonging to the sample (*i = 1, 2, 3,...,45*); *t* expresses the time variable (*t = 2006,..., 2015*); βs are the parameters to be estimated, λ is a matrix of efficiency and risk variables. Both the constant and the error terms are also indicated in the model.

INT is the ratio between net interest income over equity book value, NON is the ratio between non traditional revenues (BANK, MKT, TRAD) over equity book value, COMM is the ratio between net commission income computed as the sum of banking (BANK) and market (MKT) commission – over equity book value. TRAD is the ratio of trading profit, BANK is the ratio of banking commission, MKT is the ratio of market commission and finally ADJ_INT is the ratio of net interest margin adjusted for banking commission (INT+BANK), all variables computed as the fraction over the equity book value.

The other variables control for factors, related to the efficiency and risk sphere, potentially affecting the market valuation.

[2] We tested for our final regression specifications whether FE or RE was to be preferred (using both the Hausman specification test and the Breusch Pagan Lagrangian multiplier test). The result show that the individual effects (μi) were in most cases not significantly correlated with the explanatory variables, so that random effects was the best way to model bank level specificities. De Haas and Van Lelyveld. (2006) and Fries et al. (2002) conclude the same.

Results of Model 6 have been then used in order to define the weight of the different business mixes at market value. The variables that describe the banks' business mix are ADJ_INT, MKT, TRAD. For each of the three variables, we first compute for each bank the average over the time span; then we multiply the average for the coefficient of the panel model. Then, for each bank in the sample, we express the weight on base 100 in order to define an income composition at market value.

Once defined the weight of the different lines of income at market value, we use them in order to identify business models, using cluster analysis methodology. As in Ayadi and de Groen (2016), we use Ward's cluster analysis technique (Ward, 1963) which is an agglomerative hierarchical clustering method that forms clusters on the basis of minimising within group variance[3]. In fact, this approach forms data into clusters around a centroid, or mean. The distance between the actual observations and this centroid is the within-group variation of the cluster. Ward's method seeks to minimize the ratio of within-group variation to between-group variation, that is, the squared Euclidean distances between the centroids of the various clusters. The procedure form partitions in a hierarchical manner starting form the largest number of clusters possible and merging clusters by minimizing the within-cluster sum-of-squared-errors for any given number of clusters.

Moreover, to diagnose the appropriate number of clusters, Calinski and Harabasz's (1974) pseudo F-index, was used. This stopping rule is a sample estimate of the ratio of between-cluster variance to within-cluster variance. The configuration with the greatest pseudo-F value was chosen as the most distinct clustering.

A list of the variable used is presented in Table 1.

[Table 1 around here]

4. Empirical Results

4.1. Descriptive statistics

Table 2 reports the descriptive statistics for the sample of European BHCs. These banks are quite varied with mean average assets of € 557 billion that range from € 22 billion to € 2,590 billion. UK and French banks are the largest, with an average total assets of billion € 1,320 and 1,070 respectively. Our sample includes both low and high performing BHCs both in terms of market and accounting measures; the mean PBV is 1.06 and the median is 0.86. The mean ROAA is 0.35%, with a median of 0.39%.

As for business mix measures are concerned, the average (mean) bank generated 63.9% of its revenues from net interest income, 27.2% from net fees and commission income and 8.4% from trading profit. The composition of net fees and commission income shows a nearly equal contributions of BANK (47.7%) and MKT (52.2%) commissions; this result testifies to the relevance of fees and commissions linked to traditional banking business. Therefore banking

[3] For a discussion of the various methods of cluster analysis, see Lehmann et al. (1998).

commissions, when added to net interest income, represent on average the 76.9% of the total operating income.

[Table 2 around here]

4.2. Multivariate Analysis

The hypothesised existence of a positive relationship between market performance and different business mixes, aims to understand how and by which measures the bank business mixes contribute to profitable bank strategies in terms of market valuation proxied by price to equity book value (Table 3).

The main result is that especially non-interest components foster market valuation (column 1). When we control for the different components of non-interest income a clearer picture emerges. Trading profit (columns 2-6) and market commissions (columns 3-6) have a statistically significant effect and the latter impact more on price to equity book value than banking ones (column 3).

The disaggregation of the net fees and commission income introduced in the present contribution seems to represent a critical step in the understanding of how the financial market evaluates the different banks' business mix. Our results suggest that financial market seems to associate to market fees and commissions, compared to the banking ones a higher value creation (i.e.: better risk-return trade-off).

Turning to the variables more linked to efficiency and risk factors, all of them produce results consistent with our expectations. The market negatively reacts to an increase in the level of operating expenses, of the cost of credit and of the degree of systemic risk (Table 3, columns 1-6). These results enable also to appreciate the choice of market value as dependent variable. In fact, Price-to-equity-book value captures directly both forward-looking market expectations and return and risk features of the different strategies as testified by the significance of the risk factors (Beta and LLP). Differently from the more consolidated literature that puts into relation business model characteristics and risk, introducing risk as a dependent variable (see Altunbas et al. 2011; Bonaccorsi et al. 2016), the choice to use market value enable us to explicit and directly count for the risk dimension.

The negative and statistical significant sign for the dummy break variables suggests that both crisis, as expected, unequivocally negatively impact bank market value and that sovereign debt crisis hits more than financial one, Turning to the country effect, the negative sign of the two country dummy variables signal that banks belonging to the euro area have testified a stronger reduction in market value than banks located outside euro area (United Kingdom, Sweden, Switzerland, Denmark and Poland).

[Table 3 around here]

Results of Model 6 have been then used in order to define the weight of the different business mixes at market value. Once defined the weight of the different lines of income, we use them in order to identify business models, using cluster analysis methodology.

Applying Calinski and Harabasz's (1974) pseudo F-index (Table 4), we identify 3 clusters.

[Table 4 around here]

Cluster characteristics can be easily summarised with a radar plot (Figure 1). Cluster 3, made up of 8 banks[4], includes banks "Market oriented" with the highest incidence of market commissions and trading profits and the lowest rate of adjust net interest income; these are banks for which a considerable proportion of the income is raised from non-traditional activities that represent the largest share of profits. Cluster 1, made up of 16 banks[5], includes banks with the highest incidence of net interest income and banking commissions and the lowest share of market commission (Retail banks). The second cluster stands between the other two groups. It is composed by 21 banks[6] "Retail diversified" that show a higher incidence of market commissions than cluster 1 but lower than cluster 3, and a lower ratio of net interest income and banking commission than cluster 1 but higher than cluster 3. In Table 5 we summarize the principal characteristics of the groups identified.

[Table 5 around here]

Cluster 3 is characterised by the highest ratio of operating costs on equity book value, confirmed also by the highest cost to income ratio, and by the lowest cost of credit risk. These are banks characterised also by the highest degree of internazionalisation.

The different clusters do not show significant differences in terms of performance measure, with two principal exceptions. On the one hand, the risk-adjusted performance measure is higher for Cluster 3 as testified by the highest SHROAA while, on the other hand, the probability of default, proxied by the Zscore, is higher for Cluster 1 which encloses banks more linked to traditional banking business.

From the perspective of the efficiency and risk strategies (our second level of BM definition, that is the managerial choices that pursue revenue enhancement, cost efficiency, risk

[4] Crédit Industriel et Commercial SA – CIC; Credit Suisse Group AG; Deutsche Bank AG; Julius Baer Group Ltd; Natixis SA; Skandinaviska Enskilda Banken AB; Société Générale SA; UBS Group AG

[5] Aareal Bank AG; Allied Irish Banks plc; Banca popolare dell'Emilia Romagna; Banco Bilbao Vizcaya Argentaria SA; Banco Comercial Português, SA-Millennium bcp; Banco de Sabadell SA; Banco Popular Espanol SA; Barclays Plc; Caixabank, S.A.; Danske Bank A/S; Deutsche Postbank AG; Erste Group Bank AG; Lloyds Banking Group Plc; Powszechna Kasa Oszczednosci Bank Polski SA - PKO BP SA; Raiffeisen Bank International AG; Royal Bank of Scotland Group Plc (The)

[6] Banca Monte dei Paschi di Siena SpA-Gruppo Monte dei Paschi di Siena; Banca Popolare di Milano SCaRL; Banco Popolare - Società Cooperativa-Banco Popolare; Banco Santander SA; Bankia; Bankinter SA; BNP Paribas; Commerzbank AG; Crédit Agricole S.A.;HSBC Holdings Plc; ING Groep NV; Intesa Sanpaolo; Jyske Bank A/S (Group); KBC Groep NV/ KBC Groupe SA-KBC Group; Mediobanca SpA-MEDIOBANCA - Banca di Credito Finanziario Società per Azioni; Nordea Bank AB (publ); Standard Chartered Plc; Svenska Handelsbanken; Swedbank AB; UniCredit SpA; Unione di Banche Italiane Scpa-UBI Banca

management in the different business areas to capture value from the adopted business mix), the clustering based on the business mix reveals differences in all our measures of efficiency and risk (operating costs, internationalization, credit risk), except beta. This means that the bank's systematic risk, and consequently its cost of equity capital, does not depend on the business mix only. Therefore, the way in which the business mix is managed seems to be relevant especially for the non-diversifiable risk profile of the bank.

4.3. Robustness checks

In this section, we investigate the likely impact of different measures of bank market performance.

At this purpose, we re-run our baseline Model (Model 6) changing the definition of PBV employed. We use PBV measured at subsequent periods of time (Table 6). In column 1, we use year-end PBV for year *t* as in Table 3; in the subsequent columns (2-6) we use PBV computed respectively at the end of January, at the end of February, at the end of March, at the end of April and at the end of May of year *t+1*. The adjustment aims to control for the date at which the accounting data enter into the market information set. In this sense, the end of the year stock prices may not fully reflect the value implications of annual report information. While generally financial statements are approved by the shareholders meetings between the months of April and May; it is also true that the boards of directors approve the financial statement proposals in previous months, between February and March, and simultaneously they disclose key data. Even before this disclosure, the investors deal with analysts' estimates centered on up to date information. So it is quite possible that on the one hand at the end of the year *t*, the market capitalization already reflects the year *t* accounting information as, on the other, that the value implications of annual report information on stock prices follow a slower process. Following Calomiris and Nissim (2014), to control for this potential bias and avoid the distorting effects of any capital increases or other extraordinary operations, the market cap of the months from January to May of the year *t+1* is computed multiplying the end-of-year market value by one plus the cumulative stock return till the reference date.

[Table 6 around here]

As can be seen in Table 6 also considering PBV measured at different time interval, our major empirical findings remain qualitatively unchanged with the exception of Beta that loses its statistical significance.

5. Conclusions

This paper empirically investigates the way in which the financial market defines and evaluates different business models/business mix, using a sample of 45 relevant listed European banking groups, in the period 2006-2015.

We define business models as the result both of portfolio choices and of strategic abilities to exploit the market positioning in order to create value in the different business areas. The portfolio choices find evidence in the different mix of strategic business areas (SBAs) and are

proxied by the different business mix composition or the different income components. Strategic abilities embrace the managerial choices that pursue revenue enhancement, cost efficiency, risk management in the different business areas as to capture value from the adopted business mix and are proxied by efficiency and risk factors included in the empirical specification.

These choices enable us to classify European banking groups based on the values that the market attributes to the main components of income once we control for the effects on market value of other strategic variables.

The main results suggest that non interest components foster market valuation and that financial market seems to associate to non banking fees and commissions, compared to the banking ones (i.e.: better risk-return trade-off). Moreover, as expected, financial market negatively reacts to an increase in the level of operating expenses, of the cost of credit and of the degree of systemic risk. Our major empirical findings remain qualitatively unchanged even considering price to equity book value measured at different time interval.

This evidence enable us to identify 3 cluster of European banking groups based on the values that the market attributes to the main components of income. The different clusters do not show significant differences in terms of performance measure, with two principal exceptions: risk return profile is higher for "Market oriented banks" while the probability of default, proxied by the Z-score, is higher for "Retail banks" group which encloses banks more linked to traditional banking business. The second cluster, "Retail diversified", stands between the other two groups.

These findings solicit some interesting considerations also in terms of policy implications.

First of all, our study contributes to define the concept of BM and stresses that BM includes not only strategic variables related to the asset mix composition but also efficiency and risk variables that most contribute to shareholders' and customers' value. Given this, it is necessary to deepen and to analyze the nexus between these variables to understand the strategic decisions interdependencies and their connection with banks performance.

Our analysis suggest that financial market seems to associate a better risk-return trade-off to market-oriented banks. This result is not only linked to the more intense trading activities developed by these banks but to the wide and articulated range of services related to custody and administration of securities, to underwriting operations, to portfolio management and advisory service. Although it is a bunch of activities with a high incidence of operating costs, it allows to achieve a level of revenues that is reflected in a higher market value. The conclusions of our work on this topic are not in line with the prevalent literature on bank diversification that indicates that the higher revenues linked to security activities are more than offset by the higher level of risk associated to this market activity (Mercieca et al. 2007, Lepetit et al. 2008, Baele et al. 2007, Stiroh and Rumble, 2006).

From the point of view of the banking supervision, business model analysis (BMA) embedded in the SREP should take into consideration capital market data since equity prices are forward-looking and hence better identifiers of prospective performance and risks associated with different strategic choices. Our study shows how the different variables that affect BM are associated to different market values. Since SREP exercise is developed also in order to evaluate the bank capital adequacy, the point of view of the market should not be ignored.

The last consideration is associated to the theme of information disclosure. As underlined before, from the shareholder point of view, the banking business model is an important element in the evaluation of banks' ability to create value. This valuation is strictly connected to the type, amount and quality of information disclosed.

In the most consolidated literature on bank diversification, one way to capture the degree of diversification of bank activities is to consider net interest income generated by traditional activities and non-interest income produced by non-traditional ones in aggregate term or at best, distinguishing the two principal components of non-interest income: commission and fee revenue on the one hand and the net results of financial operations on the other. The aggregate analysis of the net fee and commission income does not allow for their allocation to the various areas of banking activity. In the recent literature on banks' BM a classification of business activities based on the composition of the balance sheet assets and liabilities prevails in order to overcome the limitations associated to aggregate income measures.

We overcome the limitations associated to aggregate income measures by identifying those banks that provide detailed data on fees and commission income. In fact, our study deals with the main European banks for several reasons: because of their systemic importance, for their greater articulation by business segments and last but not least for the deeper and more detailed disclosure of balance sheet information provided. This type of informational disclosure enable us to disaggregate fee income in relation to the type of activity developed. Based on this breakdown, our study allows to distinguish the market value created from services more linked to traditional banking business from those associated to financial markets.

To conclude, our contribution also shows the importance of disclosure and the need to harmonize, among the different European countries, the reported breakdown of the different sources of income. A finer classification of the net fees and commission components is essential since they stem from activities materially different one from the other and given their growing role in the formation of operating income and in conditioning bank performance.

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Table 1 Variables names and definitions

Name	Definition
PBV	Market price to equity book value
INT	Net interest income over equity book value
ADJ_INT	Net interest income over equity book value + Banking commission over equity book value
COMM	Banking commission over equity book value + Market commission over equity book value
BANK	Banking commission over equity book value
MKT	Market commission over equity book value
TRAD	Trading profit over equity book value
NON	Non-interest income [COMM+TRAD] over equity book value
TOP	Total operating income [INT+COMM+TRAD] over equity book value
COST	Total operating expenses [Personnel and other administrative expenses] over equity book value
LLP	Loan loss provisions over equity book value
BETA	Systemic risk
ROAE	Net results from ordinary activity over total average equity
ROAA	Net results from ordinary activity over total average asset
SHROA	Annual ROA over its standard deviation calculated over the entire sample period
Z-SCORE	$Z-score_{i,t} = \frac{\left(ROA_{i,t} + \frac{E_{i,t}}{TA_{i,t}}\right)}{\sigma ROA_i}$
COST-INCOME	Total operating expenses over intermediation margin
TA	Total asset (euro mln)

Table 2 Summary statistics for all banks in the sample, on average over the period 2006-2015

	Obs	mean	min	p25	p50	p75	max	sd
Performance Measure								
PBV	424	1.06	0.19	0.56	0.86	1.36	3.57	0.65
ROAA	424	0.35	-1.94	0.14	0.39	0.64	2.11	0.57
SHROA	423	1.22	-2.15	0.33	1.07	2.09	5.21	1.41
Z-SCORE	424	17.53	1.25	10.59	15.05	23.92	49.35	9.35
Business Mix								
INT/BV	424	0.271	0.089	0.205	0.253	0.325	0.761	0.095
ADJ_INT/BV	423	0.328	0.111	0.242	0.303	0.386	0.929	0.125
NON/BV	424	0.163	-0.118	0.098	0.144	0.193	0.612	0.102
COMM/BV	427	0.120	0.000	0.078	0.109	0.151	0.332	0.062
BANK/BV	423	0.040	-0.245	0.010	0.033	0.058	0.356	0.066
MKT/BV	423	0.064	-0.001	0.033	0.052	0.082	0.287	0.054
TRAD/BV	427	0.056	0.000	0.031	0.046	0.072	0.210	0.043
Business Mix composition								
INT/TOP	423	63.9%	15.7%	57.6%	66.3%	72.8%	107.7%	14.8%
COMM/TOP	427	27.2%	0.0%	21.2%	26.8%	31.4%	67.4%	10.6%
TRAD/TOP	424	8.4%	-130.0%	2.5%	8.2%	14.4%	50.7%	15.8%
ADJ_INT/TOP	423	76.9%	23.8%	69.4%	78.6%	87.6%	157.6%	18.0%
MKT/TOP	424	77.3%	-137.1%	62.9%	76.8%	89.4%	509.9%	41.6%
COMM/NON	424	22.7%	-409.9%	10.6%	23.2%	37.1%	237.1%	41.6%
TRAD/NON	415	47.7%	0.0%	31.5%	44.3%	64.4%	101.8%	26.0%
BANK/COMM	416	52.2%	-2.2%	35.6%	55.7%	68.4%	100.0%	26.1%
MKT/COMM	423	63.9%	15.7%	57.6%	66.3%	72.8%	107.7%	14.8%
Efficiency and risk								
COST/BV	424	0.295	0.100	0.221	0.273	0.339	1.009	0.114
LLP/BV	424	0.085	-0.018	0.029	0.065	0.112	0.719	0.090
BETA	431	1.329	0.033	0.965	1.301	1.659	2.791	0.522
COST_INCOME	424	0.629	0.358	0.534	0.616	0.688	1.622	0.147
TA [billion]	432	557	22	121	267	843	2,590	593

For a definition of the variables, see Table 1.

Table 3 Market performance and business mix

This table reports the results of a panel data random effect. Regression coefficients are reported with standard error in parenthesis. The dependent variable is year end PBV for year "t". INT measures net interest margin over equity book value. ADJ_INT is the ratio of net interest margin plus banking commission over equity book value. NON is the ratio of non-interest income [COMM+TRAD] over equity book value, COMM is the sum of banking and market commission over equity book value. BANK, MKT and TRAD measure respectively, the ratio of banking commission, of market commission and of the trading profit over equity book value. The following bank efficiency and risk variables are included in the regression: COST is the ratio between personnel and other administrative expenses over equity book value, LLP is the ratio of loan loss provisions to equity book value, BETA is a measure of systemic risk. Two time dummy variables are included in the analysis: CRISIS_FIN equals to one for the years 2008 and 2009 and equals to zero otherwise; CRISIS_GOV equals to one for the years 2010, 2011 and 2012 and equals to zero otherwise. Two country dummy variables are included in the analysis: EURO_CORE equals to one for France, Germany, Ireland, Belgium and Austria and equals to zero otherwise; EURO_NON_CORE equals to one for Spain, Italy and Portugal.

For a definition of the variables, see Table 1. The observation period is 2006–2015.

	(1) Mod. 1	(2) Mod. 2	(3) Mod. 3	(4) Mod. 4	(5) Mod. 5	(6) Mod. 6
Constant	1.210***	1.225***	1.189***	1.154***	0.969***	1.111***
	(0.134)	(0.143)	(0.139)	(0.141)	(0.134)	(0.151)
INT	0.572	0.554	0.728			
	(0.489)	(0.503)	(0.544)			
ADJ_INT				1.135***	1.498***	1.605***
				(0.432)	(0.413)	(0.410)
NON	1.842***					
	(0.345)					
COMM		3.063***				
		(0.778)				
BANK			1.610			
			(1.119)			
MKT			3.661***	3.702***	3.338***	2.954***
			(1.033)	(1.027)	(0.976)	(0.962)
TRAD		1.835***	1.769***	1.953***	1.347***	1.303***
		(0.450)	(0.450)	(0.444)	(0.420)	(0.422)
COST	-0.124	-0.698	-0.662	-0.796	-0.637	-0.591
	(0.500)	(0.584)	(0.584)	(0.604)	(0.567)	(0.570)
LLP	-1.749***	-1.725***	-1.599***	-1.593***	-1.325***	-1.285***
	(0.360)	(0.369)	(0.380)	(0.382)	(0.358)	(0.363)
BETA	-0.317***	-0.312***	-0.301***	-0.315***	-0.127**	-0.124**
	(0.056)	(0.057)	(0.058)	(0.058)	(0.059)	(0.060)
CRISIS_FIN					-0.364***	-0.377***
					(0.066)	(0.066)
CRISIS_GOV					-0.426***	-0.436***
					(0.057)	(0.058)
EURO_CORE						-0.277*
						(0.142)
EURO_NON_CORE						-0.214*
						(0.137)
Observations	401	395	388	389	389	389
Number of ID	45	45	45	45	45	45
Adj. R2	0.2315	0.2434	0.2428	0.2553	0.3714	0.3669

***, **, * indicates statistical significance at the 1%, 5% and 10% respectively

Table 4 Pseudo-F (Calinski-Harabasz)

Number of clusters	Pseudo-F (Calinski-Harabasz)	Number of clusters	Pseudo-F (Calinski-Harabasz)
2	19.99	9	18.32
3	**22.30**	10	17.83
4	21.26	11	17.72
5	21.62	12	17.66
6	20.97	13	17.71
7	20.56	14	17.41
8	19.20	15	17.08

The Calinski and Harabasz (1974) pseudo-F index is an estimate of the between-cluster variance divided by within-cluster variance

Table 5 The performance of identified clusters

This table reports the results descriptive statistics for the cluster identified. We use Ward's cluster analysis technique. Market Weight represents the weight of the different business mixes over total revenues (ADJ_INT, MKT, TRAD) evaluated at market value. Accounting Weight represents the weight of the different business mixes over total revenues (ADJ_INT, MKT, TRAD) as determined by accounting measure. ADJ_INT is the ratio of net interest margin plus banking commission over total revenue. MKT is the ratio of market commission over total revenue, TRAD is the ratio of trading over total revenue. INT is the ratio of net interest income over total revenue. BANK is the ratio of banking commission over total revenue. COST is the ratio between personnel and other administrative expenses over equity book value, LLP is the ratio of loan loss provisions to tangible book value, INTERNATIONALIZATION is the bank's internationalization index, BETA is a measure of systemic risk, ROAE is the return on average equity, ROAA is the return on average asset, SHROAA is the risk adjusted return on average asset, Z-score is the measure of bank insolvency risk in terms of distance to default, COST-INCOME is the ratio between total operating expenses over intermediation margin, TA is the total asset in billions of euros. All the variable are expressed in terms of mean value for each bank over the ten year time span.

For a definition of the variables, see Table 1. The observation period is 2006–2015.

	Cluster 1	Cluster 3	Cluster 4
Business Model	Retail	Retail Diversified	Market based
Number of banks	16	21	8
Business Mix			
Market Weight ADJ_INT	83.7%*	67.9%*	41.4%*
Market Weight MKT	10.4%*	26.2%*	47.6%*
Market Weight TRAD	5.9%*	5.9%*	10.9%*
Accounting Weight ADJ_INT	85.5%*	76.6%*	52.0%*
Accounting Weight INT	68.2%*	66.7%*	42.5%*
Accounting Weight BANK	17.2%*	9.8%*	9.4%*
Accounting Weight MKT	5.2%*	15.7%*	34.4%*
Accounting Weight TRAD	9.4%*	7.8%*	13.7%*
Efficiency and risk			
COST	29.4%*	26.8%*	36.6%*
LLP	12.2%*	8.0%*	2.6%*
INTERNATIONALIZATION	-4.3%*	3.2%	4.1%*
BETA	1.25	1.39	1.33
Performance measures			
ROAE	5.66%	6.18%	7.12%
ROAA	0.39%	0.34%	0.31%
SHROAA	1.04*	1.29*	1.43*
Zscore	16.13*	17.57	20.84
COST-INCOME	62.0%*	60.9%*	79.0%*
TA (euro billion)	428*	600*	723*

* statistically significant differences at the 5% level based on pair-wise t-test comparisons

Figure 1 Radar Plot – Distribution of weights among the clusters (mean value)

This figure reports the radar plot for the cluster identified using Ward's cluster analysis technique. Market Weights (MKT_WEIGHT) represents the weight of the different business mixes over total revenues (ADJ_INT, MKT, TRAD) evaluated at market value. Accounting Weights (ACC_WEIGHTS) represents the weight of the different business mixes over total revenues (ADJ_INT, MKT, TRAD) as determined by accounting measure.

ADJ_INT is the ratio of net interest margin plus banking commission over total revenue. MKT is the ratio of market commission over total revenue, TRAD is the ratio of trading over total revenue.

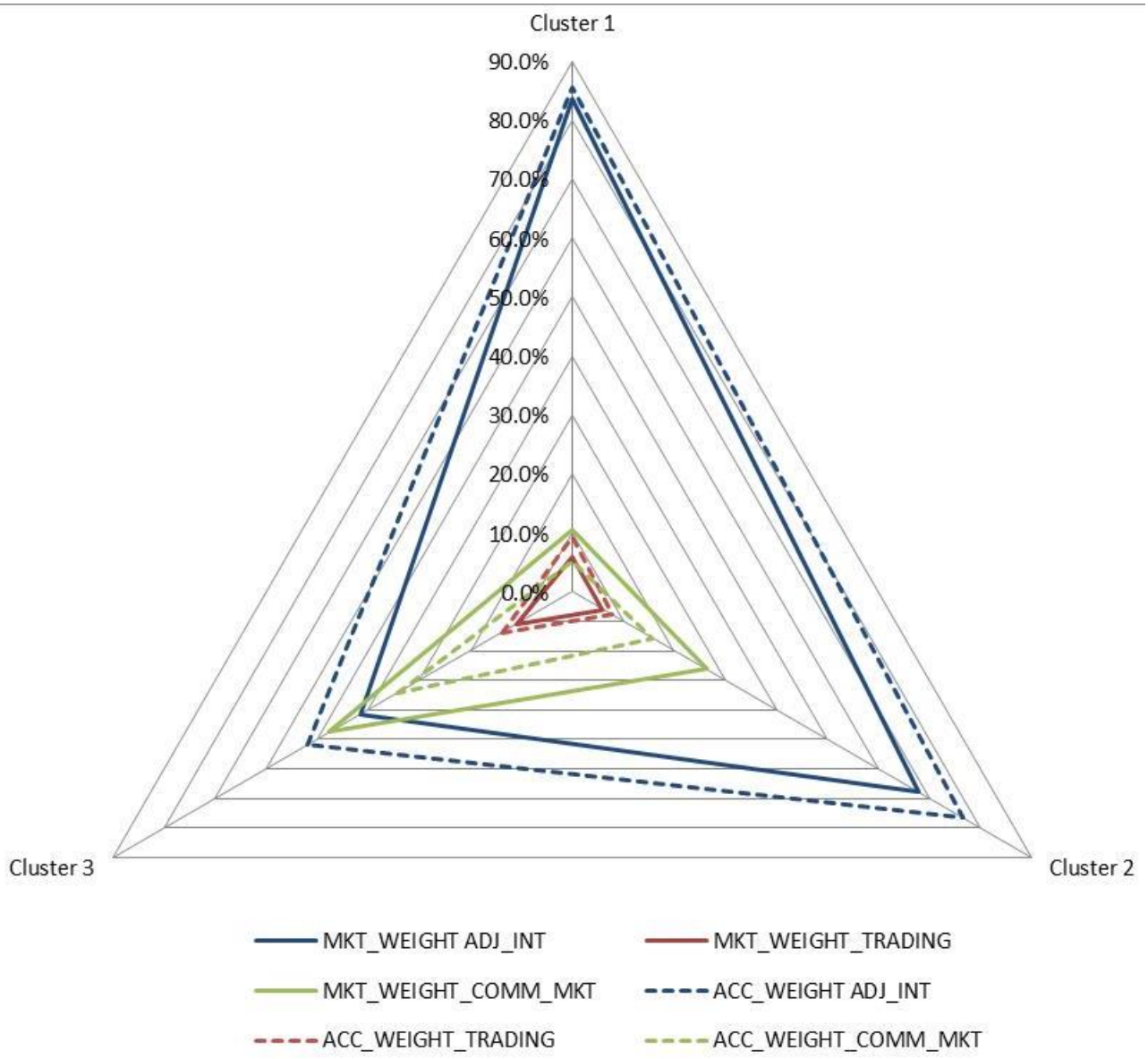

Table 6 Different market performance measures: Robustness check

This table reports the results of a panel data random effect. Regression coefficients are reported with standard error in parenthesis. The dependent variables are year end PBV for year *t* (1); PBV computed at the end of January *t+1* (2); PBV computed at the end of February *t+1* (3); PBV computed at the end of March *t+1* (4); PBV computed at the end of April *t+1* (5); PBV computed at the end of May *t+1* (6). ADJ_INT is the ratio of net interest margin plus banking commission over equity book value. MKT and TRAD measure respectively, the ratio of market commission and the trading profit over equity book value. The following bank efficiency and risk variables are included in the regression: COST is the ratio between personnel and other administrative expenses over equity book value, LLP is the ratio of loan loss provisions to tangible book value, BETA is a measure of systemic risk. Two time dummy variables are included in the analysis: CRISIS_FIN equals to one for the years 2008 and 2009 and equals to zero otherwise; CRISIS_GOV equals to one for the years 2010, 2011 and 2012 and equals to zero otherwise. Two country dummy variables are included in the analysis: EURO_CORE equals to one for France, Germany, Ireland, Belgium and Austria and equals to zero otherwise; EURO_NON_CORE equals to one for Spain, Italy and Portugal.

For a definition of the variables, see Table 1. The observation period is 2006–2015.

	(1) PBV_YEAR_END	(2) PBV_JAN	(3) PBV_FEB	(4) PBV_MARCH	(5) PBV_APRIL	(6) PBV_MAY
Constant	1.111***	1.004***	0.930***	0.899***	1.091***	1.089***
	(0.151)	(0.153)	(0.142)	(0.145)	(0.151)	(0.152)
ADJ_INT	1.605***	1.045**	1.534***	1.483***	1.047**	1.096***
	(0.410)	(0.418)	(0.391)	(0.399)	(0.412)	(0.419)
MKT	2.954***	1.550*	1.235*	1.284*	2.070**	1.463*
	(0.962)	(0.964)	(0.886)	(0.906)	(0.959)	(0.968)
TRAD	1.303***	1.207***	1.385***	1.392***	1.367***	1.090**
	(0.422)	(0.441)	(0.409)	(0.415)	(0.434)	(0.448)
COST	-0.591	-0.354	-0.130	-0.243	-0.145	-0.077
	(0.570)	(0.562)	(0.518)	(0.529)	(0.564)	(0.571)
LLP	-1.285***	-0.921***	-1.658***	-1.573***	-0.590*	-0.750**
	(0.363)	(0.353)	(0.354)	(0.359)	(0.350)	(0.359)
BETA	-0.124**	-0.098*	-0.042	-0.026	-0.077	-0.096
	(0.060)	(0.062)	(0.057)	(0.058)	(0.061)	(0.062)
CRISIS_FIN	-0.377***	-0.455***	-0.522***	-0.458***	-0.420***	-0.448***
	(0.066)	(0.069)	(0.064)	(0.065)	(0.068)	(0.070)
CRISIS_GOV	-0.436***	-0.300***	-0.323***	-0.391***	-0.381***	-0.392***
	(0.058)	(0.059)	(0.055)	(0.056)	(0.059)	(0.061)
EURO_CORE	-0.277*	-0.264*	-0.321**	-0.325**	-0.228*	-0.238*
	(0.142)	(0.140)	(0.128)	(0.132)	(0.138)	(0.135)
EURO_NON_CORE	-0.214*	-0.221*	-0.217*	-0.210*	-0.251*	-0.259**
	(0.137)	(0.136)	(0.124)	(0.128)	(0.133)	(0.130)
Observations	389	392	391	390	392	390
Numb. of ID	45	45	45	45	45	45
Adj. R2	0.3669	0.2777	0.3382	0.3322	0.2851	0.2783

***, **, * indicates statistical significance at the 1%, 5% and 10% respectively

Table A.1 List of European listed banks

Country	Bank Name	Average TA [000,000]
AT	Erste Group Bank AG	202,493
AT	Raiffeisen Bank International AG	125,671
BE	KBC Groep NV/ KBC Groupe SA-KBC Group	248,286
CH	Credit Suisse Group AG	750,358
CH	Julius Baer Group Ltd	62,668
CH	UBS Group AG	905,762
DE	Aareal Bank AG	47,559
DE	Commerzbank AG	569,159
DE	Deutsche Bank AG	1,742,877
DE	Deutsche Postbank AG	163,863
DK	Danske Bank A/S	451,624
DK	Jyske Bank A/S (Group)	53,912
ES	Banco Bilbao Vizcaya Argentaria SA	650,626
ES	Banco de Sabadell SA	174,261
ES	Banco Popular Espanol SA	156,109
ES	Banco Santander SA	1,247,980
ES	Bankia, SA	258,653
ES	Bankinter SA	57,329
ES	Caixabank, S.A.	342,843
FR	BNP Paribas SA	1,947,418
FR	Crédit Agricole S.A.	1,563,645
FR	Crédit Industriel et Commercial SA - CIC	242,077
FR	Natixis SA	532,306
FR	Société Générale SA	1,276,903
IE	Allied Irish Banks plc	112,703
IT	Banca Monte dei Paschi di Siena SpA-Gruppo MPS	192,612
IT	Banca popolare dell'Emilia Romagna	61,328
IT	Banca Popolare di Milano SCaRL	50,076
IT	Banco Popolare - Società Cooperativa-Banco Popolare	125,389
IT	Intesa Sanpaolo SpA	655,697
IT	Mediobanca SpA - Banca di Credito Finanziario SpA	73,174
IT	UniCredit SpA	869,329
IT	Unione di Banche Italiane Scpa-UBI Banca	123,916
NL	ING Groep NV	1,020,533
PL	Powszechna Kasa Oszczednosci Bank Polski SA - PKO BP SA	54,113
PT	Banco Comercial Português, SA-Millennium bcp	80,749
SE	Nordea Bank AB (publ)	653,706
SE	Skandinaviska Enskilda Banken AB	279,792
SE	Svenska Handelsbanken	283,145
SE	Swedbank AB	220,194
UK	Barclays Plc	1,663,703
UK	HSBC Holdings Plc	2,090,164

UK	Lloyds Banking Group Plc	1,080,090
UK	Royal Bank of Scotland Group Plc (The)	1,314,515
UK	Standard Chartered Plc	538,401

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