Was there a "small-bank" anomaly in the Great Crisis of 2007-09?

by

Paola Bongini[♦] Giovanni Ferri[♥] and Punziana Lacitignola[♥]

Abstract

Drawing on a large set of listed banks from Europe, the US and Japan we start noticing that smaller-sized banks suffered less than larger banks in conjunction with the unfolding of the Great Crisis of 2007-09. Was this a small-bank anomaly analogous to the classic small firm effect?
We conjecture that what seems to be a small bank anomaly might, in fact, signal a generalized market reassessment of the banking business model and tested whether stock markets penalized less the banks that kept more rooted to the traditional "originate-to-hold" (OTH) model while forgoing the opportunities disclosed by the "originate-to-distribute" (OTD) model. By an event study methodology, we focus on September 29, 2008, the day in which the initial rejection by Congress of the Paulson Plan provoked a true panic on the instability of banking worldwide and led the VIX (the main index measuring equity market volatility) to shoot to the highest level in 6 years. Our results detect that, indeed, banks that had kept closer to the OTH model – as proxied by a higher net interest income/operating income – experienced less negative abnormal returns. In spite of this, we still keep finding that larger-sized banks' share prices were penalized more than the share prices of their smaller-sized homologues. Presumably, the "Too Big (or Interconnected) To Fail" credence, at least for a while, had been overruled. We also find that European and Japanese banks experiences less negative abnormal returns.

JEL Classification codes: G01, G21.

Keywords: small size anomaly; Great Crisis of 2007-09; bank business model; event study.

[♦] University of Milano – Bicocca

[♥] University of Bari

Corresponding author: paola.bongini@unimib.it

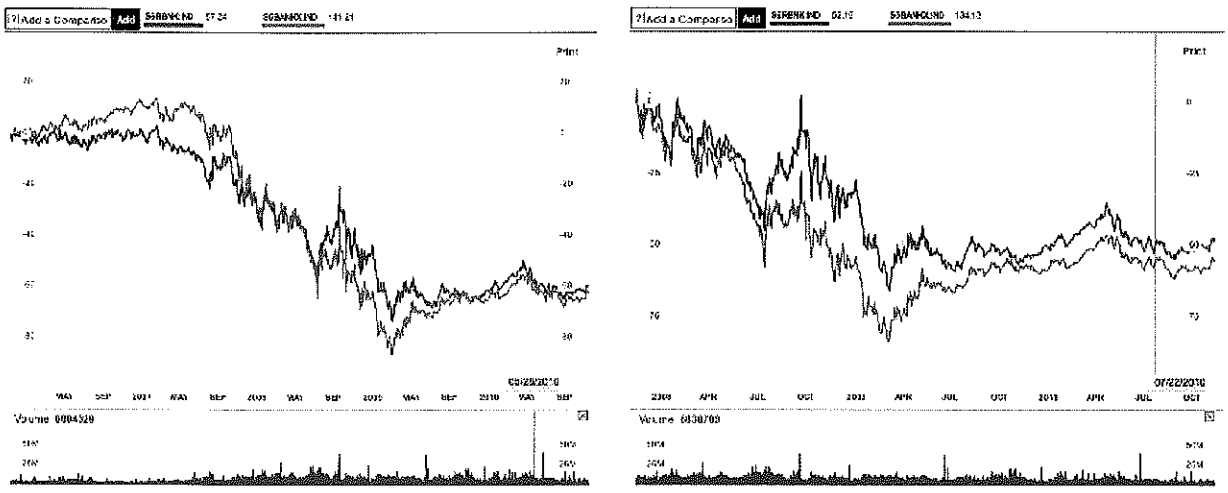
We are grateful to Ettore Croci, Li-Gang Liu, Andrea Resti and Zeno Rotondi for valuable insights. Beneficial comments were also provided by various participants in seminars where a preliminary draft of the paper was presented at Bellagio (Fondazione Rosselli Report 2009), Asian Development Bank Institute (Tokyo), Finance Academy (Moscow), European Association of Cooperative Banks (Brussels). Dario Giannini and Angelo Leogrande gave us precious help in collecting the data.

1. Introduction

The subprime crisis triggered an unprecedented global turmoil in banking. However, within the common downtrend some banks were battered more than others. To researchers, this provides a good vantage point to study which factors proved helpful and which ones detrimental for banks to weather the storm. Drawing on a large sample of listed banks from Europe, the US and Japan we notice that – contrary to the Too Big to Fail tenet – smaller-sized banks fared much better than their bigger homologues. For instance, between the market close of Friday September 26 and that of the following 29 the shares of the five largest European banks (Royal Bank of Scotland, Deutsche Bank, BNP Paribas, Barclays and UBS) lost 10.8% on average, while the average share drop for their five smallest peers (the three Swiss banks Bank Linth Llb Ag-Reg, Hypothekarbank Lenzburg-Reg and Banque Cantonale du Jura-Br, Italy's Banca Popolare di Spoleto and France's Banque de la Reunion)[1] was a mere 1.6%. On longer horizons in the US, it is instructive to compare the S&P 600 Regional Banks Index (devoted to small-cap banks) to the S&P 500 Banks Index (including all the large financial institutions). Small-cap banks were underperforming during 2007 (Figure 1, Panel A), moved almost on par with their large-sized homologues until July 2008 but switched to overperforming thereafter. The gap between the small bank and the large bank indices opened wide exactly in September-October 2008 and, though decreasing, persisted being positive up to recently (Figure 1, Panel B). How can this be explained? Is there a small-bank anomaly analogously to the small-firm effect studied at length in the finance literature?

Figure 1. S&P 600 Regional Banks Index versus S&P 500 Banks Index

Panel A (2006-2010) **Panel B (2008-2010)**



Source: Bloomberg.

Considering that the crisis was largely associated with structured financial products originated by banks, we conjecture that what seems to be a small bank anomaly might, in fact, signal (also) a generalized reassessment of the banking business model by the stock market. Indeed, smaller-sized banks tend to stick to the traditional "originate-to-hold" (OTH) model contrary to the large banks, which moved closer to the "originate-to-distribute" (OTD) model, intensely intertwined with financial markets.[2] While a larger reliance on non traditional bank activities could help banks diversify their income sources in good times, high exposition to financial market risks could be particularly chastising at the time of the systemic crisis when more traditional banks might be

[1] The average asset size of the five largest banks at the end of 2007 was 863 times that of the smallest five banks.

[2] Still referring to the two groups above, the ratio of net interest income to operating income (the proxy we will use to identify the bank business model) in 2007 was 0.34 on average for the five largest banks while it was 0.71 for the smallest five banks.

reputed more stable. In view of the above, we test whether stock markets indeed penalized less those banks that kept rooted to the OTH model.

Using an event study methodology, we focus our analysis on a specific event: September 29 2008, when the world financial markets experienced deep turmoil as the US Congress initially rejected the Paulson Plan (the Troubled Asset Relief Program, TARP) to salvage the US financial institutions. By then a large part of the American financial institutions were in trouble, as the crisis had escalated on September 15, when, lacking support by either the Fed or the US Treasury, one of the largest Wall Street investment banks (Lehman Brothers) went bankrupt, to the surprise of most market participants. Though the TARP was eventually approved (on October 3) after partial rewriting, the initial rejection was a major blow that deeply unnerved the markets, risking to trigger a meltdown of the financial system. On September 29 the Dow Jones lost 6.98%, the Nasdaq dipped 10.52% and the VIX (the main index measuring equity market volatility) shot to the highest level in 6 years. Our results detect that, indeed, banks that had kept closer to the OTH model – as proxied by a higher net interest income/operating income – experienced less negative abnormal returns. The fact that size is still negative and significant seems to suggest that the "Too Big (or Interconnected) To Fail" credence, at least for a while, had been overruled.

The issue is relevant for one main reason. As the OTD model seems to have collapsed under the burden of weakened incentives, the banking business is now in search for a new paradigm under which facing the challenges of greater market volatility, globalization and sustainable financial innovation. Will such a paradigm imply the demise of large universal banks and the re-birth of a smaller-sized, segmented banking model? Our study may help answer such an important question.

In the rest of the paper we draw a brief survey of the relevant literature (Section 2). We devote Section 3 to present the dataset we assembled together with some preliminary descriptive statistics. In Section 4, we introduce our event study methodology and perform the related regression analysis. Finally, Section 5 draws the paper to a close by recapping the main results we reached and outlining their policy implications.

2. Review of the literature

There are two strands of literature relevant to our paper. First, we will go a little deeper in terms of the banking specialization model. Furthermore, we will briefly recapitulate the small firm effect. This Section will thus be able to set the stage to ask our research question: Namely, if it is confirmed that small-sized banks suffered less in terms of share price losses during the subprime crisis, is this the result of a small bank anomaly or does it depend on something else?

2.1 The transformation of the banking model

With financial innovation, the growth of financial markets along with the deregulation of the financial sector, banks have tended to move into non-bank financial services. At the level of revenues' composition, this implies a growth in non-interest revenues and a corresponding reduction in the weight of interest margins with respect to total revenues. Such a shift represents a means to avoid the fall in profitability implicit in the intensification of market competition. Besides, it is even more interesting to note that the shift towards non-interest income is often seen as a means not only to strengthen but also to stabilize bank profitability and risk. In fact, fee-based products and activities are seen as more stable (or less cyclical) income source than loan-based earnings and as a font of overall risk reduction through diversification.

This conventional wisdom rests on the hypothesis that non-interest income and net interest income are negatively or less than perfectly correlated: diversifying banks' product mix would thus help, as portfolio theory shows for a diversified portfolio of financial instruments, achieving lower volatility of bank profits and lower risk. In addition, extending the product range would permit,

along with the exploitation of additional economies, such as scale or scope economies, the stabilization of banks' profits stemming from a supposed lower sensitivity of non-interest revenues to the movements in interest rates and to economic downturns.

Empirical work on bank diversification effects has taken several distinct approaches. A sizeable number of studies have long analyzed the effect of diversification on bank cost structure and the related benefits in terms of economies of scale, joint production and X-efficiencies. In the U.S. market, in general, substantial benefits are gained, in terms of higher income and lower risk, in those organizations (Bank Holding Companies) diversifying their portfolios into activities different from the traditional loan intermediation, such as insurance and/or asset management (Herring and Santomero, 1990; Gallo et al., 1996; for methodically rich summaries on these themes see Berger and Mester, 1997, and Harker and Zenios, 2000).

A second recent approach examines the relationships between product mix and earnings volatility and casts some doubts on the tenet that an increasing diversification of income sources, associated with higher non-interest income shares, may reduce bank profit volatility.

Regarding the US, initial doubts on the hypothesis were raised by Roland (1997) and De Young and Roland (1999): the main idea is that traditional relationship lending activities tend to generate more stable revenues because switching and information costs tend to reduce the likelihood that either the borrower or the lender will terminate the relationship. Borrowers are less prone to shop around in search for better prices, a behavior that, viceversa, characterizes trading activities. Besides, as Berger and Mester (1999) highlight, the expansion towards fee-based activities requires substantial fixed investments (particularly those related to the information technology) with negative effects on the reduction of operating costs, and therefore on the benefits of economies of scale and scope, let alone on the level of operational risk taken on by the bank. Considering that until the recent proposal by the Basle Committee no request for capital was made with respect to operational risk, the final effects of diversification could result in an incremental risk not associated with an increase in the level of capital. Later on, Stiroh (2004; 2006) assessing the potential diversification benefits of non-interest income finds that, in the aggregate, declining volatility of net operating revenue reflects reduced volatility of net interest income, not diversification benefits from non-interest income, which is quite volatile and increasingly correlated with net interest income. In addition, at the bank level, greater reliance on non-interest income is associated with lower risk-adjusted profits and higher risk. Thus, the author concludes that the diversification benefits from the ongoing shift toward non-interest income are not obvious.

Regarding Europe, Staikouras et al. (2000) and Staikouras and Wood (2003) bring evidence in favor of diversification observing that, with the single exception of large German banks, there exists a positive correlation of non-interest income with bank profits. However, the study also demonstrates that the positive effects of diversification, in terms of profit stabilization and risk reduction, are somewhat limited. Adopting a comparative approach that focuses on the level of revenue diversification for a sample of European and US banks, Bongini, Di Battista and Nieri (2000) confirm the positive effects of diversification on bank profitability; it remains uncertain, however, what the implications are in terms of profit stabilization. The study, however, is limited to the period 1993-1998; therefore it doesn't completely capture the effect of heavier reliance on trading revenues and its impact on profits when markets rally to a downturn. In turn, Baele, Van der Vennet and Van Landschoot (2004) observe that market participants perceive functionally diversified banks as being better protected against a deterioration in money and credit market conditions compared to their more specialized competitors.

It is quite clear by now that the transformation of the bank business model from the *classic* "originate-to-hold" (OTH) into the *fashionable* "originate-to-distribute" (OTD) was part of the problem as the severance of the bank-borrower relationship implied by the second model allows the

borrowers to undertake suboptimal investment and operating decisions, in the absence of the discipline of intense bank screening and monitoring (Berndt and Gupta, 2008).

In theory, the OTD model would simply imply a reconfiguration of banking with banks increasingly operating as originators and packagers of credit risks which are ultimately assumed by others (Llewellyn, 1999). When it functions correctly – that is when banks focus on the origination, servicing and monitoring of loans, those activities where they have a competitive advantage because of their specialization – such model may have the capacity to distribute risks widely and efficiently while at the same time diversifying the revenue stream of the banks (BIS, 2008). However, the potential problems associated with a widely implemented OTD model were less clear. In particular, the OTD model suffered from agency problems coupled with a tendency to lower underwriting standards as well as inadequate transparency standards (Pagano and Vopin, 2008). The originator of the loans had every incentive to boost loan volumes while it had little incentives to screen and monitor for loan quality – as the originated loans were quickly dismissed from its books and the related risk distributed to market participants. Those at the beginning of the loan chain (mortgage brokers) were lured by originating fees and focused only on maintaining origination volume. Banks, at the centre of the securitization process, focused more on loan repackaging and on profits generated by the distribution of the securitized assets and less on the quality of underlying assets; they also disregarded the liquidity problems generated by their commitments towards their special purpose vehicles. On their part, poorly regulated investment banks pushed commercial banks in their quest for creating new securities. In turn, rating agencies underestimated risks of structured assets by overlooking how systemic liquidity problems would depress market valuations; failed to see how the passage from OTH to OTD had lowered credit standards; ventured into rating extremely complex structured products by "marking them to model" on the basis of too rosy assumptions; sometimes underwent conflicts of interest by acting also as consultants in the structuring process of the products they were to rate. Finally, those at the end of the loan chain, investors (with banks among them!), paid little attention to the problem of asset quality, placing too much trust on the due diligence of originators and packagers and on the correctness of rating agencies' judgments.

As the crisis unfolded and revealed the faults of the OTD model, at least of its degeneration, the assumption that bank revenues should be diversified away, via a greater expansion of banks' activities that involves market's circuits, was increasingly questioned. A number of recent studies analyzing the link between the expansion of non-interest income activities and bank's risk find that banks performing traditional intermediation activities are either perceived by the market as being less risky (stock prices less sensitive to fluctuations in the stock market index) or present a lower levels of risk-taking (Mercieca et al, 2007; Baele et al, 2007; de Nicolo et al, 2004).

All in all, there seems to be evidence of a positive – not a negative – link between growing reliance on non-interest income and bank profit volatility. In the jargon of the Capital Asset Pricing Model, one could argue that as non-interest income is an aggressive asset it should also require higher return.

As said, an explanation of the fact that, in the subprime crisis, listed smaller-sized banks suffered less than larger-sized ones may rest on a type of small-bank anomaly similar to the "small-firm effect" studied at length in the finance literature (see below). The alternative (or additional) explanation, which we will test subsequently, is that rather than a small-bank effect, there was an effect whereby stock markets penalized less those banks that had kept closer to the old fashioned relationship banking (OTH) model.

2.2 The small firm effect

The Small Firm Effect (SFE) is one of the most interesting market anomalies outlined by the finance literature. In practice, several studies highlight that portfolios made of stocks having a low

capitalization (small-caps) reach average yearly returns above those attained by portfolios of stocks with high capitalization (large-caps). Thus, it seems that size can significantly contribute to determine share prices. Clearly, the SFE violates the Efficient Market Hypothesis (EMH) and the Capital Asset Pricing Model (CAPM). The SFE would, in fact, imply the existence of unjustified extra profit opportunities. Such market anomaly is a factor used to explain superior returns in the Fama-French Three Factor Model or the Cahart Four Factor Model (Fama and French, 1992).

The SFE puzzle was first revealed by Banz (1981). Referring to a large sample of stocks exchanged on the NYSE for at least five years between 1925 and 1976, Banz found a negative correlation between firm size and the return on its stock. He subdivided the studied stocks in five portfolios on the basis of company size (measured by capitalization). Each of these portfolios was then further subdivided into five sub-portfolios depending on the value of the individual stock's beta. The resulting 25 sub-portfolios were meant to comprise the same number of stocks also similar in terms of market capitalization and risk profile. Referring to them, Banz showed that the companies with smallest capitalization had abnormal monthly returns exceeding by 0.4% with respect to the companies with largest capitalization. Accordingly, even though this puzzle lacks theoretical foundations, Banz states that the CAPM, as proposed by Sharpe in 1964, should be augmented as follows:

$$ER_i = r + \beta_i (ER^m - r) + \delta (\Phi_i + \Phi_m) / \Phi_m \qquad (1)$$

where:

ER_i = expected return on stock i;

r = risk free return (or expected return on the zero-beta portfolio);

β_i = beta of the stock i;

$(ER^m - r)$ = expected excess return for the market portfolio over the risk free rate;

δ = constant measuring the contribution of size to the securities' return;

Φ_i = market value of security i

Φ_m = average market value

It is easy to appreciate how the model by Banz – though he never provided a theoretical foundation for it – is just an augmented CAPM. Its novelty is the final component on the right hand side of the equation. Through this, Banz intends to justify the excess returns explained by size. Indeed, coefficient δ should be zero if securities' returns were independent of their size, thus falling back on the ordinary CAPM. To be sure, Banz's findings are at odds with the ordinary CAPM as well as with the Efficient Market Hypothesis.

Several studies addressed the SFE after the seminal paper by Banz. One of the most influential of these studies is that by Reinganum (1982). Subdividing the market portfolio into ten deciles, he shows that the smallest capitalization one (MV1) reaches a composite return of 42% per annum, much beyond the 6% per annum obtained by the largest capitalization decile (MV10). This huge difference in returns can hardly be explained by the difference in the respective betas, which is 0.7 between MV1 and MV10.

Later on, Elfakhani and Zaher (1998) try to explain the SFE on the basis of the difference between small and large enterprises in terms of the information actually available to investors. Indeed, the former obtain less coverage by the media vis-à-vis the latter and if less is known on small enterprises with respect to what is known on large ones then the assumptions at the basis of the EMH may be violated. But why the prospect of extra profits does not motivate the media to give a better coverage to smaller-capitalization enterprises? Elfakhani and Zaher (1998) analyze a

sample of companies listed on the NYSE and AMEX markets from January 1986 to December 1990. To be included in the sample, the listed companies must be covered by a certain number of financial analysts who report their views on IBES (Institutional Brokers' Estimate System). Consistently with the previous literature on the SFE, the sample is then broken down into ten decile portfolios depending on individual company market capitalization. It is presumed that less information on the small cap shares raises the uncertainty on their pricing, whence investors require an extra return, which is the SFE. In reality, the size of the listed enterprise is strongly positively correlated to the interest shown by the financial analysts. Clearly, there are more potential investors interested in a large cap than there are interested in a small cap.

Finally, to further confuse things, it seems that the SFE did not vanish but changed sign in the late 1980s at least for the UK and the US markets. According to Dimson and Marsh (1999) this was possibly caused by the different sectoral specialization of the large caps vs. the small caps: sectors such as telecommunications, pharmaceuticals, banking and utilities, are much underrepresented in the small caps with respect to the large caps.

3. Dataset and summary statistics

Our sample consists of 247 listed banks from Europe, Japan and the United States (Table 1). We considered the whole population of bank holding companies or independent banks listed in Austria, Belgium, France, Finland, Germany, Greece, Italy, the Netherlands, Portugal, Spain, Sweden, Switzerland, the UK and Japan. For the US, we limited the analysis to those banks listed at the NYSE and included in the large, mid and small cap market indexes.

Table 1 The sample: country coverage

Country	n. of banks	Average total assets (2007) Mil €
Europe	80	315,180
Usa	75	81,977
Japan	92	56,058
Total	247	144,840

Market data are compiled from the Bloomberg database, while measures of size, income diversification, capitalization, liability structure and on/off balance sheet structure are collected from the Bankscope database. Our sample period covers 2005-2008 for relevant market information, and 2005-2007 for financial statement data.

A selection of financial indicators, taken from consolidated financial statements, were used to proxy a bank's business model, either the old-style "Originate and hold model" or the "OTD model"; these ratios are listed in Table 2 and should provide us with information about:

a) the type of business chosen (structural indicators);

b) the operational characteristics of the business model (financial position and capital position);

c) the economic results (profitability ratios).

Table 2 The set of financial indicators

INDICATORS of	Ratios
STRUCTURE	Loans/Deposits
	Off Balance Sheet Activities /Total Assets
CAPITAL AND FINANCIAL POSITION	Liquid Assets/Total Borrowings
	Leverage (Equity/ Total Assets)
	Tier1/ Risk weighted assets
	Total capital ratio
PROFITABILITY AND RISK	ROE
	ROA
	Cost to income
	Non performing loans/Loans
INCOME DIVERSIFICATION	Net interest income /Operating income

An OTH model of bank business means the bank sticks to the traditional intermediation process, that is, on the asset side, greater importance of the loan portfolio and, on the liability side, large deposit taking activity from customers and possibly higher capitalization ratios as a buffer against the potentially higher credit risk. This in turn should be associated with a lower level of Off balance sheet activities, a higher level of net interest revenues over total revenues, a higher capitalization and higher liquidity buffers (Beccalli et al., 2009; Bongini et al., 2009).

Table 3 presents summary statistics for our sample of banks divided by countries.

Table 3. Summary statistics by countries

		MEAN					MEDIAN			
Country		USA	Japan	Europe	Total		USA	Japan	Europe	Total
Total assets (mil €)	2005	79,740	58,331	246,126	122,263	2005	7,094	17,288	38,225	15,352
	2006	73,162	54,226	278,496	129,375	2006	7,365	16,002	45,258	14,263
	2007	81,977	56,058	319,497	145,453	2007	7,184	15,349	49,649	14,764
Net Interest revenue/Operating Income (%)	2005	69.45%	82.15%	57.76%	70.86%	2005	72.05%	85.41%	59.40%	73.96%
	2006	70.18%	82.34%	56.28%	70.57%	2006	72.55%	85.60%	58.02%	74.99%
	2007	70.10%	82.86%	56.15%	70.71%	2007	71.48%	85.36%	60.29%	75.00%
Off Balance Sheet Activities/Total Assets (%)	2005	27.69%	1.48%	14.50%	12.90%	2005	2.08%	1.10%	8.72%	1.61%
	2006	35.88%	1.11%	16.27%	15.88%	2006	2.03%	0.82%	9.37%	1.44%
	2007	31.77%	1.01%	13.69%	13.87%	2007	1.94%	0.74%	9.38%	1.44%
Loans / Total borrowings (%)	2005	82.06%	69.93%	95.53%	81.42%	2005	84.16%	70.77%	94.00%	76.32%
	2006	84.32%	70.99%	96.97%	83.09%	2006	84.76%	71.83%	98.05%	78.63%
	2007	85.66%	71.69%	98.07%	84.10%	2007	86.50%	71.72%	105.38%	78.98%
Tier 1 ratio	2005	10.54%	8.30%	9.66%	9.34%	2005	10.30%	8.33%	7.94%	8.56%
	2006	10.66%	8.70%	9.17%	9.45%	2006	10.10%	8.56%	7.90%	8.90%
	2007	10.07%	8.72%	9.44%	9.34%	2007	9.72%	8.70%	8.20%	8.98%
Total capital ratio	2005	12.70%	10.54%	12.48%	11.69%	2005	12.20%	10.22%	11.45%	11.30%
	2006	12.75%	11.09%	12.22%	11.90%	2006	12.30%	10.77%	11.20%	11.50%
	2007	12.23%	10.98%	11.97%	11.64%	2007	11.50%	10.79%	11.20%	11.20%

Equity/total assets (%)	2005	9.60%	5.47%	7.03%	7.19%	2005	8.98%	5.33%	6.90%	6.79%
	2006	10.13%	5.75%	6.55%	7.33%	2006	9.51%	5.57%	6.52%	6.91%
	2007	9.85%	5.26%	6.35%	7.00%	2007	9.47%	5.21%	6.45%	6.56%
Liquid Assets / Deposits (%)	2005	8.09%	17.29%	10.39%	12.41%	2005	4.52%	16.56%	9.40%	12.02%
	2006	7.73%	17.18%	10.72%	12.30%	2006	4.49%	16.02%	8.57%	11.92%
	2007	7.95%	15.55%	10.89%	11.79%	2007	3.90%	15.49%	8.45%	11.24%
Interbank position (%)	2005	-0.06%	-3.43%	3.76%	-0.22%	2005	N.A.	-3.22%	0.07%	N.A.
	2006	N.A.	-3.68%	-0.10%	-2.10%	2006	N.A.	-3.46%	0.48%	-2.82%
	2007	-5.79%	-3.62%	0.39%	-1.85%	2007	-5.79%	-3.42%	0.65%	-2.64%
Return on Average Assets (ROAA)	2005	1.33%	0.30%	0.82%	0.77%	2005	1.37%	0.29%	0.74%	0.66%
	2006	1.29%	0.31%	0.87%	0.78%	2006	1.29%	0.31%	0.76%	0.67%
	2007	1.02%	0.22%	0.87%	0.66%	2007	1.05%	0.22%	0.77%	0.60%
Return on Average Equity (ROAE)	2005	14.40%	4.64%	13.02%	10.15%	2005	14.65%	5.37%	11.33%	9.99%
	2006	13.74%	4.83%	14.09%	10.41%	2006	13.44%	5.28%	13.56%	9.86%
	2007	10.60%	3.78%	13.36%	8.82%	2007	11.73%	4.07%	13.02%	8.25%
Cost to Income Ratio (%)	2005	55.92%	63.17%	59.52%	59.87%	2005	57.72%	64.30%	60.05%	60.55%
	2006	56.99%	63.38%	58.22%	59.83%	2006	58.55%	64.33%	58.87%	60.91%
	2007	59.96%	66.44%	58.16%	61.92%	2007	58.92%	68.45%	57.84%	61.58%
Impaired loans/gross loans (%)	2005	0.47%	4.67%	3.22%	2.94%	2005	0.32%	4.43%	2.78%	2.61%
	2006	0.38%	4.22%	2.96%	2.64%	2006	0.33%	3.95%	2.66%	2.48%
	2007	0.97%	3.95%	2.73%	2.66%	2007	0.66%	3.84%	2.31%	2.44%

Being listed is a common characteristics of Japanese and US banks irrespective of bank's size, while in Europe listed banks tend to concentrate in the dimensionally largest segment of the banking market. Such differences are reflected in our sample average and median values for total assets: EU banks, on average, are 4 and 6 times larger than US and Japanese banks.

The widespread adoption of the universal bank model among European banks and their larger dimension explain their greater diversification of income sources, as indicated by a lower level of the net interest income to operating income ratio, with respect to Japanese and US banks.

Off balance sheet activities (over total assets) are more relevant among US banks as that banking system experienced intense securitization process. In contrast, European banks seem to operate in an old-fashioned intermediation model, with a greater propensity to close the intermediation circuit, as shown by their higher Loan-to-total borrowings ratio.

As far as the liquidity measures is concerned, the picture is less clear: Japanese banks seem to be the more liquid in our sample, with a higher ratio of liquid assets over deposits; however, they are also net borrower in the interbank market – see negative sign of the ratio "interbank position over total assets".

Regarding the capital position, US banks show much higher capital adequacy ratios than EU and Japanese banks and similarly lower leverage ratios. The higher gearing of EU banks helps explain their greater capital profitability (ROE). On the contrary, notwithstanding the comparatively low level of their ratio "equity to total assets", Japanese banks are the least profitable, both in terms of ROA and ROE and show higher cost income ratios.

Finally, the risk profile of our sample banks is quite limited: in the three years under investigation, only Japanese banks show levels of non performing loans to total loans distributed around 4%.

All in all, our sample confirms the results of Beccalli et al. (2009), which highlighted the absence of country-specificities in the diffusion of the OTD/OTH models of intermediation.

More interesting results are to be found in Table 4, which illustrates our sample distribution by Total Assets (as of 2007).

Our sample of banks has been divided in four groups according to the following criteria:

a) small banks group if the bank's total assets as of year-end 2007 fall in the lowest 25th percentile;
b) medium banks group if the bank's total assets as of year-end 2007 is comprised between the 25th percentile and the median value;
c) large banks group if the bank's total assets as of year-end 2007 is comprised between the median value and the 75th percentile;
d) very large banks group if the bank's total assets as of year-end 2007 fall is greater than the highest 75th percentile.

Table 4 Size distribution of our sample

Our sample of banks has been divided in four groups according to the following criteria: a) small banks group if the bank's total assets (TA) as of year-end 2007 fall in the lowest 25th percentile; b) medium banks group if the bank's total assets as of year-end 2007 is comprised between the 25th percentile and the median value; c) large banks group if the bank's total assets as of year-end 2007 is comprised between the median value and the 75th percentile; d) very large banks group if the bank's total assets as of year-end 2007 fall is greater than the highest 75th percentile.

	TA 07<25° pct		*25° pct<=TA 07<50° pct*		*50°pct<TA 07<75°pct*		*TA 07>=75°pct*	
	Mean	*Median*	*Mean*	*Median*	*Mean*	*Median*	*Mean*	*Median*
Net Interest revenue/Operating Income	78.52%	80.83%	76.12%	79.17%	76.64%	82.05%	51.54%	55.47%
Off Balance Sheet Activities/Total Assets	2.66%	1.29%	3.26%	1.25%	3.21%	0.73%	47.50%	14.65%
Interbank position /Total assets	-3.16%	-4.32%	-5.74%	-4.66%	-2.36%	-2.69%	2.89%	1.64%
Impaired loans/gross loans	2.75%	1.47%	2.75%	2.65%	3.29%	3.46%	1.78%	1.24%
Tier 1 ratio	9.76%	9.74%	10.17%	9.16%	9.40%	9.11%	8.00%	7.49%
Total capital ratio	11.62%	11.16%	11.89%	11.30%	11.63%	11.20%	11.41%	11.00%
Equity/total assets	8.43%	7.96%	7.17%	6.72%	6.48%	6.23%	5.92%	5.75%
Return on Assets	0.71%	0.74%	0.76%	0.62%	0.45%	0.33%	0.75%	0.74%
Return on Equity	7.57%	8.01%	9.29%	8.78%	5.76%	4.84%	12.67%	13.16%
Cost to Income Ratio	62.47%	62.52%	63.26%	63.28%	62.38%	61.93%	59.52%	58.38%
Loans / Total Borrowings	88.96%	85.20%	87.84%	81.63%	81.50%	71.72%	78.19%	76.28%
Liquid Assets / Deposits	8.52%	5.15%	12.17%	11.50%	14.31%	15.04%	12.18%	8.02%

Small and medium banks share similar characteristics and with respect to large and very large banks tend to:

a) rely more on interest income as a source of revenue;
b) have less Off Balance Sheets Activities over Total assets;
c) show higher capitalization ratios (equity/total assets and capital adequacy ratios);
d) be a bit less efficient, but only with respect to large banks;
e) be more profitable in terms ROA, yet not in terms of ROE – especially if compared to very large banks;
f) have a less risky lending activity, though only with respect to large banks.

In other words, an OTD model of intermediation is more likely to be associated with large size, while small and medium sized banks tend to keep rooted to the OTH model.

4. The empirical analysis

4.1 Event study

We set up our event study to analyze the effects of a main disruptive financial event on the banking system. To that end, we selected the 29th of September 2008, when the world financial markets experienced deep turmoil as the US Congress initially rejected the Paulson Plan (the Troubled Asset Relief Program, TARP) to salvage the US financial institutions. By then a large part of the American financial institutions were in trouble, as the crisis had escalated on September 15, when, lacking support by either the Fed or the US Treasury, one of the largest Wall Street investment banks (Lehman Brothers) went bankrupt, to the surprise of most market participants. Though the TARP was eventually approved (on October 3) after partial rewriting, the initial rejection was a major blow that deeply unnerved the markets, risking to trigger a meltdown of the financial system.

If this event conveys useful information to banking system, the abnormal returns associated to it should be significant. Abnormal returns are measured as the extra returns; i.e. the deviations of actual returns (normal returns) from the predicted ones.

Abnormal returns are defined as:

$$(1)\quad AR_{it} = R_{it} - E(R_{it} \mid X_t)$$

where AR_{it}, R_{it} and $E(R_{it} \mid X_t)$ are the abnormal, actual and normal returns respectively for time period t. X_t is the conditioning information for the normal return model.

We use an estimation window of 120 trading days going from the 10th January 2007 to the 29th June 2007. In turn, our event window of 11 trading days: from *t-5* to *t+5* where *t* is the event date. The event date is September 29 2008. The estimation period is the period used as the basis for estimating what the values of the observed time series during the event window would have been if the event had not occurred. The estimation period excludes the event window because it may influence the normal performance model parameter estimates. Also some days ahead the event window are usually excluded to keep away some surrounding event effects. In our case, we end our

estimation window at the end of June 2007 to avoid the contamination of the earlier phase of the crisis, which started at the beginning of August 2007, when central banks were forced to scale up their liquidity injections because of the crisis and banks' market indices (and the overall markets, as well) plummeted in a long lasted downward spiral.

Returns of bank stocks price are used to calculate stock returns; we assume that stock returns are jointly multivariate normal and independently and identically distributed through time.

Normal return are calculated using the market model; this model relates the return of any security to the return on the market portfolio. As market portfolio we use for each country its main national stock index. The model's linear specification follows from the assumed joint normality of asset returns.

For any security i the market model is:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it}$$

$$E(\varepsilon_{it} = 0) \qquad var\,(\varepsilon_{it}) = \sigma_{\varepsilon i}^2$$

where R_{it} and R_{mt} are the period-t return on security i and the market portfolio, respectively, and ε_{it} is the zero mean disturbance term; α_I, R_{mt} and $\sigma_{\varepsilon i}^2$ are the parameters of the market model.

Both individual stock returns and the market return are calculated as follows:

$$R_{it} = \frac{P_{it} - P_{it-1}}{P_{it-1}}; \qquad R_{mt} = \frac{P_{mt} - P_{mt-1}}{P_{mt-1}}$$

Once the normal return is estimated, the deviation of individual returns from normal return is calculated (abnormal return). The abnormal return is a measure of the unexpected change in the stock prices after the event is realized. We assume that the event is exogenous with respect to the change in the market value of stocks, and the change in the value of bank stocks bond is caused by the event. The specific null hypothesis to be tested is whether the mean abnormal return at time t is equal to zero.

Predicted (normal) returns are calculated by OLS estimation. Then normal return estimation are used to estimate abnormal returns:

$$AR_{it} = R_{it} - \widehat{\alpha}_i - \widehat{\beta}_i R_{mt}$$

where AR_{it} is the sample of abnormal return for stock i in the event window.

Under the null hypothesis, conditional on the event window market returns, the abnormal returns will be jointly normally distributed with a zero conditional mean and conditional variance $\sigma^2(AR_{it})$:

$$\sigma^2(AR_{it}) = \sigma_{\varepsilon_i}^2 + \frac{1}{L}[1 + \frac{(R_{mt} - \overline{R}_m)^2}{\sigma_m^2}]$$

where $\overline{R}_m$ is the mean return of the market portfolio. With L large, $\sigma^2(AR_{it}) \rightarrow \sigma^2_{\varepsilon_i}$; i.e. the additional variance due to the sampling error in α_i and β_i approaches zero; from that we derive that abnormal returns are not correlated.

To construct our tests, abnormal returns are aggregated both across bonds and across time. Aggregation across bonds is obtained averaging the abnormal returns for all bonds in the sample on a given day. We call this average AAR_t, which is the average residual across all firms on day t, where t is measured relative to the event day (t=0 is the event date).

$$AAR_t = \frac{1}{N}\sum_{i=1}^{N} AR_{it}$$

where for L large the variance is:

$$VAR(AAR_t) = \frac{1}{N^2}\sum_{i=1}^{N} \sigma^2_{\varepsilon_i}$$

AAR_t significance is tested by the t-test

In order to test the persistence of the effects of rating variations during the event window, AAR_t are aggregated through time. Aggregation over time is a simple accumulation of the AAR_t over the event window days. The cumulative abnormal return, CAR_{t_1,t_2} is the sum of all the AR_t between t_1 and t_2 , the beginning and the end of the event window:

$$CAR_i(t_1,t_2) = \sum_{t=t_1}^{t_2} AR_{it}$$

To test the null hypothesis of zero cumulative abnormal returns, it is possible to formulate a Z test as $CAR_i(t_1,t_2) \approx N(0,\sigma_i^2(t_1,t_2))$:

$$Z = \frac{CAR}{(\sigma_i^2(t_1,t_2))^{1/2}} \approx N(0,1)$$

Robustness matters bring us using also the sign test to check the significance of AARs and CAARs; sign test is not based on the assumption of the normality of abnormal return.

Estimation results and test statistics are provided in table 5.

Table 5 Average abnormal returns: simple (AAR) and cumulated (CAAR)

Passing the t-test and/or the sign-test means that the abnormal return is statistically significantly different from zero at that time horizon.

Event window						
T	AAR	t-test	sign-test (p-value)	CAAR	t-test	sign-test (p-value)
-5	-0.0246	-3.75*	0.0000*			
-4	-0.0008	-0.48	0.9488			
-3	-0.0001	-0.51	0.8477			
-2	-0.0069	-2.19*	0.0056***			
-1	-0.0095	-0.15	0.5213			
0	-0.0242	-2.13*	0.0177**	-0.0242	-1.99*	0.0177**
+1	0.0197	4.06*	0.0470**	-0.0287	-3.22*	0.3692
+2	0.0295	2.43*	0.0001*	-0.0038	-2.41*	0.0000*
+3	0.0074	2.46*	0.0470**	0.0285	2.91*	0.0000*
+4	-0.0038	-4.09*	0.0024**	0.0571	1.35	0.0085
+5	-0.0084	-3.59*	0.0399**	0.0708	1.00	0.2764

*, **,*** stands, respectively, for 1%, 5% and 10% level of significance.

We also use the non-parametric sign test, to be sure our results don't stem from the possible violation of the normality assumption about the abnormal returns. The AARs are negative since t-5 but they are not significant in the whole event window, they are significant in t-5, t-2, t0; after the event date the AARs start to become positive and significant in t+1 t+2, t+3, and in t+4 and t+5 they become again negative. Since AARs are not persistently negative ahead the event date, and the AARs mostly felt in the event date (2,4%) we decide to cumulate the Average Abnormal Return (CAARs) since the 29th of September 2008 (t=0). CAAR in t+1 is negative and significant (for t-test but not for the sign test, this may be due to the greater variance of AARs in financial markets because of the event). They still remain negative and significant in t+2, but they turn out positive since t+4 and significant only accordingly to the sign test in t+4 but not in t+5. Thus it seems to make more sense looking at the CAARs from t0 to t+2.

4.2 Regression analysis

This section explores the relationship between size and the business model chosen by a bank and our sample's market performance following the initial rejection of the Paulson rescue plan (the 29th of September, 2008).

The dependent variable represents the cumulative abnormal returns that each bank registered in day *t*, *t+1* and *t+2* after the chosen event (CAR2). There are two chief reasons to consider not only *t* but also the two immediately following days. First, the smoothing over more than one day can reduce measurement errors. Second, due to the different times of market opening, by limiting the analysis to *t* only there could be asymmetries between the US, Europe and, especially, Japan.

Our independent variables are proxy measures of size, income diversification, capitalization, liquidity, profitability and balance sheet structure[3] as indicated in table 2, for the year 2007. A dummy variable distinguishing between European, Japanese and US banks is also included in order to capture country-specific effects.

Table 6 presents the results of a stepwise OLS regression. With a stepwise regression, only relevant variables are retained among the many included in the list of independent, potential explanatory variables. As one can read from Table 6 only two variables, (smaller) dimension and (lower) credit risk, appear to be relevant in either insulating banks or reducing the negative effects of a plummeting capital market. Surprisingly, higher leverage brings similar results. This unusual result might be driven by the large presence of US banks that, at the same time, were more capitalized (9.8 against 5.7% of the rest of the sample, on average) and experienced larger share price drops. The dummy for Europe is also statistically significant: its sign is positive possibly reflecting the initial belief by the markets that Euro banks were less exposed to the subprime segment and therefore to the (negative) effects of the rejection of the US rescue plan.

Table 6: Regression analysis

Stepwise OLS regression with robust standard errors; the dependent variable is the abnormal return experienced in the occasion of the event represented by the rejection by the US Parliament of the Paulson rescue plan (the 29th of August 2008). Independent variables are proxy for size (log of total assets), income diversification (net interest income/operating income), liquidity position (liquid assets/total deposits), capitalization (equity/total assets, capital adequacy ratios), profitability and risk (Roe, Roa, Cost to income, Non performing loans /loans), balance sheet structure (Loans/total borrowings). A dummy variable distinguishing between European, Japanese and US banks is also included in order to capture country-specific effects.

	CAR 2
Constant	0.1323**
	[0.0542]
Size (Log Total Assets)	-0.0093***
	[0.0034]
Income diversification (Net Interest revenue/Operating Income)	0.0209
	[0.0158]
Credit risk (Impaired Loans /Total loans)	-0.5677**
	[0.2648]
Capitalization (Equity /Total Assets)	-0.5219**
	[0.2558]
Europe	0.0354**
	[0.0157]
Japan	0.029
	[0.0181]
Adjusted R-squared	0.0653
N. of observations	208

[3] The limited number of our sample banks showing data on their OBSA hindered the use of such a variable as independent estimator in our equations.

As seen in the previous section, a large dimension is more likely to be associated with balance sheets characteristics indicating a move towards an OTD model of intermediation. Therefore our variable "size" could hide the facts that the market was penalizing less small banks as they tended to keep close to the old fashioned intermediation model.

In order to disentangle the two effects, we adopt a two-step methodology of analysis.

First, we run an ancillary OLS regression with size as the dependent variable and the financial statement ratios as independent variables.[4] From this regression we calculate a new indicator for size, given by the residuals of such a regression, which should be a correct proxy for the dimensional effects irrespective of (orthogonal to) the business model adopted by the bank.

As a second step, we rerun the OLS regression exploring the relationship between the market performance following the rejection of the Paulson rescue plan (CAR2) and the financial statement proxies for OTD/OTH models and the new depurated proxy for bank dimension.

Results are shown in table 7.

Table 7

Stepwise OLS regression with robust standard errors; the dependent variable is the abnormal return experienced in the occasion of the event represented by the rejection by the US Parliament of the Paulson rescue plan (the 29th of August 2008). Independent variables are proxy for size (residuals of an OLS regression of "log of total assets" on financial statements ratios proxies for OTH/OTD models), income diversification (net interest income/operating income), liquidity position (liquid assets/total deposits), capitalization (equity/total assets, capital adequacy ratios), profitability and risk (Roe, Roa, Cost to income, Non performing loans /loans), balance sheet structure (Loans/total borrowings). A dummy variable distinguishing between European, Japanese and US banks is also included in order to capture country-specific effects.

	dependent variable CAR 2
Constant	-0.0252
	[0.0161]
Size (Residuals)	-0.0097**
	[0.0039]
Income diversification (Net Interest revenue/Operating Income)	0.0412***
	[0.0156]
Credit risk (Impaired Loans /Total loans)	-0.6041**
	[0.2679]
Japan	0.0525***
	[0.0144]
Europe	0.0461***
	[0.0143]
Adjusted R-squared	0,473611111
N. of observations	223

[4] The independent variables used are: the ratio of net interest income over operating income, the ratio of liquid assets over total deposits, the capitalization ratio (equity/total assets), ROE as a measure of profitability and the ratio of Loans over total borrowings.

Along with size and credit risk, also income diversification becomes relevant in explaining banks' abnormal returns when the US government rescue plan was rejected. Banks with greater reliance on interest income – that is banks relying on the traditional intermediation model – experienced positive abnormal returns. Dummies for Japan and Europe are also significant and show a positive sign. This could be indicating that the contagion from the US was not extreme as possibly it was thought that the European and Japanese banks were less contaminated by the fallout of the subprime related losses.

These results are in line with Beccalli et al. (2009) and Olivier De Jonghe (2009).

The former study analyzes the evaluation of bank intermediation models by the markets before and after the outburst of the subprime crisis. In their study, concentrating on European banking, the authors found that the markets were indeed discriminating and punishing more those large banks which, on the basis of financial statement data, were seen as having adopted an OTD model of intermediation. Similarly, concentrated on European banking, the second study explores the relationship between banks' divergent strategies toward specialization and diversification of financial activities and their ability to withstand a banking sector crash. The author finds that, in addition to smaller size and better capitalization, banks less depending on non-interest generating activities are better able to withstand extremely adverse conditions.

5. Conclusions

Drawing on a large set of listed banks from Europe, the US and Japan we started noticing that smaller-sized banks suffered less than larger banks in conjunction with the unfolding of the subprime crisis. Was this a small-bank anomaly analogous to the classic small firm effect?

We conjectured that what seems to be a small bank anomaly might, in fact, signal (also) a generalized market reassessment of the banking business model and tested whether stock markets penalized less the banks that kept more rooted to the traditional "originate-to-hold" (OTH) model while forgoing the opportunities disclosed by the "originate-to-distribute" (OTD) model.

By an event study methodology, we focused on September 29 2008, the "dies irae" (the day of wrath) when the US Congress rejected the Paulson Plan (the Troubled Asset Relief Program, TARP) to salvage the US financial institutions. By then a large part of the American financial institutions were in trouble, as the crisis had escalated on September 15, when, lacking support by either the Fed or the US Treasury, one of the largest Wall Street investment banks (Lehman Brothers) went bankrupt, to the surprise of most market participants. Though the TARP was eventually approved (on October 3) after partial rewriting, the initial rejection was a major blow that deeply unnerved the markets, risking to trigger a meltdown of the financial system.

Our results detect that, indeed, banks that had kept closer to the OTH model – as proxied by a higher net interest income/operating income – experienced less negative abnormal returns. In spite of this, we still keep finding that larger-sized banks' share prices were penalized more than the share prices of their smaller-sized homologues. Possibly, the "Too Big (or Interconnected) To Fail" credence, at least for a while, had been overruled. We also find that European and Japanese banks experiences less negative abnormal returns.

References

Baele, L., R. Van der Vennet and A. Van Landschoot (2004), Bank risk strategies and cyclical in bank stock returns, Gent University, Faculty of Economics working paper 2004/17, January.

Baele, L., O. de Jonghe and R. Van der Vennet (2007), Does the stock market value bank diversification?, Journal of banking and Finance 31, 1999-2023

Banz, R.W. (1981), The Relationship Between Return and Market Value of Common Stock, *Journal of Financial Economics*, vol.9, 3-18.

Beccalli, E., P. Bongini and A. Patarnello (2009), Modelli di intermediazione delle banche europee e la valutazione del mercato, in Osservatorio Monetario, n. 1/2009.

Berger, A. and L. Mester (1997), Inside the black box: What explains differences in the efficiencies of financial institutions? Journal of Banking & Finance.

Berger, A. and L. Mester (1999), What explains the dramatic changes in cost and profit performance of the U.S. Banking industry?, Federal Reserve Bank of Philadelphia working paper n.99-01.

Berndt, A. and A. Gupta (2008), Moral Hazard and Adverse Selection in the Originate-to-Distribute Model of Bank Credit, downloadable at www.ssrn.com.

BIS (2008), Some reflections on the future of the originate-to-distribute model in the context of the current financial turmoil, Speech by Mr Malcolm D Knight, General Manager of the BIS, at the Euro 50 Group Roundtable on "The future of the originate and distribute model", London, 21 April 2008.

Bongini, P., M.L. Di Battista and L. Nieri (2000), Diversificazione produttiva e redditività bancaria: un'analisi comparata, in "Il sistema bancario e l'UME: effetti sui prezzi, sui prodotti e sulla concorrenza, Biffis (ed.), Giappichelli editor, Torino.

Bongini, P., M.L. Di Battista and L. Nieri (2009), Crisi finanziaria, interventi statali di ricapitalizzazione e modelli di intermediazione: quale relazione per le banche europee?, in "Dopo la crisi. L'industria finanziaria italiana tra stabilità e sviluppo" ed. by G. Bracchi and D. Masciandaro, 14° rapporto sul Sistema Finanziario Europeo, Edibank Milan, 453-470.

De Nicolo G., P. Bartholomew, J. Zaman and M. Zephirin (2004), Bank Consolidation, Internationalization and Conglomeration: Trends and Implications for Financial Risk, Financial Markets, Institutions & Instruments, Vol. 13, No. 4, pp.173-217.

De Young, R. and K.P. Roland (1999), Product Mix and Earnings Volatility at Commercial Banks: Evidence from a Degree of Leverage Model, Federal Reserve Bank of Chicago, Working paper 99-6.

Dimson, E. and Marsh, P. (1999), Murphy's Law and Market Anomalies, Journal of Portfolio Management, vol.25, 53–69.

Elfakhani, S. and T. Zaher (1998), Differential Information Hypothesis, Firm Neglect and the Small Firm Size Effect, Journal of Financial and Strategic Decisions, vol.11, n.2.

Fama, E.F. and K.R. French (1992), The Cross-Section of Expected Stock Returns, Journal of Finance, vol.47, 427–465.

Gallo J., V. Apilado and J. Kolari (1996), Commercial bank mutual fund activities: implications for bank risk and profitability, in Journal of Banking and Finance, vol. 20(10)

Harker, P. and S. Zenios (2000), Performance of financial institutions, Cambridge University Press.

Herring R.J. and A.M. Santomero (1990), The corporare structure of financial conglomerates, in Journal of Financial Service Research Vol. 4 N.4, 471- 497.

Llewellyn, D.T. (1999), The new economics of banking, SUERF studies n.5

Mercieca, S. Schaeck K., Wolfe S. 82007), Small European banks: benefits from diversification?, Journal of banking and Finance 31, 1975-1998

Pagano, M. and P.F. Volpin (2008), Securitization, Transparency and Liquidity, CEPR Discussion Paper No. DP7105, December.

Reinganum, M.R. (1982), A Direct Test of Roll's Conjecture on the Firm Size Effect, Journal of Finance, vol.37, n.1, 27-35.

Roland, K.P. (1997), Profit Persistence in Large US. Bank Holding Companies: an empirical Investigation, Office of the Comptroller of the Currency, Economics working paper 97-2.

Staikouras, C., G. Wood and R. Denney (2000), Bank Non-Interest Income: a source of stability?, City University London working paper series, scaricabile dal sito http://papers.ssrn.com.

Staikouras, C. and G. Wood (2003), Non-interest income and total income stability, Bank of England working paper n.98

Stiroh, K.J. (2004), Diversification in Banking: Is Noninterest Income the Answer?, Journal of Money, Credit, and Banking, Vol. 36, No. 5: 853-882.

Stiroh, K.J. (2006), A portfolio view of banking with interest and noninterest activities, Journal of Money, Credit, and Banking, Vol. 38, 1351-1362.