Bancassurance and scale economies: evidence from Italy

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Abstract

Integration between banks and insurers is a widely investigated trend in financial markets. Despite heterogeneity of bancassurance across countries, the financial crisis is reshaping both intermediaries and customers' demand. While previous research provides evidence of economies of scale in bancassurance, we add to this literature by investigating differences due to alternative ownership models over an extended and recent period (1998-2012) and testing for the effects of the financial crisis through a translog cost function. We focus on the Italian market, where bancassurance dominates the life insurance market and all ownership models are present. We find that the cost function changed significantly after 2007 as new unexploited scale economies emerged, especially for independent insurers that showed earlier optimal returns to scale. More integrated groups, despite a remarkable difference in their trend for total costs, diverge in a similar fashion from independent insurers in terms of scale economies.

Keywords: Bancassurance, Scale Economies, Life insurance, Italian market, Financial crisis

1. Introduction

Consolidation and convergence processes impressively animated the evolution in the financial sector in recent years. An increasing removal of barriers between sectors, the achievement of a global market for capital flows and several major shifts towards prudential supervision allowed firms to aim at greater performances and efficiency to cope with an increased competition. From consumers' perspective, an easier access to a wider range of financial products enhanced the demand for less expensive, better performing and more sophisticated investment opportunities.

Within this framework, bancassurance can be considered a keystone, since the early innovations dating back to 1965 in the UK to a wider penetration traceable to French and Spanish experiences of 1970s and 1980s. Distribution of insurance products through bank branches has been recently explored by an increasing number of European institutions, in spite of a high degree of heterogeneity in models and differences in market shares across countries. Among potential explanations for benefits and risks of this process, if retail markets and life insurance are considered, potential for cost synergies and distribution advantages still represent the main focus of bancassurance, due to cross-selling opportunities and joint back-office activities (asset management, human resources and IT).

At the same time, different models of bancassurance exist and influence variability of advantages and successes across time and countries, in particular towards ownership models and their level of integration (distribution agreements, joint ventures and acquisitions, captive companies, mergers) [Hoschka (1994); Locatelli *et al*. (2003)].

In this study we focus on the effects of bancassurance ownership models on scale economies. Despite a wide literature on scale economies or determinants of bancassurance exists, we add to previous research by jointly considering this aspect and by testing previous findings in the post-crisis scenario, when we expect to find that adverse systemic market conditions increased scale inefficiencies.

Our paper focuses on the Italian market and considers it a proper testing ground for several reasons. Since the 1990s, the Italian insurance industry has undergone major changes, after deregulation allowed banks to own controlling interests in the insurance sector. Unlike several other countries, banks entered an already mature market, fostering a significant product diversification and a noticeable reduction of distribution costs. The Italian life insurance market has been strongly influenced by bancassurance, where bank branches represent a comprehensive market share of 50 per cent, after exceeding 60 per cent in 2006 [ANIA (2013)], whereas their importance is even higher when considering policies with higher levels of financial risks. The entrance of quasi-banking insurance products reshaped the industry in the 1990s throughout the mid 2000s and increased the exposure of market players to the financial crisis. Finally, all bancassurance models are present and active in the Italian market, allowing a comparative analysis of their performance.

The remainder of this paper is structured as follows. Section 2 provides a review of the most relevant literature on this topic. In Section 3 we describe our data and methodology. In Section 4 we discuss our findings. Section 5 concludes our paper and provides our policy considerations and suggestions for further research.

2. Literature review

Within the European financial sector, the removal of regulatory barriers, the integration and harmonization processes within the single market and the evolution of the securities' industry pushed market players to pay greater attention on their efficiency in allocating resources in a more competitive environment. At the same time, the demand expressed more sophisticated financial needs and contributed to the fast and heterogeneous expansion of bancassurance. Literature in this area can be connected to the broader field of mergers and acquisitions, where bancassurance is investigated from a number of different perspectives. We distinguish mainly two groups of contributions.

The first stream involves qualitative and theoretical literature exploring the foundations and development of bancassurance. Accordingly to Chen *et al.* (2009), this is the most numerous if compared to more recent quantitative research. Banks and insurers express several similarities [Voutilainen (2005)] that underline potential benefits of convergence and cross-sector linkages [Bergendahl (1995); Kist (2001); Falautano and Marsiglia (2003); Staikouras (2006)], however with strategic and managerial challenges [Benoist (2002); Dorval (2002); Van den Berghe and Verweire (2001)]. Within the same stream, several authors have focused on specific markets to describe similarities or to compare evolutionary trends across countries, also encompassing convergence models between banks and insurers [Morgan *et al*. (1994); Verweire (1999); Benoist (2002); Dorval (2002); Lymberopoulos *et al*. (2004); Chevalier *et al*. (2005); Staikouras (2006); Kalotychou and Staikouras (2007); Artikis *et al*. (2008); Bikker and Van Leuvensteijn (2008)].

The second stream focuses on quantitative and empirical research with a number of different methodological perspectives. Within this literature we can distinguish between three major issues: the first encompasses equity wealth effects of bancassurance deals and the determinants of value creation, the second focuses on risk profiles of aggregations between banking and non-banking entities, while the third specifically addresses scale economies for this market.

Regarding the first subset, few studies have provided evidence of positive size-related effects of mergers across the financial sector [Johnston and Madura (2000); Carow (2001a and 2001b); Carow and Heron (2002)]. Diversification within financial conglomerates provides mixed evidence [Cowan et al. (2001)], from positive effects due to scale economies [Templeton and Severiens (1992); Estrella (2001)] and market responses [Cybo-Ottone and Murgia (2000)], or even finding evidence of a discount factor placed on conglomerates due to agency conflicts [Laeven and Levine (2005)]. Research focused on bancassurance recently evidenced positive market reactions to mergers, with strong links with the benefits of economies of scale, scope and geographical diversification [Fields et al. (2007)]. Staikouras (2009) examines a global sample of major bancassurance ventures between 1990 and 2006 through an event study methodology, finding significant positive returns for bank bidders, and significant losses for insurance-bidders. Moreover, results indicate that profitability and size of the deal are the major value drivers, while abnormal returns and functional diversification exhibit a negative relationship. Considering only deals with banks as acquirers, the relative deal size is found to be significantly value-enhancing also in Elasyani and Staikouras (2010). These results are consistent with Dontis-Charitos *et al.* (2011), who find positive stock market reactions to bancassurance deals for bank bidders, while for insurer bidders results are not significant. This could be explained within the contestable market theory, where the deal might reduce long-term profits for existing insurance firms and increase competition in the insurance market.

The second subset focuses on the analysis of risks associated with bancassurance deals through GARCH methodologies, providing mixed results. Casu *et al.* (2011) find that, despite total and idiosyncratic risks of acquiring institutions are not affected significantly, an increase of systematic risk exposure of banks is observed. Looking at specific determinants of risk, they also find that results are driven by the size of operations. Elyasiani and Staikouras (2010) investigate international deals with banks as acquirers between 1990 and

2006, finding a decline in the overall risk exposure for the acquirer due to a decrease in unsystematic risk. This is interpreted as a consequence of the increased market share of conglomerates, raising concerns on a greater post-deal systemic risk exposure.

The third quantitative subset investigates cost benefits of bancassurance and their link with competition: conglomerization is expected to grow until scale economies are depleted. On the role of bancassurance in Italy, Cummins *et al.* (1996) provide a pioneer study which, applying micro-econometric methodologies, investigates the effects on technical efficiency of technological changes in the insurance industry over the period 1985-1993. Results show no effects on efficiency and a significant decline in productivity, noticeably in years following banks' entrance in the insurance market and attributable to a technological regress. Consistently, Turchetti and Daraio (2004) show that for motor insurance, not being affected by banks' entry, results do not show strong variations either in efficiency or technological change over the period 1982-1993. Fiordelisi and Ricci (2011), employ a stochastic frontier methodology to analyze cost and profit efficiency due to distribution and bank ownership for the life insurance market in 2005-2006. They find evidence in favor of bancassurance in terms of cost efficiency stemming from firm-specific factors such as share of premiums collected through bank branches and proportion of quasi-banking products, whereas joint ventures' specialization in financial products is negatively related with profit efficiency. Although looking at the relationship between bancassurance and efficiency, previous studies do not consider the effects on scale economies.

Scale economies within the insurance sector have been investigated by several studies. Fecher *et al.* (1991) analyze the French life and non-life insurance market to address the optimal scale and productive efficiency of various institutional forms (stock, foreign, mutual and public companies), arguing that scale economies contribute to relatively high prices and finding overall scale economies in life insurance, except for public entities. Bikker and Van Leuvensteijn (2008) and Bikker (2012), studying the Dutch life insurance industry, measure competition by looking at scale economies through a translog cost function and find the existence of substantial unused scale economies. Bikker (2012), following the structure-conduct-performance paradigm, stresses the relevance of scale economies as a measure of competition and thus inefficiency. In the US, Houston and Simon (1970), Prichett (1971) and Cho (1986) find some evidence of increasing scale economies in the life sector in different years. Results on a more comprehensive sample provided by Grace and Timme (1992) show positive returns to scale for most firms (except for the largest agency companies). Kellner and Mathewson (1983), instead, find that firm size for the Canadian market is consistent with zero profits. More recently, Fenn *et al.* (2008) provide a cross-country research for Europe between 1995 and 2001, arguing that over this period most insurers were operating under increasing returns to scale. Focusing on the Italian market, Focarelli (1992) uses a translog cost function with cross-section data for 1987, i.e. before deregulation allowed banks to enter the insurance market: modest scale economies that increase moderately with company size are found and attributed to the maturity of the market.

In Table 1 we provide a brief summary of the main output and input variables and proxies adopted by prominent literature on insurance and scale economies.

[Insert Table 1 about here]

Although the choice of output proxies for the analysis of insurance industry has been widely debated, the majority of papers focused on insurance adopt the production approach [Fiordelisi and Ricci (2011); Bikker and Van Leuvensteijn (2008); Fenn *et al*. (2008)], consistently with Cummins and Weiss (1998), who define insurance output by looking at the value added in three main areas:

- Risk pooling/risk bearing activity: by insuring, life policyholders benefit from a risk pooling mechanism for the risks of premature death or survival. The actuarial and underwriting expenses incurred are important components of the value added by the industry, including holding equity capital to bear residual risks.
- Real financial services relating to insured losses: insurers provide a variety of specialized services for policyholders, including financial planning and management of collective annuities and health insurance plans.
- Intermediation: insurers invest premiums' proceedings in assets that are not available to most investors (for instance privately placed bonds and structured securities). Insurers' value added is reflected in the net interest margin between returns earned on invested and those credited to policyholders.

According to Cummins and Weiss (1998) output can be proxied by premium income or by the present value of incurred losses, incurred benefits can proxy the expected present value of future claims and, to take into account the intermediation function, additions to provisions are added to incurred claims. A minor stream in the literature refers to the intermediation approach [Focarelli (1992); Berger and Humphrey (1997); Brockett *et al.* (2005)], seeing financial institutions as primarily intermediating funds between savers and investors. Accordingly, the main insurers' activity is to borrow funds and transforming liabilities into assets, receiving and paying interests as a compensation for the time value of funds.

3. Data and Methodology

We employ the database INFOBILA published by ANIA (Italian National Association of Insurance Companies). The database gathers financial statements and segment reporting for about 90% of licensed companies in the Italian market. The raw sample consists of all direct life insurers collecting premiums from 1998 to 2012, leading to 1,314 firm-year observations. After eliminating unreliable (negative or zero values, since our models requires logarithms), not relevant (i.e. subject to liquidation processes) or missing data, we came to a refined unbalanced panel of 1,303 firm-year observations, with individual data deflated at 2012 prices.

Companies are then divided in groups depending on their ownership model, consistently with Fiordelisi and Ricci (2011). We reconstructed each company's history through four main sources of information:

- publicly available data from "*Le Principali Società Italiane*", edited by *Mediobanca*, which identifies insurance groups and related participating interests;
- the database *Zephir* from *Bureau Van Dijk*, for data on mergers and acquisitions;
- reports from the Italian Antitrust Authority (AGCM) on non-controlling participating interests;
- companies' websites and press releases.

Companies are divided in three groups[1]: independent insurers, insurers totally owned by banks[2] and joint ventures. Companies that are part of financial conglomerates are considered held by banks or insurers on the basis of the prominent activity of the whole group and their leading supervisory authority.

Differences in output production and specialization across bancassurance models are summarized by Figure 1, presenting the relative market share of our three groups.

[1] In an earlier version of this paper we divided our sample in six groups, considering intermediate levels of integration. However, additional groups showed poor statistical significance and a reduced number of observations: therefore, we focused on these three major models.

[2] Due to its particular nature, this group includes *Postevita* (controlled by *Poste Italiane*) which distributes insurance products exclusively through post branches.

[Insert Figure 1 about here]

Until 2005, bancassurers eroded independent insurers' market shares. Then, just before the triggering of the financial crises, the latter recovered at the expense of insurers owned by banks, whereas more recently joint ventures' seem to steadily lose ground compared to the other groups. This evolution can be explained by considering product differentiation at the firm's level. The financial crisis impacted heavily the banking sector and affected quasi-banking insurance products, such as unit-linked policies, which are mainly distributed by bancassurers. As a result, bancassurance groups and joint ventures in particular switched to more traditional and with-profits policies, especially those with guaranteed minimum returns, where independent insurers are still market leaders.

To grasp these time-effects, we further detail our sample by considering two sub-periods, based on output growth and composition, as well as M&A waves that took place in this market and effects due to the financial crises:

- 1998-2006: in this period unit- and index-linked products grew substantially and peaked in 2005-2006. The market experienced in 2004-2005 a wave of mergers and acquisitions: active companies were on average 94 per year.
- 2007-2012: the post-crisis period sees traditional policies leading the overall output. The average number of active players is 76 per year.

Table 2 shows the size of our sample, underlining how consolidation mainly invested independent insurers and companies owned by banks if compared to joint ventures.

[Insert Table 2 about here]

Figure 2 shows the evolution of average total costs for the three bancassurance groups.

[Insert Figure 2 about here]

Total costs significantly increased in the analyzed span but at different paces, supporting the hypothesis of ownership model's effects on cost efficiency. Independent insurers experienced a lower level almost constantly growing, whereas the two integrated groups behaved similarly until 2005 and, especially, diverging significantly after 2009.

In order to analyze scale economies, we adopt the traditional translog cost function [Christensen *et al*. (1973)], which can be written, for the *s*-th company as:

$$\ln TC_s = \alpha + \beta_1 \ln(y_s) + \beta_2 \ln(distr_s) + \beta_3 \ln(adm_s) + 1/2\beta_{11} \ln(y_s)^2 + 1/2\beta_{22} \ln(distr_s)^2 + \\ + 1/2\beta_{33} \ln(adm_s)^2 + \beta_{12} \ln(y_s)\ln(distr_s) + \beta_{13} \ln(y_s)\ln(adm_s) + \beta_{23} \ln(distr_s)\ln(adm_s) + \varepsilon_s$$

with $\varepsilon_s \sim i.i.d.(0, \sigma_\varepsilon^2)$ (1)

TC are total costs (incurred claims and benefits, change in technical provisions, bonuses and rebates, acquisition costs, administrative expenses, financial charges including those arising from contracts where the investment risk is borne by policyholders, other technical expenses, other operating expenses, non-operating expenses and income taxes, all gross of reinsurance); *y* represents gross written premiums [Bikker and Van Leuvensteijn (2008); Fecher *et al.* (1991)]; *distr* is the ratio between distribution costs and gross premiums as a proxy for the price of distribution channels [Fecher *et al.* (1991); Focarelli (1992)]; *adm* is the ratio between administrative expenses and gross written premiums as a proxy for the price of human resources, marketing and IT activities. Unlike Fenn *et al.* (2008) and Fiordelisi and Ricci (2011) we do not extend the model to variables exogenous to accounting data, such as proxies for investment returns, debt capital or labor costs, because of scarce availability of market data able to discriminate between production technologies for our three groups.

Estimations are carried through a mixed-effect panel data model [Laird and Ware (1982)], where the individual company effect is treated as a random effect: the individual-specific constant terms are seen as randomly distributed across cross-sectional units. Data are grouped in order to consider individual firms throughout time: every group is composed by the various observations of the same individual in different years.

For the single group or firm (*s*) the model takes the following form:

$$\ln TC_{st} = \alpha + \gamma_t + D_{2s}\psi_2 + D_{3s}\psi_3 + \beta_1 \ln(y_{st}) + \beta_2 \ln(distr_{st}) + \beta_3 \ln(adm_{st}) + 1/2\beta_{11} \ln(y_{st})^2 + \\ + 1/2\beta_{22} \ln(distr_{st})^2 + 1/2\beta_{33} \ln(adm_{st})^2 + \beta_{12} \ln(y_{st})\ln(distr_{st}) + \beta_{13} \ln(y_{st})\ln(adm_{st}) + \\ + \beta_{23} \ln(distr_{st})\ln(adm_{st}) + b_s + \varepsilon_{st} \tag{2}$$

with $\varepsilon_{st} \sim i.i.d.(0, \sigma_\varepsilon^2)$
$b_s \sim i.i.d.(0, \sigma_b^2)$

The term $b_s + \varepsilon_{st}$ is the stochastic part of the model encompassing the stochastic error ε_{st} and the random-effect b_s, which depends only from the individual and is randomly distributed. The term γ_t is the dummy fixed-effect for time, independent from the individual company. The term $D_{2s}\psi_2 + D_{3s}\psi$ is a dummy for the bancassurance model, treated as a fixed-effect (respectively, for insurers owned by banks and joint ventures). The other terms are the independent variables of the translog cost function. We estimate the coefficients of the model using a restricted maximum likelihood estimator (REML)[3].

In order to check for the existence of scale economies, we employ a typical measure of output's cost-elasticity [Clark (1988)]. In the case of a multiproduct firm, scale economies or diseconomies exist if the derivative of total costs with respect to output is significantly different from the unity:

$$\sum_i \frac{\partial \ln(TC_s)}{\partial \ln(y_i)} \tag{3}$$

Since our production function considers only one output:

[3] For a review of restricted maximum likelihood estimators, see Harville (1977). More details on the methodology used in this paper are provided in the Appendix.

- $\frac{\partial \ln(TC_s)}{\partial \ln(y_i)} > 1$ indicates diseconomies of scale;
- $\frac{\partial \ln(TC_s)}{\partial \ln(y_i)} < 1$ indicates economies of scale.

The statistical significance is based on a Wald Chi-square test with the null-hypothesis being the elasticity equal to one and with constraints vectors fixed to mean values for each bancassurance group.

Given the translog function described by Equation 1, elasticity results as follows:

$$\frac{\partial \ln(tc)}{\partial \ln(y)} = \beta_1 + \beta_{11} \ln(y) + \beta_{12} \ln(distr) + \beta_{13} \ln(amm) \quad (4)$$

From the translog specification, the change in elasticity as output changes is given by β_{yy}. The coefficient of the squared output is determinant in analyzing the existence of scale economies: if positive, it indicates that smaller firms experience larger cost benefits on additional production.

4 Empirical findings and discussion

Table 3 provides the descriptive statistics for our data.

[Insert Table 3 about here]

The mean of the dependent variable (i.e. total costs), for the two spans is higher for groups II and III in comparison to the sample mean. All three groups experienced an increase in total costs in the second sub-period but with different sizes: independent insurers by almost 58 per cent, companies owned by banks by 67 per cent and joint ventures by almost 9 per cent. Insurers linked to banks are on average larger in terms of premiums than independent insurers. The average output growth is higher for independent insurers and bank-owned entities in more recent years (respectively, by around 65 and 60 per cent), whereas joint ventures decreased in output by 3.5 per cent. The incidence of distribution and administrative costs on premiums appears lower for bancassurance models, although insurers owned by banks show a higher dispersion in terms of distribution prices in more recent years. Finally, distribution costs have been slightly increasing over the period 1998-2012, whereas administrative costs decreased only in more recent years.

The first set of results obtained from our regression is summarized in Table 4.

[Insert Table 4 about here]

Distribution costs as a share of written premiums do not explain the variability of total costs. Written premiums and the administrative costs ratio, instead, are both positive and significant for both periods. However, the two sub-periods present different cost functions. In early years, the cost function is homothetic: output-prices cross-products coefficients β_{12} and β_{13} are not significantly different from zero. In more recent years, instead, β_{13} is significantly different from zero and exhibits a negative sign. Moreover, in 2007–2012 the own output elasticity β_{11} reveals a negative sign. In presence of a negative coefficient, as in our case for 2007-2012, unexhausted scale economies are more likely for bigger firms, possibly implying that further consolidation would not be efficient. The more recent sub-period is also characterized by a higher volatility, attributable to the systemic shock due to the financial crises.

Table 5 presents results referred to the time-effect.

[Insert Table 5 about here]

Coefficients for the time dummy consider the first year in each sub-period as its benchmark. We find significant coefficients only for 2008 and 2009, following the triggering of the financial crises. We argue that changes in the demand and turbulence in financial markets impacted heavily the whole bancassurance market and enhanced differences in cost efficiency across firms regardless of their ownership model.

Table 6 presents the group-effect, analyzed by taking independent insurers as our benchmark: dummies' coefficients therefore measure if bancassurers on average show differences in total costs if compared to independent insurers.

[Insert Table 6 about here]

Our three groups do not show significant cost differences in the first sub-period, while bancassurance models diverge significantly from independent insurers in the aftermath of the financial crises. These results might reinforce the hypothesis that, despite diversification benefits for bancassurance ventures normally exist, the financial crises exposed higher cost levels for more integrated models.

The latter finding should be completed by investigating the existence of scale economies: results deriving from Equation 4 are presented in Table 7.

[Insert Table 7 about here]

Our first sub-period is characterized by the presence of scale diseconomies for bancassurance groups, due to average higher premium collection mainly through bank branches, while independent companies show constant returns to scale. The higher cost efficiency and lower profit efficiency of bancassurers before the financial crisis [Fiordelisi and Ricci (2011)] may have led these groups to overcome the optimal production scale within a slightly increasing demand for unit- and index-linked products. In more recent years, however, we find diffused scale economies, which is consistent with recent results for other European countries [Bikker (2012)]. The crisis that hit the financial industry led to wide changes in the demand for quasi-banking and traditional insurance products, as well as a shift across these products as investors moved from riskier investments to safer traditional or with-profit policies. This temporary shock on institutions and demand seem to have restored some scale economies that are lower for bancassurance groups. Finally, since the market showed an overall good level of competition and consolidation in 1998-2006, from our results it could be argued that scale inefficiency emerging from the financial crises might fade in forthcoming years as market players adapt to new market conditions.

5 Conclusions

The theoretical literature predicts the existence of cost-efficiency benefits for life insurers adopting bancassurance models, despite empirical contributions do not always lead to consistent finding. Different forms of bancassurance integration co-exist (distribution channels, back-office activities, conglomerates) and alternative ownership models may influence advantages and risks for banks and insurers.

Examining a unique dataset on all active Italian life insurers from 1998 to 2012, we search for cost benefits and scale economies explained by ownership models. We focus on the Italian market because of the relevance of bancassurance, the presence of all integration forms, its importance within Europe market and the recent entry of banks in an already mature insurance sector.

We distinguish between three groups of entities, based on the strength of their integration with the banking sector. We test for the existence of scale economies within each group through a mixed-effect model of a translog cost function. In order to assess the effects of product diversification, consolidation and the financial crises, we consider two separate time spans: therefore, we are able also to control for industry-wide time-effects.

We add to the existing literature by finding that bancassurers do not overperform independent insurers in terms of scale economies. Before 2007, insurers owned by banks and joint ventures seem to have exceeded the optimum level of output and show modest scale diseconomies. On the contrary, independent insurers appear in equilibrium in the same period. The post-crisis period, however, shows that changes in demand and shocks in the financial sector generated scale economies for all groups, but in particular for independent insurers. The life insurance market operated with different cost functions before and after the crisis, with no significant explanatory power of distribution costs. Therefore, we provide additional evidence that the level of scale economies can change significantly in a mature market when external shocks reshape market conditions. Moreover, a product mix favoring traditional and with-profits policies could imply a more stable environment for independent insurers. Finally, unexhausted scale economies in the post-crisis sub-period and the negative coefficient for the own output elasticity might suggest to competition authorities and policymakers that a new consolidation phase within the life insurance industry would not be efficient.

This analysis is limited by not considering specific exogenous variables to control for effects of bank branches in distribution channels, as in Fiordelisi and Ricci (2011), i.e. not considering less integrated cross-selling agreements for which scarce data is publicly available and that could represent a major extension of our model. Finally, we acknowledge that future developments of this stream of research should include variables exogenous to accounting data and able to discriminate between production technologies across bancassurance groups.

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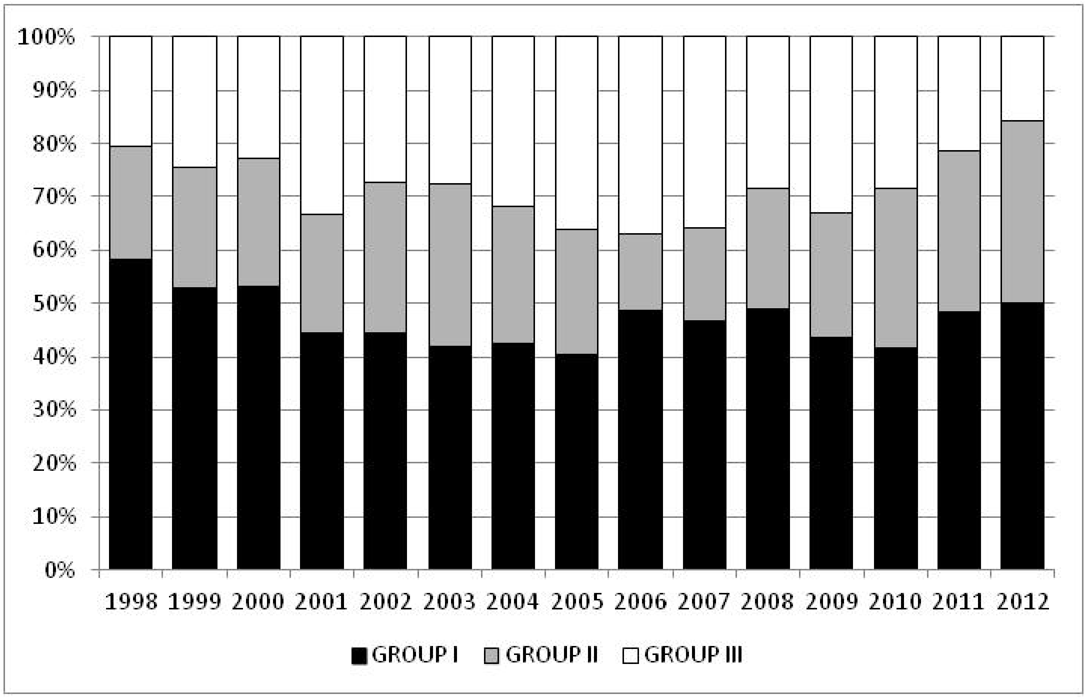
Tables and figures

Table 1: Input and output metrics

	Output	Output proxies	Input/netput	Input prices proxies
Focarelli (1992)	(i) flow of direct insurance (ii) flow of reinsurance (iii) flow of financial management (iv) flow of real estate management	Attribution of operating revenues and expenses to the four output areas	Labor Capital Commercial network	HP of perfect competitive labor and capital markets. Cross section one year data: distribution costs as ratio between commercial expenses and premiums
Fiordelisi and Ricci (2011)	Expected present value of future claims	Net claims paid, plus bonuses and rebates, plus addition to provisions	Equity Technical Provisions (as netputs) Business services and materials (as inputs) Investments	Ratio of net operating expenses and technical charges on total assets (technical costs) Ratio of investment charges on total assets (investment costs)
Fenn *et al*. (2008)	Expected present value of future claims	Net claims paid, plus bonuses and rebates, plus addition to provisions	Total capital and reserves Total technical provisions Debt capital	HP of competitive input markets. Nominal insurance wages. Long term government bond rates as price of debt capital
Bikker and Van Leuvensteijn (2008)		Premium income	Reinsurance Distribution	Reinsurance ratio Acquisition ratio
Fecher *et al*. (1991)		Premium income Claims	Reinsurance Distribution	Reinsurance ratio Acquisition ratio

Source: own elaboration

Figure 1: Life insurance market share and ownership model



Source: own elaboration on ANIA-INFOBILA database

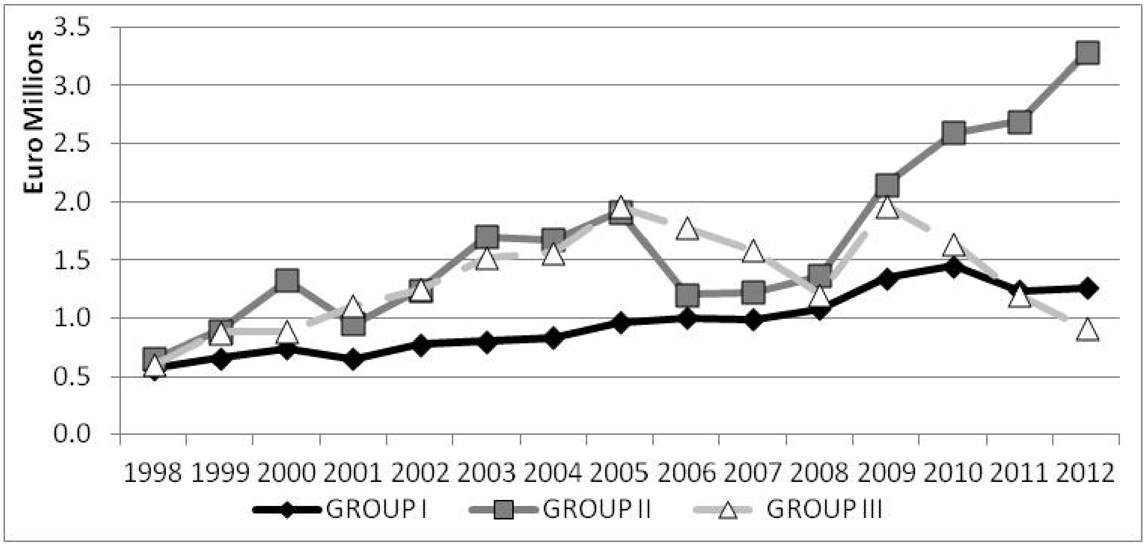
Groups are defined as follows: Group I are insurers independent from banks, Group II are insurers totally controlled by banks, Group III are insurers jointly held by banks and other insurers. Market shares are based on gross written premiums.

Table 2: Sample size

	Group I	**Group II**	**Group III**	**Total**
1998	67	15	15	**97**
1999	65	15	16	**96**
2000	65	14	17	**96**
2001	61	16	20	**97**
2002	61	19	18	**98**
2003	61	17	17	**95**
2004	58	15	19	**92**
2005	55	14	20	**89**
2006	54	13	20	**87**
2007	51	14	20	**85**
2008	47	14	21	**82**
2009	43	13	21	**77**
2010	40	14	21	**75**
2011	41	11	19	**71**
2012	38	10	18	**66**
1998-2006	*547*	*138*	*162*	***847***
2007-2012	*260*	*76*	*120*	***456***
Total firm-year obs.	**807**	**214**	**282**	**1,303**

Groups are defined as follows: Group I are insurers independent from banks, Group II are insurers totally controlled by banks, Group III are insurers jointly held by banks and other insurers.

Figure 2: Average total costs and ownership model



Source: own elaboration on ANIA INFOBILA Database

Groups are defined as follows: Group I are insurers independent from banks, Group II are insurers totally controlled by banks, Group III are insurers jointly held by banks and other insurers. Average total costs are calculated as the within-group average of incurred claims and benefits, change in technical provisions, bonuses and rebates, acquisition costs, administrative expenses, financial charges including those arising from contracts where the investment risk is borne by policyholders, other technical expenses, other operating expenses, non-operating expenses and income taxes, all gross of reinsurance.

Table 3: Main descriptive statistics

TC: Total costs ('000 Euro)										
	1998-2006					2007-2012				
	Mean	St. dev.	Median	Min	Max	Mean	St. dev.	Median	Min	Max
Group I	771	1,409	210	<1	9,280	1,215	2,163	286	1	11,345
Group II	1,284	1,702	578	26	8,139	2,145	3,313	695	20	13,335
Group III	1,316	1,777	722	7	10,812	1,432	1,634	793	27	6,495
TOTAL	**959**	**1,554**	**344**	**<1**	**10,812**	**1,427**	**2,298**	**460**	**1**	**13,335**

Y: Output ('000 Euro)										
	1998-2006					2007-2012				
	Mean	St. dev.	Median	Min	Max	Mean	St. dev.	Median	Min	Max
Group I	504	912	137	<1	6,810	829	1,574	194	<1	9,418
Group II	1,028	1,341	468	24	6,763	1,641	2,610	499	11	10,517
Group III	1,103	1,474	589	6	9,104	1,064	1,259	534	17	5,432
TOTAL	**704**	**1,147**	**272**	**<1**	**9,104**	**1,026**	**1,742**	**355**	**<1**	**10,517**

DISTR: Distribution costs ratio										
	1998-2006					2007-2012				
	Mean	St. dev.	Median	Min	Max	Mean	St. dev.	Median	Min	Max
Group I	0.0852	0.0684	0.0701	0.0014	0.4890	0.0840	0.1157	0.0540	0.0003	0.7194
Group II	0.0569	0.0663	0.0403	0.0120	0.4618	0.0741	0.1386	0.0320	0.0035	0.6237
Group III	0.0426	0.0288	0.0341	0.0118	0.1937	0.0523	0.0901	0.0297	0.0024	0.5799
TOTAL	**0.0724**	**0.0648**	**0.0538**	**0.0014**	**0.4890**	**0.0740**	**0.1144**	**0.0436**	**0.0003**	**0.7194**

ADM: Administrative costs ratio										
	1998-2006					2007-2012				
	Mean	St. dev.	Median	Min	Max	Mean	St. dev.	Median	Min	Max
Group I	0.0608	0.1028	0.0303	0.0018	0.8672	0.0488	0.0785	0.0267	0.0020	0.6136
Group II	0.0143	0.0131	0.0105	0.0010	0.0833	0.0223	0.0285	0.0127	0.0023	0.1318
Group III	0.0130	0.0172	0.0068	0.0020	0.1213	0.0238	0.0347	0.0112	0.0027	0.2114
TOTAL	**0.0441**	**0.0861**	**0.0206**	**0.0010**	**0.8672**	**0.0378**	**0.0642**	**0.0202**	**0.0020**	**0.6136**

Groups are defined as follows: Group I are insurers independent from banks, Group II are insurers totally controlled by banks, Group III are insurers jointly held by banks and other insurers. All variables are gross of reinsurance and expressed at 2012 prices. Accounting data is obtained from the public database INFOBILA, issued by ANIA (Italian National Association of Insurance Companies). TC *are the sum of incurred claims and benefits, change in technical provisions, bonuses and rebates, acquisition costs, administrative expenses, financial charges including those arising from contracts where the investment risk is borne by policyholders, other technical expenses, other operating expenses, non-operating expenses and income taxes, all gross of reinsurance;* Y *are gross written premiums,* DISTR *is the ratio between distribution costs and gross written premiums,* ADM *is the ratio between administrative expenses and gross written premiums.*

Table 4: Cost Function Estimates

Variable	1998 -2006			2007-2012		
	Beta	**Std.Err.**	**t-value**	**Beta**	**Std.Err.**	**t-value**
Const.	2.1002 ***	0.2566	8.1859	1.1544 *	0.5401	2.1374
	(<0,001)			*(0.0333)*		
log(y)	0.8481 ***	0.0518	16.3768	1.2520 ***	0.1144	10.9454
	(<0,001)			*(<0.001)*		
log(distr)	0.0966	0.0614	1.5728	0.0153	0.0859	0.1785
	(0,1162)			*(0.8585)*		
log(adm)	0.2879 ***	0.0608	4.7325	0.8682 ***	0.1476	5.8807
	(<0,001)			*(<0.001)*		
log(y)^2	0.0117 *	0.0027	2.2000	-0.0390 **	0.0064	-3.0572
	(0.0281)			*(0.0024)*		
log(distr)^2	0.0124 *	0.0055	2.2617	-0.0117	0.0066	-0.8793
	(0.0240)			*(0.3799)*		
log(adm)^2	0.0148	0.0075	0.9824	0.0127	0.0191	0.3327
	(0.3262)			*(0.7396)*		
log(y) log(distr)	0.0002	0.0062	0.0386	-0.0011	0.0095	-0.1128
	(0.9692)			*(0.9103)*		
log(y) log(adm)	-0.0085	0.0069	-1.2293	-0.0447 *	0.0184	-2.4344
	(0.2194)			*(0.0154)*		
log(distr) log(adm)	-0.0033	0.0107	-0.3075	0.0161	0.0164	0.9790
	(0.7586)			*(0.3283)*		
AIC	*-945.2907*			*-162.3320*		
BIC	*-841.4990*			*-84.7240*		
Log-likelihood	*494.6453*			*100.1663*		

*Significance codes: '***' expresses significance at the 0.999 level, '**' at 0.99 and '*' at 0.95*

The table illustrates Betas *and* p-values *for the translog cost function within the model described in Equation 2.* Y *are gross written premiums,* DISTR *is the ratio between distribution costs and gross written premiums,* ADM *is the ratio between administrative expenses and gross written premiums. The goodness-of-fit is measured by the AIC (Akaike information criterion), the BIC (Bayesian information criterion) and the log-likelihood of the entire model described in Equation 2.*

Table 5: Time Effect Estimates

Year	1998 – 2006		
	Gamma	**Std. Err.**	**t-value**
1999	0.0135 *(0.3696)*	0.0151	0.8977
2000	-0.0184 *(0.2251)*	0.0152	-1.2141
2001	-0.0082 *(0.5929)*	0.0154	-0.5349
2002	0.0053 *(0.7361)*	0.0156	0.3372
2003	0.0045 *(0.7783)*	0.0159	0.2817
2004	-0.0049 *(0.7626)*	0.0163	-0.3022
2005	0.0152 *(0.3652)*	0.0167	0.9062
2006	0.0097 *(0.5650)*	0.0169	0.5757

Year	2007 – 2012		
	Gamma	**Std. Err.**	**t-value**
2008	0.0702 *** *(<0.001)*	0.0205	3.4181
2009	0.0809 *** *(<0.001)*	0.0218	3.7164
2010	0.0272 *(0.2336)*	0.0228	1.1931
2011	0.0302 *(0.1783)*	0.0224	1.3488
2012	-0.0131 *(0.5726)*	0.0232	-0.5647

*Significance codes: '***' expresses significance at the 0.999 level*

The table illustrates the time effect within the model described by Equation 2 (γ_t), together with standard errors, t-test *and* p-values*. Each period is analyzed by comparison to a benchmark year, respectively 1998 and 2007.*

Table 6: Group Effect Estimates

Group	1998 – 2006			2007 – 2012		
	Psi	**Std.Err.**	**t-value**	**Psi**	**Std.Err.**	**t-value**
Group II	-0.0482	0.0279	-1.7285	0.1557 ***	0.0464	3.3529
	(0.0843)			*(<0.001)*		
Group III	-0.0125	0.0254	-0.4918	0.1686 ***	0.0402	4.1975
	(0.6230)			*(<0.001)*		
AIC	*-945.2907*			*-162.3320*		
BIC	*-841.4990*			*-84.7240*		
Log-likelihood	*494.6453*			*100.1663*		

*Significance codes: '***' expresses significance at the 0.999 level*

The table illustrates the group effect within the model described by Equation 2 as $D\psi$ *, together with standard errors,* t-test *and* p-values*. Groups are defined as follows: Group I are insurers independent from banks, Group II are insurers totally controlled by banks, Group III are insurers jointly held by banks and other insurers. Each period is analyzed by comparison to a benchmark group (Group I). The goodness-of-fit is measured by the AIC (Akaike information criterion), the BIC (Bayesian information criterion) and the log-likelihood of the entire model described in Equation 2.*

Table 7: Scale economies

Group	1998 – 2006		2007 – 2012	
	Elasticity	χ^2	**Elasticity**	χ^2
Group I	1.012	3.244	0.857 **	10.283
	(0.071)		*(0.001)*	
Group II	1.040 ***	25.705	0.933 ***	14.902
	(<0.001)		*(<0.001)*	
Group III	1.041 ***	25.756	0.942 ***	11.137
	(<0.001)		*(<0.001)*	

*Significance codes: '***' expresses significance at the 0.999 level, '**' at 0.99 and '*' at 0.95*

The table illustrates the elasticity of total costs with respect to output as described by Equation 4, together with the Wald Chi-square test and p-values*. Groups are defined as follows: Group I are insurers independent from banks, Group II are insurers totally controlled by banks, Group III are insurers jointly held by banks and other insurers.*

APPENDIX

LINEAR MIXED EFFECT MODELS

In analyzing panel data we rely on fixed effects if we assume that differences across individuals are characterized by differences of the constant term. However, multiple measurements for each individual, such as repeated observation over time, generally result in correlation of within-subjects' errors. Moreover, considerable variation among individuals in number and timing of observations might often affect data. The resulting unbalanced datasets are typically not effectively analyzed using a general multivariate model with unrestricted covariance structure [Laird and Ware (1982)]. Instead, data of this form can be analyzed using a variant of a two-stage model, generally referred to as mixed-effects models. In this formulation, the probability distribution for the multiple measurements has the same form for each individual, but parameters of that distribution are allowed to vary across individuals. The distribution of these parameters or random effects in the population constitutes the second stage of the model [Laird and Ware (1982)].

In our analysis we use a particular type of mixed-effect models considering only random intercepts for subjects and a constant slope with respect to the covariates. In this approach, fixed effects describe patterns of change in the mean response over time in the population, while the random variables represent the individual's deviation from the population mean intercept, after the covariates have been accounted for. In order to consider variations among repeated observations of the same individual, data are clustered in groups composed by observations for individual (*s*) over time. The hierarchical notation is as follows:

$$TC_s = a + \gamma_t + D_s \psi + X_s \beta + Z_s b_s + \varepsilon_s$$

With $\varepsilon \sim i.i.d.N(0, \sigma_\varepsilon^2 I)$ and $b \sim i..i.d.N(0, \Phi)$.

TC is the response vector which comprises the logarithm of the total costs, α is the vector for the general intercept, γ_t is the dummy for the time effect, $D\psi$ includes the dummy matrix D and the coefficients vector ψ to be estimated in order to grasp the effect of ownership models, $X\beta$ comprises the matrix X with the logarithms of the cost function variables and the vector of coefficient β to be estimated, $Zb+\varepsilon$ is the stochastic part of the model which encompasses the stochastic error term ε_s, a random variable b_s and $Z_s = 1_s$ to include only random intercept and constant slope. Finally, Φ is a positive definite symmetrical matrix independent from *s.*

The parameters have been estimated through the restricted maximum likelihood approach (REML) using the "*nlme"* package of R. For a literature review on estimates through maximum likelihood, see Harville (1977).