

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 but incentivizes EU life insurers to hold less capital. 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. Results show that competition on average decreased in the years after the financial crisis.

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). 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 that the soundness of the market would improve, 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, 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 are about to implement 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, the 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, which is consistent with the industrial organization literature that demonstrates competition reallocates profits from inefficient to efficient firms (Olley and Pakes, 1996; Stiroh, 2000). (ii) We investigate the nexus between competition, efficiency and soundness. In doing so, we estimate a general class of panel data models where the dependent variable is a measure of insurance soundness (the Z-score) and we use as independent variables the Boone competition indicator as well as a set of insurance-and-country-specific variables.

This 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 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 (e.g. Fenn et al., 2008, Cummins et al., 2013), to the

best of our knowledge, only Bikker and Van Leuvensteijn (2008) and Bikker (2012) have applied the Boone indicator in the context of the (Dutch) 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 gives the details of the sample and the variables used in the analysis. The results are presented 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 recently 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 shortcomings of these proxies. Boone’s methodology (also referred to as the profits

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

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. 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 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.

The first step of our paper is to analyze the link between competition and efficiency in 10

European life insurance markets from 1999 to 2011², a period after the deregulation introduced by the Third Generation Directives, by using the Boone indicator which is a measure of competition based on the *efficient structure (ES) hypothesis*.³To the best of our knowledge, Bikker and Van Leuvensteijn (2008) and Bikker (2012) are the only two papers in the insurance industry using the Boone indicator of competition, 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 (2012) 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. It is expected that increased competition forces insurance firms to drive up their efficiency. The empirical evidence regarding 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 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

²We calculated the Boone indicator of competition for each country for the sample period 1999-2011 by using company level data from 1998-2011.

³Choi and Weiss (2005) for the US property-liability insurance industry and Berry-Stölze et al. (2011) for the European non-life insurance industry provide evidence supporting the *efficient structure hypothesis* by incorporating an explicit measure of efficiency.

European countries over the period 1995-2008 but raise concerns about the robustness of TFP growth estimates to different measures of insurance outputs. Cummins, Rubio-Misas and Zi (2013), 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 upward 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 more 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, it could be questionable whether life insurers are able to withstand unfavorable developments such as a long-term 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 (2013), 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.

3. Empirical Modelling Strategy

3.1. The Boone Indicator

Several measures of competition have been developed in the empirical literature, which

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.

can broadly be classified as direct and indirect measures. Direct measures of competition include concentration (e.g. 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; Brailaet al. 2010). Intensified competition will usually be 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. The Boone indicator is empirically constructed from a regression equation as:

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

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 β coefficient in absolute value, the stronger is competition.⁵ 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, 2013).⁶ 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 life insurance country level.

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:

$$\pi_{it} = \alpha + \sum_{p=1}^T \beta_p D_p \ln(ac_{it}) + \sum_{p=1}^{T-1} \gamma_p D_p + \varepsilon_{it} \quad (2)$$

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

⁵ While the Boone indicator is expected to be negative, there is no defined threshold to classify a market as being competitive or not. In addition, it is not unusual to obtain positive coefficients on the Boone indicator, particularly when measured over time (see e.g. Van Leuvensteijn et al., 2011).

⁶ Some attempts have also been made to estimate marginal costs from a cost function or cost frontier (e.g., Bikker and Leuvensteijn, 2008; Van Leuvensteijn et al., 2011) but this approach is not as straightforward when estimating multi-output cost functions.

costs are measured as the ratio of variable costs to variable revenues. Variable costs are the sum of net incurred claims and operating expenses, while variable revenues consist of net premiums and net investment income.

3.2. The Nexus Between Competition, Efficiency and Soundness

To examine the nexus between competition, efficiency and soundness we estimate the following model:

$$Z_{ijt} = \alpha + \beta Boone_{jt} + \gamma Firm_{ijt} + \eta Country_{jt} + \varepsilon_{ijt} \quad (3)$$

where the dependent variable is a measure of insurance soundness (the Z-score) for insurer i at year t in country j , 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. The Z-score is calculated as

$$Z = \frac{ROA + \backslash EqAst}{\sigma_{ROA}} \quad (4)$$

where ROA is the return on assets, EqAst is the equity to assets ratio, and σ_{ROA} is the standard deviation of the rate of return on assets. We use a three-year rolling window for σ_{ROA} to allow for variation in the denominator of the Z-score and to avoid the Z-scores being exclusively driven by the variation in the level of ROA and EqAst⁷ (see Pasiouras and Gaganis, 2013; Schaeck, and Cihák, 2013).

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) and banking (e.g. Demirgüç-Kunt et al., 2008; Schaeck, and Cihák, 2013). It shows the number of standard deviation a return

⁷In other words, we use data from the period 1998-2000 to calculate the 2000 Z scores, from the period 1999-2001 to calculate the 2001 Z scores and so on.

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. We use the logarithm of the Z-score to control for non-linear effects and outliers (Demirgüç-Kunt et al., 2008, Pasiouras and Gaganis, 2013). In equation (3), 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 the firm characteristics, we use the log of total assets in the regression to control for size. The use of reinsurance (ceded premiums to direct premiums plus reinsurance premium assumed) is also included to account for differences in the quality of insurance services, risk management, performance and conduct (Weiss and Choi, 2008)⁸. The 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 because this ratio has been shown to be related to firm performance in previous studies (e.g. Cummins et al., 2004). In addition, to control for ownership, we use a dummy variable that takes 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

⁸Ceding 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 reducing the incentive conflict 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).

growth in real per capita gross domestic product (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 is used to control for the level of insurance activity in the country where the firm is domiciled.⁹ We control for the size of the domestic market using the log of total life premiums in each country. In addition, we include a time trend to capture the gradual nature of changes in the regulatory environment. A crisis dummy variable 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 2011.¹⁰ Annual financial statements are obtained from the ISIS database provided by Bureau van Dijk to construct the relevant variable of interest. For each insurer, we use reports prepared under International Financial Reporting Standards/International Accounting Standards (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. All monetary variables are expressed in millions of Euros and deflated by the country-specific Consumer Price Index (CPI) to the base year 2000. Country-specific CPIs are obtained from the International Labor Organization (ILO). The final sample is a result of a series of screening tests. We eliminated non-viable firms such as firms with non-positive incurred losses, invested assets, equity capital, total debt (including technical reserves), net premiums or operating expenses. The final sample includes a total of 7034 year-firm observations.

⁹Life insurance penetration is defined as the ratio of life insurance premiums to GDP.

¹⁰Countries 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.

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 issued 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). The governance characteristics of the country were obtained from the 2013 updated World Bank database on governance indicators (see Kaufman et al., 2009)¹¹. 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.¹² The market share of foreign companies in total domestic life business was collected from the OECD insurance statistics database. Growth in real per capita GDP was sourced from the World Development Indicators and inflation rates from the Eurostat database. The data on the market size (measured by total

¹¹These governance characteristics are political stability and absence of violence (capturing perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, 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).

¹²Insurance Europe was known as Comité Européen des Assurances (CEA) until 2012.

country life premium) were obtained from Insurance Europe.

5. Results and Discussion

5.1. Summary Statistics

This section presents and discusses our empirical results. 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 among the national life insurance markets. Several such differences emerge from Table 1: At the firm level we can see that the insurer's size (measured by its total assets) fluctuated from 1.613 billion Euros in Spain to 27.734 billion Euros in the Netherlands; the capitalization ratio (equity capital to total assets) of life insurers varied from 4.7% in Austria to 34.8% in Sweden; the use of reinsurance varied from 7.1% in Holland to 21.3% in Austria; 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 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 0.9% in France to 35.7% in the UK; the life insurance penetration ratio extended from 2.6% in Austria to 11.8% 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 20808 euros in Spain to 40039 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 size of the public bond market ranged from 33.8% of GDP in Austria to 85.3% of GDP in Italy;

and the size of 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 84.5% in Belgium to 165.8% in the Netherlands.

Institutional and political factors also differ amongst the analysed EU countries. We consider six dimensions of governance as well as an indicator of institutional development constructed as an average of 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 could be estimated using equation (2) with standard panel data techniques (controlling for 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 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 to estimate equation (2). One-year lags of the explanatory variables are used as instruments and the results 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 very minor exceptions such as for Sweden in 2006 and Italy in 2009, the coefficients are negative and statistically significant.

The resulting Boone indicators are graphed for each country in Figure 1. Given that a large absolute value of the Boone indicator implies increasing competition, for most of the countries, competition levels appear to have decreased over time or in some cases have remained stable throughout the period (e.g., Belgium, Denmark, and France).

Table 2 compares the pre-, 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 -0.120 and -0.093, 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. 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 et al., 2013). The country variables considered in the analysis include: the size of the market (measured by the log of the country life premium); market structure (measured by the five firms concentration ratio); stock market development (through 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 (through the public domestic debt securities issued by government as a share of GDP and through the ratio of private domestic debt securities issue by financial institutions and corporations as a share of GDP, respectively); banking sector development (proxied by total claims of deposit money in banks and other financial institutions to domestic non-financial sectors); and the market share of foreign companies in total domestic life premiums.

We also control for the legal system of the country, because the legal system 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 three dummies variables to capture countries' legal systems: for French civil law, German civil law, and Scandinavian civil law, with English common law being the omitted category. We also utilize two control variables for macroeconomic conditions: the inflation rate and growth in real per capita GDP.

Finally, the regressions also control for country governance quality, proxied by indicators of political stability and absence of violence, government effectiveness, regulatory quality, rule of law, voice and accountability, and control of corruption. In addition, we include the institutional development variable which is calculated by averaging these six governance indicators. Because the seven governance measures are correlated, they are included individually in the regression analysis.

Panel A of Table 3 presents correlation coefficients between the Boone indicator variable and the non-governance control variables, and correlation coefficients between the Boone indicator and the governance variables appear in Panel B of Table 3. We expect an increase in competition when the size of the market and life insurance penetration increase. However it is usually accepted that higher levels of concentration ratios tend to make the market less competitive. The foreign market share in total domestic life of business proxies a decline in entry

barriers and consequently it is expected an increase in competition correlates with higher values of this variable. As life insurance products have an important component of assets accumulation, we can expect that in countries with well-developed financial markets of the possible substitutes (such as banking products, stocks and bonds) for the life insurance products, the life insurance market will be more competitive. Better economic conditions as reflected in higher levels of real per capita GDP and lower inflation level are expected to increase competition. To sum up, we expect a negative relationship between the Boone indicator of competition and life insurance penetration, the size of the market, the foreign market share, the development of the stock market, the banking market and the debt market as well as the real per capita GDP growth. However, we expect a positive relationship between the Boone indicator and the concentration ratios as well as inflation.

Regarding the governance variables, as higher values of these variables reflect higher quality of governance we expect them to increase market competition and therefore we expect a negative relationship between these variables and the Boone indicator of competition. The correlation between the Boone indicator of competition and the size of the market, the foreign market share in total domestic life of business, stock market development, and the inflation rate is negative and significant, while the correlations between the Boone indicator and the five-firm concentration and private bond market development are positive and significant.

The regression results from a random effects model of the Boone indicator on country variables are presented in Table 4. Since lower (more negative) values of the Boone (2008) indicator signify more competition, a positive sign in the coefficients of the dependent variable means that an increase in this variable reduces competition and conversely for a negative sign of the coefficient. The coefficients of the three dummy variables representing the country legal systems are positive and significant in all models, providing evidence that the greater protection

of shareholder and creditor rights provided by the English common law system leads to higher competition in the EU life insurance market compared to alternative legal systems.

Two of the governance variables – regulatory quality and voice and accountability – are positive and weakly significant, suggesting higher quality governance along these dimensions reduces competition in EU life insurance markets. Taking into account the definition of the regulatory quality variable, this finding suggests less competition when policy makers implement regulations that permit and promote private sector development. Better macroeconomic conditions, as reflected by higher GDP growth and private bond market development are associated with higher life insurance market competition. However, the size of the public bond market and the size of the life insurance market are associated with lower competition in EU life insurance markets.

5.3. Results on Competition, Efficiency, and Soundness

The nexus between competition, efficiency and soundness controlling for firm and country characteristics is captured by equation (3). 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 the potential concern around the endogeneity of the Boone indicator we use the two-stage least squares estimator and instrument the Boone indicator with the institutional development index and an interaction term of the real GDP per capita and the market share of foreign company in total domestic life premiums. The institutional development variable proxies good governance in a country, which is an important precursor for competition. The interaction term of the real GDP per capita and foreign market share will increase whenever the country 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) increase or 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 problem¹³. We note that amongst the set of independent variables in these regressions, we exclude GDP growth as a determinant of the Z score, in view of the earlier finding from Table 4 that this variable was a significant determinant of the Boone indicator. Focusing in 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 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 insurance markets. This result provides support to the transmission mechanism hypothesis that 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.

Table 5 also provides evidence of the effects of competition on the three components of Z-score, ROA, EqAstand σ_{ROA} . The results are reported in columns (2), (3), and (4) respectively. 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, providing some support that competition positively affects profitability. However this

¹³Given 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 (e.g. Guan, 2003).

coefficient is not significant. Regarding the regression analysis of the capitalization ratios, the coefficient of the Boone indicator is positive and significant, indicating that competition incentivizes EU life insurers to hold less capital. Consequently the effects of competition on EU life insurers' capital ratios do not drive the higher Z-scores. This finding would be 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 Grace, 1994; Cummins and Nini, 2002). 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 σ_{ROA} analysis. To sum up, these findings indicate that competition drives Z-scores higher basically through the reduction in the volatility of profits followed by the reallocation of profits to the extent that they compensate the incentive to reduce capital ratios.

Finally, we conducted an additional analysis to determine whether the effect of competition on soundness depends upon the insurers' financial health. That is, we explore if weaker insurers may respond in a different way to competition than healthy 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-score. Given our earlier concerns around the endogeneity of the Boone indicator, we instrument it in the quantile regressions using the same instruments as described earlier. The quantile

regressions are carried out in two stages, whereby in the first stage we regress the Boone indicator on the instruments and other independent variables in the model and use the fitted values of the dependent variable in place of the Boone indicator in the second stage quantile regressions.

The quintile regression results are presented in Table 6, which reports the coefficients for the 10th, 25th, 50th, 75th, and 90th percentiles of the distribution of Z-scores.¹⁴ The coefficient of the Boone indicator of competition is negative and significant in the first four percentiles (10th, 25th, 50th, and 75th) but it is positive and insignificant in the 90th percentile.¹⁵ 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 in the 50th and 75th percentiles, but becoming insignificant in the 90th percentile. Since the higher percentiles of the Z-scores identify the financially healthy insurers, these findings suggest that the soundness-enhancing effect of competition is larger for weak insurers than 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 (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

¹⁴ Bootstrapped standard errors are reported in parentheses.

¹⁵ Although not reported here, we also find a positive but insignificant coefficient on the Boone indicator at the 99th percentile.

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 soundness of the industry. This effect however is not homogeneous across financially weak and financially healthy life insurers. Up to the median value of the Z score, increasing levels of competition have a very strong effect in increasing the solvency of life insurers. Beyond the median value of the Z score, the effect is less pronounced, and is even insignificant towards the higher percentiles.

Our findings offer some potentially useful insights to policymakers in terms designing policies to promote competition. The fact that competition levels, as measured in this paper, did not improve, or 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.

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Table 1: Mean Values of Key Variables by Country

This Table presents the mean values for each country of the key variables used in the estimations. We first present the key variables at the firm level which were collected from the ISIS database provided by Bureau van Dijk. Z-score is a measure of distance to default which is inversely related to the probability of insolvency. Return on assets (ROA), Equity/Total Assets (capitalization ratio) and Standard Deviation ROA are the three components of the Z-score. The use of reinsurance variable is the ratio of premium ceded to gross premium. The ratio invested assets to total assets is used to control for the efficiency of insurers' accounts receivable management. The net premium to equity is an insurance leverage ratio. The size of the firm is measured by its total assets and it is expressed in billion Euros. At the country level we report the cumulative market share held by the 5 largest insurers in a country (CR5 ratio) was sourced by Insurance Europe. The foreign market share in total domestic life of business (foreign market share) was collected from the OECD insurance statistics. The life insurance penetration (total life insurance premiums to GDP), stock market development (the ratio of the value of total shares traded to average real market capitalization), public bond market development (public domestic debt securities issued by government as a share of GDP), private bond market development (private debt securities issued by government as a share of GDP), and banking sector development (total claims of deposit money in banks and other financial institutions to domestic non-financial sectors as a share of GDP) variables were sourced from the updated version of the World bank database on financial development and structure (Beck et al., 2010, Cihák et al., 2012). Real GDP per capita is expressed in thousand euros and was sourced from the World Development Indicators. Inflation rates were obtained from the Eurostat database. The size of the market (measured by total life insurance premiums per country and expressed in billion euros) was obtained from Insurance Europe. The six country governance variables (voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law and control of corruption) were sourced from the 2013 updated World Bank database on governance indicators (see Kaufman et al., 2009). The institutional development indicator was constructed as an average of these six variables. These World Bank governance variables were measured in units ranging from about -2.5 to 2.5, with higher values corresponding to better governance.

	Austria	Belgium	Germany	Denmark	Spain	France	UK	Italy	Holland	Sweden	All
				<i>Firm Level Variables</i>							
Z Score	21.762	5.649	2.533	5.209	6.937	11.376	4.827	11.511	7.771	8.472	6.036
Return on Assets (%)	0.440	0.694	0.005	0.694	1.233	0.456	0.750	0.215	1.447	1.249	0.459
Std. Dev. Return on Assets (%)	0.277	2.700	4.431	3.054	2.716	0.830	2.661	1.045	2.420	6.071	3.062
Equity/Assets (%)	4.686	12.131	8.551	9.396	13.094	7.475	11.083	8.149	13.709	34.792	10.136
Ceded/Gross Premium	0.213	0.102	0.103	0.077	0.076	0.091	0.207	0.096	0.071	0.094	0.110
Invested Assets/Total Assets	0.977	0.937	0.949	0.961	0.949	0.933	0.932	0.952	0.907	0.959	0.945
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
				<i>Country Level Variables</i>							
Five-Firm Concentration Ratio	0.705	0.673	0.384	0.655	0.439	0.540	0.479	0.631	0.564	0.738	0.488
Foreign Market Share	0.212	0.023	0.195	0.163	0.117	0.009	0.357	0.233	0.227	0.120	0.195
Life Insurance Penetration	0.026	0.060	0.033	0.059	0.027	0.065	0.118	0.044	0.046	0.053	0.050
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	1.112	0.845	1.113	1.427	1.574	0.960	1.574	0.910	1.658	0.892	1.219
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 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
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
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

Figure 1: Boone Indicator 1999-2011.

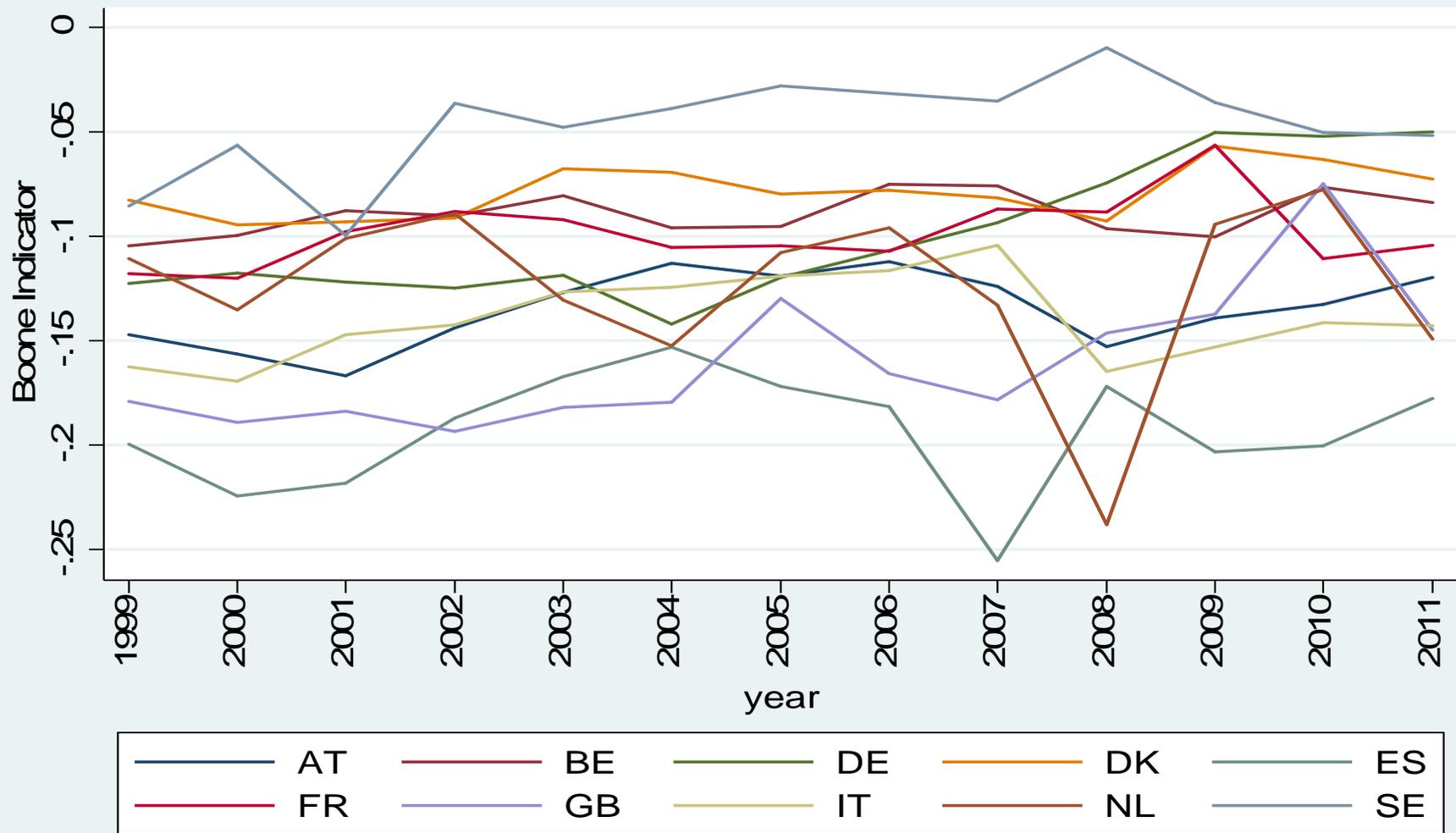


Table 2: Boone Indicators

We present 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 t values testing differences in mean Boone indicator values between the pre- and the post-crisis period.

Country	Avg. (1999-2011)	Pre-crisis Avg. (1999-2007)	Post-crisis avg. (2008-2011)	t-test for pre- & post-crisis avg. differences
Austria	-0.131	-0.128	-0.137	2.716***
Belgium	-0.089	-0.088	-0.09	1.68*
Germany	-0.097	-0.118	-0.057	-130.559***
Denmark	-0.079	-0.082	-0.071	-8.22***
Spain	-0.193	-0.196	-0.19	-3.56***
France	-0.099	-0.103	-0.09	-8.51***
UK	-0.16	-0.175	-0.123	-24.836***
Italy	-0.085	-0.134	0.008	-8.104***
Netherlands	-0.123	-0.117	-0.137	2.903***
Sweden	-0.042	-0.046	-0.036	-2.569**
All countries	-0.112	-0.120	-0.093	-2.034****

***, **, * significant at 1%, 5% and 10% level respectively.

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.

Panel A

	Boone	Life Pen.	Life Premiums	Conc. Ratio	Foreign Mkt Share	Stock MktDev	Public Bonds	Private Bonds	Bank Devt.	GDP growth	Inflation
Boone Indicator	1										
Life Penetration	-0.00768	1									
Total Life Premium	-0.165*	0.575***	1								
Five Firm Concentration Ratio	0.432***	-0.104	-0.447***	1							
Foreign Market Share	-0.263***	0.169*	0.113	-0.0405	1						
Stock Market Devt.	-0.282***	0.0376	0.430***	-0.307***	0.245***	1					
Pub. Bond	0.112	-0.0799	0.0504	0.211**	-0.274***	-0.157*	1				
Priv. Bond	0.347***	-0.0768	-0.384***	0.232***	-0.0564	-0.190**	-0.132	1			
Banking Devt.	-0.126	0.171*	0.0845	-0.113	0.335***	0.260***	-0.430***	0.512***	1		
GDP growth	-0.138	0.0431	-0.0846	-0.0604	-0.0284	0.0136	-0.0680	-0.232***	-0.318***	1	
Inflation	-0.215**	-0.0729	-0.0892	-0.0898	0.0673	0.216**	0.0674	-0.0517	0.109	0.156*	1

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Panel B

	(1) Boone	Voice & Accountability	Political Stability	Govt. Effectiveness	Regulatory Quality	Rule of Law	Control of Corruption	Institutional Devt.
Boone Indicator	1							
Voice and Accountability	0.450***	1						
Political Stability No Violence	0.495***	0.589***	1					
Government Effectiveness	0.343***	0.822***	0.605***	1				
Regulatory Quality	0.192**	0.793***	0.463***	0.755***	1			
Rule of Law	0.327***	0.809***	0.567***	0.879***	0.843***	1		
Control of Corruption	0.341***	0.852***	0.613***	0.897***	0.876***	0.947***	1	
Institutional Development	0.399***	0.888***	0.729***	0.933***	0.871***	0.947***	0.973***	1

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4: Determinants of Boone Indicator. Random Effects Models

This table provides regression results of the Boone (2008) indicator on country factors to provide evidence on country characteristics that affect the competition of the EU life insurance markets. Panel data random effects models are used in the regression analyses. We include as explanatory variables the size of the market (log of total life insurance premiums), the market structure (the cumulative market share held by the 5 largest insurers), the life insurance penetration, the market share of foreign companies in total domestic life business, the stock market development, the public bond market development, the private bond market development, the banking sector development as well as two macroeconomic determinants – the inflation rate and the growth in real per capita GDP. We also control for the legal system of the country by using three dummies variables: one for French civil law, one for German civil law, and one for Scandinavian civil law, with English common law being the omitted category. A crisis dummy variable is included to control for the period since the financial crisis started. We also control for country governance variables, but as these seven governance indicators are correlated, they are included individually in the regression analysis. Results are presenting in the corresponding columns. Standard errors are in parenthesis.

	Political Stability	Government Effectiveness	Regulatory Quality	Rule of Law	Voice & Accountability	Control of Corruption	Institutional Devt.
Size of Market	0.020*	0.023**	0.024**	0.020*	0.023**	0.021**	0.023**
	(0.010)	(0.011)	(0.010)	(0.011)	(0.010)	(0.010)	(0.011)
Five-firm Concentration Ratio	0.031	0.046	0.038	0.030	0.028	0.033	0.035
	(0.045)	(0.046)	(0.045)	(0.045)	(0.045)	(0.045)	(0.045)
Life Penetration	0.009	0.007	0.006	0.009	0.007	0.009	0.007
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Foreign Market Share	0.000	0.001	0.001	0.001	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Stock Market Devt.	-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)
Public Sector Bond	0.001*	0.001**	0.001**	0.001*	0.001**	0.001**	0.001**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Private Sector Bond	-0.001**	-0.001**	-0.001**	-0.001**	-0.001**	-0.001**	-0.001**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Banking Sector Devt	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)
GDP Growth	-0.007**	-0.007**	-0.007***	-0.007**	-0.008***	-0.007***	-0.008***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Inflation	-0.003	-0.003	-0.004	-0.003	-0.002	-0.002	-0.003
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
French Law	0.141***	0.146***	0.147***	0.153***	0.138***	0.154***	0.145***
	(0.049)	(0.048)	(0.047)	(0.047)	(0.048)	(0.047)	(0.048)
Germanic Law	0.167***	0.176***	0.167***	0.180***	0.165***	0.181***	0.167***
	(0.060)	(0.057)	(0.056)	(0.057)	(0.057)	(0.056)	(0.058)
Scandinavian Law	0.240***	0.248***	0.245***	0.255***	0.235***	0.253***	0.242***
	(0.060)	(0.058)	(0.057)	(0.058)	(0.059)	(0.057)	(0.058)
Crisis Dummy	0.008	0.009	0.011	0.006	0.009	0.009	0.009
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
Governance Indicator	0.019	0.026	0.058*	0.019	0.070*	0.021	0.040
	(0.018)	(0.020)	(0.030)	(0.026)	(0.040)	(0.018)	(0.027)
Constant	-0.689***	-0.797***	-0.802***	-0.711***	-0.803***	-0.747***	-0.788***
	(0.187)	(0.217)	(0.198)	(0.205)	(0.203)	(0.203)	(0.207)
No. of observations	130	130	130	130	130	130	130
Overall R-squared	0.547	0.575	0.559	0.575	0.579	0.571	0.609

Notes:***, **, * significant at 1%, 5% and 10% level, respectively

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

This table reports the regression results of Z score and its components (ROA, Equity/Assets, σ ROA) on Boone indicator of competition controlling for firm and country characteristics in addition to the gradual nature of changes in the regulatory environment (the time trend variable) and a crisis dummy variable to control for the period since the financial crisis started (i.e. 2008-2011). We use the two-stage least squares estimator and instrument the Boone indicator. The firm characteristics we control for are the size of the firm (by the log of total assets), the use of reinsurance (by the ratio Ceded premiums/Gross premiums), the efficiency of insurers' account receivable management (by the ratio invested assets/total assets) and the insurance leverage ratio (net premiums/equity). The country characteristics we control for are the size of the market (through the log of total life premiums in each market), one main macroeconomic condition (the inflation rate), the market structure (by the cumulative market share held by the 5 largest insurers) and the level of insurer activity in the country where the firm is domiciled (the life insurance penetration ratio which is the ratio of total life insurance premiums to GDP). We present the test of exogeneity of the Boone indicator that is rejected. The Sargan test for overidentifying restrictions cannot reject the null hypothesis that the instruments used are valid. Bootstrapped standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

	lnZ b/se	ROA b/se	Equit/Assets b/se	σ ROA b/se
Boone Indicator	-8.782*** (1.517)	-0.062 (0.520)	60.186*** (17.490)	1.459** (0.715)
Ln(Assets)	-0.025** (0.010)	0.030*** (0.003)	-3.177*** (0.152)	-0.009*** (0.002)
Group	0.113 (0.088)	-0.014 (0.039)	1.198** (0.579)	0.011 (0.030)
Ceded Premium/Gross Premium	-0.000 (0.001)	0.001** (0.000)	0.020** (0.010)	0.001*** (0.000)
Invested Assets/Total Assets	-0.007*** (0.002)	0.001* (0.001)	-0.137*** (0.035)	0.002*** (0.001)
Net Premium/Equity	-0.001 (0.002)	0.004** (0.002)	-0.191*** (0.049)	0.002*** (0.001)
Size of Market	-0.037 (0.042)	0.012 (0.017)	-1.755** (0.343)	-0.129*** (0.011)
Inflation	-0.114** (0.053)	-0.001 (0.024)	0.510 (0.651)	0.045* (0.023)
5-firm Concentration Ratio	3.743*** (0.260)	-0.114** (0.056)	-0.254 (2.429)	-1.326*** (0.059)
Life Penetration	-10.122*** (1.622)	-0.501 (0.408)	139.756*** (14.022)	9.664*** (0.511)
Trend	0.013 (0.012)	0.021*** (0.005)	0.239* (0.132)	0.012*** (0.003)
Crisis Dummy	0.144 (0.091)	-0.251*** (0.024)	-0.777 (0.919)	-0.102*** (0.024)
Constant	-0.994 (0.854)	-0.688** (0.277)	97.067*** (6.999)	2.832*** (0.186)
No. of observations	2917	3248	3284	3284
R-squared	0.111	0.046	0.291	0.178
Endog. Test	36.163	0.155	19.596	13.472
p-value	0.000	0.694	0.000	0.000
Sargan Test	0.046	0.426	5.604	2.980
p-value	0.831	0.514	0.018	0.084

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

This table reports two-stage quantile regressions. The first stage regress the Boone indicator on the instruments and other independent variables by using OLS. While the second stage uses quantile regression to obtain slope coefficients for the 10th, 25th, 50th, 75th, and 90th percentiles of the Z score, being the predicted Boone (2008) indicator from the first stage the explanatory variable in addition to the explanatory variables used in the regression analyses presented in Table 5.

	10th perc.	25th perc.	50th perc.	75th perc.	90th perc.
Boone Indicator	-11.028*** (2.814)	-11.112*** (1.978)	-10.330*** (1.541)	-5.258*** (1.545)	2.144 (1.830)
Ln(Assets)	-0.019 (0.021)	-0.018 (0.013)	-0.025 (0.016)	-0.028*** (0.007)	-0.040*** (0.014)
Group	0.090 (0.146)	-0.056 (0.119)	0.117* (0.063)	0.151** (0.070)	0.142** (0.069)
Ceded Prem/Gross Premium	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)	-0.001** (0.001)	-0.000 (0.001)
Invested Assets/Total Assets	-0.008*** (0.002)	-0.006** (0.002)	-0.007*** (0.001)	-0.007*** (0.002)	-0.005 (0.003)
Net Premium/Equity	-0.003 (0.009)	-0.001 (0.003)	-0.001 (0.002)	-0.002 (0.003)	0.008 (0.006)
Size of Market	0.206*** (0.062)	0.177*** (0.054)	-0.098 (0.064)	-0.330*** (0.044)	-0.400*** (0.036)
Inflation	-0.389*** (0.089)	-0.230*** (0.086)	-0.149* (0.071)	-0.073* (0.039)	0.115* (0.067)
5-firm Concentration ratio	4.957*** (0.486)	4.938*** (0.324)	4.119*** (0.266)	2.903*** (0.184)	1.568*** (0.272)
Life Penetration	-18.394*** (2.552)	-17.027*** (1.748)	-9.564*** (1.859)	-0.021 (1.849)	7.567*** (1.533)
Trend	0.039 (0.025)	0.020 (0.014)	0.002 (0.018)	0.001 (0.011)	0.015 (0.019)
Crisis Dummy	0.068 (0.227)	0.237** (0.105)	0.190*** (0.070)	0.248*** (0.063)	0.196* (0.116)
Constant	-6.603*** (1.360)	-5.923*** (1.017)	-0.023 (1.242)	5.383*** (0.796)	7.785*** (0.761)
No. of observations	2925	2925	2925	2925	2925
Pseudo R-squared	0.074	0.096	0.112	0.128	0.116
F stat (equality of coefficients)					13.718
p-value					0.000

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Bootstrapped standard errors in parentheses.

Appendix 1: Boone Indicator Regressions

	AT	BE	DE	DK	ES	FR	GB	IT	NL	SE
Year 1999	-0.147*** (0.011)	-0.105* (0.057)	-0.123*** (0.013)	-0.083*** (0.010)	-0.200*** (0.013)	-0.118*** (0.007)	-0.179*** (0.018)	-0.163*** (0.019)	-0.111*** (0.010)	-0.086*** (0.023)
Year 2000	-0.156*** (0.008)	-0.100 (0.110)	-0.118*** (0.012)	-0.094*** (0.010)	-0.224*** (0.019)	-0.120*** (0.008)	-0.189*** (0.015)	-0.169*** (0.025)	-0.135*** (0.010)	-0.057*** (0.017)
Year 2001	-0.167*** (0.013)	-0.088 (0.055)	-0.122*** (0.013)	-0.093*** (0.009)	-0.218*** (0.031)	-0.098*** (0.008)	-0.184*** (0.016)	-0.147*** (0.026)	-0.101*** (0.011)	-0.100*** (0.036)
Year 2002	-0.144*** (0.008)	-0.090** (0.042)	-0.125*** (0.015)	-0.091*** (0.011)	-0.187*** (0.025)	-0.088*** (0.009)	-0.193*** (0.017)	-0.143*** (0.029)	-0.089*** (0.016)	-0.036 (0.043)
Year 2003	-0.127*** (0.008)	-0.081*** (0.029)	-0.119*** (0.016)	-0.067*** (0.010)	-0.167*** (0.033)	-0.092*** (0.009)	-0.182*** (0.020)	-0.127*** (0.031)	-0.130*** (0.020)	-0.048* (0.029)
Year 2004	-0.113*** (0.005)	-0.096*** (0.031)	-0.142*** (0.012)	-0.069*** (0.008)	-0.153*** (0.022)	-0.105*** (0.008)	-0.179*** (0.016)	-0.125*** (0.041)	-0.152*** (0.016)	-0.039 (0.032)
Year 2005	-0.119*** (0.005)	-0.095*** (0.021)	-0.120*** (0.008)	-0.080*** (0.008)	-0.172*** (0.026)	-0.105*** (0.007)	-0.130*** (0.018)	-0.119** (0.050)	-0.108*** (0.013)	-0.028 (0.027)
Year 2006	-0.112*** (0.005)	-0.075*** (0.019)	-0.107*** (0.007)	-0.078*** (0.013)	-0.182*** (0.025)	-0.107*** (0.008)	-0.166*** (0.019)	-0.117** (0.054)	-0.096*** (0.016)	0.000 (0.061)
Year 2007	-0.124*** (0.007)	-0.076*** (0.017)	-0.094*** (0.008)	-0.082** (0.033)	-0.255*** (0.025)	-0.087*** (0.012)	-0.179*** (0.015)	-0.104 (0.072)	-0.133*** (0.020)	-0.035* (0.020)
Year 2008	-0.153*** (0.007)	-0.096*** (0.019)	-0.074*** (0.008)	-0.093*** (0.016)	-0.172*** (0.054)	-0.088*** (0.018)	-0.147*** (0.026)	-0.165*** (0.059)	-0.238** (0.102)	-0.010 (0.058)
Year 2009	-0.139*** (0.007)	-0.100*** (0.018)	-0.050*** (0.007)	-0.057*** (0.017)	-0.203*** (0.018)	-0.056*** (0.006)	-0.137*** (0.021)	0.466** (0.195)	-0.094 (0.074)	-0.036 (0.031)
Year 2010	-0.133*** (0.009)	-0.077*** (0.018)	-0.052*** (0.008)	-0.063*** (0.011)	-0.200*** (0.015)	-0.111*** (0.008)	-0.075*** (0.020)	-0.141*** (0.038)	-0.078*** (0.024)	-0.050** (0.023)
Year 2011	-0.120*** (0.013)	-0.084** (0.041)	-0.050*** (0.008)	-0.073*** (0.012)	-0.178*** (0.031)	-0.104*** (0.013)	-0.145*** (0.016)	-0.143*** (0.051)	-0.149*** (0.042)	-0.052** (0.025)
N	77	112	2354	358	578	589	700	611	254	122
Endog. Test	25.553	12.293	295.220	22.214	27.937	37.783	60.198	73.822	46.012	13.358
p-value	0.020	0.504	0.000	0.052	0.009	0.000	0.000	0.000	0.000	0.421
Anders. Corr.	53.660	41.798	1689.330	25.271	103.994	338.040	301.352	15.430	21.918	22.186
p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Notes: AT- Austria; BE- Belgium; DE- Germany; DK- Denmark; ES- Spain; FR- France; GB- The UK; IT- Italy; NL- The Netherlands; SE- Sweden; Year intercept dummies are omitted for space considerations. ***, **, * significant at 1%, 5% and 10% level respectively.