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

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**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 2012-2015 . The main results suggest that both net interest income and non -interest components foster market valuation and that financial market seems to associate a better risk-return trade-off to non-banking fees and commissions, compared to the banking ones. This evidence enables us to identify 3 cluster of European banking groups based on the values that the market attributes to 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**

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# 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 on the one hand, and regulator and supervisors on the other hand.

From the managerial point of view, the crisis has caused a deep revision of banks' business models (BBM) and the enhancement of their strategic ability to exploit market positioning and business mix in order to create value.

From the point of view of banking supervision, the same interest is testified by the strong focus on business model analysis (BMA) embedded in the SREP; it is also a key area of the supervisory activity by the 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.

A key issue in BMA is the identification of bank business model types: which variables and typical characteristics should be considered? Another issue regards the definition of clusters of banks with similar business models to develop the peer analysis. The peer analysis is a technique often used by supervisory authorities (SREP) and the definition of peers is a crucial point since the allocation of certain banks to a specific peer group may create problems in the analysis and determine misleading results as the intermediary meets several of the characteristics of different business models.

From the shareholder point of view, the banking business model is an important element in the evaluation of banks' ability to create value. In a phase of high volatility of financial markets and relevant needs of fund raising, it is crucial to understand how the market assesses and evaluates a bank's process of restructuring and the changes in the strategies and business mix. As a consequence, the market evaluation of the viability and sustainability of each bank's business model is an important element in the management strategic choices. Therefore, a key question is whether banking supervisors take into consideration the market evaluation of the strategic positioning of the supervised banks.

In the last two decades, the business model (BM) 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 define and evaluate 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 tangible 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 identify clusters on the basis of market value.

Our sample (proprietary data set) is made up of consolidated accounting data, for the period 2012-2105, of listed European banking groups with a total asset value greater than 50 billion US$ at 2015. The final dataset includes 184 bank-year observations corresponding to 48 bank holding companies (BHCs) belonging to 14 countries. We select 31 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 both net interest income and non-interest components foster market valuation; in fact both of them positively impact on market value. Disentangling the components of net fees and commission income reveals that financial market seems to associate 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 tangible 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.
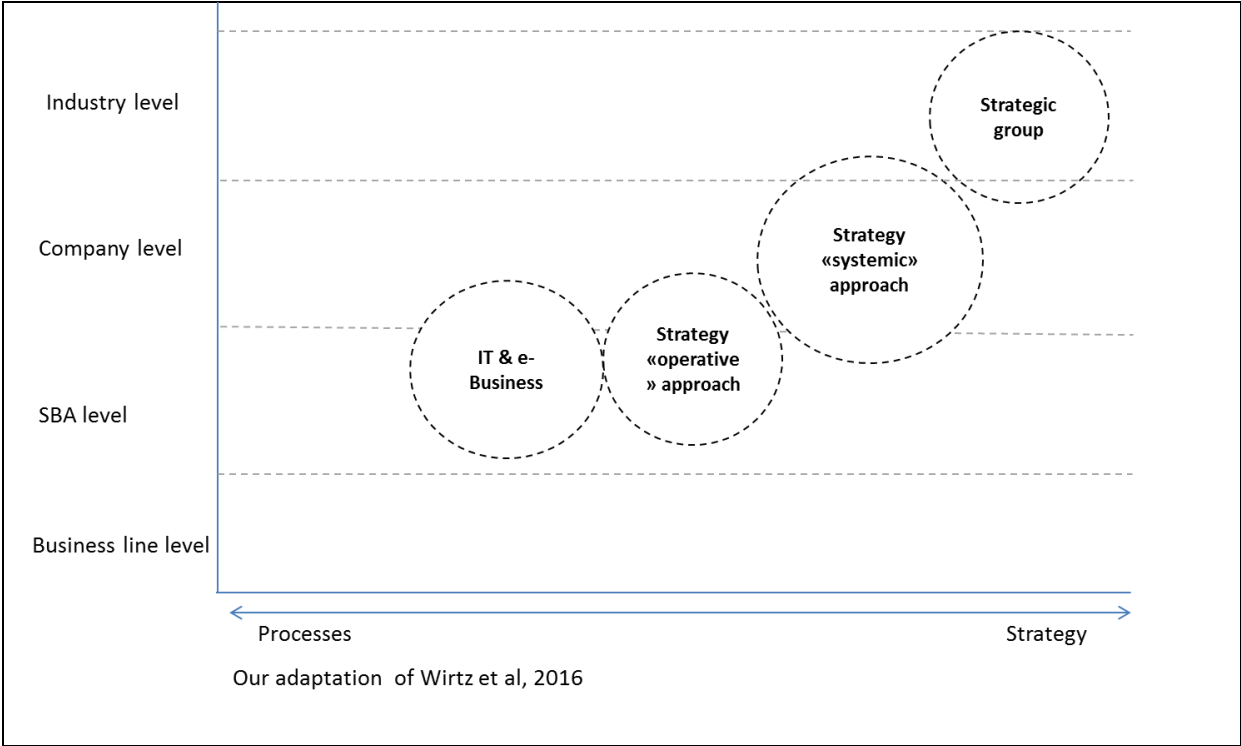
## 2.    Literature Review

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. Three different strands of literature deal with BMs: IT and e-business, strategy, and strategic groups. In the former, the BM symbolizes how a firm creates, distributes, and captures value. In particular, this literature has developed a BM concept aimed to embrace all the elements and relationships that enables IT-based or Internet-based firms to generate value. It follows the idea that the system (a sort of gestalt) creates more value than the sum of individual parts and the BM is essential to enhance it (Amit and Zott, 2001; Zott et al. 2011). Therefore, according to these analyses, BM is interpreted as a representation of the set of decisions, activities, and relationships between them that explain how an organization creates, delivers (to its stakeholders, including customers) and captures the value (Osterwalder and Pigneur 2012), building a sustainable competitive advantage in defined markets (Morris et al., 2005). Often these contributions tend to give greater emphasis to some components of this systemic representation. Some stress how the firms generate value, i.e. the value proposition (Baden-Fuller and Haefliger, 2013), or how they optimize the structure of cost/revenue (ie. the value capture); some others focus on the way in which the relationships with the enterprise's network (suppliers, customers, delivery channels, partners, competitors) increase value. Notwithstanding the different focus on BM components, there is consensus on the idea that BM offers a useful holistic perspective for understanding not only what businesses firms do (e.g., what products and services they produce to serve needs of customers in addressable market spaces) but also how they do it (e.g., how they bridge resources and product markets in serving the needs of customers). So that BM becomes a new unit of analysis which puts an emphasis on firm's activity system to create value as well as to capture it (Zott et al., 2011).

In the second field of 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. Some scholars (Shafer et al. 2005) see a clear distinction between strategy and BM: strategy focuses on market and external competition while BM has a more operative nature focusing on the internal consistency of strategic choices (operative approach). For some others (Mottura, 2011), BM and strategy are different but strongly related since BM is the direct result of a firm's realized strategy (systemic approach). A systemic approach is detectable in the latter strand as well, but with reference to groups of companies with similar strategies (strategic groups) instead of single firm. Cluster analysis of data at firm's level is adopted to identify the strategic groups (Short et al. 2007, Leask 2004); since the input data are usually the result of both strategic and operative choices, the overlap between strategy and BM is amplified.

**Figure 1 – BM definition: the different approaches of management literature**



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 2 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.2 Bank Business models' strategic components**
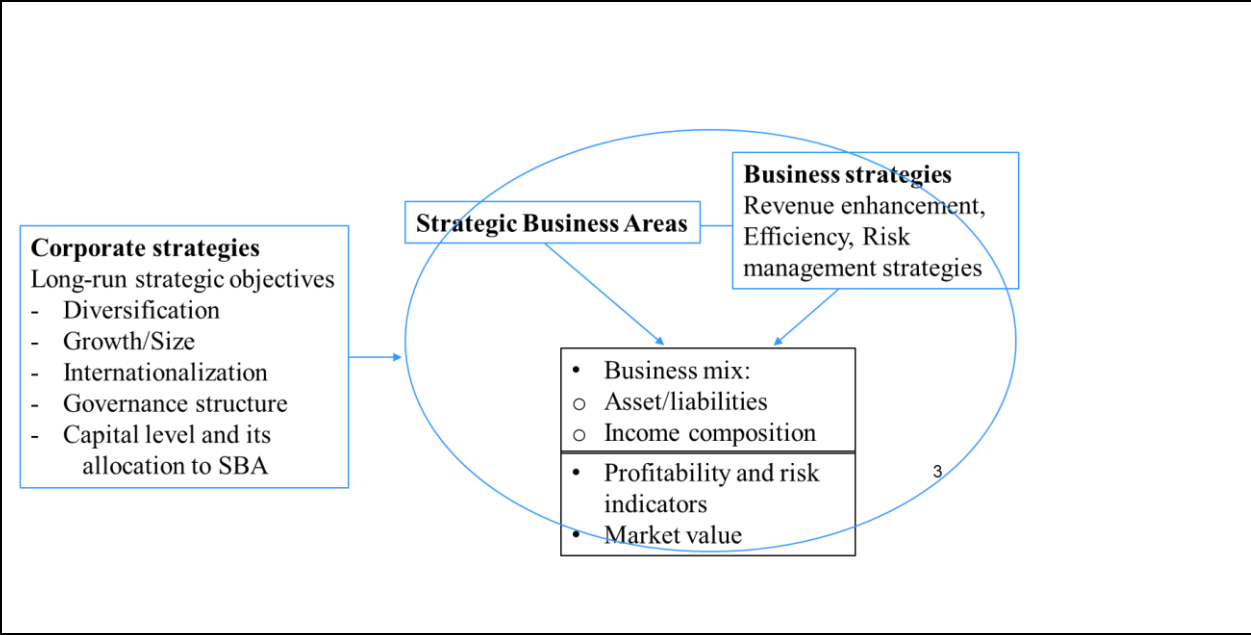


A first classification of the literature concerns the different emphasis set on the identification of bank peer groups characterized by similar business models. Several studies follow the strategic group literature and aim at finding evidence of how banking industry can be classified into few different bank BMs that display different performance with respect to economic and financial context. However, 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. (2016a) 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. The comparison of the bank clusters on the risk-return frontier confirms the higher risk and volatility of investment banks, while during the financial crisis the diversified retail banks seem to perform better thanks to their higher revenue stability. Even 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, in the period 2005-2013. When valued in terms of performance the retail funded group displays the highest average level and the lowest variability of profitability over time. The trading banks are the group with the highest volatility of return on equity and cost base. The wholesale funded group stands between the other two groups in term of return levels and volatility. The study finds significant shifts across different BMs before and after the crisis and the performance statistics show that the change in banks' BM induced a prevailing worsening in profitability. A different result with respect to migration between bank clusters over time is that showed by Franch and Zochowsky (2016) in their classification of European banks in the period 2007-14. Comparing the high numbers of bank clusters based on size, asset/liability and income composition indicators, they find that most of the banks remained in the same group as evidence of "sticky" business models not easily adapting to a changing environment or in anticipation of stress. 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) the authors consider as attributes of strategic choices. Among the eight resultant peer groups, retail banks show the highest return on asset in the years preceding the financial crisis but the worst performances at the peak of the sovereign debt crisis as effect of the deterioration of credit quality. The specificity of bank strategies is the focus of Mergaert and Vennet (2016) analysis. They define the BM in term 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. The authors conclude for a substantial variation of business model effects over different bank types and show that retail-oriented banks perform better in terms of both profitability and stability and that diversification improves profitability, but also increases probability of distress. 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 threshold values of balance sheet parameters like size, lending propensity, international credit exposure. Moreover, they qualify *a priori* two groups represented respectively by Network and Public Development banks. The study points to the macroeconomic conditions as the main driver of current differences in profitability across bank types, whereas the riskiness seems reflect both differences in borrowers' riskiness and the extent to which IRB models are employed by banks. How the management of risk weights is linked to the BM adopted by banks is the theme the study of Ayadi et al. (2016b) is focused on. By applying the Ayadi et al. (2016a) cluster approach and using the same group classification, the authors provide evidence of the different degree of regulatory arbitrage across bank business models. Notably the IRB adoption seems to have a positive effect on the riskiness of the Retail diversified banks, signalling the existence of regulatory arbitrage taking place within this banking business model, possibly via Basel risk weights manipulation.

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. Most of the studies deals with the risk of individual banks. When the analysis extends to the systemic risk relevant implications for regulators emerge: some BM variables have opposite effects on bank tail risk and its exposure to severe shocks in the financial system. 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. These 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. These strategic variables along with the reliance on short-term market funding are statistically significant in explaining the bank distress. 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. The analysis evaluates the relation with regard to the main institutional bank categories: commercial, saving and cooperative, investment banks with a focus on listed 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. The econometric study of Köhler confirms some results found in the bank diversification literature pointing to the risk of shifting the bank activity on the financial markets (securities and wholesale fund market). Even in a recent study of ECB (2016) on a sample of 143 euro area banking groups over the period 1995-2014, the z-score variable is regressed on several bank-specific business model characteristics, including some business mix measures (like retail ratio, income diversification, short term borrowing), the cost-to-income ratio, a leverage ratio and size. Other explanatory variables regard, macroeconomic conditions and structural market features. In the pre-crisis phase the income diversification is associated with higher default risk whereas during and after the emergence of the financial crisis more diversified banks displayed lower default risk levels.

The bulk of these studies focuses on the nexus between BM variables and individual bank risk, whereas only few of them deal with the effects of strategic choices on systemic risk. An analysis of the nexus between business models variables and measures of individual and systemic bank risk based on market values is that proposed by Van Oordt and Zhou (2014) who rely on stock market data from CRSP of US Bank Holding Companies from 1991 to 2011. Drawing on the literature on market risk the authors separate two dimensions of banks' systemic risk: the bank tail risk and the linkage between a bank's tail risk and severe shocks in the financial system. As expected they find a stronger dependence between large banks and the systemic risk, that is a positive association between size and the sensitivity to severe shocks in the financial system (approximated by severe changes in the financial sector index).

## 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 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 48 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 four years of data, 2012–2015. The starting date is 2012 since we limit our analysis to a period in which banks, after the peak of the crisis, are reorganizing their activity.

The final dataset includes 184 bank-year observations corresponding to 48 bank holding companies (BHCs) belonging to 14 countries. We select 31 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 evaluate if consolidated financial statements are available; on the other hand, diversification benefits may exist for the institution as a whole and not for the single subsidiary. 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 from larger measurement problems than the asset-based measure (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.

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 tangible book value (INT) and on the other the ratio between net commission and trading income over tangible book value (NON).

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[1] 2014 figures.

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 principal components have been identified: net fee 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, the analysis of the balance sheet information enable us to disaggregate fee income in relation to the type of activities developed. In particular, we divide net fees and commission revenue along three 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;

- Other commissions (O), that comprise commission income that cannot be allocated to one of the previous categories since banks balance sheet do not disclose related information.

To our purpose, the variable total net fees and commission income (COMM) is the sum of Banking and Market commission; in other words in our analysis we do not take into consideration the aggregate Other commission given classification problems.

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 tangible book value.

### 3.3. Market based and accountancy performance measures

Market based performance is measured in terms of Price to tangible book value (TBV). We measure the market-to-tangible book ratio as the ratio of market value of common equity at year end to tangible common equity (PTBV). 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 assets (ROAA) defined as the ratio of net profits to total average assets. To adjust this 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. $SHROA_{i,t}$ indicate 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 measure of insolvency risk computed in terms of the Z-score. The Z-Score is a proxy for insolvency risk and is measured 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:

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

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

### 3.4.  Efficiency and risk variables

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

To measure the effect of efficiency on bank profitability (COST) we introduce in the analysis the ratio of operating expenses over Tangible 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 were obtained by estimating, with the OLS method, the market model. More precisely, the BETA of bank $j$ for the year $t$ was 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. Also this variable is employed when we compare the performance of the bank clusters.

### 3.5.  Empirical methodology

The approach is based on the panel fixed effect relationship between the market-to-book ratio (our dependent variable) and proxies for bank activities, which are based on measures derived from accounting concepts. 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:

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

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

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

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

where *i* identifies the individual bank-observation belonging to the sample (*i = 1, 2, 3,...,48*); *t* expresses the time variable (*t = 2012,…, 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 tangible book value, NON is the ratio between non traditional revenues (BANK, MKT, TRAD) over Tangible book value, COMM is the ratio between net commission income computed as the sum of banking (BANK) and market (MKT) commission. 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 Tangible book value.

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

Results of Model 3 have been then used to define the weight of the different business mixes at market value. First of all, we computed the fitted PTBV or in other terms we calculated the linear prediction from the fitted model for the PTBV for the different banks and for the different year. Then we averaged it out for the single individual bank along the 4 years time span obtaining the average predicted PTBV for each bank. To define the weight we proceeded as follow.

In model 3, the variables that describe the banks' business mix are INT, BANK, MKT, TRAD. For each of the four variables, we first compute the average over the time span; then we multiply the average for the coefficient of the panel fixed effect model. Finally, for each bank in the sample, we compute the weight as the fraction of the market value of the variable over the average fitted PTBV.

Once defined the weight of the different lines of income, we use them in order to identify bank groups, using cluster analysis methodology. 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.

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


*[Table 1 around here]*


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## 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 € 559 billion that range from € 34.6 billion to € 2,210 billion. UK and French banks are the largest, with an average total assets of € 1,337.4 and € 1,112.5 respectively. Our sample includes both low and high performing BHCs both in terms of market and accounting measures; the mean PTBV is 1.108 and the median is 0.945. The mean ROAA is 0.171, with a median of 0.270.

As for business mix measures are concerned, the average (mean) bank generated 62.1% of its revenues from net interest income, 27.3% from net fees and commission income and 10.6% from trading profit. The composition of net fees and commission income shows a nearly equal contributions of BANK (49.8%) and MKT (50.2%) commissions; this result testifies to the relevance of fees and commissions linked to traditional banking business. Therefore banking commissions, when added to net interest income, represent on average the 74.4% 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 tangible book value (Table 3).

The main result is that both net interest income and non-interest components foster market valuation (column 1); in fact both of them positively impact on value. When we control for the different components of non-interest income a clearer picture emerges. On the one hand, no statistically significant effect is evident with respect to trading profit (columns 2-3-4), while, on the other, market commissions impact more on price to tangible 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 1-4). These results enable also to appreciate the choice of market value as dependent variable. In fact, Price-to-tangible-book value captures directly both forward-looking market expectations and also 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 put 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.

*[Table 3 around here]*

Results of Model 3 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.

We identify 3 clusters. Cluster characteristics can be easily summarised with a radar plot (Figure 1). Cluster 3, made up of 6 banks, includes banks "Market oriented" with the highest incidence of market commissions and trading profits and the lowest rate of net interest income. Cluster 1, made up of 17 banks, 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 22 banks "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 4 we summarize the principal characteristics of the groups identified.

*[Table 4 around here]*

Cluster 3 is characterised by the highest ratio of operating costs on tangible 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 value creation (the risk-return tradeoff) is higher for Cluster 3 as testified by the highest Price to tangible book value 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. These results are in line with De Meo et al. (2016).

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 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 3) changing the definition of PTBV employed. We use PTBV measured at subsequent periods of time (Table 5). In column 1, we use year-end PTBV for year *t* as in Table 3; in the subsequent columns (2-6) we use PTBV 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 of common equity by one plus the cumulative stock return till the reference date.

*[Table 5 around here]*

As can be seen in Table 5 also considering PTBV 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 48 relevant listed European banking groups, in the period 2012-2015.

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 both net interest income and non interest components foster market valuation and that financial market seems to associate to non banking fees and commissions, compared to the banking ones, a higher value creation (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 tangible 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 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.

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 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.

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 consolidate 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 |
|---|---|
| PTBV | Market price to tangible book value |
| INT | Net interest income over tangible book value |
| ADJ_INT | Net interest income over tangible book value + Banking commission over tangible book value |
| COMM | Banking commission over tangible book value + Market commission over tangible book value |
| BANK | Banking commission over tangible book value |
| MKT | Market commission over tangible book value |
| TRAD | Trading profit over tangible book value |
| NON | Non interest income over tangible book value = COMM+TRAD |
| TOP | Total operating income over tangible book value = INT+COMM+TRAD |
| COST | Total operating expenses over tangible book value |
| LLP | Loan loss provisions over tangible 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 | $Z-score_{i,t} = \dfrac{\left( ROA_{i,t} + \dfrac{E_{i,t}}{TA_{i,t}} \right)}{\sigma\left(ROA_{i,t}\right)}$ |
| 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 2012-2015**

| | Obs | mean | min | p25 | p50 | p75 | max | sd |
|---|---|---|---|---|---|---|---|---|
| **Performance Measure** | | | | | | | | |
| PTBV | 180 | 1.108 | 0.009 | 0.666 | 0.945 | 1.339 | 5.890 | 0.823 |
| ROAA | 184 | 0.171 | -6.830 | 0.070 | 0.270 | 0.495 | 1.950 | 0.798 |
| SHROA | 184 | 2.818 | -2.831 | 0.210 | 1.131 | 2.986 | 35.718 | 5.795 |
| Z-SCORE | 184 | 46.761 | -1.578 | 14.611 | 30.188 | 50.434 | 333.758 | 55.475 |
| | | | | | | | | |
| **Business Mix** | | | | | | | | |
| INT | 180 | 0.289 | -0.045 | 0.212 | 0.263 | 0.323 | 0.817 | 0.148 |
| ADJ_INT | 180 | 0.349 | -0.053 | 0.249 | 0.302 | 0.394 | 1.115 | 0.191 |
| NON | 180 | 0.189 | -0.017 | 0.122 | 0.166 | 0.231 | 0.717 | 0.121 |
| COMM | 180 | 0.135 | -0.012 | 0.084 | 0.120 | 0.162 | 0.540 | 0.090 |
| BANK | 180 | 0.060 | -0.009 | 0.029 | 0.049 | 0.074 | 0.456 | 0.057 |
| MKT | 180 | 0.075 | -0.003 | 0.030 | 0.056 | 0.083 | 0.538 | 0.085 |
| TRAD | 180 | 0.054 | -0.070 | 0.020 | 0.043 | 0.073 | 0.476 | 0.058 |
| | | | | | | | | |
| **Business Mix composition** | | | | | | | | |
| INT/TOP | 180 | 62.1% | 20.1% | 56.3% | 63.6% | 71.4% | 100.0% | 13.8% |
| COMM/TOP | 180 | 27.3% | 4.9% | 20.8% | 25.9% | 31.8% | 64.6% | 10.3% |
| TRAD/TOP | 180 | 10.6% | -27.0% | 5.1% | 9.5% | 15.0% | 67.2% | 9.7% |
| ADJ_INT/TOP | 180 | 74.4% | 20.1% | 67.7% | 76.3% | 86.0% | 109.1% | 17.0% |
| MKT/TOP | 180 | 15.0% | -0.5% | 6.4% | 12.7% | 18.9% | 64.6% | 12.6% |
| COMM/NON | 180 | 74.0% | 6.8% | 61.3% | 73.5% | 84.9% | 238.1% | 21.6% |
| TRAD/NON | 180 | 26.0% | -138.1% | 15.1% | 26.5% | 38.7% | 93.2% | 21.6% |
| BANK/COMM | 180 | 49.8% | 0.0% | 34.2% | 47.0% | 66.5% | 101.9% | 27.3% |
| MKT/COMM | 180 | 50.2% | -1.9% | 33.5% | 53.0% | 65.8% | 100.0% | 27.3% |
| | | | | | | | | |
| **Efficiency and risk** | | | | | | | | |
| COST | 180 | 0.327 | -0.100 | 0.216 | 0.298 | 0.395 | 1.226 | 0.178 |
| LLP | 180 | 0.099 | -0.247 | 0.026 | 0.061 | 0.137 | 0.962 | 0.130 |
| BETA | 180 | 1.246 | 0.033 | 0.881 | 1.183 | 1.584 | 2.584 | 0.544 |
| COST_INCOME | 184 | 0.652 | 0.409 | 0.544 | 0.624 | 0.702 | 2.892 | 0.227 |
| TA [000,000] | 184 | 559,000 | 34,600 | 124,000 | 281,000 | 843,000 | 2,210,000 | 568,000 |

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 regression. Regression coefficients are reported with standard error in parenthesis. The dependent variable is year end PTBV for year "t". INT measures net interest margin over tangible book value. ADJ_INT is the sum of net interest margin plus banking commission. COMM is the sum of banking and market commission. BANK, MKT and TRAD measure respectively, the ratio of banking commission, of market commission and of the trading profit over tangible 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 tangible book value, LLP is the ratio of loan loss provisions to tangible book value, BETA is a measure of systemic risk. For a definition of the variables, see Table 1. The observation period is 2012–2015.

|  | (1) Mod. 1 | (2) Mod. 2 | (3) Mod. 3 | (4) Mod. 4 |
|---|---|---|---|---|
| Constant | 0.250* | 0.157 | 0.152 | 0.143 |
|  | (0.143) | (0.138) | (0.138) | (0.138) |
| INT | 3.130*** | 3.177*** | 3.255*** |  |
|  | (0.481) | (0.458) | (0.468) |  |
| ADJ_INT |  |  |  | 3.482*** |
|  |  |  |  | (0.457) |
| COMM+TRAD | 1.880*** |  |  |  |
|  | (0.516) |  |  |  |
| COMM |  | 6.562*** |  |  |
|  |  | (1.144) |  |  |
| BANK |  |  | 5.763*** |  |
|  |  |  | (1.724) |  |
| MKT |  |  | 6.566*** | 5.656*** |
|  |  |  | (1.140) | (0.922) |
| TRAD |  | 0.621 | 0.601 | 0.608 |
|  |  | (0.551) | (0.558) | (0.562) |
| COST | 0.005 | -1.683*** | -1.586** | -1.109** |
|  | (0.502) | (0.608) | (0.638) | (0.528) |
| LLP | -1.596*** | -1.581*** | -1.534*** | -1.463*** |
|  | (0.345) | (0.324) | (0.335) | (0.333) |
| BETA | -0.199*** | -0.147** | -0.151*** | -0.163*** |
|  | (0.060) | (0.058) | (0.058) | (0.058) |
| Observations | 179 | 179 | 179 | 179 |
| Number of ID | 45 | 45 | 45 | 45 |
| Adj. $R^2$ | 0.4201 | 0.4824 | 0.4892 | 0.4942 |

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

## Table 4  The performance of identified clusters

This table reports the results descriptive statistics for the cluster identified. of a panel fixed effect data regression. We use Ward's cluster analysis technique. COST is the ratio between personnel and other administrative expenses over tangible 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, PTBV is the price to tangible book value, ROAA is the return on average asset, SHROAA is the risk adjusted return on average asset, Zscore is the measure of bank insolvency risk, Cost-income is the ratio between personnel and other administrative expenses over intermediation margin, TA is the total asset in millions of euros. All the variable are expressed in terms of average for each bank over the four year time span. For a definition of the variables, see Table 1. The observation period is 2012–2015.

|  | Cluster 1 | Cluster 2 | Cluster 3 |
|---|---|---|---|
| Number of banks | 17 | 22 | 6 |
| **Business Mix** | | | |
| Weight ADJ_INT | 84.62%* | 72.52%* | 35.87%* |
| Weight INT | 59.10%* | 55.59% | 31.53%* |
| Weight BANK | 25.53%* | 16.93%* | 4.34%* |
| Weight MKT | 13.12%* | 25.71%* | 61.57%* |
| Weight TRAD | 2.26% | 1.77%* | 2.55% |
| **Efficiency and risk** | | | |
| COST | 35.87* | 25.28* | 52.38* |
| LLP | 17.38* | 6.21* | 2.68* |
| INTERNATIONALIZATION | -1.49* | 2.51 | 7.17* |
| BETA | 1.27 | 1.22 | 1.28 |
| **Performance measures** | | | |
| PTBV | 1.02 | 1.11 | 1.37* |
| ROAA | 0.08 | 0.21 | 0.25 |
| SHROAA | 1.28 | 4.32 | 1.57 |
| Zscore | 36.33* | 53.49 | 52.60 |
| Cost-income | 0.63 | 0.63* | 0.81* |
| TA (000,000) | 413,982* | 573,705 | 941,783* |

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

**Figure 1  Radar Plot – Distribution of weights among the clusters (median value)**
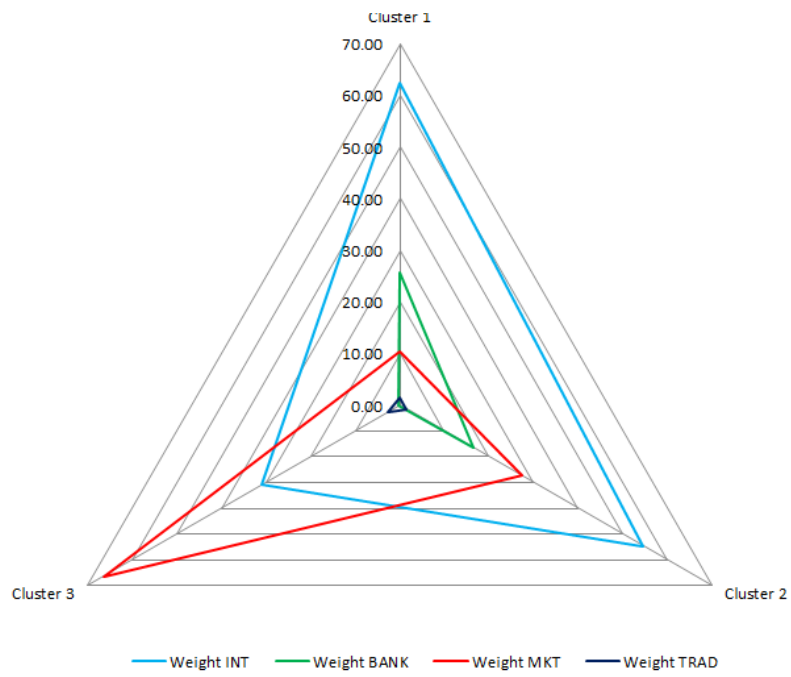
## Table 5  Different market performance measures: Robustness check

This table reports the results of a panel data regression. Regression coefficients are reported with standard error in parenthesis. The dependent variables are year end PTBV for year *t* (1); PTBV computed at the end of January *t+1* (2); PTBV computed at the end of February *t+1* (3); PTBV computed at the end of March *t+1* (4); PTBV computed at the end of April *t+1* (5); PTBV computed at the end of May *t+1* (6). INT measures net interest margin over tangible book value. BANK, MKT and TRAD measure respectively, the ratio of banking commission, of market commission and the trading profit over tangible 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 tangible book value, LLP is the ratio of loan loss provisions to tangible book value, BETA is a measure of systemic risk. For a definition of the variables, see Table 1. The observation period is 2012–2015.

| | (1) PTBV_YEAR_END | (2) PTBV_JAN | (3) PTBV_FEB | (4) PTBV_MARCH | (5) PTBV_APRIL | (6) PTBV_MAY |
|---|---|---|---|---|---|---|
| Constant | 0.152 | -0.024 | -0.103 | -0.075 | -0.092 | -0.101 |
| | (0.138) | (0.145) | (0.162) | (0.166) | (0.158) | (0.160) |
| INT | 3.255*** | 3.371*** | 3.603*** | 3.387*** | 3.423*** | 3.546*** |
| | (0.468) | (0.490) | (0.552) | (0.572) | (0.541) | (0.546) |
| BANK | 5.763*** | 5.076*** | 6.209*** | 6.902*** | 6.612*** | 6.178*** |
| | (1.724) | (1.803) | (2.013) | (2.058) | (1.969) | (1.990) |
| MKT | 6.566*** | 5.445*** | 5.910*** | 6.014*** | 5.936*** | 6.407*** |
| | (1.140) | (1.192) | (1.328) | (1.354) | (1.298) | (1.313) |
| TRAD | 0.601 | 0.301 | 0.408 | 0.516 | 0.347 | 0.384 |
| | (0.558) | (0.585) | (0.671) | (0.712) | (0.658) | (0.664) |
| COST | -1.586** | -1.341** | -1.597** | -1.538** | -1.425* | -1.699** |
| | (0.638) | (0.667) | (0.747) | (0.767) | (0.731) | (0.739) |
| LLP | -1.534*** | -1.292*** | -1.455*** | -1.677*** | -1.607*** | -1.355*** |
| | (0.335) | (0.351) | (0.401) | (0.422) | (0.393) | (0.397) |
| BETA | -0.151*** | -0.013 | 0.022 | 0.005 | 0.018 | 0.044 |
| | (0.058) | (0.061) | (0.070) | (0.074) | (0.068) | (0.069) |
| Observations | 179 | 179 | 179 | 179 | 179 | 179 |
| Number of ID | 45 | 45 | 45 | 45 | 45 | 45 |
| Adj. $R^2$ | 0.4892 | 0.4372 | 0.4130 | 0.4106 | 0.4243 | 0.4207 |

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

**Table A.1  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 | ABN AMRO Bank NV | 385,741 |
| 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 |