COMPETITION, EFFICIENCY AND SOUNDNESS IN EUROPEAN LIFE INSURANCE MARKETS*

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ABSTRACT

This paper provides cross-country evidence on the association between soundness and competition in the life insurance industry, where competition is measured by the Boone indicator. We analyze 10 European Union (EU) life insurance markets over the post-deregulation period 1999-2011. The results indicate that competition increases the soundness of the EU life insurance markets. Since the Boone indicator measures competition based on the reallocation of profits from inefficient insurers to efficient ones, our results suggest that efficiency is the mechanism through which competition contributes to insurer solvency. The soundness-enhancing effect of competition is greater for weak insurers than for healthy ones.

Keywords: Competition, Soundness, Boone Indicator, European Life Insurers, Financial Crisis

JEL Classification Numbers: G22, G28, G01.

Highlights:

- This is the first cross-country study analysing the effects of competition on soundness in the insurance industry by investigating the EU life insurance markets.
- Competition increases the soundness of European Union life insurance markets over the period 1999-2011.
- Efficiency is the mechanism through which competition contributes to insurer solvency.
- The soundness-enhancing effect of competition is greater for financially weak insurers.

Competition, Efficiency and Soundness in European Life Insurance Markets

1. Introduction

The past two decades have witnessed a deregulation process – particularly through the European Union's (EU) Third Generation Insurance Directives implemented in July 1994 – with a view to creating a single European insurance market. The main goal of deregulation was to increase competition in order to enhance products and services and to result in better diversification of underwriting and investment risks, which would have a positive effect on consumers by increasing the choice of insurance products (Cummins and Rubio-Misas, 2006). The deregulation of the insurance market led to an increase in mergers and acquisitions (M&As) in this sector, particularly towards the end of the 1990s (Cummins and Weiss, 2004; Cummins et al. , 2015). It also resulted in increased cross-border trade in insurance and has transformed the structure of the European insurance market. On the one hand, M&As have led to a market with more consolidated firms, and on the other, the opening up of these markets has exposed insurance companies to higher cross-border competition. It is clear that in both cases, one would expect to see higher levels of efficiency in the market: one of the objectives of M&As is to benefit from efficiency gains while increased competition raises efficiency levels by disciplining the market.

If such competition has resulted in a reallocation of profits from inefficient to efficient firms, one would hope to see an improvement in the financial stability (soundness) of the market, with efficiency being the conduit through which competition contributes to financial stability. The life insurers' soundness is of major importance for policyholders that are very sensitive to the reliability of the respective firms because most life insurance policies have a long life span. However, solvency is also important for other stakeholders, such as investors and policymakers. Although the contagion effects from failures of insurers may not be as consequential as in the

banking industry (Chen et al., 2013), they have significant potential to disrupt the financial system and negatively impact the economy (Das et al., 2003). This justifies policy makers in endorsing supervisions and regulations to reduce insolvency risk and to promote confidence in the financial stability of the insurance industry. European insurers have just implemented Solvency II, a risk-based economic approach with the aims of adopting solvency requirements that better reflect the risks that companies face and to deliver a supervisory system that is consistent across member states. In addition, with the financial crisis, a new round of discussion on the soundness of European insurers focuses not only on the protection of policyholders but also on the contribution of the insurance sector to the stability of the financial system.

The aim of this paper is to understand how competition has evolved in the life insurance sector in the light of the deregulation process and to test the relationship between competition and soundness in the European life insurance market. The analysis is carried out in two parts: (i) we estimate the Boone (2008) indicator of competition in 10 European life insurance markets over the period 1999-2011. The Boone indicator captures the impact of competition on the performance of efficient insurers, consistent with the industrial organization literature, which demonstrates that competition reallocates profits from inefficient to efficient firms (Olley and Pakes, 1996; Stiroh, 2000); (ii) we investigate the nexus between competition and soundness. In doing so, we estimate a general class of panel data models where the dependent variable is a measure of insurance soundness (calculated by the Z-score) and we use as independent variables the Boone competition indicator as well as a set of insurance-and-country-specific variables.

Our paper contributes to the literature by providing the first analysis in the insurance industry of the effects of competition on soundness, where efficiency is considered as the transmission mechanism through which competition can contribute to soundness. Efficiency is often used as an indirect measure of competition. While a few studies have investigated the

efficiency of European insurance companies using frontier measurement methods (e.g. Fenn et al., 2008; Cummins and Rubio-Misas, 2016), to the best of our knowledge, only Bikker and Van Leuvensteijn (2008) and Bikker (2016) have applied the Boone indicator in the context of the (Dutch life) insurance industry. Thus, our paper is the first attempt to understand the evolution of competition in the insurance industry in a cross-country context using the Boone indicator, a relatively novel approach to measuring competition.

The remainder of the paper is organized as follows: Section 2 presents the background and a review of the literature; section 3 describes the empirical modelling strategy; and section 4 details the sample and the variables used in the analysis. The results are discussed in section 5, and section 6 concludes.

2. Background and Literature Review

It is a well-established argument in the industrial organization literature that competition tends to trigger reallocations of profits from inefficient to efficient firms (Olley and Pakes, 1996; Stiroh, 2000). More efficient firms outperform their less efficient counterparts in terms of profits, hence fostering industry-wide efficiency. Many of the "direct" measures of competition traditionally employed in the industrial organisation literature such as the Herfindahl-Hirschman index, concentration ratios, or the price-cost margin are known to suffer from theoretical and empirical difficulties. In particular, they have been increasingly recognised as being non-monotonic measures of competition. The recent empirical literature on financial institutions that measures competition through concentration levels has shown the link between concentration and competition to be ambiguous (e.g., Berger et al., 2004).[1]

Recently, Boone (2008) developed a novel approach to measuring competition that overcomes the shortcomings of these proxies. Boone's methodology (also referred to as the

[1] Traditionally, higher concentration levels were associated with lack of competition. But if higher competition forces firms to consolidate, concentration would be positively related to competition.

profits elasticity approach) is grounded in the *efficient structure hypothesis* and the idea that competition rewards efficiency: an efficient firm will gain a higher market share and realise higher profits than a less efficient one.[2] Firms are punished more harshly for being inefficient. Hence, in more competitive markets, efficient firms perform better – in terms of market share and profits – than inefficient firms. Consequently, the Boone indicator captures the idea that more efficient firms achieve superior performance at the expense of their less efficient counterparts, and this effect is monotonically increasing in the degree of competition when firms interact more aggressively and when entry barriers decline.

The European life insurance industry provides a particularly interesting environment in which to analyse the effects of competition. In the insurance industry, since the founding of the European Community in 1957, a large number of Directives has been adopted to create a more integrated economic market. Among these Directives, the Third Generation Insurance Directives implemented in 1994 constituted the most significant step so far of deregulation, with the introduction of a single EU license that allows insurers licensed in one EU country to write business in all EU countries without additional licenses having to be sought or being subject to regulations by host countries. An important objective of the Third Generation Insurance Directives was to increase competition by removing entry barriers. Consequently, we expect an increase in competition in the European life insurance markets in the period following the deregulation introduced by the Third Generation Directives. However, there are country factors such as legal systems, institutional and cultural characteristics, tax systems, and language that may serve as entry barriers and hamper competition. Therefore, the degree and evolution of competition may vary across European life insurance markets.

[2] Choi and Weiss (2005) provide evidence supporting the efficient structure hypothesis for the US property-liability insurance industry and Berry-Stölze et al. (2011) provide evidence supporting the hypothesis for the European non-life insurance industry.

The first step of our paper is to measure and evaluate competition in 10 European life insurance markets from 1999 to 2011, a period after the deregulation introduced by the Third Generation Directives. We measure competition using the Boone indicator.[3] Bikker and van Leuvensteijn (2008) and Bikker (2016) are the only two insurance papers using the Boone indicator, and both analyze the Dutch life insurance industry. Bikker and van Leuvensteijn (2008) analyse the period 1995-2003 and find a weakening of competition in the last years of the sample period. Bikker (2016) analyses the Dutch life insurance industry as a whole as well as submarkets for the period 1995-2010, showing that competition is higher on the collective policy market and lower on the unit-linked market.

Efficiency is often used as an indirect measure of competition. Theory suggests that increased competition would force insurance firms to drive up their efficiency. The empirical measurement of efficiency has triggered a large literature offering methods and techniques to measure economic efficiency. The development of frontier efficiency measurement techniques such as Data Envelopment Analysis and Stochastic Frontier Analysis have resulted in a large number of empirical papers measuring firm-level efficiency in different industries. For the insurance industry, the empirical evidence regarding the efficiency of European insurance markets in a cross-country setting is limited, and most extant studies show beneficial effects of deregulation on efficiency and productivity (e.g., Cummins and Rubio-Misas, 2006). Nevertheless, among these studies, Diacon et al. (2002) show that technical efficiency declined from 1996 to 1999 in 15 European countries. However, Fenn et al. (2008) analysing 14 European countries for the period 1995-2001 find increasing returns to scale for the majority of EU insurers and that mergers and acquisitions facilitated by liberalised EU markets have led to efficiency gains. Berry-Stölze et al. (2011) analysing non-life insurers in 12 European countries

[3] We calculated the Boone indicator of competition for each country for the sample period 1999-2011 by using company level data from 1998-2011.

for the period 2003-2007 provide support for the efficient structure hypothesis. Vencappa et al. (2013) find a decline in total factor productivity (TFP) growth in 14 European countries over the period 1995-2008 but raise concerns about the robustness of TFP growth estimates to different measures of insurance outputs. Cummins and Rubio-Misas (2016), analysing the same 10 countries as in the present paper for the period 1998-2007, find an increase in both the average metafrontier cost efficiency as well as the average metafrontier revenue efficiency for the 10 EU life insurance markets as a whole, providing evidence of integration in the EU life insurance market.

In European national markets, several studies have analysed efficiency and productivity covering a period following the deregulation introduced by the Third Generation Insurance Directives. Most of them show that the market experienced significant total factor productivity gains (e.g., Mahlberg and Url, 2003, for Austria; Barros et al., 2005, for Portugal; Cummins and Rubio-Misas, 2006, for Spain; and Mahlberg and Url, 2010, for Germany). Regarding the evolution of efficiency levels, Cummins and Rubio-Misas (2006) for the period 1989-1998 show that efficiency trended upwards in the Spanish insurance industry. Mahlberg and Url (2010), studying the German insurance industry for the period 1991-2006, provide evidence that the dispersion of cost efficiency scores declined over time. Bikker and Gorter (2011), analysing the restructuring of the Dutch non-life insurance industry for the period 1995-2005, show substantial scale economies and support both the *efficient structure* and the *strategic focus hypotheses.*

The second part of our paper analyses the relationship between competition and soundness in EU life insurance markets. Life insurers need to remain in sound financial condition over many decades to pay out the promised benefits because most life insurance policies have a long life span. Hence, an important question is whether higher competition is good or bad for the financial soundness of life insurers. An increase in competition may force

life insurance prices downwards with a short-run advantage for consumers. But this alone could reduce the amount of insurance premiums raised, which could affect the profitability of the firms. Without sufficient profitability, life insurers may not be able to withstand unfavorable developments such as a decline of long-term interest rates. Therefore, in the longer term, consumers may suffer from competition if it tends to increase long-term risk with respect to insurance benefits. On the other hand, lower insurance prices resulting from increased competition may not necessarily lead to a decrease in profitability if such competition translates into increased cost efficiency. Furthermore, financial stability depends not only on profitability but also on other factors, such as risk and capitalization that can affect financial soundness.[4]

An appropriate approach to evaluate the effects of competition on financial soundness is by testing the *transmission mechanism hypothesis*. This hypothesis, recently developed by Schaeck and Cihák (2014), posits that competition measured by the Boone indicator enhances financial stability, with efficiency being the transmission mechanism through which competition increases financial stability. Based on the industrial organization literature, an increase in competition could lead to an increase in efficiency, and efficiency improvements will in turn enhance financial stability. In this paper we follow a similar approach and test the transmission mechanism hypothesis for European life insurers. That is, we test whether competition, measured by the Boone (2008) indicator, increases life insurers' soundness in 10 EU markets for the post-deregulation period 2000-2011.

[4] Regarding the appropriate level of capitalization that an insurer should maintain, Cummins and Nini (2002) argue that the objective is to attain an optimal level of insolvency risk that balances the marginal benefits (by reducing the associated expected costs of financial distress) and costs (agency costs, cost arising from adverse selection and moral hazard, regulatory costs and corporate income taxation) of holding equity capital.

3. Empirical Modelling Strategy

3.1. The Boone Indicator

Several measures of competition have been developed in the empirical literature, which can broadly be classified as direct and indirect measures. Direct measures of competition include concentration (e.g., the Herfindahl index), rents, entry-exit rates, firm mark-up, and market share. Such "direct" measures are non-monotone in competition in that they can in some cases incorrectly show competition to have decreased (increased), when in fact competition may have increased (decreased). This has been increasingly recognised in the recent empirical literature on competition (e.g. Boone, 2008; Braila et al., 2010). Intensified competition is usually accompanied by two effects – a selection effect and a reallocation effect. With the selection effect, the least efficient firm active in the market sees a fall in its profits. With the reallocation effect, the profit of a more efficient firm increases relative to the profit of a less efficient firm. The direct measures of competition, although simpler to calculate, do not appropriately account for the reallocation effects and hence become non-monotone with competition.

Indirect measures of competition have been proposed that are better grounded in theory, although more difficult to calculate and more sensitive to the specification chosen. The Boone (2008) indicator is one such indirect measure that captures the reallocation effect and produces a monotonic measure of competition. The Boone indicator is empirically modelled as a relationship between profitability and marginal costs. The rationale behind this indicator to capture the relationship between profitability and marginal costs is that in all markets, an increase in costs reduces profits but in a more competitive market the same percentage increase leads to a greater decline in profits because firms are punished more harshly for being inefficient. Hence, the elasticity of profit to costs will capture the degree of competition in that market - a

larger elasticity will indicate a more competitive market.[5]

The Boone indicator is empirically constructed from a regression equation as:

$$\pi_{it} = \alpha + \beta \ln(mc_{it}) + \varepsilon_{it} \qquad (1)$$

where π_{it} and mc_{it} measure the profits and marginal costs of life insurer *i* in year *t*, respectively. The parameter β, called the Boone indicator, is expected to be negative, reflecting that more efficient life insurers (with lower marginal costs) make higher profits. Therefore, increases in competition raise profits of more efficient firms relative to less efficient ones. The larger the absolute value of β, the stronger is competition.[6]

While measures of profit are relatively easy to construct from financial accounts, marginal cost data cannot be observed directly. Boone et al. (2005) suggest using average costs as a proxy for marginal costs, and a number of subsequent papers estimating the Boone indicator have followed this approach (e.g., Bikker and van Leuvensteijn, 2008; Schaeck and Cihák, 2014).[7] We also use average costs as a proxy for marginal costs in this paper to construct the Boone indicator from micro-level data to gauge the magnitude of the reallocation effect at the aggregate country level for the life insurance industry.

To capture the evolution of the Boone indicator over time, equation (1) is modified to include year dummies and their interactions with the average cost variable as follows:

$$\pi_{it} = \alpha + \sum_{t=1}^{T} \beta_t D_t \ln(ac_{it}) + \sum_{t=1}^{T-1} \gamma_t D_t + \varepsilon_{it} \qquad (2)$$

where π_{it} is the profit of insurer i in year t as a proportion of its total assets, ac_{it} is average

[5] The Boone indicator is also referred to as the profits elasticity approach to measuring competition.

[6] While the Boone indicator, through the estimated coefficient, is expected to be negative, there is no defined threshold to classify a market as being competitive or not. In general, the larger the magnitude of the estimated coefficient, the stronger is competition. In addition, it is not unusual for empirical studies to report positive coefficients on the Boone indicator, particularly when measured over time (see e.g. Van Leuvensteijn et al., 2011).

[7] Some attempts have also been made to estimate marginal costs from a cost function or cost frontier (e.g., Bikker and Leuveinsten, 2008; Van Leuveinsten et al., 2011) but this approach is not as straightforward when estimating multi-output cost functions.

variable costs, D_t are dummy variables for years 1 to T, and ε_{it} is the error term. Equation (2) is estimated for each country separately, and the parameters β_t are designed to capture the degree to which competition changes over time.

To construct the variables in (2), we follow Boone (2008) and measure profits as the difference between variable revenues and variable costs, scaled by total assets. Average variable costs are measured as the ratio of variable costs to variable revenues. Variable costs are constructed as the sum of net incurred claims and operating expenses, while variable revenues are calculated as the sum of net premiums and net investment income.

3.2. The Nexus Between Competition, Efficiency and Soundness

We examine the nexus between competition, efficiency and soundness through an empirical model that regresses soundness on competition and efficiency, controlling for firm and country-specific factors. Soundness of the insurance industry is measured by the Z-score, calculated for insurer i at year t in country j as (see Laeven and Levine, 2009):

$$Z_{ijt} = \frac{ROA_{ijt} + EqAst_{ijt}}{\sigma_{ROAijt}} \qquad (3)$$

where ROA is return on assets, EqAst is the equity to total assets ratio, and σ_{ROA} is the standard deviation of the return on assets.[8] We use a three-year rolling window for σ_{ROA} to allow for variation in the denominator and to avoid the Z-scores being exclusively driven by the variation in the level of ROA and EqAst (see Pasiouras and Gaganis, 2013; Schaeck, and Cihák, 2014).[9]

The Z-score is an accounting measure of financial stability used for financial institutions both in insurance (e.g. Shim, 2011; Pasiouras and Gaganis, 2013; Mühlnickel and Weiβ, 2015)

[8] We use profits before taxes in calculating ROA because using profits after taxes could make insurers from countries with higher tax rates appear less profitable (for a similar definition see e.g. Shim, 2011).

[9] In other words, the standard deviation of the rate of returns on assets of one specific year (e.g. 2000) is calculated as the average of the three-year rolling values (1998-2000).

and banking (e.g. Demirgüc-Kunt et al., 2008; Leaven and Levine, 2009; Schaeck, and Cihák, 2014). It shows the number of standard deviations a return realization has to fall in order to deplete the firm's equity. Given that in insurance, as in banking, equity serves as a buffer against unforeseen losses and is critical to an insurer's ability to meet its obligations, the Z-score can serve as an indicator of the insurer's soundness (see Shim, 2011; Pasiouras and Gaganis, 2013). The Z-score is a measure of distance to default, which is inversely related to the probability of insolvency.

The empirical model that examines the nexus between competition, efficiency, and soundness is given as:

$$\ln(Z_{ijt}) = \alpha + \beta\, Boone_{jt} + \gamma\, Firm_{ijt} + \eta\, Country_{jt} + \varepsilon_{ijt} \qquad (4)$$

where the dependent variable is the natural logarithm of the Z-score defined in equation (3), the Boone indicator is our country specific time-varying measure of competition, and *Firm* and *Country* represent firm-specific and country-specific variables, which are explained below. We use the logarithm of the Z-score to control for non-linear effects and outliers (see Demirgüc-Kunt et al., 2008; Pasiouras and Gaganis, 2013).

In equation (4), a negative sign on the coefficient of the Boone indicator variable would be interpreted as providing evidence that the reallocation effect of profits from inefficient insurers to efficient ones enhances soundness in the insurance industry.

With regard to firm-level characteristics, we use the log of total assets in the regression to control for size. Reinsurance utilization (the ratio of ceded premiums to direct premiums plus reinsurance premiums assumed) is also included to account for differences in the quality of insurance services, risk management, performance, and conduct (Weiss and Choi, 2008).[10] The

[10] Ceding premiums reduces insurers' insolvency risk by stabilizing loss experience, increasing capacity, limiting liability of specific risks, and/or protecting against catastrophes. In addition, reinsurance reduces agency costs by

ratio of invested assets to total assets is used to control for the efficiency of insurers' accounts receivable management. An important insurance leverage ratio, the ratio of premiums to equity capital, is included as it has been shown to be related to firm performance and solvency in previous studies (e.g. Cummins, Rubio-Misas, and Zi, 2004). In addition, to control for ownership, we use a dummy variable taking value 1 if the decision making unit is a group of insurers and 0 if it is an unaffiliated single company.

At the country level, we include two control variables for the main macroeconomic conditions under which the life insurers of each country are operating – the inflation rate and growth in real per capita GDP. The cumulative market share held by the 5 largest insurers is used to control for the effect of market structure. The life insurance penetration variable (ratio of life insurance premiums to GDP) is used to control for the level of insurance activity in the country where the firm is domiciled. We control for the size of the domestic insurance market using the log of total life premiums in each country. In addition, a crisis dummy is used to control for the period since the financial crisis started (i.e. 2008-2011).

4. Data and Sample Selection

The data set we use for the analysis is an unbalanced panel of life insurers from 10 of the most important EU countries in terms of premiums volume spanning a 14-year-period from 1998 to 2011.[11] Annual financial statements are obtained from the ISIS database provided by Bureau van Dijk to construct the relevant variables of interest. For each insurer, we use reports prepared under International Financial Reporting Standards/International Accounting Standards

reducing incentive conflicts between the different stakeholders (Cummins et al., 2008). However, transferring risk to reinsurers is expensive. Reinsurance price can be several times the actuarial price of risk transferred (Froot, 2001).

[11] Countries included in the analysis are Austria, Belgium, Denmark, France, Germany, Italy, the Netherlands, Spain, Sweden, and the United Kingdom (UK). The last nine have the largest volume of life insurance premiums in the EU. Austria was included because its insurance market has been analyzed previously (Mahlberg and Url, 2003). Hence, the objective is to include relatively developed insurance markets. Using an unbalanced panel avoids survivorship bias.

(IFRS/IAS) where they exist, otherwise we use reports prepared under local generally accepted accounting principles. Consolidated data are used for groups of insurers and unconsolidated data for unaffiliated single insurance companies.[12] All monetary variables are expressed in Euros and deflated by the country-specific Consumer Price Index (CPI) to base year 2000. Country-specific CPIs are obtained from the International Labor Organization (ILO). We eliminated non-viable firms such as those with non-positive incurred losses, invested assets, equity capital, total debt (including technical reserves), net premiums, or operating expenses. The resulting final sample has 6,584 firm-year observations.

We augment the insurer financial statement data with country-level data obtained from a variety of sources. Information on stock market development (measured as the ratio of the value of total shares traded to average real market capitalization), banking sector development (measured as total claims of deposit money in banks and other financial institutions to domestic non-life financial sectors as a share of GDP), bond market development distinguishing between public bond market and private bond market (measured by the public domestic debt securities issued by government as a share of GDP and private domestic debt securities issue by financial institutions and corporations as a share of GDP, respectively), and life insurance penetration (the ratio of total life insurance premiums to GDP) were collected from the updated version of the World Bank database on financial development and structure (Beck et al., 2010, Cihák et al., 2012). Data on governance characteristics were obtained from the 2013 updated World Bank database on governance indicators (see Kaufman et al., 2009). We use six dimensions of governance: political stability and absence of violence (capturing perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means,

[12] Unaffiliated insurance companies are associated to the country where they are domiciled. Group of insurers are linked to the country where the group is domiciled, although a group may have subsidiaries domiciled in different countries from the group. Groups' subsidiaries are not included to avoid double counting.

including politically-motivated violence and terrorism), government effectiveness (capturing perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies), regulatory quality (capturing perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development), rule of law (capturing perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence) voice and accountability (capturing perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media) and control of corruption (capturing perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests (Kaufman et al., 2009, page 6).

The ratio of the market share held by the five largest life insurers in each national market was obtained from the European insurance and reinsurance federation, Insurance Europe.[13] The market share of foreign companies in total domestic life business was collected from the OECD insurance statistics database. Real per capita GDP, growth in real per capita GDP figures were sourced from the World Development Indicators and inflation rates from the Eurostat database. The data on market size (measured by total country life premium) were obtained from Insurance Europe.

5. Results and Discussion

5.1. Summary Statistics

[13] Insurance Europe, headquartered in Brussels, Belgium, was formerly known as Comité Européen des Assurances (CEA) until 2012 (http://www.insuranceeurope.eu/).

Summary statistics of the mean values of the key variables used in the estimations by country for the whole period are shown in Table 1. In spite of the regulatory efforts of the EU to achieve a fully integrated European insurance market, many differences continue to exist between the national life insurance markets. Several such differences emerge from Table 1.

At the firm level we note that the insurer's size (measured by its total assets) ranged from 1.577 billion Euros in Belgium to 27.734 billion Euros in the Netherlands; the capitalization ratio (equity capital to total assets) of life insurers varied from 4.5% in Austria to 36.5% in Sweden; reinsurance utilization varied from 7.1% in Holland to 23.2% in the UK; and the net premiums to equity insurance leverage ratio ranged from 0.8 in Sweden to 8.1 in Belgium. At the country level the size of the market (measured by the total life premiums) ranged from 6.07 billion Euros in Austria to 164.0 billion Euros in the UK; the cumulative market share held by the five largest life insurers in each national market ranged from 38.4% in Germany to 73.8% in Sweden; the market share of foreign companies in total domestic life business ranged from 0.8 % in France to 34.6% in the UK; the life insurance penetration ratio extended from 2.6% in Austria to 11.5% in the UK.

Differences in important environmental characteristics among countries could affect the competitiveness and soundness of EU life insurance markets. Table 1 reveals several differences in macroeconomic conditions. Real GDP per capita varied from around 20,808 Euros in Spain to 40,039 Euros in Denmark, and inflation ranged from 1.49% in Sweden to 2.63% in Spain. Table 1 also shows that stock market development ranged from 45.1% in Austria to 159.5% in Spain; the public bond market size ranged from 33.8% of GDP in Austria to 85.3% of GDP in Italy; and the private bond market ranged from 16.1% of GDP in the UK to 145.5% of GDP in Denmark. Banking sector development varied from 84.3% in Belgium to 165.4% in the Netherlands.

Institutional and political factors also differ among the analysed EU countries. We

consider the six dimensions of governance described earlier and construct an indicator of institutional development by averaging these six indicators. These World Bank governance variables are measured in units ranging from about -2.5 to 2.5, with higher values corresponding to better governance. From Table 1, the political stability and absence of violence ranged from -0.024 in Spain to 1.238 in Sweden; government effectiveness fluctuated from 0.569 in Italy to 2.156 in Denmark; and regulatory quality extended from 0.926 in Italy to 1.796 in the Netherlands and Denmark. Overall, institutional development is lowest in Italy (0.664) and highest in Denmark (1.840).

5.2. Boone Indicator Results

While the Boone indicator of competition in equation (2) could be estimated using standard panel data techniques (controlling for firm-level unobserved heterogeneity), this would ignore the potential endogeneity arising from the possibility that cost and performance are jointly determined. For instance, large insurers could benefit from lower costs of production due to market power, which they could exploit to extract higher rents. Hence, tackling this endogeneity problem calls for an instrumental variables technique such as two-stage least squares (TSLS) or a more efficient estimator such as the two-step generalised method of moments (GMM). GMM uses an optimal weighting matrix and relaxes the independent and identically distributed assumption. We utilize the two-step GMM estimator for equation (2). One-year lags of the explanatory variables are used as instruments. The results on the estimated β_t are reported in Appendix 1.

Tests for endogeneity reject the null hypothesis of exogeneity of the Boone indicator in all cases except for Belgium and Sweden, justifying our instrumenting this variable. Since the equation is exactly identified, we could not carry out a test of over identification (i.e., testing for the validity of the instruments). However, the Anderson correlation coefficients test rejects the

null of under identification and low instrument relevance in all cases. With some minor exceptions, the coefficients are on the whole negative and statistically significant.

The estimated β_t coefficients for each country measure the Boone indicators and these are graphed for each country in Figure 1. Given that a large negative value of the Boone indicator implies stronger competition, for most of the countries, competition levels appear to have decreased over time or in some cases have remained stable throughout the period.

Table 2 compares the pre-crisis, post-crisis and whole period averages for the countries of interest. The average Boone indicator scores across the 10 EU countries for the pre- and post-crisis periods were -0.130 and -0.101, respectively. This difference is statistically significant and suggests lower levels of competition on average in the post-crisis period compared to the pre-crisis period. This finding is generally supported in the analysis of Boone indicators by country – 7 out of the 10 life insurance markets show a decrease in competition in the post-crisis period compared to the pre-crisis period.

To provide evidence on country characteristics that affect the competition of the EU life insurance markets we regress the Boone indicator on a set of country variables:

$$Boone_{jt} = \eta_0 + \eta_1 Country_{jt} + \eta_2 Governance_{jt} + \eta_3 Legal_j + \varepsilon_{jt} \qquad (5)$$

where the dependent variable is the estimated Boone indicator of competition for country j at year t. *Country* is a matrix of independent variables capturing a set of time-varying country characteristics, *Legal* is a dummy variable capturing the legal system followed by the country and *Governance* represents the evolution of six dimensions of governance quality in each country over time.

We follow previous international insurance studies in selecting country environmental factors that may affect competition in the life insurance market (e.g. Arena, 2008; Beck and

Webb, 2003; Pope and Ma, 2008; and Cummins and Rubio-Misas, 2016). The country level variables considered in the analysis include the size of the market (measured by the log of the country's total life insurance premium), market structure (measured by the five-firm concentration ratio), life insurance penetration (measured as the ratio of life insurance premium to GDP), the market share of foreign companies in total domestic life premiums, stock market development (captured by the stock turnover ratio which measures the activity or liquidity of the stock market relative to its size), debt market development, distinguishing between public bond market and private bond market, banking sector development.[14] In addition, we add two control variables for macroeconomic conditions: growth in real per capita GDP and the inflation rate.

We also account for the legal system of the country, as it has been found to be a major determinant of the protection and enforcement provided to external creditors and shareholders (La Porta et al., 1998). We use dummy variables to capture countries' legal systems: French civil law, German civil law, Scandinavian civil law, with English common law being the omitted category. The regressions also test for country governance quality, proxied by individual indicators of political stability and absence of violence, government effectiveness, regulatory quality, rule of law, voice and accountability, and control of corruption as described earlier. As the six governance measures are correlated, they are included individually in the regression analysis. Finally, we include a crisis dummy variable to control for any potential mitigating effect on competition arising from the start of the financial crisis (i.e. 2008-2011).

Table 3 presents correlation coefficients between the Boone indicator variable and the non-governance control variables (Panel A), and correlations between the Boone indicator and the governance variables (Panel B). Recall that lower (more negative) values of the Boone (2008) indicator signify stronger competition, and hence a positive sign means that an increase in

[14] The stock market turnover ratio is the ratio of the value of total shares traded to average real market capitalization.

this variable is correlated with a fall in competition and conversely for a negative sign. The negative and significant correlation between the Boone indicator and the size of the market is as expected, since larger markets create new opportunities and attract new entrants hence raising competition. Higher life penetration is significantly associated with higher competition, as expected. The five-firm concentration ratio, which is often used to measure competition correlates positively with the Boone measure of competition, as expected. The foreign market share in total domestic life of business proxies a decline in entry barriers and consequently we would expect that an increase in competition correlates with higher values of this variable, as is the case here with statistical significance.

As life insurance products include an important component of assets accumulation, we can expect a more competitive life insurance market in countries with well-developed financial markets where possible substitutes for life insurance products exist, such as banking products, stocks and bonds. The observed bivariate correlation coefficients suggest this is the case for countries with developed stock markets, banking sector and public bond markets. Countries with developed private bond markets appear to have lower competition levels. We expect better economic conditions, as reflected in higher levels of real per capita GDP growth and lower inflation level, to be associated with higher competition levels. Our bivariate correlation coefficients suggest this is not the case for real per capita GDP growth and inflation.

We expect a negative correlation between the Boone indicator and each of our governance variables, as higher values of the governance variables reflect higher quality of governance which are expected to increase market competition. Panel B of Table 3 suggests a positive and significant correlation between the Boone indicator and each of the six governance indicators.

The panel data nature of equation (5) raises the need to control for the unobserved

heterogeneity problem normally present in the presence of countries with potentially different characteristics. We approach this issue by applying OLS on equation (5), controlling for the unobserved country fixed effects through country dummy variables.[15] The results are presented in Table 4, starting with a model where no governance indicator is included (column 1), followed by six models that include each of the six different governance indicators.

To begin with, there is strong evidence that the larger the market, the lower the level of competition. Higher life insurance penetration is associated with higher competition in EU life insurance markets across all models. The size of the public bond market is associated with lower level of competition across all measures of governance indicator, while under the measure of government effectiveness there is evidence that banking sector development is associated with lower competition.

The coefficients on the three dummy variables representing the country legal system are positive and significant in all models except for the French dummy variable under the measure of regulatory quality which is not significant. These results provide evidence that the greater protection of shareholder and creditor rights provided by the English common law system (the omitted category) leads to higher competition in the EU life insurance market compared to alternative legal systems. Among the governance variables, only regulatory quality is positive and significant, suggesting higher quality governance along this dimension reduces competition in EU life insurance markets. This finding suggests that competition is impeded when policy makers implement regulations permitting and promoting private sector development.

5.3. Results on Competition, Efficiency, and Soundness

The nexus between competition, efficiency, and soundness controlling for firm and

[15] We ran the Hausman test to decide between the fixed effects model and the random effects model. These tests were not always conclusive, but on balance, were in favour of the fixed effects model. Given the need to identify the coefficients on time invariant variables such as the country legal system, we ran the long form of the fixed effects model, i.e. applying OLS on a regression model with country dummy variables.

country characteristics is captured by equation (4). In this equation, the Boone indicator is potentially an endogenous variable since weaker insurers may increase their insolvency risk by underwriting large amounts of risky policies, which in turn can be misinterpreted as a sign of increased competition. To address this potential endogeneity concern, we estimate equation (4) using the two stage least squares instrumental variable regression. We use two instruments for the Boone indicator - an institutional development index and the interaction of real GDP per capita and market share of foreign companies in total domestic life premiums. The institutional development variable is an average of the six governance indicators described earlier, and proxies good governance in a country, which is an important precursor for competition. The interaction of real GDP per capita and foreign market share will increase whenever the country is wealthy (measured by the real GDP per capita), or the decline in entry barriers (measured by the foreign market share in total domestic life of business) increases, or when both increase, signalling aggressive competition between firms.

The regression results are reported in Table 5, with bootstrapped standard errors in parentheses, to correct for the generated regressor problem.[16] Focusing on the first column of Table 5, which is our key regression, we reject the null hypothesis of exogeneity of the Boone indicator. In addition, we observe that for the overall Z-score, the Sargan test for overidentifying restrictions cannot reject the null hypothesis that these instruments are valid. The results show that the coefficient of the Boone indicator variable is negative and significant at the 1% level indicating a positive relationship between competition and soundness in the European life

[16] Given that the second stage model includes variables constructed from parameters of the first stage regressions (the Boone indicator in this case), the covariance matrix of the second-stage estimator includes noise induced by the first-stage estimates. A number of papers have derived the asymptotic variance for two-stage estimation in different contexts (for a review, see Karaca-Mandic and Train, 2003) but these do not cover all possible applications. Bootstrapped standard errors provide a practical approach that avoids theoretical calculations of the correct standard errors where the distribution of the generated regressors is unknown (see Guan, 2003).

insurance markets. This result lends support to the transmission mechanism hypothesis which posits that efficiency is the channel through which competition is translated to soundness, since the Boone indicator captures competition via a reallocation effect to more efficient life insurers.

Columns 2, 3, and 4 in Table 5 also provide evidence of the effects of competition on the three components of Z-score (ROA, EqAst, and σ_{ROA}). This analysis allows us to understand the driving forces behind the hypothesized mechanism from competition to soundness via efficiency in the 10 insurance markets analysed in this study. Results from the ROA analysis show that the coefficient of the Boone indicator is negative and significant, providing support that competition positively affects profitability. Regarding the regression analysis of the capitalization ratios, the coefficient of the Boone indicator is positive and significant, suggesting that competition may incentivize EU life insurers to hold less capital. Consequently the effects of competition on EU life insurers' capital ratios do not drive the Z-scores. This finding is in line with Cummins and Nini (2002) who find that capital over-utilization primarily represents an inefficiency for which insurers incur significant revenue penalties. Holding equity capital in an insurance company is costly due to agency cost from unresolved owner-manager and owner-policyholder conflicts, the cost of adverse selection and moral hazard in insurance underwriting and claims settlement, corporate income taxation as well as other market frictions (Cummins and Nini, 2002).[17] Therefore higher competition levels may incentivise firms to hold less capital and reduce these market frictions.

On the other hand, our results show a positive effect of competition in reducing the volatility of profits since the coefficient of the Boone indicator is positive and significant in the model where σ_{ROA} is the dependent variable. To sum up, these findings indicate that competition

[17] Related to this issue, Gaganis et al. (2015) provides evidence of a nonlinear inverted U-shaped relationship between capital requirement and European insurers' performance.

drives Z-scores higher basically through the reallocation of profits and the reduction in the volatility of profits to the extent that they compensate for the incentive to reduce capital ratios.

In addition, following Lepetit et al. (2008), Barry et al. (2011) and Doumpos et al. (2015), we disaggregate the Z-score into two additive ratio parts: ROA/σ_{ROA} and $EqAst/\sigma_{ROA}$.[18] The first part is an inverse measure of insurer portfolio risk (known as a measure of risk-adjusted returns). The second part is an inverse indicator of leverage risk (known as a measure of risk-adjusted capitalization). Columns 5 and 6 in Table 5 provide evidence of the effects of competition on these two ratio components of Z-score. The negative and statistically significant coefficients of the Boone indicator in these two regressions indicate that competition reduces both portfolio risk and leverage risk.

The crisis dummy we include in the Z-score regression is positive and statistically significant at the 1% level suggesting that financial stability did not worsen in the EU life insurance industry since the financial crisis started.[19] One possible explanation is the increase in capital ratios of European life insurers that took place since the financial crisis started, as confirmed by a positive and statistically significant coefficient of the crisis dummy variable in the capital ratio regression.

Finally, we conducted an additional analysis to determine whether the effect of competition on soundness depends upon the insurers' financial health. To this effect, we explore if weak insurers may respond in a different way to competition than healthier insurers (i.e., insurers with higher Z-scores). To address this question, we use quantile regression because it provides information about the impact of regressors conditional upon the distribution of the Z-

[18] We follow Lepetit et al. (2008), Barry et al. (2011) and Doumpos et al. (2015) in constructing these two components but using original rather than average values. Using average values produce similar results.

[19] This finding is observed for weak insurers and also for financially healthy ones as we can see in the later analysis (see Table 6), with the crisis dummy variable being positive and significant in all five percentiles in the quantile regressions.

score. Given our earlier concerns around the endogeneity of the Boone indicator, we instrument it in the quantile regressions using the same instrumental variables as described earlier. The quantile regressions are carried out in two stages. In the first stage we run an OLS regression of the Boone indicator on the instruments and other independent variables in the model. The fitted values of the dependent variable are then used in place of the Boone indicator in the second stage quantile regressions.

The quantile regression results are presented in Table 6, which reports the coefficients for the 10^{th}, 25^{th}, 50^{th}, 75^{th}, and 90^{th} percentiles of the distribution of Z-scores, with bootstrapped standard errors reported in parentheses. The coefficient of the Boone indicator of competition is negative and significant in all five percentiles (10^{th}, 25^{th}, 50^{th}, 75^{th} and 90^{th}). We use an F-test to determine whether the coefficients of competition are equal across percentiles. This test rejects the null hypothesis of equality of coefficients, suggesting heterogeneous responses of the Z-score to competition. We observe a decreasing magnitude of the Boone indicator coefficient across the percentiles. Since the higher percentiles of the Z-scores identify financially healthy insurers, these findings suggest that the soundness-enhancing effect of competition is larger for weak insurers than for financially healthy ones.

5.4. Robustness Checks

We subject our findings to a battery of further robustness tests.[20] The main result that competition increases the soundness of the EU life insurance markets is robust to (i) using an alternative approach to calculate the Z-score, i.e., by employing a three-year rolling window for all three components of the Z-score (see Laeven and Levine, 2009; Pasiouras and Gaganis, 2013); (ii) using a different set of instruments for the Boone indicator of competition;[21] and (iii)

[20] The additional results are available from the authors upon request.

[21] The alternative instruments are the regulatory quality governance indicator and the interaction term of real GDP per capita and the market share of foreign companies in total domestic life premiums.

using year dummy variables in our model instead of a crisis dummy variable.[22]

The finding that the effect of competition on soundness is not homogeneous across financially weak and financially healthy life insurers prevails when applying the previous robustness test. A decreasing magnitude of the Boone indicator coefficients in the 25^{th} , 50^{th}, 75^{th} and 90^{th} percentiles is generally observed except in some limited instances when the alternative set of instruments are used.

Finally, following Beck et al. (2013) we use a subcomponent of the Z-score, the (negative of the) natural logarithm of the standard deviation of an insurer's return on assets as an alternative measure of soundness in the quantile regression analysis. We instrument the Boone indicator using the same variables described earlier. The results confirm that the effect of competition on financial soundness is not homogeneous across financially weak and financially healthy life insurers. Although these results did not show the same decreasing trend from lowest to highest percentiles, the coefficient of the Boone indicator of competition was negative, significant and larger in absolute values in the first percentile (10^{th}), providing support that the financially soundness-enhancing effect of competition is larger for weak insurers that for financially healthy ones.

6. Conclusions

This paper contributes to the debate about whether the deregulation brought about by the 1994 EU Third Insurance Generation Directives led to increased competition in the EU life insurance sector and whether increasing competition improves the soundness (measured by the

[22] We also estimated the Boone indicator at the firm-year level using the semi-parametric smooth coefficient model (see Brissimis and Delis, 2011 and Clerides et al., 2015 for applications of semi-parametric methods) and used them in equation (4). This method however produced a significantly large number of positive values for the firm-year measures of the Boone indicator of competition. Running equation (4) on a reduced sample of only the negative values for the Boone indicator, we still established that competition significantly enhances the soundness of the EU life insurance market held and that the soundness-enhancing effect of competition is larger for weak insurers than for financially healthy ones.

Z-score) of the life insurance industry. Using a novel measure of competition, the Boone (2008) indicator, we find no evidence of any improvement in competition over the period 1999-2011. If anything, we note that most of the 10 countries in our study experienced a worsening of competition in their life insurance sector during that period. Our investigation of the relationship between competition and financial soundness reveals a positive link between the two: higher levels of competition are found to significantly increase the financial soundness of the industry. However, this effect is not homogeneous across financially weak and financially healthy life insurers. We find evidence that higher levels of competition have a larger impact on the solvency of weaker insurers than on healthier insurers.

Our findings offer some potentially useful insights to policymakers in terms of designing policies to promote competition. The fact that competition levels, as measured in this paper, did not improve, and even deteriorated, should raise concerns about the workings of the single life insurance market, nearly two decades after the Third Insurance Directive. It is possible that country specific factors such as legal systems, institutional and cultural characteristics, tax systems, and language still act as significant "natural" entry barriers, hampering competition. In designing policies to promote competition in this sector, our results suggest that weaker insurers would benefit from increased levels of solvency if exposed to higher levels of competition.

As the process of EU expansion continues, issues surrounding competition and whether it enhances soundness in EU financial markets will become more pertinent. Member states with established pro-competitive policies will push for similar policies in other member states to achieve a level playing field for all members participating in the single market. More research is therefore needed to understand how EU competition policies evolve over time.

References

Arena, M., 2008, Does Insurance Market Activity Promote Economic Growth? A Cross-country Study for Industrialized and Developing Countries, *Journal of Risk and Insurance* 75 (4): 921-946.

Barros. C.P., N. Barroso and M.R. Borges, 2005, Evaluating the Efficiency and Productivity of Insurance Companies with a Malmquist Index: A Case Study for Portugal, *Geneva Papers on Risk and Insurance: Issues and Practice* 30 (2): 244-267.

Barry, T.A., L. Lepetit, and A. Tarazi, 2011, Ownership Structure and Risk in Publicly Held and Privately Owned Banks, *Journal of Banking and Finance* 35: 1327-1340.

Beck, T., O. De Jonghe, and G. Schepens, 2013, Bank Competition and Stability: Cross-country Heterogeneity, *Journal of Financial Intermediation* 22 (2): 218-244.

Beck, T., A. Demirguç-Kunt, and R. Levine, 2010, Financial Institutions and Markets across Countries and over time: The Updated Financial Development and Structure Database, *The World Bank Economic Review* 24 (1): 77–92.

Beck, T. and I. Webb, 2003, Economic, Demographic, and Institutional Determinants of Life Insurance Consumption across Countries, *The World Bank Economic Review* 17 (1): 51-88

Berger, A.N., A. Demirguç-Kunt, R. Levine and J. Haubrich, 2004, Bank Concentration and Competition: An Evolution in the Making, *Journal of Money, Credit and Banking* 36 (3): 433-51.

Berry-Stölzle, T., M. A. Weiss and S. Wende, 2011, Market Structure, Efficiency and Performance in the European Insurance Industry, working paper, University of Georgia, Athens, Georgia (USA).

Bikker, J.A., 2016, Performance of the Life Insurance Industry Under Pressure: Efficiency, Competition and Consolidation, *Risk Management and Insurance Review* 19(1): 73-104.

Bikker, J.A., and J. Gorter, 2011, Restructuring of the Dutch Nonlife Insurance Industry: Consolidation, Organizational Form and Focus, *Journal of Risk and Insurance* 78 (1): 163-184.

Bikker, J.A., and M. Van Leuvensteijn, 2008, Competition and Efficiency in the Dutch Life Insurance Industry, *Applied Economics* 40 (16): 2063-2084.

Boone, J., 2008, A New Way To Measure Competition, *Economic Journal* 118 (531): 1245-1261.

Boone, J., R. Griffith, and R. Harrison, 2005, Measuring Competition, Advanced Institute of Management Research (AIM) Research Working Paper 22, London (UK).

Braila, C., G. Rayp, and S. Sanyal, 2010, Competition and Regulation, Belgium, 1997 to

2004,Working Papers 3-10, Federal Planning Bureau, Brussels (Belgium).

Brissimis, S.N. and M.D. Delis, 2011, Bank-level Estimates of Market Power, *European Journal of Operational Research* 212: 508-517.

Chen, H., J.D. Cummins, K.S. Viswanathan, and M.A. Weiss, 2013, Systemic Risk and the Inter-Connectedness Between Banks and Insurers: An Econometric Analysis, *Journal of Risk and Insurance* 81 (3): 623-652.

Choi, P. and M. A. Weiss, 2005, An Empirical Investigation of Market Structure, Efficiency, and Performance in Property-Liability Insurance, *The Journal of Risk and Insurance* 72 (4): 635-673.

Cihák, M., A. Demirguç-Kunt, E. Feyen, and R. Levine, 2012, Benchmarking Financial Development Around the World, Policy Research Working Paper 6175, World Bank, Washington DC (USA).

Clerides, S., M.D. Delis, and S. Kokas, 2015, A New Data Set on Competition in National Banking Markets, *Financial Markets, Institutions and Instruments* 24 (2-3): 267-311.

Cummins, J.D. G. Dionne, R. Gagné, and A. Nouira, 2008, The Cost and Benefits of Reinsurance, working paper HEC Montreal, Montreal (Canada).

Cummins, J.D., P. Klumpes, and M.A. Weiss, 2015, Mergers and Acquisitions in the Global Insurance Industry: Valuation Effects, *The Geneva Papers on Risk and Insurance – Issues and Practice* 40 (3): 444-473.

Cummins, J. D. and G. P. Nini, 2002, Optimal Capital Utilization by Financial Firms: Evidence from the Property-Liability Insurance Industry, *Journal of Financial Services Research* 21 (1/2): 15-53.

Cummins, J. D. and M. Rubio-Misas, 2006, Deregulation, Consolidation and Efficiency: Evidence from the Spanish Insurance Industry, *Journal of Money, Credit and Banking* 38 (2): 323-355.

Cummins, J. D. and M. Rubio-Misas, 2016, Integration and Efficiency Convergence in European Life Insurance Markets, working paper, available at SSRN: https://ssrn.com/abstract=2796600

Cummins, J. D., M. Rubio-Misas, and H. Zi, 2004, The Effect of Organizational Structure on Efficiency: Evidence from the Spanish Insurance Industry, *Journal of Banking and Finance* 28 (12): 3113-3150.

Cummins, J.D. and M. A. Weiss, 2004, Consolidation in the European Insurance Industry: Do Mergers and Acquisitions Create Value for Shareholders? *Brookings-Wharton Papers on Financial Services*: 217-258.

Das, U.S., N. Davies, and R. Podpiera, 2003, Insurance and Issues in Financial Soundness, International Monetary Fund (IMF) Working Paper 03/138, Washington, DC (USA).

Demirgüc-Kunt, A., E. Detragiache, and T. Tressel, 2008, Banking on the Principles: Compliance with Basel Core Principles and Bank Soundness, *Journal of Financial Intermediation* 17 (4): 511-542.

Diacon, S.R., K. Starkey, and C. O'Brien, 2002, Size and Efficiency in European Long-term Insurance Companies: An International Comparison, *The Geneva Papers on Risk and Insurance-Issues and Practice* 27 (3): 444-466.

Doumpos, M., C. Gaganis, and F. Pasiouras, 2015, Central Bank Independence, Financial Supervision Structure, and Soundness: An Empirical Analysis around the Crisis, *Journal of Banking and Finance*, 61: 569-583.

Fenn, P., D. Vencappa, S. Diacon, P. Klumpes, and C. O'Brien, 2008, Market Structure and the Efficiency of European Insurance Companies: A Stochastic Frontier Analysis, *Journal of Banking and Finance* 32 (1): 86-100.

Froot, K., 2001, The Market for Catastrophe Risk: A Clinical Examination, *Journal of Financial Economics* 60 (2-3): 529-571.

Gaganis, C., L. Liuling and F. Pasiouras, 2015, Regulations, Profitability, and Risk-adjusted returns of European Insurers: An empirical investigation, *Journal of Financial Stability* 18: 55-77.

Guan, W., 2003, From the Help Desk: Bootstrapped Standard Errors, *Stata Journal* 3(1): 71-80.

Karaca-Mandic, P., and K. Train, 2003, Standard Error Correction in Two-Stage Estimation with Nested Samples, *Econometrics Journal* 6 (2): 401-407

Kaufmann, D., A. Kraay and M. Mastruzzi, 2009, Governance Matters VIII. Aggregate and Individual Governance Indicators 1996-2008, Policy Research Working Paper 4978, The World Bank, Washington, DC (USA).

La Porta, R., F. Lopez-de Silanes, A. Sheleifer, and R. Vishny, 1998, Law and Finance, *Journal of Political Economy* 106 (6): 1113-1155.

Laeven, L. and R. Levine, 2009, Bank Governance, Regulation, and Risk-Taking, *Journal of Financial Economics 93* (2): 259-275.

Lepetit, L., E. Nys, P. Rous, and A. Tarazi, 2008, Bank Income Structure and Risk: An Empirical Analysis of European Banks, *Journal of Banking and Finance* 32: 1452-1467.

Mahlberg, B. and T. Url, 2003, Effects of the Single Market on the Austrian Insurance Industry, *Empirical Economics* 28 (4): 813-838.

Mahlberg, B. and T. Url, 2010, Single Market Effects on Productivity in the German Insurance

Industry, *Journal of Banking and Finance* 34 (7): 1540-1548.

Mühlnickel, J. and G.N.F. Weiβ, 2015, Consolidation and Systemic Risk in the International Insurance Industry, *Journal of Financial Stability* 18: 187-202.

Olley, S.G. and A. Pakes, 1996, The Dynamics of Productivity in the Telecommunications Industry, *Econometrica* 64 (6): 1263-1297.

Pasiouras, F. and C. Gaganis, 2013, Regulations and Soundness of Insurance Firms: International Evidence, *Journal of Business Research* 66 (5): 632-642.

Pope, N. and Y. Ma, 2008, The Market Structure-Performance Relationship in the International Insurance Sector, *Journal of Risk and Insurance* 75 (4): 947-966.

Schaeck, K. and M. Cihák, 2014, Competition, Efficiency and Stability in Banking, *Financial Management* 43 (1): 215-241.

Shim, J. 2011, Merger & Acquisitions, Diversification and Performance in the US Property-Liability Insurance Industry, *Journal of Financial Services Research* 39 (3): 119-144.

Stiroh, K.J., 2000, Compositional Dynamics and the Performance of the US Banking Industry, Federal Reserve Bank of New York Staff Report No 98, New York (USA).

van Leuvensteijn, M., J.A. v., Bikker, A. A. R. J. M, v. Rixtel, and C.K. Sorensen, 2011, A New Approach to Measuring Competition in the Loan Markets of the Euro Area, *Applied Economics* 43 (23): 3155-3167.

Vencappa, D., P. Fenn, and S. Diacon, 2013, Productivity Growth in the European Insurance Industry: Evidence from Life and Non-Life Companies, *International Journal of the Economics of Business* 20 (2): 281-305.

Weiss, M.A. and B.P. Choi, 2008, State Regulation and the Structure, Conduct, Efficiency and Performance of US Auto Insurers, *Journal of Banking and Finance* 32 (1): 134-156.

Table 1: Mean Values of Key Variables by Country

This table reports mean values of the variables used in the estimation. The firm level variables presented are financial soundness (Z-score as constructed in equation 3), the components of the Z score (i.e. return on assets and its standard deviation, and the ratio of equity to total assets (Equity/Total Assets)), the firm's use of reinsurance (Ceded Premiums/Direct Premiums plus Reinsurance Premiums Assumed), the efficiency of insurers' account receivable management (Invested Assets/Total Assets), the insurance leverage ratio (Net Premiums/Equity) and size of the firm (proxied by the log of total assets). The country level variables are size of the market (proxied by the log of total life insurance premiums), market structure (Five-Firm Concentration Ratio), market share of foreign companies in total domestic life business, life insurance penetration and measures of stock market development, public bond market development, private bond market development and banking sector development. Macroeconomic indicators – real GDP per capita, real GDP per capita growth as well as inflation rate are also included. We also report mean values of seven indicators of a country's governance as defined earlier in the paper. Variables in monetary value are expressed in constant 2000 Euros.

	Austria	**Belgium**	**Germany**	**Denmark**	**Spain**	**France**	**UK**	**Italy**	**Holland**	**Sweden**	**All**
					Firm Level Variables						
Z-Score	22.884	9.301	4.152	6.084	7.417	12.361	5.650	10.813	11.810	13.418	7.310
Return on Assets	0.005	0.008	0.000	0.008	0.010	0.005	0.008	0.003	0.013	0.025	0.005
Std. Deviation of Return on Assets	0.003	0.019	0.026	0.021	0.021	0.007	0.023	0.008	0.015	0.040	0.020
Equity/Total Assets	0.045	0.112	0.078	0.095	0.110	0.069	0.106	0.070	0.132	0.365	0.092
Use of Reinsurance	0.213	0.118	0.106	0.077	0.075	0.091	0.232	0.096	0.071	0.094	0.115
Invested Assets/Total Assets	0.977	0.940	0.950	0.961	0.949	0.937	0.934	0.953	0.917	0.960	0.946
Net Premium/Equity	4.373	8.110	6.181	1.701	4.104	2.766	6.429	5.716	2.029	0.794	5.024
Size of the Firm (billion Euros)	2.404	1.577	4.278	7.090	1.613	11.493	20.088	5.423	27.734	13.088	8.348
					Country Level Variables						
Size of the Market (billion Euros)	6.070	16.379	69.814	9.888	20.037	100.130	163.998	54.718	21.633	14.625	69.536
Five-Firm Concentration Ratio	0.705	0.673	0.384	0.655	0.439	0.540	0.479	0.631	0.585	0.738	0.489
Foreign Market Share	0.290	0.028	0.195	0.168	0.117	0.008	0.346	0.233	0.221	0.114	0.187
Life Insurance Penetration	0.026	0.059	0.033	0.059	0.027	0.065	0.115	0.044	0.046	0.053	0.051
Stock Market Development	0.451	0.467	1.307	0.780	1.595	0.919	1.239	1.315	1.331	1.147	1.224
Public Bond Market Development	0.338	0.681	0.399	0.452	0.383	0.527	0.348	0.853	0.439	0.368	0.461
Private Bond Market Development	0.445	0.399	0.401	1.455	0.409	0.434	0.161	0.316	0.627	0.468	0.442
Banking Sector Development	1.106	0.843	1.113	1.654	1.574	0.945	1.574	0.910	1.628	1.049	1.233
Real GDP per capita (thousand Euros)	34.959	33.454	32.297	40.039	20.808	29.275	30.440	25.670	33.584	37.163	30.576
Real per Capita GDP Growth (%)	4.735	2.912	3.703	2.701	1.717	2.595	2.059	2.045	3.535	3.249	2.910
Inflation (%)	1.986	2.163	1.527	2.200	2.631	1.644	2.093	2.200	1.987	1.493	1.879
Voice & Accountability	1.391	1.383	1.374	1.610	1.182	1.233	1.358	1.018	1.577	1.579	1.330
Political Stability No Violence	1.154	0.822	0.921	1.155	-0.024	0.591	0.499	0.535	1.069	1.238	0.724
Government Effectiveness	1.828	1.677	1.628	2.156	1.276	1.593	1.754	0.569	1.911	1.995	1.552
Regulatory Quality	1.558	1.309	1.529	1.796	1.227	1.151	1.740	0.926	1.796	1.588	1.450
Rule of Law	1.862	1.321	1.658	1.907	1.194	1.402	1.676	0.546	1.756	1.876	1.490
Control of Corruption	1.918	1.397	1.831	2.416	1.172	1.387	1.883	0.391	2.133	2.247	1.625
Institutional Development	1.618	1.318	1.490	1.840	1.004	1.226	1.485	0.664	1.707	1.754	1.362
Number of Firm-Year Observations	87	139	2567	402	672	683	872	693	313	156	6584

Figure 1: Boone Indicator 1999-2011

The figure below represents the evolution of the Boone indicators for each country over time. These indicators are effectively line plots of the estimated parameters β_t from equation (2) for each country, as reported in the Appendix table.

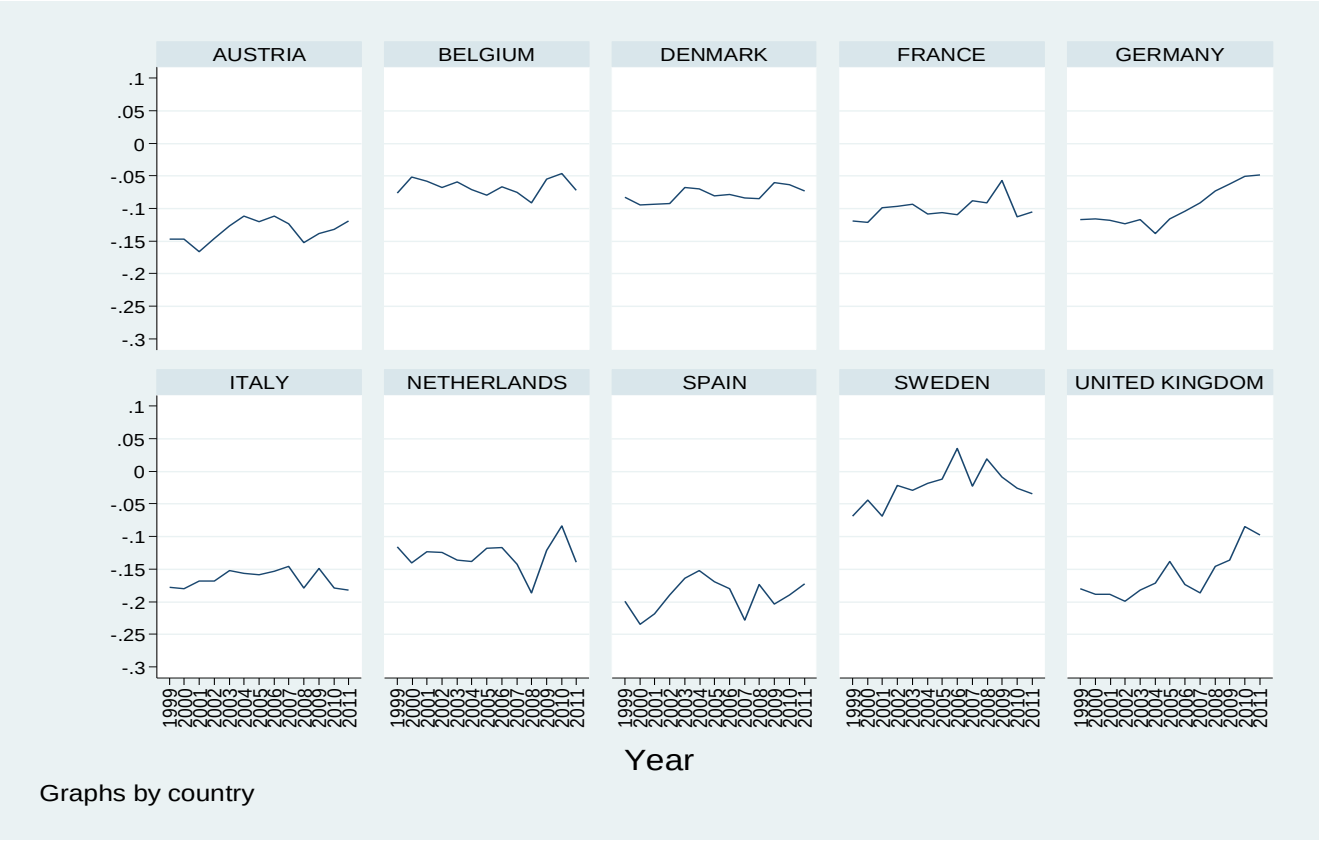

Table 2: Boone Indicators

This table reports the average values of the Boone (2008) indicator for the whole, pre- and post-crisis period for every of the 10 EU countries of the sample as well as across the 10 EU countries. The last column reports differences in mean Boone indicator values between the post- and the pre-crisis period. ***,**,* represent significance at 1%, 5% and 10% level, respectively.

Country	**Average (1999-2011)**	**Pre-Crisis Average (1999-2007)**	**Post-Crisis Average. (2008-2011)**	**Difference Between Post- and Pre-Crisis Average**
Austria	-0.131	-0.128	-0.136	-0.009***
Belgium	-0.067	-0.069	-0.065	0.003*
Germany	-0.097	-0.116	-0.059	0.058***
Denmark	-0.079	-0.083	-0.070	0.013***
Spain	-0.190	-0.194	-0.186	0.008***
France	-0.101	-0.106	-0.092	0.014***
UK	-0.159	-0.178	-0.113	0.065***
Italy	-0.165	-0.162	-0.172	-0.010***
Netherlands	-0.129	-0.128	-0.132	-0.004*
Sweden	-0.020	-0.025	-0.011	0.014***
All Countries	-0.120	-0.130	-0.101	0.032***

Table 3: Correlation Coefficients

Panel A of the table provides correlation coefficients between the Boone (2008) indicators and the country non-governance variables as well as correlation coefficients between the country non-governance variables. Panel B reports correlation coefficients between the Boone (2008) indicators and country governance variables as well as correlation coefficients between the country governance variables. ***,**,* represent significance at 1%, 5% and 10% level, respectively.

Panel A

	Boone	Life Insurance Penetration	Size of the Market	Five Firm Concentration Ratio	Foreign Market Share	Stock Market Development	Public Bond Market Development	Private Bond Market Developmetn	Banking Sector Development	Real per Capita GDP Growth	Inflation
Boone Indicator	1										
Life Insurance Penetration	-0.210***	1									
Size of the Market	-0.074***	0.478***	1								
Five-Firm Concentration Ratio	0.166***	0.160***	-0.392***	1							
Foreign Market Share	-0.118***	0.363***	0.286***	0.0274**	1						
Stock Market Development	-0.230***	-0.112***	0.164***	-0.223***	0.314***	1					
Public Bond Market Development	-0.038***	-0.120***	-0.061***	0.489***	-0.098***	-0.069***	1				
Private Bond Market Development	0.269***	-0.165***	-0.603***	0.255***	-0.230***	-0.297***	-0.089***	1			
Banking Sector Development	-0.161***	0.224***	-0.157***	0.0690***	0.233***	0.124***	-0.363***	0.409***	1		
Real per Capita GDP Growth	0.020	-0.029**	0.012	-0.0155	0.018	0.163***	0.008	-0.036***	-0.118***	1	
Inflation	-0.188***	0.007	-0.193***	0.134***	0.027**	0.304***	0.145***	-0.059***	0.146***	0.258***	1

Panel B

	Boone	Voice and Accountability	Political Stability No Violence	Government Effectiveness	Regulatory Quality	Rule of Law	Control of Corruption
Boone Indicator	1						
Voice and Accountability	0.427***	1					
Political Stability No Violence	0.491***	0.478***	1				
Government Effectiveness	0.374***	0.799***	0.549***	1			
Regulatory Quality	0.288***	0.807***	0.410***	0.771***	1		
Rule of Law	0.474***	0.818***	0.491***	0.884***	0.857***	1	
Control of Corruption	0.403***	0.855***	0.556***	0.909***	0.872***	0.947***	1

Table 4: Determinants of Boone Indicator

This table reports the results of estimating equation (5), where the dependent variable is the estimated Boone indicator of competition for country *j* at year *t*. We estimate equation (5) using OLS, with country dummy variables amongst the explanatory variables to capture unobserved country-level heterogeneity. In addition to some of the explanatory variables explained in table 1, we include dummy variables capturing the legal system of the countries in the sample: French civil law, German civil law, and Scandinavian civil law, with English common law as the omitted category. A crisis dummy variable is also included to control for the period since the financial crisis started. Since the six country governance indicators are correlated, they are included individually in the regression analysis, starting with model 1, where no governance indicator is included. Bootstrapped standard errors are in parentheses. ***,**,* represent significance at 1%, 5%, 10% level, respectively.

	(1) No Governance	(2) Political Stability	(3) Govt. Effectiveness	(4) Regulatory Quality	(5) Rule of Law	(6) Voice & Accountability	(7) Control of Corruption
Size of Market	0.068**	0.063**	0.065**	0.055*	0.068**	0.068**	0.068**
	(0.031)	(0.030)	(0.030)	(0.031)	(0.029)	(0.034)	(0.030)
Five-firm Concentration Ratio	0.013	0.010	0.022	0.023	0.013	0.013	0.015
	(0.027)	(0.027)	(0.033)	(0.031)	(0.023)	(0.028)	(0.027)
Life Insurance Penetration	-1.372**	-1.273**	-1.336**	-1.355**	-1.373***	-1.372***	-1.374***
	(0.536)	(0.532)	(0.523)	(0.570)	(0.451)	(0.520)	(0.461)
Foreign Market Share	0.000	0.002	0.001	0.010	0.000	0.000	0.003
	(0.018)	(0.018)	(0.022)	(0.022)	(0.023)	(0.026)	(0.024)
Stock Market Development	-0.006	-0.007	-0.006	-0.005	-0.006	-0.006	-0.006
	(0.007)	(0.007)	(0.007)	(0.006)	(0.007)	(0.007)	(0.007)
Public Bond Market Development	0.056**	0.057***	0.053*	0.062**	0.057**	0.057**	0.058**
	(0.026)	(0.019)	(0.028)	(0.026)	(0.027)	(0.027)	(0.027)
Private Bond Market Development	-0.040	-0.039	-0.044	-0.033	-0.040	-0.040	-0.043
	(0.030)	(0.027)	(0.027)	(0.027)	(0.025)	(0.028)	(0.028)
Banking Sector Development	0.019	0.017	0.022*	0.018	0.019	0.019	0.020
	(0.014)	(0.015)	(0.013)	(0.012)	(0.014)	(0.013)	(0.016)
Real per Capita GDP growth	0.000	0.000	0.000	-0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Inflation	-0.001	-0.000	-0.001	-0.001	-0.001	-0.001	-0.001
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
French Law	0.082**	0.084***	0.078**	0.051	0.082**	0.082**	0.081***
	(0.037)	(0.030)	(0.034)	(0.034)	(0.040)	(0.038)	(0.031)
Germanic Law	0.139**	0.136**	0.133**	0.103*	0.139**	0.139**	0.140**
	(0.062)	(0.056)	(0.059)	(0.055)	(0.060)	(0.068)	(0.059)
Scandinavian Law	0.229***	0.231***	0.222***	0.202***	0.229***	0.229***	0.229***
	(0.047)	(0.045)	(0.047)	(0.045)	(0.047)	(0.048)	(0.045)
Governance Indicator		-0.009	0.010	0.040**	-0.001	-0.000	0.005
		(0.011)	(0.011)	(0.019)	(0.026)	(0.023)	(0.015)
Financial Crisis Dummy	0.007	0.006	0.008	0.006	0.007	0.007	0.007
	(0.007)	(0.006)	(0.007)	(0.006)	(0.007)	(0.007)	(0.008)
Belgium	0.086***	0.079***	0.089***	0.103***	0.085***	0.086***	0.090***
	(0.020)	(0.020)	(0.018)	(0.019)	(0.023)	(0.019)	(0.022)
Germany	-0.117	-0.107	-0.106	-0.082	-0.117*	-0.117	-0.116*
	(0.075)	(0.071)	(0.074)	(0.074)	(0.065)	(0.082)	(0.069)
Denmark	0.004	-0.000	0.004	-0.015	0.004	0.004	0.005
	(0.030)	(0.028)	(0.025)	(0.029)	(0.024)	(0.028)	(0.028)
Spain	-0.078***	-0.087***	-0.071***	-0.052**	-0.079***	-0.078***	-0.074***
	(0.014)	(0.019)	(0.015)	(0.020)	(0.022)	(0.014)	(0.019)
France	-0.050	-0.050	-0.041	-0.002	-0.050	-0.050	-0.045
	(0.044)	(0.040)	(0.040)	(0.052)	(0.042)	(0.046)	(0.045)
UK	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Italy	-0.122***	-0.125***	-0.104***	-0.077*	-0.124***	-0.123***	-0.115***
	(0.039)	(0.033)	(0.038)	(0.045)	(0.043)	(0.039)	(0.042)
Netherlands	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Sweden	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	-0.389***	-0.366***	-0.403***	-0.404***	-0.386***	-0.388***	-0.400***
	(0.102)	(0.092)	(0.105)	(0.083)	(0.130)	(0.116)	(0.112)
Observations	130	130	130	130	130	130	130
R-Squared	0.875	0.875	0.875	0.878	0.875	0.875	0.875

Table 5: Regression of lnZ score and Components on Boone Indicator, Firm and Country Characteristics

This table reports the regression results for equation (4), where the dependent variables are the natural log of the Z score alongside each of its components (ROA, Equity/ Total Assets, σROA), all observed for firm *i* at year *t*. In addition, we also report results for the ratio components of the Z-score, ROA/σROA which measures the inverse of insurer portfolio risk, and (Equity/Total Assets)/σROA, which measures the inverse of insurer leverage risk. The estimated Boone indicator is one of the independent variables alongside others defined in table 1. We include a dummy variable capturing the effect of the financial crisis. We use the two-stage least squares estimator, instrumenting the Boone indicator. The endogeneity test reported rejects the null that the Boone indicator is an exogenous variable. The Sargan test for overidentifying restrictions cannot reject the null hypothesis that the instruments used are valid. ***,**,* means significant at 1%, 5% and 10% level, respectively. Bootstrapped standard errors are in parentheses.

	(1) Ln(Zscore)	(2) ROA	(3) Equity/Total Assets	(4) σROA	(5) ROA / σROA	(6) (Equity/Total Assets) / σROA
Boone Indicator	-5.502***	-0.029*	0.153**	0.081***	-2.416***	-13.712***
	(0.423)	(0.016)	(0.070)	(0.006)	(0.826)	(3.617)
Firm Size	-0.242***	0.001*	-0.031***	-0.000	0.025**	-1.741***
	(0.008)	(0.000)	(0.001)	(0.000)	(0.012)	(0.093)
Group	0.046	-0.003	0.015**	0.002***	-0.124	0.328
	(0.049)	(0.002)	(0.006)	(0.001)	(0.078)	(0.320)
Ceded Premium/Gross Premium	-0.076	0.008***	0.020**	0.006***	0.319***	-0.185
	(0.062)	(0.002)	(0.009)	(0.001)	(0.068)	(0.383)
Invested Assets/Total Assets	-2.447***	0.015	-0.356***	-0.004	-0.124	-16.430***
	(0.225)	(0.013)	(0.044)	(0.002)	(0.416)	(2.427)
Net Premium/Equity	-0.015	-0.000	-0.001	0.000	-0.001	-0.031
	(0.009)	(0.000)	(0.001)	(0.000)	(0.001)	(0.024)
Market Size	0.083***	-0.005***	-0.031***	-0.007***	-0.126**	0.826***
	(0.029)	(0.001)	(0.004)	(0.000)	(0.049)	(0.216)
Inflation	0.029	0.001	-0.003	-0.001**	0.036	0.214
	(0.019)	(0.001)	(0.002)	(0.000)	(0.025)	(0.150)
Five-firm Concentration Ratio	5.230***	0.004	0.062***	-0.070***	1.450***	26.646***
	(0.122)	(0.004)	(0.021)	(0.002)	(0.227)	(1.248)
Life Insurance Penetration	0.545	0.073***	1.133***	0.120***	0.009	-0.446
	(0.688)	(0.026)	(0.097)	(0.007)	(1.043)	(4.886)
Real GDP Growth	0.014***	-0.000	0.000	-0.000***	0.005*	0.062***
	(0.002)	(0.000)	(0.000)	(0.000)	(0.003)	(0.014)
Financial Crisis Dummy	0.227***	0.001	0.011**	-0.005***	-0.122**	-0.196
	(0.037)	(0.002)	(0.005)	(0.000)	(0.055)	(0.246)
Constant	-0.127	-0.002	0.489***	0.093***	-0.059	3.854
	(0.248)	(0.013)	(0.046)	(0.003)	(0.535)	(2.796)
Observations	4681	4733	4733	4733	4733	4733
R-Squared	0.478	0.019	0.310	0.386	0.046	0.297
Endogeneity Test Statistic	206.337***	5.807***	1.955	137.110***	5.762***	25.762***
Sargan Test Statistic	0.057	0.153	1.787	15.442***	0.113	0.114

Table 6: Two-Stage Quantile Regressions of lnZ score on Boone Indicator, Firm and Country Characteristics

This table reports results from applying two-stage quantile regression on equation (4), with the dependent variable being the natural log of the Z-score for firm *i* at year *t*. The first stage runs an OLS regression of the estimated Boone indicators on appropriate instruments and other independent variables. The predicted values of the dependent variable from the first stage are then used as one of the independent variables in a second stage quantile regression of the lnZ score on the variables of interest. ***,**, indicate significance at 1%, 5% and 10% level, respectively. Bootstrapped standard errors are in parentheses.

	10th percentile	25th Percentile	50th percentile	75th percentile	90th percentile
Boone Indicator	-8.392***	-7.477***	-5.687***	-4.276***	-1.625**
	(0.779)	(0.453)	(0.440)	(0.592)	(0.785)
Firm Size	-0.131***	-0.193***	-0.226***	-0.253***	-0.276***
	(0.013)	(0.011)	(0.008)	(0.008)	(0.010)
Group	-0.102	0.005	-0.017	0.034	0.051
	(0.092)	(0.067)	(0.059)	(0.057)	(0.085)
Ceded Premium/Gross Premium	-0.104	-0.189**	-0.233***	-0.148***	-0.177**
	(0.103)	(0.074)	(0.051)	(0.055)	(0.080)
Invested Assets/Total Assets	-2.313***	-2.027***	-2.135***	-1.937***	-2.649***
	(0.331)	(0.302)	(0.240)	(0.259)	(0.335)
Net Premium/Equity	-0.068***	-0.060***	-0.048***	-0.037***	-0.017
	(0.009)	(0.010)	(0.006)	(0.009)	(0.011)
Market Size	0.459***	0.257***	0.125***	-0.031	-0.182***
	(0.058)	(0.047)	(0.029)	(0.033)	(0.053)
Inflation	0.037	0.027*	0.027	0.011	0.052
	(0.032)	(0.016)	(0.017)	(0.028)	(0.033)
Five-firm Concentration Ratio	6.135***	5.406***	5.153***	4.924***	4.610***
	(0.245)	(0.156)	(0.120)	(0.116)	(0.181)
Life Penetration	-10.749***	-3.656***	1.327	5.580***	10.237***
	(1.261)	(1.240)	(0.907)	(0.752)	(1.109)
Real GDP Growth	0.014***	0.015***	0.014***	0.013***	0.009**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.004)
Financial Crisis Dummy	0.136*	0.282***	0.176***	0.154***	0.109**
	(0.070)	(0.045)	(0.034)	(0.047)	(0.051)
Constant	-2.761***	-1.641***	-0.366	0.639**	2.525***
	(0.447)	(0.406)	(0.265)	(0.310)	(0.347)
Observations	4681				
F stat (equality of coefficients)	70.649***				

Appendix 1: Boone Indicator Regressions

Notes: This table reports the results of running equation (2), with the estimated parameters β_t represented by the year coefficients presented here. We omit the coefficients on the year intercept dummies (γ_t) for space considerations. ***,**,* represent significance at 1%, 5% and 10% level, respectively.

	(1) Austria	(2) Belgium	(3) Germany	(4) Denmark	(5) Spain	(6) France	(7) UK	(8) Italy	(9) Holland	(10) Sweden
Year 1999	-0.147***	-0.076	-0.117***	-0.083***	-0.199***	-0.119***	-0.180***	-0.178***	-0.116***	-0.068***
	(0.011)	(0.047)	(0.009)	(0.010)	(0.012)	(0.008)	(0.017)	(0.005)	(0.009)	(0.024)
Year 2000	-0.147***	-0.052	-0.116***	-0.095***	-0.234***	-0.122***	-0.188***	-0.180***	-0.140***	-0.044**
	(0.010)	(0.092)	(0.009)	(0.010)	(0.016)	(0.008)	(0.014)	(0.007)	(0.009)	(0.018)
Year 2001	-0.167***	-0.058	-0.118***	-0.094***	-0.219***	-0.099***	-0.188***	-0.169***	-0.123***	-0.069***
	(0.013)	(0.045)	(0.009)	(0.009)	(0.025)	(0.009)	(0.015)	(0.007)	(0.011)	(0.024)
Year 2002	-0.146***	-0.068*	-0.123***	-0.092***	-0.189***	-0.096***	-0.200***	-0.168***	-0.124***	-0.022
	(0.008)	(0.035)	(0.010)	(0.011)	(0.021)	(0.010)	(0.016)	(0.008)	(0.020)	(0.033)
Year 2003	-0.127***	-0.059**	-0.117***	-0.068***	-0.164***	-0.094***	-0.182***	-0.152***	-0.136***	-0.029
	(0.009)	(0.025)	(0.012)	(0.010)	(0.029)	(0.009)	(0.019)	(0.009)	(0.019)	(0.030)
Year 2004	-0.111***	-0.071**	-0.138***	-0.070***	-0.152***	-0.109***	-0.171***	-0.157***	-0.139***	-0.018
	(0.005)	(0.028)	(0.009)	(0.008)	(0.020)	(0.008)	(0.016)	(0.011)	(0.020)	(0.033)
Year 2005	-0.120***	-0.079***	-0.115***	-0.080***	-0.170***	-0.106***	-0.139***	-0.159***	-0.118***	-0.012
	(0.005)	(0.018)	(0.006)	(0.008)	(0.026)	(0.007)	(0.018)	(0.014)	(0.016)	(0.028)
Year 2006	-0.112***	-0.066***	-0.104***	-0.079***	-0.180***	-0.109***	-0.174***	-0.153***	-0.117***	0.035
	(0.005)	(0.020)	(0.005)	(0.013)	(0.024)	(0.008)	(0.017)	(0.016)	(0.021)	(0.065)
Year 2007	-0.124***	-0.075***	-0.092***	-0.084**	-0.228***	-0.089***	-0.187***	-0.146***	-0.142***	-0.023
	(0.006)	(0.018)	(0.005)	(0.033)	(0.024)	(0.012)	(0.014)	(0.026)	(0.018)	(0.021)
Year 2008	-0.153***	-0.091***	-0.074***	-0.085***	-0.173***	-0.092***	-0.145***	-0.179***	-0.187***	0.019
	(0.007)	(0.016)	(0.006)	(0.013)	(0.053)	(0.018)	(0.023)	(0.027)	(0.047)	(0.060)
Year 2009	-0.139***	-0.055***	-0.063***	-0.060***	-0.204***	-0.057***	-0.136***	-0.149***	-0.122***	-0.009
	(0.007)	(0.019)	(0.005)	(0.014)	(0.017)	(0.006)	(0.019)	(0.026)	(0.044)	(0.036)
Year 2010	-0.132***	-0.046***	-0.051***	-0.064***	-0.189***	-0.113***	-0.085***	-0.179***	-0.084***	-0.026
	(0.008)	(0.018)	(0.005)	(0.011)	(0.014)	(0.008)	(0.018)	(0.014)	(0.023)	(0.024)
Year 2011	-0.119***	-0.072	-0.049***	-0.073***	-0.173***	-0.105***	-0.097***	-0.182***	-0.139***	-0.035
	(0.013)	(0.055)	(0.006)	(0.012)	(0.029)	(0.013)	(0.017)	(0.019)	(0.030)	(0.026)
Observations	77	101	2333	352	549	577	649	577	243	116
Endogeneity Test Statistic	23.342**	17.995	85.697***	19.731	22.320*	27.724***	64.519***	24.918**	42.616***	16.451
Anderson Correlation	53.780***	28.316***	1830.720***	26.130***	96.981***	337.513***	285.940***	122.371***	72.002***	23.459***
Shea Partial R-Squared	0.777	0.829	0.942	0.606	0.719	0.761	0.679	0.863	0.740	0.764