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Regulations, profitability, and risk-adjusted returns of European insurers: An empirical investigation

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ABSTRACT

This study examines the effect of regulations on European insurers' profitability and risk-adjusted returns. We find an inverted U-shaped relationship between return on assets and regulations relating to capital adequacy, accounting and auditing requirements, and disclosures to supervisors. In contrast, requirements related to technical provisions have a negative effect on return on assets, and we find no evidence of an association with regulations related to investment and supervisory power. We also find evidence of an inverted U-shaped relationship between a firm's risk-adjusted rate of return and regulations relating to capital requirements as well as corporate governance and internal control. We observe the opposite in the case of technical provisions. These results are robust to controls for various country-specific attributes such as macroeconomic environment, stock market development, overall quality of institutions, and legal origins.

1. Introduction

In recent years, many policymakers around the world have announced intentions to reform the regulatory framework of the insurance sector.[1] Although regulations mainly aim to control risk-taking, reduce insolvency risk, and protect policyholders, they may also alter the structure and competition of the industry, constrain insurers' prices and products, and impose additional costs on firms (see, e.g., Lee, 2001; Pope, 2004; Ernst and Young, 2013). Consequently, questions arise as to whether and how the various existing regulatory policies influence insurance firms' performance.

The literature on insurance regulations is scarce (Lorent, 2008), especially when compared with a rich banking literature that examines the effect of regulations on various aspects of performance such as profitability, cost of financial intermediation, efficiency, and productivity.[2]

In most cases, the literature offers conflicting theoretical arguments concerning the effect of regulations on financial firms. For example, to the extent that moral hazard encourages riskier behaviour, firms will have more incentives to increase risk if they are allowed to offer a wider portfolio of services (Boyd et al., 1998). In fact, Das et al. (2003) argue that the financial deregulation and liberalization that allowed insurers to assimilate banking-type

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[1] Australia, Canada, Singapore, and Switzerland, among others, have proposed or introduced changes to the framework for assessing insurance firms' solvency (HM Treasury and Financial Services Authority-FSA, 2006). In the European Union, the Solvency II Directive (2009/138/EC), scheduled to take effect in 2016, aims to codify and harmonize insurance regulation among countries. Like Basel II in banking, the Solvency II framework consists of three pillars. Pillar 1 focuses on the quantitative requirements, covering issues such as technical provisions and minimum capital requirements. Pillar 2 is more qualitative, focusing on issues such as governance, risk management, and the supervisory review process. Pillar 3 consists of disclosure and transparency requirements, aiming to promote market discipline.

[2] See, for example, Demirgüç-Kunt et al. (2004), Shen and Chang (2006), Pasiouras (2008), Chortareas et al. (2012), and Delis et al. (2011). The banking literature has also investigated other issues such as the relationship between regulatory policies and (i) the likelihood of a crisis (Kim et al., 2013; Cihak et al., 2013), (ii) banking sector development (Barth et al., 2004), and (iii) the output cost of banking crises (Angkinand, 2009).

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activities is one of the main factors for life insurance company failures. On the other hand, fewer regulatory restrictions may positively affect firms' franchise value, leading to prudent behaviour and increased diversification of the asset portfolio (Gonzalez, 2005).

At the same time, the limited number of studies that examine regulations and insurers' performance focus on individual countries such as Austria (Ennsfellner et al., 2004), Germany (Mahlberg and Url, 2000), Spain (Cummins and Rubio-Misas, 2006), the Ukraine (Badunenko et al., 2006), and the United States (Weiss and Choi, 2008), along with Korea, Philippines, Taiwan, and Thailand (Boonyasai et al., 2002). As Pope (2004) points out, such studies do not allow us to reach a clear conclusion concerning the influence of the regulatory framework on insurance firms' performance. One of the reasons is that these studies usually use poor regulatory proxies, such as dummy variables for deregulation (Boonyasai et al., 2002), and/or they simply compare performance before and after the deregulation period (Ennsfellner et al., 2004).[3] Thus, they do not investigate how insurers are influenced by specific regulations, such as capital requirements or technical provisions. Furthermore, it may be difficult to generalize from the results obtained for individual countries, because there is no evidence that successful practices in one country will succeed in another with a different institutional setting (Barth et al., 2004). Thus, the question of how, if at all, regulations affect insurance firms' performance remains unanswered.

Our study attempts to add to this strand of the literature by being the first to develop an ad hoc empirical model to investigate the impact of various regulations on European insurers' profitability and risk-adjusted returns. More specifically, we take advantage of information in the Insurance Laws Database, provided by the International Association of Insurance Supervisors (IAIS), to build various indices that proxy for regulations on capital requirements, supervisory power, technical provisions, accounting disclosures and auditing, investments, and corporate governance. Thus, the regulatory indicators that we use proxy for various policies promoted by the IAIS, as well as for the regulations that will be introduced with the implementation of Solvency II in Europe.[4] We then examine whether and how these regulations influence insurance firms' performance. We believe that the use of such informative regulatory indices, together with the application in a cross-country sample, enhances our understanding of the dynamics.[5]

We focus on the profitability and risk-adjusted returns of European insurers for several reasons. First, the insurance industry's importance has risen significantly in recent years, making a noticeable contribution to Europe's economic growth and development. For example, data from the European Insurance Federation indicate that with a 33% share of the global market in 2012, the European insurance industry is the largest in the world, generating premium income of more than €1100 billion, employing almost 1 million people, and investing almost €8400 billion in the economy. Second, insurance firms were the largest institutional investors in Europe, with more than 50% of all European institutional assets under management in 2011, and it is therefore not surprising that there is a close link between the performance and variability of stock markets and the financial results of insurance companies (see Lorent, 2008).[6] Third, the implementation of Solvency II is expected to introduce various changes in European insurers' operating environment (see European Central Bank-ECB, 2007; KPMG, 2011). Thus, an understanding of the factors that influence the performance of European insurers is of interest to various stakeholders including managers, regulators, stockholders, and policyholders.

The rest of the paper is structured as follows: Section 2 provides a background discussion of theoretical arguments and the findings of empirical studies. Section 3 discusses the data and variables used in the study. Section 4 presents the methodology. Section 5 discusses the results, and Section 6 concludes.

2. Background discussion

2.1. Capital/solvency requirements

As in banking, capital/solvency requirements are frequently used in insurance supervision.[7] Despite the general belief that more-stringent capital requirements will improve the well-being of insurers, the effect of such requirements is actually ambiguous. For example, various recent reports mention that capital requirements under Solvency II in Europe could force insurance managers to alter their asset allocation, redesign products, reduce capacity, change the prices of insurance products, or even withdraw from certain insurance sectors (see, e.g., Wagner and Zemp, 2012; KPMG, 2011). Apparently, such actions will affect their performance. Additionally, higher capital charges are expected to result in lower profitability and lower returns to investors. For example, a joint report published by Morgan Stanley/Oliver Wyman (2010) argues that Solvency II capital ratios will be fundamentally more volatile than those reported under Solvency I, resulting in a higher observed cost of capital for the insurance sector. In contrast, the European Central Bank (2007) anticipates that the recognition of diversification benefits will lead EU insurers to reduce their risk concentration and profit from capital relief, eventually reducing their cost of capital and increasing profitability.

Existing theoretical and empirical evidence also provides conflicting views. Munch and Smallwood (1980) find that minimum capital requirements can be effective in reducing the number of insolvencies in the United States; however, this result is achieved by limiting the entry of small risky firms in the market rather than decreasing the frequency of insolvency among firms that do enter the market. Additionally, evidence from the United States raises concern about the effectiveness of risk-based capital (RBC) requirements in facilitating prompt corrective action against troubled insurers (see, e.g., Cummins et al., 1995). Using

[3] Some studies attempt to improve upon this approach by examining differences in regulations among U.S. states (Weiss and Choi, 2008).

[4] It should be emphasized that the indices that we use do not always map exactly the regulations of Solvency II. As such, they cannot provide a direct test of the implications of Solvency II. We believe that such a test will be possible only after this framework has been implemented. Despite acknowledging this potential shortcoming, we believe that it does not reduce the value of the study because we use various informative indices that provide an idea of how various regulatory tools that relate to the policies in Solvency II could influence insurance firms' performance. In principle, our framework is similar to the one adopted in existing work in banking that relates information from the World Bank Database on Bank Regulation and Supervision to the three pillars of Basel II (see, for example, Barth et al., 2004; Pasiouras et al., 2009; Delis et al., 2011).

[5] To our knowledge, the only study that examines some of the aforementioned regulations is Pasiouras and Gaganis (2013). That study does not focus on European firms, however, and it examines the risk of insolvency rather than profitability and risk-adjusted returns.

[6] Weiß and Mühlnickel (2014) also highlight that insurers can contribute to the (in) stability of the financial system, and they provide supporting evidence from the U.S. financial sector during the recent financial crisis.

[7] As mentioned in Eling et al. (2007) a variety of frameworks have been used around the world, including ones without specific levels of capital (New Zealand), static models that can be either risk based (United States, Japan) or non-risk based (European Union under Solvency I), dynamic cash-flow-based models (Netherlands), and a combination of static factor and dynamic cash-flow-based models (United Kingdom, Switzerland).

an international sample, Pasiouras and Gaganis (2013) conclude that capital requirements do not have a robust impact on insurance firms' insolvency risk. Similarly, in one of the few studies that focuses on profitability rather than risk, Born (2001) shows that no significant relationship exists between capital requirements and return on equity across U.S. states with different regulatory environments.[8] Lin et al. (2013) provide a potential explanation for these mixed findings. They build an option pricing model that predicts a nonlinear relationship between regulatory pressure, in terms of risk-based capital standards, and insurers' risk-taking.

Based on the foregoing discussion, we formulate our null and alternative hypothesis as follows:

H0. Capital requirements are uncorrelated with insurers' performance.

Ha1. Capital requirements are positively correlated with insurers' performance.

Ha2. Capital requirements are negatively correlated with insurers' performance.

2.2. Technical provisions

Regulations related to technical provisions form another important part of the supervisory framework in the insurance industry. The IAIS (2008) guidance paper on the structure of regulatory capital requirements highlights the importance of technical provisions, stating that "These aspects of solvency assessment (namely technical provisions and capital) are intrinsically inter-related and cannot be considered in isolation in a solvency regime." IAIS (2007a) also suggests that the calibration of capital requirements depends on technical provisions. Similarly, the European Commission devotes various parts of the Solvency II Directive to the calculation of technical provisions. Within this context, a recent report by KPMG (2011) highlights that Solvency II is likely to encourage more-adequate reserving and possibly reduce the cyclicality in technical provisions but also affect the pricing of products, with potentially high volatility of technical provisions and high runoff margins. Another aspect to be emphasized is that although higher technical reserves can safeguard insurers against risks, at the same time, enhanced data, documentation, and validation requirements, along with the requirement for explicit links to other areas of the regulatory framework (as it the case in Solvency II with internal models), come with additional complexity and associated operational costs that can decrease profits. Based on the foregoing discussion, we formulate our null and alternative hypothesis as follows:

H0. Technical provisions are negatively correlated with insurers' performance.

Ha. Technical provision requirements are uncorrelated with insurers' performance.

2.3. Investments

Insurance firms' portfolio choices have also been subject to regulations, aiming to ensure that insurers invest in and hold adequate and appropriate assets to cover capital requirements and technical provisions. The first broad approach to portfolio regulation is the prudent person principle that will be implemented in Europe with Solvency II. This qualitative requirement obliges insurance firms to invest in assets as a prudent person would, given similar investment objectives. The second broad approach is the imposition of quantity restrictions, which limit the share of the portfolio that can be invested in specific assets. In theory, each approach has its advantages and disadvantages.

The main argument against quantitative portfolio regulations is that they can reduce diversification benefits, result in inefficient capital allocation, and lead to suboptimal returns and risk-taking. For example, Dickinson (1998) argues that restrictions may introduce difficulties in dealing with some of the underlying risk of life insurance business, such as interest risk on annuities and term policies. Klein (2011) points out, however, that despite various theoretical reasons for which a principles-based approach could be preferred, in practice the success of this approach depends heavily on the principles and standards that are set and the competence and motivation of regulators to take corrective action when it is needed. Furthermore, compliance with limits on portfolios is more readily verified and monitored by supervisors than by prudent person rules (Davis, 2002). Within this context, portfolio regulations may be more appropriate when managers and regulators are inexperienced or the markets are volatile and open to manipulation by insiders (Davis, 2002). Furthermore, the Organization for Economic Co-operation and Development (OECD, 2000) highlights that regardless of the adopted approach, it is important to follow some basic principles such as diversification and dispersion, maturity matching, and currency matching.

The empirical evidence on this issue is scarce, and the results are mixed. Using a cross-country sample, Pasiouras and Gaganis (2013) find that more-detailed regulations on admissible assets may decrease insolvency risk compared with a prudent person rule. In contrast, Cheng et al. (2011) examine a sample of U.S. life insurers to conclude that prudent person laws compel investors to curtail risk. Davis (2002) assesses the real returns achieved on life insurers' and pension funds' portfolios while comparing the prudent person and restriction-based regimes in nine OECD countries. He concludes that in his sample, pension funds are much more adversely affected by quantitative restrictions than are life insurance companies. We formulate the null and alternative hypothesis as follows:

H0. Investment restrictions are uncorrelated with insurers' performance.

Ha1. Investment restrictions are positively correlated with insurers' performance.

Ha2. Investment restrictions are negatively correlated with insurers' performance.

2.4. Corporate governance and internal control

Internal control and corporate governance systems have received increased attention in recent years, with policymakers proposing various principles for the insurance sector (see, e.g., IAIS, 2007b). The European Commission also incorporated corporate governance in its Solvency II Directive, stating that "Member States shall require all insurance and reinsurance undertakings to have in place an effective system of governance which provides for sound and prudent management of the business" (p. 151).

The theoretical justification for the importance of corporate governance and internal control systems lies in agency problems and managerial incentives that play a role in determining capital and risk in insurance markets (Cummins and Sommer, 1996). Excessive risk appetite and lack of managerial integrity

[8] In addition to these studies, Finkelstein (2004) examines the consequences of imposing large, binding minimum standards on a voluntary private health insurance market. She concludes that the minimum standards are associated with a substantial decline in insurance coverage.

are highlighted among the main problems of firms that either breach their solvency requirements or are close to doing so (Ashby et al., 2003).

Although there is no research linking insurance regulations relating to internal control and corporate governance with insurers' performance, a few recent studies examine the impact of firm-level governance policies.[9] Huang et al. (2011) examine the U.S. Property and Liability industry during the 2000–2007 period, revealing a significant relationship between cost efficiency and corporate governance.[10] In contrast, Hardwick et al. (2011) find no evidence to support the argument that governance mechanisms such as a high proportion of actuaries on the board, the existence of an audit committee, and CEO duality have significant effects on the profit efficiency of U.K. life insurers.[11] In another study of the U.K. insurance sector, Diacon and O'Sullivan (1995) find that CEO tenure and formal governance factors, such as the number of directors and the existence of audit and remuneration committees, have a nonlinear impact on most of their performance measures, and they conclude that too much governance may be harmful.

Thus, the effect of corporate governance on performance is ambiguous, and we formulate the null and alternative hypothesis as follows:

H0. Corporate governance and internal control requirements are uncorrelated with insurers' performance.

Ha1. Corporate governance and internal control requirements are positively correlated with insurers' performance.

Ha2. Corporate governance and internal control requirements are negatively correlated with insurers' performance.

2.5. Supervisory power

The power of supervisory bodies can possibly play a critical role in the efficient implementation of regulations, because the regulators themselves must design and put into practice the policymaking initiatives. Along this line of reasoning, the official supervision theory claims that sound governance of firms and incentives for prudent behaviour can be induced through supervisory bodies that have the expertise and incentives to overcome information and transaction costs (Beck et al., 2006). Consistent with this view, IAIS discusses supervisory power in several documents, suggesting that supervisors must have adequate powers to (i) require an insurer to assess and manage its risk exposures, (ii) set regulatory financial requirements for individual insurers to protect policyholders' interests, (iii) require that, if necessary, an insurer holds additional capital or takes action to reduce its risks so that the assets it holds are sufficient and appropriate, and (iv) take remedial action in a timely manner (see, e.g., IAIS, 2007a). Solvency II also specifies the role of the supervisory authorities. In particular, Article 34 clearly states that the Member States shall ensure that the supervisory authorities must be fully empowered to carry out their tasks.

An alternative hypothesis, however, suggests that regulators may become captive of the industry or other pressure groups (Becker, 1983; Shleifer and Vishny, 1998). Regulators might thus respond to political pressure rather than the economic needs of the insurance industry, or they might use their position to gain favour with the industry, presumably in return for political support during election campaigns (Schiro, 2006; Grace and Phillips, 2008). Indeed, Grace and Phillips (2008) show that regulatory officials in the United States who obtain the position of insurance commissioner by popular election and those who seek higher elective office following their tenure as insurance commissioner allow higher overall "unit prices" relative to competitive market states. Within this context, one could argue that in cases where powerful supervisors respond to political pressure and corruption, they will exert a negative influence on the insurance sector's long-term development.

Research on the effects of supervisory power on insurers is scarce; however, Pasiouras and Gaganis (2013) report robust evidence of a positive association between supervisory power and the risk of insurers' insolvency, a finding that is consistent with some studies on the banking sector.[12] Our hypotheses are as follows:

H0. Supervisory power is uncorrelated with insurers' performance.

Ha1. Supervisory power is positively correlated with insurers' performance.

Ha2. Supervisory power is negatively correlated with insurers' performance.

2.6. Reporting requirements

The disclosure of information to the public and the regulators is considered essential for assessing insurance firms' performance and risk-taking. The main idea underlying the private monitoring hypothesis is that regulations that promote market discipline, such as disclosure of information to the public, will result in better outcomes for the insurance sector. In other words, we would expect improved private monitoring of insurers to boost their functioning and performance. Therefore, unsurprisingly, regulators promote the disclosure of information at an international level (see, e.g., IAIS, 2006), whereas at the European level, both the implementation of IFRS Phase II and Pillar 3 of Solvency II aim to enhance disclosures to both the public and regulators. Currently, the issue of market discipline in the insurance industry has not been

[9] Some recent studies focus on risk. Eling and Marek (2014), in a study of the U.K. and German insurance sectors, find that higher levels of compensation, more-independent boards with more meetings, and more blockholders are associated with lower risk taking. In the only study (to our knowledge) that examines the effect of related regulations on the insolvency risk of insurers, Pasiouras and Gaganis (2013) report an insignificant relationship.

[10] In more detail, they find that board size, the proportion of independent directors on the audit committee, director tenure, the average number of directorships, the proportion of insiders on the board, and auditor independence have a positive effect on cost efficiency. In contrast, the proportion of financial experts on the audit committee and the percentage of block shareholder ownership are negatively related to cost efficiency.

[11] They do find, however, that the proportion of non-executive directors on the board exhibits a significant effect on the profit efficiency once they include in the regressions the interaction effects with CEO duality and the existence of an audit committee.

[12] Results from studies on the banking industry are mixed. For example, Barth et al. (2002) find that supervisory power has no impact on bank profitability, measured by return on assets and return on equity. Barth et al. (2004) obtain similar results, concluding that there is no strong association between banking-sector development, performance, and official supervisory power. More recent studies, however, such as Pasiouras (2008) and Pasiouras et al. (2009), find that supervisory power has a positive effect on various measures of bank efficiency. Similarly, Barth et al. (2013) find that the strengthening of official supervisory power is positively associated with bank efficiency; however, this association is conditional on the supervisory authorities' independence.

extensively researched, as is the case with banking, with existing work rarely using non-U.S. data (Eling, 2012).[13,14]

Wagner and Zemp (2012) argue that the publication of the same risk-based economic information for all insurance companies provides opportunities for management to benchmark its own indicators of economic performance, as well as to set the firm apart from competitors. Requirements for increased disclosures can also negatively affect profitability, however, as a result of direct costs of making additional disclosures, maintaining investor relations departments, additional time and effort to prepare formal disclosure documents, and the release of sensitive information to competitors (Duarte et al., 2008). Thus, the effect of the disclosures on performance is ambiguous, and to some extent, it will also depend on whether insurance companies will try to pass the costs onto their policyholders by increasing the premiums.

Based on the foregoing discussion, we formulate the following hypotheses:

H0. Disclosure requirements are uncorrelated with insurers' performance.

Ha1. Disclosure requirements are positively correlated with insurers' performance.

Ha2. Disclosure requirements are negatively correlated with insurers' performance.

3. Data and variables

3.1. Dependent variables

We use two indicators of performance. The first is the return on assets (ROA), a traditional measure of profitability. Like Demirgüç-Kunt and Huizinga (2010), we also use the Sharpe ratio (SHARPE) as a proxy for the risk-adjusted rate of return. The SHARPE for a firm i in year t is calculated as the return on equity in year t divided by the standard deviation of the return on equity over the entire period for which data are available.[15]

3.2. Regulatory variables

The IAIS database contains various measures that describe the insurance industry's regulatory environment. To use this information in our analysis, we follow an approach that resembles one used in many studies on banking that draw from the World Bank database (Barth et al., 2001), as well as an insurance study by Pasiouras and Gaganis (2013).[16] We use regulatory indices, which in most cases quantify the information in the IAIS database by summing a number of answers coded as zero or one.[17] In all the cases, the indices are constructed in such a way that higher values indicate stricter requirements. In the following discussion, we briefly outline these indices (further information about their construction is available in Appendix A).

CAPRQ is a capital requirements index indicating whether factors such as the volume of business/premium income, the nature of the business, and risk exposures, among others, are considered during the calculation of the solvency/capital requirements.

TPROV is a technical provisions index revealing whether there are special coverage requirements to be covered by admissible assets, as well as whether insurers set up technical provisions for items such as unearned premiums, unexpired risk, life insurance/other mathematical provisions, and unit-linked life insurance policies.

INVEST refers to the system of investment regulations, indicating whether regulators follow an approach of detailed regulations on admissible assets, a prudent-person approach, or a combination of the two systems. It also reveals the extent of regulation on investments by considering whether regulations exist concerning, among other factors, the security of investments and their yield.

SPOWER is an index of supervisory power indicating the extent of the actions that are available to supervisors, such as the following: (i) a request to set up a recovery plan, (ii) a request to increase capital or a change of technical provisions, (iii) restriction on dividend payments, (iv) prohibition of underwriting new business or certain investments, or (v) withdrawal or temporary suspension of the insurer's license. Additionally, it considers actions that may be taken to enforce orders as well as sanctions available when an insurer does not comply with laws and/or regulations.

GOVINT is an index of corporate governance and internal control requirements. The main dimensions that it considers are as follows: (i) the role of the supervisory agency in corporate governance, (ii) whether corporate governance rules in a country refer to various issues such as board composition or the responsibilities of certain parties, (iii) whether the insurance supervisor applies fit and proper requirements to members of a firm's board of directors and other key managers, (iv) whether internal control procedures in insurance companies address issues such as the independence of key functions, (v) whether the insurance legislation imposes the compulsory setup of various committees, (vi) whether internal control procedures are required or recommend by law or professional standards, and (vii) who supervises the internal control procedures.

ACCAUD is an index of accounting and auditing that serves as a proxy for the public disclosure requirements and refers to the extent of items that are disclosed on the balance sheet, the extent of auditing, the responsibilities of auditors, and the requirements to become an external auditor of an insurance company.

SREPORT is a supervisory reporting index that considers whether insurers have to file various documents/information with the supervisory authority, along with the extent of information that must be filed with the financial returns for supervisory purposes at specified time intervals.[18]

[13] Motivated by the upcoming Solvency II, Höring and Gründl (2011) examine the risk disclosure practices in the European insurance industry. Their focus is not on regulations, however. Rather, they construct a risk disclosure index by examining the annual reports of European primary insurers in the Dow Jones Stoxx 600 Insurance Index between 2005 and 2009. Their main results can be summarized as follows: (i) risk disclosures of the European insurance industry are still moderate, on average, but with a strong dispersion among the sample insurers; (ii) a positive relationship exists between the extent of risk disclosure and insurer size; (iii) a positive relationship exists between risk disclosure and insurers' risk; (iv) a negative relationship exists between risk disclosure and insurer profitability; (v) cross-listing status and ownership dispersion influence the extent of risk disclosures; and (vi) there exist inter-insurer and inter-country differences in risk disclosure practices.

[14] In general, evidence from the banking sector supports the private monitoring view, indicating that enhanced disclosure requirements can have a positive effect on productivity (Delis et al., 2011), cost and profit efficiency (Pasiouras et al., 2009) and a negative effect on risk-taking (Agoraki et al., 2011).

[15] As discussed earlier, we require data for at least three years in order to include a given firm in the sample. In more detail, we had information for five years for around 50% of the firms in the sample, for three years for approximately 3% of the sample, and the remaining had information for four years. Both ROA and the Sharpe ratio were capped at the 5th and 95th percentile to reduce the effect of outliers while retaining all the observations in the sample.

[16] See, for example, Agoraki et al. (2011), Chortareas et al. (2012), and Delis et al. (2011).

[17] This approach avoids the arbitrary (or data-driven) assignment of weights to the various questions, by giving them an equal weight. At the same time, it is quite evident how the change in the answer to a question changes the constructed regulatory index (see Barth et al., 2008).

[18] The IAIS questionnaire allows supervisors to indicate whether the requested information about the financial returns (for example, solvency/capital report and details on premium income) must be filed monthly, quarterly, biannually, annually,

3.3. Control variables

In our regressions, we control for various firm-specific attributes. To control for the effects of group structure, we include a dummy variable (AFFIL) that takes the value of one in the case of affiliated companies and zero in the case of unaffiliated ones. Insurance firms also vary on the basis of business activity and may engage in long-term (life insurance) or short-term (property/casualty insurance) business, with differences in actuarial principles, notice for changes in underwriting terms, and adjustments for unanticipated losses (Adams et al., 2003). We therefore include two dummy variables to distinguish among life (LIFE), composite (COMP), and non-life insurance firms, with the latter being the reference category. Building on agency theory, the literature also suggests that managerial incentives in the insurance industry depend on the firm's organizational structure. Therefore, as in Cummins et al. (1995) and Adams et al. (2003), we include a dummy variable to distinguish between stock and mutual insurers (MUTUAL). We also use the ratio of shareholders' funds to total assets (EQAS) to control for firms' solvency position.[19] We examine the natural logarithm of total assets (SIZE) to control for differences in firm size (Cummins et al., 1995; Cummins and Sommer, 1996).

In our sensitivity analysis, we include additional firm-level and various country-level variables in alternative specifications. The first set of country-level variables aims to capture macroeconomic conditions through real per capita GDP growth (GDPGR) and the inflation rate (INFL). Second, we include the market-capitalization-to-GDP ratio to control for stock market development. Third, we control for the overall quality of the institutions (INSTDEV) in the country by taking the average of the following six factors: voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law, and control of corruption. Finally, we control for the sample countries' legal origins using information from La Porta et al. (2008).

3.4. Data

We collect our data from various sources. Information for all the regulatory variables is from the IAIS database. Data for the other country-level variables are from (i) the Global Market Information Database, (ii) the 2010 update of the Beck et al. (2000) World Bank database on Financial Development and Structure, (iii) the World Bank database on Worldwide Governance Indicators (Kaufmann et al., 2010), and (iv) La Porta et al. (2008). Our data source for firm-specific information is A.M. Best's Insurance Report—Non-US, Version 2010.3, which contains information on insurance firms from a number of countries for 2005 through 2009. In constructing our sample, we (i) use unconsolidated statements, to avoid double-counting arising from the aggregation of information at various levels, (ii) exclude holding companies and branches of insurance firms, (iii) exclude firms for which we lack at least three years of data, and (iv) focus on EU countries with available information in the IAIS insurance regulations database. The full sample consists of 299 life, 732 non-life, and 245 combined insurance firms operating in 18 countries, producing an unbalanced sample of 5744 yearly observations.[20]

Table 1
Descriptive statistics.
Notes: Statistics calculated on the basis of firm-level yearly observations. ROA is the firm-specific ratio of profit before taxes to total assets. SHARPE is a firm-specific indicator of risk-adjusted returns. CAPRQ is a country-level index of capital requirements in the insurance sector. TPROV is a country-level index of insurance regulations related to technical provisions. INVEST is a country-level index of requirements related to insurers' investments. SPOWER is a country-level index of the power of insurance supervisors. GOVINT is a country-level corporate governance and internal control index for the insurance sector. ACCAUD is a country-level index of disclosures and auditing in the insurance sector. SREPORT is a supervisory reporting index for the insurance sector. AFFIL is a firm-specific indicator of an insurer's group structure. LIFE and COMP are firm-specific proxies of business activity, indicating life insurers and composite insurers, respectively. MUTUAL is a firm-specific indicator of organizational form. EQAS is the equity to assets ratio. SIZE is the natural logarithm of total assets (in thousands of US dollars). GDPGR is the real GDP growth. INFL is the annual inflation rate. MCAP is the country-level ratio of stock market capitalization to GDP. INSTDEV is an indicator of institutional development. BRIT, FRENCH, SCAND are country-level dummy variables that indicate the legal origin.

	Average	Median	St. dev.
ROA	0.031	0.020	0.049
SHARPE	1.895	1.339	2.450
CAPRQ	4.331	4.000	1.011
TPROV	5.701	5.000	2.113
INVEST	9.741	10.000	1.853
SPOWER	21.670	19.000	9.205
GOVINT	18.919	18.000	7.850
ACCAUD	12.936	12.000	2.699
SREPORT	14.409	14.000	0.826
AFFIL	0.483	0.000	0.500
LIFE	0.233	0.000	0.423
COMP	0.195	0.000	0.396
MUTUAL	0.204	0.000	0.403
EQAS	0.297	0.217	0.245
SIZE	12.383	12.370	2.502
GDPGR	1.625	2.118	2.972
INFL	2.361	2.000	1.529
MCAP	0.946	0.940	0.489
INSTDEV	1.274	1.241	0.429
BRIT	0.003	0.000	0.053
FRENCH	0.708	1.000	0.455
SCAND	0.218	0.000	0.413

4. Methodology

The insurance firms in our sample are nested in countries over a number of years. Therefore, we use hierarchical linear modelling (HLM), also called multilevel modelling, an approach used in many recent studies that examine firm and business segment performance (Goldszmidt et al., 2011).[21] HLM is preferred over ordinary least squares (OLS) because it accounts for the fact that our data have different levels of aggregation, providing error terms that control for any potential dependency resulting from nesting effects. In more detail, multilevel models assume that firms within a country are more similar to one another than to firms from different countries, and they allow the separation of the variance in

in periods higher than a year, or only at request. Both the extent of the requested information and the frequency of reporting can be become very complicated because the frequency may change from one item to another. Therefore, we decided to consider only whether there is a periodic reporting requirement versus reporting only at request.

[19] To reduce the impact of outliers, we capped EQAS at the upper and lower 5% percentiles.

[20] The number of yearly observations per country is as follows: Austria (180), Belgium (403), Cyprus (16), Czech Republic (122), Denmark (684), France (961), Hungary (32), Italy (596), Latvia (49), Lithuania (60), Luxembourg (73), Malta (13), Netherlands (802), Romania (75), Slovakia (55), Slovenia (21), Spain (1031), and Sweden (571). Unfortunately, some important European insurance sectors, such as the United Kingdom, are not part of our sample because the IAIS database lacks information. We hope that future research can explore a broader dataset.

[21] The terms "hierarchical linear model," "multilevel model," and "mixed-effects model" denote essentially the same modelling approach. We use these terms interchangeably in our discussion.

Table 2
Correlation coefficients.
Notes: ***Statistically significant at the 1% level, **Statistically significant at the 5% level, *Statistically significant at the 10% level. CAPRQ is a country-level index of capital requirements in the insurance sector. TPROV is a country-level index of insurance regulations related to technical provisions. INVEST is a country-level index of requirements related to insurers' investments. SPOWER is a country-level index of the power of insurance supervisors. GOVINT is a country-level corporate governance and internal control index for the insurance sector. ACCAUD is a country-level index of disclosures and auditing in the insurance sector. SREPORT is a supervisory reporting index for the insurance sector. AFFIL is a firm-specific indicator of an insurer's group structure. LIFE and COMP are firm-specific proxies of business activity, indicating life insurers and composite insurers, respectively. MUTUAL is a firm-specific indicator of organizational form. EQAS is the equity to assets ratio. SIZE is the natural logarithm of total assets (in thousands of US dollars). GDPGR is the real GDP growth. INFL is the annual inflation rate. MCAP is the country-level ratio of stock market capitalization to GDP. INSTDEV is an indicator of institutional development. BRIT, FRENCH, SCAND are country-level dummy variables that indicate the legal origin.

	CAPRQ	TPROV	INVEST	SPOWER	GOVINT	ACCAUD	SREPORT	AFIL	LIFE	COMP
CAPRQ	1.000									
TPROV	−0.204***	1.000								
INVEST	0.099***	0.106***	1.000							
SPOWER	−0.235***	−0.144***	0.176***	1.000						
GOVINT	−0.499***	0.183***	0.341***	0.366***	1.000					
ACCAUD	−0.332***	0.075***	0.060***	0.436***	0.511***	1.000				
SREPORT	−0.252***	0.143***	0.181***	−0.061***	0.507***	−0.126***	1.000			
AFFIL	−0.187***	0.029**	0.101***	0.046***	0.154***	−0.041***	0.161***	1.000		
LIFE	−0.227***	0.706***	−0.028**	0.025*	0.014	−0.037***	0.090***	0.022	1.000	
COMP	0.015	0.165***	0.078***	−0.079***	0.052***	−0.005	0.045***	0.095***	−0.271***	1.000
MUTUAL	0.103***	−0.062***	−0.143***	0.005	−0.205***	−0.044***	−0.157***	−0.272***	−0.008	−0.117***
EQAS	0.136***	−0.408***	−0.119***	0.007	−0.204***	−0.062***	−0.259***	−0.225***	−0.350***	−0.246***
SIZE	−0.223***	0.330***	0.092***	0.027**	0.154***	−0.019	0.297***	0.339***	0.274***	0.315***
GDPGR	0.220***	−0.041***	−0.084***	−0.207***	−0.217***	−0.038***	−0.238***	−0.066***	−0.029**	0.072***
INFL	0.318***	0.061***	0.014	−0.109***	−0.160***	−0.080***	−0.308***	−0.083***	−0.027**	0.072***
MCAP	0.044***	0.013	0.064***	−0.015	−0.263***	0.116***	−0.016	−0.046***	0.050***	−0.186***
INSTDEV	−0.290***	−0.221***	−0.322***	0.289***	−0.185***	0.285***	−0.228***	−0.003	−0.002	−0.208***
BRIT	−0.174***	−0.027**	−0.055***	−0.010	−0.060***	−0.098***	−0.090***	−0.051***	−0.029**	0.007
FRENCH	0.152***	0.261***	0.180***	−0.316***	0.215***	0.192***	0.166***	−0.103***	0.031**	−0.022
SCAND	−0.048***	−0.271***	−0.150***	0.458***	−0.295***	−0.276***	−0.262***	0.068***	0.021	−0.149***

	MUTUAL	EQAS	SIZE	GDPGR	INFL	MCAP	INSTDEV	BRIT	FRENCH	SCAND
MUTUAL	1.000									
EQAS	0.222***	1.000								
SIZE	−0.173***	−0.641***	1.000							
GDPGR	−0.019	0.012	−0.130***	1.000						
INFL	−0.051***	0.001	−0.149***	0.339***	1.000					
MCAP	0.113***	0.062***	0.038***	−0.240***	−0.249***	1.000				
INSTDEV	0.225***	0.203***	−0.040***	−0.171***	−0.421***	0.416***	1.000			
BRIT	−0.027**	0.013	−0.031**	0.043***	0.024*	−0.025*	−0.038***	1.000		
FRENCH	−0.124***	−0.173***	0.042***	0.120***	0.065***	0.055***	−0.526***	−0.082***	1.000	
SCAND	0.205***	0.236***	−0.057***	−0.191***	−0.198***	0.123***	0.625***	−0.028**	−0.824***	1.000

firm-level performance explained by the firm-versus country-level independent variables.

We use a multilevel mixed model with random intercepts at both the country and the firm-within-country levels, fitted using an iterative restricted maximum likelihood estimation (REML) in which the fixed and random effects are estimated simultaneously until the model converges.[22] In its combined form, the model is as follows:

$$PERF_{ijt} = \underbrace{a + \beta F_{ijt} + \gamma C_{jt}}_{fixed\_components} + \underbrace{u_{ij} + e_j + \varepsilon_{ijt}}_{random\_components} \quad (1)$$

where $PERF_{ijt}$ is the indicator of performance (either ROA or SHARPE) of firm i in country j in year t; F is a vector of firm-level explanatory variables; and C is a vector of country-level variables.

The model contains explanatory variables at the firm and the country levels. The random variables u_{ij} and e_j allow the intercept $(\alpha + u_{ij} + e_j)$ to be random and unique to every firm and country. The term ε_{ijt} is the residual. Thus, in model (1), the intercept is random and all slope coefficients are fixed.

5. Results

5.1. Base results

Table 1 presents descriptive statistics of the firm-level and country-level variables used in the regressions. Table 2 presents the correlation coefficients. Tables 3 and 4 present regressions of ROA and the Sharpe ratio on regulations while controlling for firm-specific variables. In all cases, the LR test confirms that the HLM model is more appropriate than linear regression.

The *capital requirements index* (CAPRQ) has a positive and statistically significant effect on performance, consistent with the effect of the firm-level equity-to-assets ratio on ROA. Its squared term (CAPRQsq), however, carries a negative and statistically significant coefficient. A policy implication from this finding is that regulators should take into account that stricter capital requirements are not necessarily better, as evidenced by the nonlinear, inverted U-shaped relationship between capital requirements and European insurers' performance. Thus, when designing the capital requirements framework, regulators should consider that once

[22] The restricted maximum likelihood estimation can be seen as a special case of the MLE that partitions the likelihood under normality into two parts, one being free of the fixed effects. Maximizing this part yields the REML estimators. Thus, this approach incorporates the degrees of freedom used to estimate fixed effects into the estimation of the variance components.

Table 3
Insurance firms' performance & regulations: base model (dependent variable: ROA).
Notes: Restricted maximum likelihood estimates from a multilevel model with fixed and random components; Standard errors in brackets; *** Statistically significant at the 1% level. ** Statistically significant at the 5% level. * Statistically significant at the 10% level. The dependent variable is the ratio of profit before taxes to total assets (ROA). AFFIL is a firm-specific indicator of an insurer's group structure. LIFE and COMP are firm-specific proxies of business activity, indicating life insurers and composite insurers, respectively. MUTUAL is a firm-specific indicator of organizational form. EQAS is the equity to assets ratio. SIZE is the natural logarithm of total assets (in thousands of US dollars). CAPRQ is a country-level index of capital requirements in the insurance sector. TPROV is a country-level index of insurance regulations related to technical provisions. INVEST is a country-level index of requirements related to insurers' investments. SPOWER is a country-level index of the power of insurance supervisors. GOVINT is a country-level corporate governance and internal control index for the insurance sector. ACCAUD is a country-level index of disclosures and auditing in the insurance sector. SREPORT is a supervisory reporting index for the insurance sector. sq denotes the squared term of the corresponding variable.

Fixed effects							
AFFIL	0.005**	0.003*	0.006***	0.004**	0.005**	0.004*	0.005**
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
LIFE	−0.015***	−0.005	−0.017***	−0.020***	−0.020***	−0.020***	−0.020***
	[0.003]	[0.003]	[0.003]	[0.003]	[0.002]	[0.003]	[0.003]
COMP	−0.020***	−0.011***	−0.016***	−0.020***	−0.020***	−0.022***	−0.020***
	[0.003]	[0.004]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]
MUTUAL	−0.012***	−0.012***	−0.011***	−0.012***	−0.012***	−0.013***	−0.012***
	[0.003]	[0.002]	[0.003]	[0.002]	[0.002]	[0.002]	[0.002]
EQAS	0.071***	0.070***	0.077***	0.070***	0.070***	0.070***	0.069***
	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]
SIZE	0.003***	0.003***	0.003***	0.003***	0.003***	0.003***	0.003***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.000]
CAPRQ	0.071***						
	[0.013]						
CAPRQsq	−0.008***						
	[0.002]						
TPROV		−0.009**					
		[0.004]					
TPROVsq		0.000					
		[0.000]					
INVEST			−0.030				
			[0.022]				
INVESTsq			0.001				
			[0.001]				
SPOWER				−0.001			
				[0.001]			
SPOWERsq				0.000			
				[0.000]			
GOVINT					0.003		
					[0.002]		
GOVINTsq					−0.000**		
					[0.000]		
ACCAUD						0.028*	
						[0.015]	
ACCAUDsq						−0.001**	
						[0.000]	
SREPORT							0.113**
							[0.048]
SREPORTsq							−0.004**
							[0.002]
Constant	−0.163***	0.009	0.134	−0.002	−0.036	−0.177	−0.817**
	[0.025]	[0.013]	[0.098]	[0.014]	[0.026]	[0.110]	[0.345]
Random effects parameters							
St. dev [Country-level]	0.032	0.01	0.015	0.009	0.015	0.028	0.008
	[0.008]	[0.003]	[0.004]	[0.003]	[0.004]	[0.006]	[0.003]
St. dev [Firm-level]	0.028	0.028	0.028	0.028	0.028	0.028	0.028
	[0.000]	[0.001]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
St. dev [residual]	0.035	0.035	0.037	0.035	0.035	0.035	0.035
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
LR test Estimated Model vs. Linear regression	1165.22***	1186.56***	976.97***	1134.84***	1174.92***	1224.84***	1135.57***
No. of yearly observations	5744	5622	4783	5744	5744	5622	5744
No. of firms	1276	1251	1060	1276	1276	1251	1276
No. of countries	18	17	17	18	18	17	18

such requirements reach a certain point, both ROA and the Sharpe ratio of insurers will start to decrease.

One potential explanation for the positive relationship that we observe at the beginning is that stricter capital requirements result in higher levels of equity capital, lowering the probability of financial distress and reducing risk premia on potentially costly risk management activities. Additionally, higher capital is associated with higher client confidence and is likely to generate increased flow of business, posting higher returns. As for the negative relationship that we observe after the critical point, this shift could result from a reduction in insurers' appetite for writing new traditional business, as well as

Table 4
Insurance firms' performance and regulations: base model (dependent variable: Sharpe ratio).
Notes: Restricted maximum likelihood estimates from a multilevel model with fixed and random components; Standard errors in brackets; *** Statistically significant at the 1% level. ** Statistically significant at the 5% level. * Statistically significant at the 10% level. The dependent variable is the Sharpe ratio, a firm-specific indicator of risk-adjusted returns. AFFIL is a firm-specific indicator of an insurer's group structure. LIFE and COMP are firm-specific proxies of business activity, indicating life insurers and composite insurers, respectively. MUTUAL is a firm-specific indicator of organizational form. EQAS is the equity to assets ratio. SIZE is the natural logarithm of total assets (in thousands of US dollars). CAPRQ is a country-level index of capital requirements in the insurance sector. TPROV is a country-level index of insurance regulations related to technical provisions. INVEST is a country-level index of requirements related to insurers' investments. SPOWER is a country-level index of the power of insurance supervisors. GOVINT is a country-level corporate governance and internal control index for the insurance sector. ACCAUD is a country-level index of disclosures and auditing in the insurance sector. SREPORT is a supervisory reporting index for the insurance sector. sq denotes the squared term of the corresponding variable.

Fixed effects							
AFFIL	0.160	0.073	0.256*	0.139	0.139	0.077	0.148
	[0.133]	[0.133]	[0.145]	[0.132]	[0.132]	[0.134]	[0.132]
LIFE	−0.286*	−0.192	−0.428**	−0.590***	−0.612***	−0.624***	−0.584***
	[0.163]	[0.169]	[0.173]	[0.157]	[0.157]	[0.157]	[0.157]
COMP	−0.152	0.283	0.060	−0.272	−0.284	−0.363**	−0.240
	[0.183]	[0.207]	[0.197]	[0.180]	[0.180]	[0.184]	[0.179]
MUTUAL	−1.123***	−1.126***	−1.123***	−1.105***	−1.105***	−1.128***	−1.114***
	[0.161]	[0.160]	[0.167]	[0.160]	[0.160]	[0.160]	[0.160]
EQAS	0.257	0.189	0.412*	0.216	0.182	0.197	0.211
	[0.207]	[0.209]	[0.224]	[0.208]	[0.206]	[0.208]	[0.208]
SIZE	0.074***	0.080***	0.010	0.070***	0.077***	0.082***	0.065**
	[0.026]	[0.026]	[0.031]	[0.026]	[0.025]	[0.026]	[0.026]
CAPRQ	1.552***						
	[0.458]						
CAPRQsq	−0.137**						
	[0.061]						
TPROV		−0.990***					
		[0.210]					
TPROVsq		0.069***					
		[0.016]					
INVEST			−0.763				
			[0.095]				
INVESTsq			0.035				
			[0.053]				
SPOWER				−0.004			
				[0.072]			
SPOWERsq				−0.001			
				[0.001]			
GOVINT					0.338***		
					[0.088]		
GOVINTsq					−0.009***		
					[0.002]		
ACCAUD						0.947	
						[0.610]	
ACCAUDsq						−0.041**	
						[0.019]	
SREPORT							2.726
							[3.774]
SREPORTsq							−0.088
							[0.132]
Constant	−2.933***	3.908***	5.600	1.649*	−1.799*	−3.889	−19.662
	[0.889]	[0.670]	[4.194]	[0.931]	[0.989]	[4.543]	[26.865]
Random effects parameters							
St. dev. [Country-level]	0.891	0.720	0.795	0.665	0.808	1.100	0.697
	[0.228]	[0.160]	[0.181]	[0.177]	[0.177]	[0.238]	[0.158]
St. dev. [Firm-level]	2.049	2.033	1.973	2.040	2.04	2.035	2.039
	[0.043]	[0.044]	[0.046]	[0.043]	[0.043]	[0.044]	[0.043]
St. dev. [residual]	1.058	1.061	1.061	1.067	1.055	1.052	1.068
	[0.011]	[0.011]	[0.012]	[0.011]	[0.012]	[0.011]	[0.011]
LR test Estimated Model vs. Linear regression	5364.11***	5470.46***	4356.73***	5255.525**	5410.30***	5552.17***	5537.75***
No. of yearly observations	5744	5622	4783	5744	5744	5622	5744
No. of firms	1276	1251	1060	1276	1276	1251	1276
No. of countries	18	17	17	18	18	17	18

from investing in risky asset classes (see Morgan Stanley/Oliver Wyman, 2010).[23]

Higher stringency in technical provisions decreases both ROA and the Sharpe ratio, as indicated by the negative sign of TPROV in Tables 3 and 4. One potential explanation is that because technical provisions are amounts set aside from profits, higher technical provisioning requirements to cover unearned premiums, unexpired risks, and so on result in lower values for earnings, all else equal. Another explanation is that more regulatory details related to adequate provisioning increase the calculations' complexity, requiring additional effort and resources in terms of time, energy, and money, eventually decreasing profitability, at least in the short run.

Although we find no evidence of a nonlinear relationship between regulations on technical provisions and ROA, the squared

[23] Based on the coefficients in Tables 3 and 4, the critical point for CAPRQ is 4.44 in the case of ROA and 5.66 in the case of the Sharpe ratio.

term of TPROV is positively associated with the Sharpe ratio, indicating a U-shaped relationship. This finding could be explained by considering the importance of technical reserves and the complementary role of equity in the insurance industry. All insurers are required to build adequate technical reserves to address the risks associated with insurance contracts and ensure that the firm can fulfil its obligations at any time. In fact, according to a report by the Joint Forum (2001), technical reserves may account for more than 80% of a life insurer's liabilities (60% in the case of a non-life insurer), with capital serving as a complementary source to cover deficiencies resulting from inadequate reserving or unexpected losses. Consequently, the magnitude of technical reserves reflects an insurer's risk, and it could explain the difference between the ROA and the Sharpe ratio, because the latter incorporates the firm's risk tolerance. Furthermore, because firms will be forced to generate additional reserves under stricter provisioning requirements, they will end up operating with lower equity, resulting in higher ROE and justifying the positive relationship with the Sharpe ratio after a certain point.

The *investments index* (INVEST) and the *supervisory power index* (SPOWER) appear to have no effect on our performance measures. Thus, the existence of regulations regarding various investment characteristics such as security, yield, marketability, concentration, and diversification, along with the system of investments, do not influence European insurers' profitability or risk-adjusted returns. As discussed in Born (2001), the impact of insurance regulations associated with limitations on investments depends on (1) whether or not the limits are binding, (2) whether alternative investments with similar risk–return characteristics are available, and (3) the expected rate of return on those alternative investments. Consequently, it is possible that these restrictions may have no effect on the portfolio, or some effect on the portfolio but little or no influence on profitability. Thus, one potential policy implication is that with respect to European insurers' profitability or risk-adjusted returns, it might not really matter whether regulators adopt a system that will impose quantity restrictions or a prudent person rule, such as the one currently being promoted under Solvency II.[24]

With regard to SPOWER, our findings are consistent with evidence from the banking industry.[25] A policy implication that emerges from all these studies is that reform strategies that promote supervisory power, such as certain pillars of Basel II and Solvency II, might not have a significant effect on financial firms' performance. Nonetheless, our results do not necessarily suggest that official regulatory agencies are unimportant. First, the present study focuses on profitability and risk-adjusted returns rather than on the probability of insurers' failure or on the protection of policyholders that could be at the top of regulatory agencies' agendas. Second, our findings should also be interpreted with some caution because the supervisory power index used in our study, as well as in similar studies for the banking sector, measures only the power that supervisors have on the books, not what actually happens in practice.[26] Thus, similar to Barth et al. (2004), we simply raise a caution flag about the effectiveness of such regulatory approaches to supervision.

In the case of the corporate governance and internal control index, the results are mixed. At first we find a positive but insignificant relationship between GOVINT and ROA. This finding is consistent with studies that examine firm-level corporate governance mechanisms to conclude that contrary to expectations, board composition and/or the existence of various board committees do not improve firm profitability and value (see, e.g., Bhagat and Black, 2002; Weir et al., 2002; Dulewicz and Herbert, 2004).

Yet, the consideration of risk through the use of the risk-adjusted rate of return alters this finding. In this case, both GOINVT and its squared term are significant, being positive and negative, respectively. Thus, the main policy implication is that when promoting corporate governance and internal control rules, regulators should take into account the inverted U-shaped relationship that exists between such requirements and the risk-adjusted performance of insurers. Specifically, more rules about corporate governance and internal control, referring to detailed corporate structure, board composition and responsibilities, or a variety of internal control procedures, initially increase the risk-adjusted returns of European insurance firms.[27]

There is a turning point, however, after which these regulations negatively affect the firms' risk-adjusted returns.[28] There are two potential explanations for this. First, the primary reason for introducing governance and internal controls is to mitigate risk-taking.[29] Thus, increasing these mechanisms improves risk management, but after a certain point it (i) lowers overall returns or (ii) results in lower risk-adjusted returns in line with the board of directors' risk appetite. Second, it appears that introducing too many internal control procedures to ensure compliance with standards and legislation, documenting corporate governance issues and decisions, and establishing various committees results in a high cost burden for the firms that outweighs the benefits of these procedures.[30,31]

[24] We do not claim that investment regulations will not influence any outcomes in the insurance industry. Apparently, they could influence the insurance sector's development, policyholder demand, or insurers' insolvency risk. We note only that in line with the argument by Born (2001), we find that the net effect of investment restrictions on insurers' performance is not statistically significant.

[25] Barth et al. (2002) find no relationship between ROA and the power of supervisors. Barth et al. (2004) report that official supervisory power is unrelated to bank development or bank efficiency. Delis et al.'s (2011) results from a sample of transition economies indicate that supervisory power exercises a statistically significant (at the 10% level) effect on bank productivity only in the post-crisis sub-period of their analysis.

[26] For example, it would be interesting to examine how many times regulators have performed on-site inspections on specific firms, whether they took specific action against these insurers, along with the reasons driving their decision. Unfortunately, such data are not available in the IAIS databases, and in most countries, they are not made publicly available. Banking studies that use information from the World Bank Database to construct bank supervisor power indices are subject to the same limitation. We hope that future research will improve upon this.

[27] The results of the firm-level studies are also mixed. In contrast to some studies mentioned in section 2.4, others find that corporate governance mechanisms at a firm level improve firm value and performance (see, e.g., Gani and Jermias, 2006; O'Connell and Cramer, 2010).

[28] Based on the coefficients in Table 4, the turning point for GOVINT is 18.78.

[29] The role of corporate governance and internal control mechanisms in mitigating risk could also explain the difference between the ROA and the Sharpe ratio.

[30] For example, as Ahmed et al. (2010) mention, the passage of the Sarbanes–Oxley Act in the United States imposed a number of direct costs, such as fees for internal control audits, other internal control expenditures, and higher board costs, along with indirect costs, such as opportunity costs associated with diverted managers and increased managerial risk aversion. Their empirical results from a sample of 1400 U.S. firms confirm that operating cash flows (excluding audit fees) declined by 1.3% of total assets or by 1.8% of revenue in the post-SOX period (2004 through 2007) relative to the pre-SOX period (2001 through 2002).

[31] To some extent, this nonlinear relationship is consistent with firm level evidence from recent studies. For example, Diacon and O'Sullivan (1995) conclude that most of the governance factors have a nonlinear relationship with the performance of U.K. insurers. Similarly, de Andres and Vallelado (2008) find an inverted U-shaped relation between the proportion of non-executive directors and bank performance. Coles et al. (2008) also report that the relation between Tobin's Q and board size is U-shaped. Furthermore, Faleye et al. (2011) find that the improvement in board monitoring quality from having a majority of independent directors serving on at least two of the three primary monitoring committees (audit, compensation, and nominating committees) comes with a significant cost of weaker advising and greater managerial myopia. Their results with regard to firm value indicate that the negative advising effects outweigh the benefits from greater sensitivity of CEO

The two indices that relate to insurers' disclosures, namely the *accounting and auditing requirements index* (ACCAUD) and the *supervisory reporting index* (SREPORT), are positive and insignificant in the case of the Sharpe ratio; however, they have a statistically significant and inverted U-shaped relationship with ROA. The latter is consistent with the view that increased disclosures will put managers under greater scrutiny, making them more efficient and improving firm profitability.[32] The negative association of the squared terms with ROA, however, clearly indicates that although the disclosure of information and its external auditing is a prerequisite for effective discipline, there is an extra cost for the firms that, after a certain point, exceeds the aforementioned benefits. As Duarte et al. (2008) mention, disclosures are costly for managers because of the direct costs of making additional disclosures, additional time and effort to prepare formal disclosure documents, the costs of maintaining an investor relations department, as well as indirect costs such as the release of sensitive information to competitors. Focusing on the economic consequences of Regulation Fair Disclosure, Duarte et al. (2008) find that although NYSE/Amex firms experienced no significant change in the cost of capital, Nasdaq firms experienced an increase in the cost of capital between 10 basis points and 19 basis points per annum. Bushee and Leuz (2005) also provide evidence that the imposition of disclosure requirements on firms quoted on the Over-the-Counter Bulletin Board results in significant costs for smaller firms, forcing them off the OTCBB.[33] So, once again, it appears that the regulators may have to weigh the advantages and disadvantages of imposing additional disclosure requirements, because there is an optimal point that will balance the need for information to be released to the stakeholders with firms' need for strong performance.

5.2. Sensitivity analysis

First, we re-estimate our base specifications shown in Tables 3 and 4, adding three more firm-specific variables. The first is the risk retention ratio, calculated as net premium to gross premium (NGPREM). It reveals an insurer's overall underwriting strategy and indicates what proportion of the risk is passed on to the reinsurers. The second is the net technical reserves to net premium ratio (RESPR), which reveals whether reserves increase in step with the volume of business. The inclusion of these variables is motivated by the importance of premiums and reserves for insurers, as well as their potential impact on profitability and risk-adjusted returns.[34] The third variable relates to firms' liquidity management, captured by the liquid assets to total liabilities ratio (LIQUID). The main results remain the same.[35]

Then, we re-estimate our base model while adding in turn country-level variables to control for (i) macroeconomic conditions, (ii) stock market development, (iii) overall quality of the institutions in the country, and (iv) legal origins. Appendix B presents these estimations, which indicate that in most cases, the results obtained thus far are robust to the inclusion of these variables in the regressions.[36]

6. Conclusions

A number of countries have introduced or plan to introduce changes in the regulatory and supervisory framework for their insurance industries. Yet, the relationship between regulation and insurance firms' performance, in terms of profitability and risk-adjusted returns, is under-researched.

The present study explores the effect of various regulatory policies on the performance of European insurers. Using a sample of 1276 firms operating in 18 countries from 2005 through 2009, we estimated a multilevel mixed model with random intercepts at both the country and the firm-within-country levels. Controlling for various firm-specific attributes, we found an inverted U-shaped relationship between return on assets and regulations relating to capital adequacy, accounting and auditing requirements, and disclosures to the supervisors. Requirements related to technical provisions had a negative effect on return on assets, whereas we found no evidence of a relationship with regulation related to investments, supervisory power, and corporate governance and internal control. Considering insurers' risk tolerance, through the use of an accounting measure of risk-adjusted return, slightly changes this picture. We found an inverted U-shaped relationship with capital requirements and corporate governance and internal control, and we observed the opposite for technical provisions. The remaining regulations had no effect on our measure of risk-adjusted returns. In most cases, these findings were robust in further regressions in which we controlled for macroeconomic conditions, stock market development, the overall quality of the institutions in the country, and legal origins.

Our findings have implications for various stakeholders, in particular policymakers. For example, one could argue that a movement towards the adoption of bank models of capital regulation to insurance might not be straightforward. Our results show a nonlinear relationship, which means that a turning point exists beyond which the costs outweigh the benefits, at least in terms of insurers' profitability and risk-adjusted returns. Taking into account that this nonlinearity is evident in numerous cases, our results confirm that designing optimal insurance regulations poses serious challenges, and regulators must consider the trade-offs that exist between

turnover to firm performance, lower excess executive compensation, and reduced earnings management.

[32] For example, Barth et al. (2004) conclude that in the case of the banking industry, regulations that encourage and facilitate private monitoring—such as disclosures, certified auditing, and deposit insurance—are associated with better outcomes, including greater bank development, lower net interest margins, and lower ratio of nonperforming loans (as a share of total assets).

[33] Furthermore, with regard to the impact of the introduction of Solvency II on European insurers, it has been argued that revealing the true volatility of the European insurance sector's balance sheet could increase the cost of capital, whereas the combination of reforms to the accounting and solvency frameworks will create significant operational challenges for insurers (Morgan Stanley/Oliver Wyman, 2010).

[34] We would like to thank an anonymous reviewer for a comment that motivated us to consider these additional firm-level control variables. As the reviewer noted, it is worthwhile to point out that premiums can be subject to strong underwriting cycles (see, for example, Cummins and Outreville, 1987; Christodoulakis and Mamatzakis, 2010).

[35] We find that (i) RESPR has a negative and statistically significant impact on both ROA and the Sharpe ratio, (ii) NGPREM has a positive effect on profitability, and (iii) LIQUID has a positive and statistically significant impact on the Sharpe ratio. As discussed in the text, the main results that relate to the effect of regulations on performance remain the same. The only difference is that in the regression with ROA, the TPROVsq index becomes significant, albeit at the 10% level only. Given these similarities, we do not present these results here to conserve space. All the estimations are available upon request from the authors.

[36] The differences from the base regressions in the case of ROA can be summarized as follows. Controlling for macroeconomics results in an inverted U-shaped relationship with TPROV; however, the squared term is statistically significant only at the 10% level. When we control for the origins of law, both INVEST and SPOWER enter with a negative coefficient that is statistically significant at the 10% level, whereas GOVINT appears to have an inverted U-shaped relationship with ROA that is consistent with earlier findings for the Sharpe ratio. Including market capitalization in the regression results in both ACCAUD and SREPORT becoming insignificant. Furthermore, the latter becomes insignificant in the regression that controls for macroeconomics. In the case of the Sharpe ratio, the main differences are observed in the regression that controls for macroeconomics, with CAPRQ becoming insignificant and SPOWER appearing with an inverted U-shaped relationship.

risk mitigation and sustainability of insurers. Additionally, we find some evidence to support the banking literature findings that market discipline may be more important than supervisory power.

Our study provides a first effort to empirically investigate the relationship between various regulations and the performance of European insurers. It is not, however, without limitations. First, data unavailability has prevented us from incorporating into the analysis a few interesting measures that were only recently added to the IAIS database, including the exact types of risk that are recognized when calculating the required capital. Second, the questionnaire used to build the IAIS database reflects whether laws or regulations are on the books but not the extent to which they are implemented in practice. We hope that future research will address these shortcomings.

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Appendix A. Details on the calculation of the regulatory variables

Regulatory Variables		
CAPRQ	Capital requirements index	Add 1 if the answer is yes and 0 otherwise to the following seven questions. Is the solvency/capital requirement for existing insurance companies calculated by considering: (1) the volume of business/premium income? (2) the nature of business? (3) the company's assets? (4) the company's liabilities? (5) reinsurance arrangements? (6) claims incurred? (7) risk exposures? CAPRQ can take values between 0 and 7, with higher values indicating higher stringency.
TPROV	Technical provisions index	Assign a value of 2 if there are special coverage requirements (i.e., requirements to hold assets of certain quality, the amount of which at least equals the technical provisions) to be covered by admissible assets on a gross basis; 1 if they are covered net of reinsurance; and 0 if there is no coverage requirement. In addition, we add 1 if the answer is yes and 0 otherwise to the following eight questions: (1) Are there specific regulations concerning the technical provisions of the insurance companies according to insurance supervisory law? (2–8) Do insurers set up technical provisions for: (i) unearned premiums? (ii) unexpired risks? (iii) life insurance/other mathematical provision? (iv) claims outstanding, including IBNR? (v) equalization/catastrophe provision? (vi) bonuses and rebates/funds for future appropriation? (vii) unit-linked life insurance policies? TPROV can take values between 0 and 10, with higher values indicating higher stringency.
INVEST	Investments index	Add 1 if the answer is yes and 0 otherwise to the following questions: Are there regulations on investments referring to: (1) security of investments? (2) yield of investments? (3) marketability of investments? (4) concentration of investments? (5) diversification of investments between categories? (6) liquidity? (7) systems and controls over asset management, (8) currency matching, (9) maturity matching? Also add 1 in the case of a prudent person approach, 3 in the case of derailed regulations on admissible assets, and 2 in the case of a combination of both systems. INVEST can take values between 0 and 10, with higher values indicating higher stringency.
SPOWER	Supervisory power index	Add 1 for each of the following actions that are available to the supervisor whereby the insurer still fulfils the financial requirements for carrying on business (i.e. "early intervention"): (1) asking for a recovery plan to be set up, (2) requiring an increase of capital, (3) restriction on payment of dividend, (4) disqualification of auditor or restriction on audit firm, (5) requiring a change of technical provisions, (6) prohibition of underwriting new business, (7) limitation of premium income, (8) prohibition of certain investments, (9) prohibition of free disposal of assets, (10) custody of assets by the authority, (11) reducing benefits of existing contracts, (12) suspension of claims payments, (13) mandatory portfolio transfer, (14) measures with regard to reinsurance ceded, (15) removal of members of the board of directors, (16) removal of other managers, (17) appointment of a special commissioner, (18) actuarial investigation, (19) calling a general meeting of shareholders, (20) temporary suspension of license, (21) withdrawing the license, (22) petition in bankruptcy or winding-up, (23) initiating or recommending to start a criminal proceeding, (24) any action for the purpose of protecting policyholders. Add 1 for each of the above 24 actions that are available to the supervisor "late intervention" when the insurer no longer fulfils the financial requirements for carrying on business (i.e., late intervention). Add 1 for each of the following actions that may be taken to enforce orders: (i) fining the insurer, (ii) fining members of the board of directors, (iii) imprisonment. Add 1 for each of the following sanctions that are available when an insurer does not comply with laws and/or regulations: (i) fining the insurer, (ii) fining members of the board of directors, (iii) imprisonment. SPOWER can take values between 0 and 54, with higher values indicating more powerful supervisors.

Regulatory Variables		
GOVINT	Corporate governance and internal control index	Add 1 if the answer is yes and 0 otherwise to the following questions: (1–10) Do corporate governance rules in your jurisdiction refer to: (i) detailed corporate structure? (ii) board composition? (iii) board responsibilities, (iv) organizational structure of the board? (v) senior management responsibilities? (vi) responsibilities of the actuary? (vii) responsibilities of the internal auditor? (viii) responsibilities of the external auditor? (ix) responsibilities of the risk management officer? (x) responsibilities of the compliance officer? (11–18) Are there fit and proper requirements applied by the insurance supervisor to: (i) members of the board of directors? (ii) chief executive officer? (iii) senior management? (iv) other employees? (v) actuary? (vi) external auditor? (vii) management of a branch? (viii) shareholders-owners? (19–26) Do internal control procedures in insurance companies address: (i) compliance with legislation? (ii) compliance with standards? (iii) structure/organization of the company? (iv) procedures of the company? (iv) independence of key functions? (v) conflicts of interest? (vi) internal reporting system? (vii) Documentation of corporate governance issues and decisions? (27–31) Do the insurance legislation imposes the compulsory set up of: (i) audit committee? (ii) accounting committee? (iii) compensation committee? (iv) investment committee? (v) risk management committee? Assign the value of 3 if internal control procedures in insurance companies are required by law or regulation, 2 if they are recommended by law or regulation, 1 if they are recommended by professional standards, and 0 if they not required nor recommended. Assign the value of 2 if the carrying out of internal control procedures is supervised by both external (i.e., supervisory, external auditor) and internal (management, board of directors, management board, supervisory board, internal auditors, risk management unit, compliance unit) bodies, the value of 1 if only one of the two is involved in the supervision, and 0 otherwise. With regard to the role of insurance supervisor in corporate governance, assign the value of: 3 if the supervisor can take measures when he is not satisfied with corporate governance in an insurance company, 2 if the supervisory may intervene only if bad corporate governance might impair the policyholders' interests, 1 if the insurance supervisor has the authority to request insurance companies to meet certain corporate governance requirements, 0 if the insurance supervisor is not dealing with corporate governance issues. With regard to the role of supervisors in the case of persons who are subject to fit and proper requirements, add 1 if one of the following applies: the appointment of such a person is subject to prior approval by the supervisory authority or the supervisory authority has the right to veto a candidate before or after the appointment. Add 0 if nothing of the above applies. GOVINT can take values between 0 and 40, with higher values indicating more demanding requirements for governance and internal control rules.
ACCAUD	Disclosure and auditing index	Add 1 if the answer is yes and 0 otherwise to the following questions. Are the following amounts disclosed in the balance sheet (gross amount)? (1) life insurance provision/other mathematical provision? (2) technical provision for unit-linked life insurance policies, (3) provision for bonuses and rebates/funds for future appropriation, (4) provision for unearned premiums, (5) provision for unexpired risk, (6) claims outstanding, (7) equalization/catastrophe provision? Add 1 if the answer is yes and 0 otherwise to the following questions that related to auditing. Do the external auditors: (1) certify at the end of the financial year that accounting and the annual/shareholders' accounts are in line with the legal requirements? (2) prepare an opinion statement on the annual/shareholders' account? (3) certify compliance with the provisions on solvency/capital adequacy? (4) examine the filing and data supply system? (5) prepare a management letter to the board of directors on the examination of the insurance company's annual/shareholders' accounts? (6) report regularly to the supervisory authority? (7) have an obligation to provide immediate information to the supervisory authority in prescribed cases? (8) audit the financial/supervisory returns? (9) give an opinion statement on the financial/supervisory returns? (10) comment on the internal controls of the insurance company? Are the following qualifications or requirements necessary in to order to become an external auditor of an insurance company: (11) university degree or other educational requirements? (12) experience in auditing insurance companies? (13) membership in a professional organization? ACCCAUD can take values between 0 and 20, with higher values indicating more information disclosure and external auditing requirements.
SREPORT	Supervisory reporting index	Add 1 if the answer is yes and 0 otherwise to the following questions: Which of the following documents need to be filed with the supervisory authority? (1) annual/shareholders' account, (2) financial returns for supervisory purposes, (3) additional data for statistical purposes, (4) minutes of the shareholders' meetings or an equivalent body, (5) auditor's management letter, (6) actuary's report. Do the financial returns for supervisory purposes require information of the following to be filed periodically (e.g., monthly, quarterly, bi-annually, annually, other period) rather than only at request? (1) solvency/capital report, (2) details on premium income, (3) details on commissions, (4) details on claims payments, (5) details on claims outstanding, (6) details on life insurance provisions, (7) details on other technical provisions, (8) details on investments, (9) yield of investments, (10) run-off results of claims outstanding. SREPORT can take values between 0 and 16, with higher values indicating more demanding information disclosure to the supervisors.

Note: Authors' calculations based on data from the International Association of Insurance Supervisors.

Appendix B. Results of further regressions

See Tables A1–A8.

Table A1
Insurance firms' performance and regulations: controlling for macroeconomics (dependent variable: ROA).
Notes: Restricted maximum likelihood estimates from a multilevel model with fixed and random components; Standard errors in brackets; *** Statistically significant at the 1% level. ** Statistically significant at the 5% level. * Statistically significant at the 10% level. The dependent variable is the ratio of profit before taxes to total assets (ROA). AFFIL is a firm-specific indicator of an insurer's group structure. LIFE and COMP are firm-specific proxies of business activity, indicating life insurers and composite insurers, respectively. MUTUAL is a firm-specific indicator of organizational form. EQAS is the equity to assets ratio. SIZE is the natural logarithm of total assets (in thousands of US dollars). GDPGR is the real GDP growth. INFL is the annual inflation rate. CAPRQ is a country-level index of capital requirements in the insurance sector. TPROV is a country-level index of insurance regulations related to technical provisions. INVEST is a country-level index of requirements related to insurers' investments. SPOWER is a country-level index of the power of insurance supervisors. GOVINT is a country-level corporate governance and internal control index for the insurance sector. ACCAUD is a country-level index of disclosures and auditing in the insurance sector. SREPORT is a supervisory reporting index for the insurance sector. sq denotes the squared term of the corresponding variable.

Fixed effects							
AFFIL	0.004**	0.003	0.006**	0.004** [0.002]	0.004**	0.003	0.004**
	[0.002]	[0.002]	[0.002]		[0.002]	[0.002]	[0.002]
LIFE	−0.017***	−0.007**	−0.017***	−0.020***	−0.021***	−0.021***	−0.020***
	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]
COMP	−0.021***	−0.011***	−0.016***	−0.021***	−0.021***	−0.022***	−0.021***
	[0.003]	[0.004]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]
MUTUAL	−0.013***	−0.013***	−0.011***	−0.013***	−0.013***	−0.013***	−0.013***
	[0.003]	[0.002]	[0.003]	[0.002]	[0.002]	[0.002]	[0.002]
EQAS	0.072***	0.071***	0.077***	0.071***	0.070***	0.071***	0.071***
	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]
SIZE	0.004***	0.003***	0.003***	0.003***	0.003***	0.004***	0.003***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
GDPGR	0.001***	0.001***	0.001***	0.002***	0.001***	0.001***	0.002***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
INFL	−0.006***	−0.006***	−0.007***	−0.006***	−0.006***	−0.006***	−0.006***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
CAPRQ	0.046***						
	[0.012]						
CAPRQSQ	−0.005***						
	[0.002]						
TPROV		−0.012***					
		[0.004]					
TPROVSQ		0.001*					
		[0.000]					
INVEST			−0.020				
			[0.024]				
INVESTSQ			0.001				
			[0.001]				
SPOWER				0.002			
				[0.002]			
SPOWERSQ				−0.000			
				[0.000]			
GOVINT					−0.001		
					[0.002]		
GOVINTSQ					−0.000		
					[0.000]		
ACCAUD						0.022*	
						[0.013]	
ACCAUDSQ						−0.001**	
						[0.000]	
SREPORT							0.024
							[0.063]
SREPORTSQ							−0.001
							[0.002]
Constant	−0.098***	0.032**	0.104	−0.028	0.012	−0.132	−0.134
	[0.024]	[0.014]	[0.104]	[0.022]	[0.025]	[0.093]	[0.453]
Random effects parameters							
St. dev [Country-level]	0.026	0.014	0.017	0.017	0.013	0.022	0.011
	[0.008]	[0.004]	[0.004]	[0.006]	[0.004]	[0.005]	[0.003]
St. dev. [Firm-level]	0.028	0.028	0.028	0.028	0.028	0.028	0.028
	[0.001]	[0.000]	[0.001]	[0.001]	[0.000]	[0.001]	[0.001]
St. dev. [residual]	0.034	0.034	0.036	0.034	0.034	0.034	0.034
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
LR test Estimated Model vs. Linear regression	1207.08***	1297.99***	1033.54***	1265.44***	1214.04***	1293.36***	1266.00***
No. of yearly observations	5741	5619	4780	5741	5741	5619	5741
No. of firms	1276	1251	1060	1276	1276	1251	1276
No. of countries	18	17	17	18	18	17	18

Table A2
Insurance firms' performance and regulations: controlling for institutional development (dependent variable: ROA).
Notes: Restricted maximum likelihood estimates from a multilevel model with fixed and random components; Standard errors in brackets; *** Statistically significant at the 1% level. ** Statistically significant at the 5% level. * Statistically significant at the 10% level. The dependent variable is the ratio of profit before taxes to total assets (ROA). AFFIL is a firm-specific indicator of an insurer's group structure. LIFE and COMP are firm-specific proxies of business activity, indicating life insurers and composite insurers, respectively. MUTUAL is a firm-specific indicator of organizational form. EQAS is the equity to assets ratio. SIZE is the natural logarithm of total assets (in thousands of US dollars). INSTDEV is an indicator of institutional development. CAPRQ is a country-level index of capital requirements in the insurance sector. TPROV is a country-level index of insurance regulations related to technical provisions. INVEST is a country-level index of requirements related to insurers' investments. SPOWER is a country-level index of the power of insurance supervisors. GOVINT is a country-level corporate governance and internal control index for the insurance sector. ACCAUD is a country-level index of disclosures and auditing in the insurance sector. SREPORT is a supervisory reporting index for the insurance sector. sq denotes the squared term of the corresponding variable.

Fixed effects							
AFFIL	0.005**	0.003*	0.006***	0.004**	0.005**	0.004*	0.005**
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
LIFE	−0.014***	−0.005	−0.017***	−0.020***	−0.020***	−0.020***	−0.020***
	[0.003]	[0.003]	[0.003]	[0.003]	[0.002]	[0.003]	[0.003]
COMP	−0.020***	−0.011***	−0.016***	−0.020***	−0.020***	−0.022***	−0.020***
	[0.003]	[0.004]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]
MUTUAL	−0.012***	−0.012***	−0.011***	−0.012***	−0.012***	−0.013***	−0.012***
	[0.003]	[0.002]	[0.003]	[0.002]	[0.002]	[0.002]	[0.002]
EQAS	0.071***	0.070***	0.077***	0.070***	0.070***	0.070***	0.070***
	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]
SIZE	0.003***	0.003***	0.003***	0.003***	0.003***	0.003***	0.003***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
INSTDEV	0.001	0.004	0.003	0.006	0.001	0.005	0.001
	[0.009]	[0.005]	[0.007]	[0.005]	[0.007]	[0.009]	[0.006]
CAPRQ	0.072***						
	[0.013]						
CAPRQSQ	−0.008***						
	[0.002]						
TPROV		−0.009**					
		[0.004]					
TPROVSQ		0.000					
		[0.000]					
INVEST			−0.028				
			[0.023]				
INVESTSQ			0.001				
			[0.001]				
SPOWER				−0.002			
				[0.001]			
SPOWERSQ				0.000			
				[0.000]			
GOVINT					0.003		
					[0.002]		
GOVINTSQ					−0.000**		
					[0.000]		
ACCAUD						0.028*	
						[0.015]	
ACCAUDSQ						−0.001**	
						[0.000]	
SREPORT							0.109*
							[0.058]
SREPORTSQ							−0.004*
							[0.002]
Constant	−0.165***	0.005	0.122	−0.006	−0.037	−0.177	−0.788*
	[0.027]	[0.015]	[0.104]	[0.014]	[0.027]	[0.109]	[0.414]
Random effects parameters							
St. dev. [Country-level]	0.033	0.001	0.016	0.008	0.016	0.027	0.008
	[0.008]	[0.003]	[0.004]	[0.003]	[0.004]	[0.006]	[0.003]
St. dev. [Firm-level]	0.028	0.028	0.028	0.028	0.028	0.028	0.028
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
St. dev. [residual]	0.035	0.035	0.037	0.035	0.035	0.035	0.035
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
LR test Estimated Model vs. Linear regression	1113.89***	1187.70***	959.07***	1113.06***	1168.49***	1210.16***	1126.17***
No. of yearly observations	5744	5622	4783	5744	5744	5622	5744
No. of firms	1276	1251	1060	1276	1276	1251	1276
No. of countries	18	17	17	18	18	17	18

Table A3
Insurance firms' performance and regulations: controlling for market development (dependent variable: ROA).
Notes: Restricted maximum likelihood estimates from a multilevel model with fixed and random components; Standard errors in brackets; *** Statistically significant at the 1% level. ** Statistically significant at the 5% level. * Statistically significant at the 10% level. The dependent variable is the ratio of profit before taxes to total assets (ROA). AFFIL is a firm-specific indicator of an insurer's group structure. LIFE and COMP are firm-specific proxies of business activity, indicating life insurers and composite insurers, respectively. MUTUAL is a firm-specific indicator of organizational form. EQAS is the equity to assets ratio. SIZE is the natural logarithm of total assets (in thousands of US dollars). MCAP is the country-level ratio of stock market capitalization to GDP. CAPRQ is a country-level index of capital requirements in the insurance sector. TPROV is a country-level index of insurance regulations related to technical provisions. INVEST is a country-level index of requirements related to insurers' investments. SPOWER is a country-level index of the power of insurance supervisors. GOVINT is a country-level corporate governance and internal control index for the insurance sector. ACCAUD is a country-level index of disclosures and auditing in the insurance sector. SREPORT is a supervisory reporting index for the insurance sector. sq denotes the squared term of the corresponding variable.

Fixed effects							
AFFIL	0.005**	0.003	0.006***	0.004**	0.004**	0.003	0.004**
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
LIFE	−0.016***	−0.007**	−0.017***	−0.020***	−0.021***	−0.021***	−0.020***
	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]
COMP	−0.021***	−0.013***	−0.017***	−0.021***	−0.021***	−0.023***	−0.021***
	[0.003]	[0.004]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]
MUTUAL	−0.012***	−0.012***	−0.010***	−0.012***	−0.012***	−0.013***	−0.012***
	[0.003]	[0.002]	[0.003]	[0.002]	[0.002]	[0.002]	[0.002]
EQAS	0.073***	0.072***	0.078***	0.072***	0.072***	0.072***	0.072***
	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]
SIZE	0.004***	0.004***	0.003***	0.004***	0.004***	0.004***	0.004***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
MCAP	−0.012***	−0.011***	−0.011***	−0.013***	−0.011***	−0.011***	−0.013***
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
CAPRQ	0.060***						
	[0.014]						
CAPRQsq	−0.007***						
	[0.002]						
TPROV		−0.008*					
		[0.004]					
TPROVsq		0.000					
		[0.000]					
INVEST			−0.018				
			[0.027]				
INVESTsq			0.001				
			[0.001]				
SPOWER				−0.000			
				[0.002]			
SPOWERsq				0.000			
				[0.000]			
GOVINT					0.003		
					[0.003]		
GOVINTsq					−0.000**		
					[0.000]		
ACCAUD						0.026	
						[0.016]	
ACCAUDsq						−0.001**	
						[0.001]	
SREPORT							0.121
							[0.090]
SREPORTsq							−0.004
							[0.003]
Constant	−0.134***	0.013	0.085	−0.010	−0.033	−0.161	−0.881
	[0.027]	[0.014]	[0.118]	[0.025]	[0.028]	[0.123]	[0.640]
Random effects parameters							
St. dev. [Country-level]	0.034	0.017	0.020	0.020	0.018	0.032	0.017
	[0.008]	[0.005]	[0.005]	[0.005]	[0.005]	[0.007]	[0.005]
St. dev. [Firm-level]	0.028	0.028	0.028	0.028	0.028	0.028	0.028
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
St. dev. [residual]	0.035	0.035	0.036	0.035	0.035	0.035	0.035
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
LR test Estimated Model vs. Linear regression- chi2	1220.79***	1231.47***	1008.76***	1195.68***	1218.78***	1265.02***	1194.72***
No. of yearly observations	5732	5610	4771	5732	5732	5610	5732
No. of firms	1276	1251	1060	1276	1276	1251	1276
No. of countries	18	17	17	18	18	17	18

Table A4
Insurance firms' performance and regulations: controlling for legal origins (dependent variable: ROA).
Notes: Restricted maximum likelihood estimates from a multilevel model with fixed and random components; Standard errors in brackets; *** Statistically significant at the 1% level. ** Statistically significant at the 5% level. * Statistically significant at the 10% level. The dependent variable is the ratio of profit before taxes to total assets (ROA). AFFIL is a firm-specific indicator of an insurer's group structure. LIFE and COMP are firm-specific proxies of business activity, indicating life insurers and composite insurers, respectively. MUTUAL is a firm-specific indicator of organizational form. EQAS is the equity to assets ratio. SIZE is the natural logarithm of total assets (in thousands of US dollars). BRIT, FRENCH, SCAND are country-level dummy variables that indicate the legal origin. CAPRQ is a country-level index of capital requirements in the insurance sector. TPROV is a country-level index of insurance regulations related to technical provisions. INVEST is a country-level index of requirements related to insurers' investments. SPOWER is a country-level index of the power of insurance supervisors. GOVINT is a country-level corporate governance and internal control index for the insurance sector. ACCAUD is a country-level index of disclosures and auditing in the insurance sector. SREPORT is a supervisory reporting index for the insurance sector. sq denotes the squared term of the corresponding variable.

Fixed effects							
AFFIL	0.005**	0.004*	0.007***	0.005**	0.005**	0.004*	0.005**
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
LIFE	−0.013***	−0.005	−0.016***	−0.020***	−0.020***	−0.020***	−0.020***
	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.002]	[0.003]
COMP	−0.019***	−0.011***	−0.016***	−0.020***	−0.020***	−0.022***	−0.020***
	[0.003]	[0.004]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]
MUTUAL	−0.012***	−0.012***	−0.010***	−0.012***	−0.012***	−0.012***	−0.012***
	[0.003]	[0.002]	[0.003]	[0.002]	[0.002]	[0.002]	[0.002]
EQAS	0.071***	0.071***	0.077***	0.070***	0.070***	0.070***	0.070***
	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]
SIZE	0.003***	0.003***	0.003***	0.003***	0.003***	0.003***	0.003***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
BRIT	0.140***	0.050**	0.044*	0.053***	0.045*	0.115**	0.050***
	[0.029]	[0.020]	[0.023]	[0.020]	[0.025]	[0.053]	[0.020]
FRENCH	−0.000	0.002	−0.001	0.001	0.003	0.013	−0.002
	[0.011]	[0.008]	[0.010]	[0.007]	[0.010]	[0.019]	[0.006]
SCAND	−0.008	−0.003	−0.013	0.00	−0.010	0.001	−0.008
	[0.015]	[0.010]	[0.014]	[0.010]	[0.014]	[0.027]	[0.008]
CAPRQ	0.075***						
	[0.013]						
CAPRQsq	−0.008***						
	[0.002]						
TPROV		−0.009**					
		[0.004]					
TPROVsq		0.000					
		[0.000]					
INVEST			−0.045*				
			[0.024]				
INVESTsq			0.002				
			[0.001]				
SPOWER				−0.002*			
				[0.001]			
SPOWERsq				0.000			
				[0.000]			
GOVINT					0.004*		
					[0.003]		
GOVINTsq					−0.000**		
					[0.000]		
ACCAUD						0.062***	
						[0.022]	
ACCAUDsq						−0.002***	
						[0.001]	
SREPORT							0.139***
							[0.048]
SREPORTsq							−0.005***
							[0.002]
Constant	−0.180***	0.008	0.199*	0.001	−0.050*	−0.442**	−1.006***
	[0.026]	[0.015]	[0.108]	[0.015]	[0.029]	[0.171]	[0.341]
Random effects parameters							
St. dev [Country-level]	0.017	0.009	0.014	0.008	0.015	0.028	0.007
	[0.005]	[0.003]	[0.004]	[0.003]	[0.004]	[0.007]	[0.002]
St. dev. [Firm-level]	0.028	0.028	0.028	0.028	0.028	0.028	0.028
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
St. dev. [residual]	0.035	0.035	0.037	0.035	0.035	0.035	0.035
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
LR test Estimated Model vs. Linear regression- chi2	1187.93***	1166.95***	970.46***	1082.27***	1160.11***	1225.62***	1112.14***
No. of yearly observations	5744	5622	4783	5744	5744	5622	5744
No. of firms	1276	1251	1060	1276	1276	1251	1276
No. of countries	18	17	17	18	18	17	18

Table A5
Insurance firms' performance and regulations: controlling for macroeconomics (dependent variable: Sharpe ratio).
Notes: Restricted maximum likelihood estimates from a multilevel model with fixed and random components; Standard errors in brackets; *** Statistically significant at the 1% level. ** Statistically significant at the 5% level. * Statistically significant at the 10% level. The dependent variable is the Sharpe ratio, a firm-specific indicator of risk-adjusted returns. AFFIL is a firm-specific indicator of an insurer's group structure. LIFE and COMP are firm-specific proxies of business activity, indicating life insurers and composite insurers, respectively. MUTUAL is a firm-specific indicator of organizational form. EQAS is the equity to assets ratio. SIZE is the natural logarithm of total assets (in thousands of US dollars). GDPGR is the real GDP growth. INFL is the annual inflation rate. CAPRQ is a country-level index of capital requirements in the insurance sector. TPROV is a country-level index of insurance regulations related to technical provisions. INVEST is a country-level index of requirements related to insurers' investments. SPOWER is a country-level index of the power of insurance supervisors. GOVINT is a country-level corporate governance and internal control index for the insurance sector. ACCAUD is a country-level index of disclosures and auditing in the insurance sector. SREPORT is a supervisory reporting index for the insurance sector. sq denotes the squared term of the corresponding variable.

Fixed effects							
AFFIL	0.111	0.019	0.205	0.096	0.097	0.036	0.098
	[0.132]	[0.133]	[0.144]	[0.132]	[0.132]	[0.133]	[0.132]
LIFE	−0.457***	−0.384**	−0.506***	−0.668***	−0.668***	−0.675***	−0.662***
	[0.162]	[0.168]	[0.172]	[0.157]	[0.156]	[0.157]	[0.156]
COMP	−0.260	−0.247	−0.039	−0.355**	−0.360**	−0.432**	−0.351*
	[0.181]	[0.207]	[0.197]	[0.180]	[0.179]	[0.182]	[0.179]
MUTUAL	−1.122***	−1.147***	−1.128***	−1.116***	−1.113***	−1.135***	−1.116***
	[0.160]	[0.160]	[0.167]	[0.160]	[0.160]	[0.160]	[0.160]
EQAS	0.297	0.255	0.421*	0.284	0.243	0.256	0.277
	[0.204]	[0.205]	[0.220]	[0.204]	[0.203]	[0.205]	[0.204]
SIZE	0.111***	0.117***	0.046	0.111***	0.110***	0.113***	0.109***
	[0.025]	[0.026]	[0.031]	[0.026]	[0.025]	[0.026]	[0.026]
GDPGR	0.060***	0.063***	0.048***	0.065***	0.057***	0.059***	0.066***
	[0.005]	[0.006]	[0.006]	[0.005]	[0.006]	[0.006]	[0.005]
INFL	−0.178***	−0.200***	−0.194***	−0.191***	−0.171***	−0.178***	−0.184***
	[0.013]	[0.014]	[0.014]	[0.014]	[0.014]	[0.014]	[0.013]
CAPRQ	0.580						
	[0.437]						
CAPRQsq	−0.033						
	[0.058]						
TPROV		−1.209***					
		[0.209]					
TPROVsq		0.089***					
		[0.016]					
INVEST			−1.169				
			[0.948]				
INVESTsq			0.060				
			[0.053]				
SPOWER				0.206**			
				[0.089]			
SPOWERsq				−0.004**			
				[0.002]			
GOVINT					0.191**		
					[0.085]		
GOVINTsq					−0.005***		
					[0.002]		
ACCAUD						0.819	
						[0.531]	
ACCAUDsq						−0.033*	
						[0.017]	
SREPORT							0.881
							[3.834]
SREPORTsq							−0.028
							[0.134]
Constant	−0.794	4.523***	7.240*	−0.830	−0.472	−3.591	−5.760
	[0.855]	[0.678]	[4.145]	[1.138]	[0.955]	[3.948]	[27.294]
Random effects parameters							
St. dev. [Country-level]	0.686	0.689	0.794	0.913	0.712	0.835	0.711
	[0.171]	[0.152]	[0.191]	[0.333]	[0.159]	[0.189]	[0.158]
St. dev. [Firm-level]	2.043	2.033	1.969	2.039	2.039	2.034	2.038
	[0.043]	[0.043]	[0.046]	[0.043]	[0.043]	[0.043]	[0.043]
St. dev. [residual]	1.031	1.028	1.031	1.034	1.030	1.027	1.035
	[0.011]	[0.011]	[0.012]	[0.010]	[0.011]	[0.011]	[0.011]
LR test Estimated Model vs. Linear regression	5476.92***	5652.49***	4469.30***	5591.74***	5530.29***	5669.34***	5696.12***
No. of yearly observations	5741	5619	4780	5741	5741	5619	5741
No. of firms	1276	1251	1060	1276	1276	1251	1276
No. of countries	18	17	17	18	18	17	18

Table A6
Insurance firms' performance and regulations: controlling for institutional development (dependent variable: Sharpe ratio).
Notes: Restricted maximum likelihood estimates from a multilevel model with fixed and random components; Standard errors in brackets; *** Statistically significant at the 1% level. ** Statistically significant at the 5% level. * Statistically significant at the 10% level. The dependent variable is the Sharpe ratio, a firm-specific indicator of risk-adjusted returns. AFFIL is a firm-specific indicator of an insurer's group structure. LIFE and COMP are firm-specific proxies of business activity, indicating life insurers and composite insurers, respectively. MUTUAL is a firm-specific indicator of organizational form. EQAS is the equity to assets ratio. SIZE is the natural logarithm of total assets (in thousands of US dollars). INSTDEV is an indicator of institutional development. CAPRQ is a country-level index of capital requirements in the insurance sector. TPROV is a country-level index of insurance regulations related to technical provisions. INVEST is a country-level index of requirements related to insurers' investments. SPOWER is a country-level index of the power of insurance supervisors. GOVINT is a country-level corporate governance and internal control index for the insurance sector. ACCAUD is a country-level index of disclosures and auditing in the insurance sector. SREPORT is a supervisory reporting index for the insurance sector. sq denotes the squared term of the corresponding variable.

Fixed effects							
AFFIL	0.157	0.070	0.253*	0.136	0.139	0.074	0.147
	[0.133]	[0.133]	[0.145]	[0.132]	[0.132]	[0.134]	[0.132]
LIFE	−0.283*	−0.192	−0.429**	−0.590***	−0.613***	−0.625***	−0.585***
	[0.163]	[0.169]	[0.173]	[0.157]	[0.157]	[0.157]	[0.157]
COMP	−0.141	0.291	0.077	−0.262	−0.280	−0.360*	−0.238
	[0.183]	[0.207]	[0.197]	[0.180]	[0.180]	[0.184]	[0.180]
MUTUAL	−1.131***	−1.133***	−1.139***	−1.116***	−1.109***	−1.133***	−1.117***
	[0.161]	[0.160]	[0.168]	[0.160]	[0.160]	[0.160]	[0.161]
EQAS	0.265	0.193	0.425*	0.219	0.186	0.204	0.215
	[0.207]	[0.209]	[0.224]	[0.208]	[0.206]	[0.208]	[0.208]
SIZE	0.075***	0.080***	0.011	0.071***	0.077***	0.084***	0.066**
	[0.026]	[0.026]	[0.031]	[0.025]	[0.025]	[0.026]	[0.026]
INSTDEV	0.374	0.292	0.693**	0.34	0.188	0.364	0.191
	[0.282]	[0.269]	[0.284]	[0.259]	[0.277]	[0.297]	[0.286]
CAPRQ	1.509***						
	[0.458]						
CAPRQsq	−0.131**						
	[0.061]						
TPROV		−0.991***					
		[0.210]					
TPROVsq		0.069***					
		[0.016]					
INVEST			−0.613				
			[0.974]				
INVESTsq			0.027				
			[0.054]				
SPOWER				−0.011			
				[0.071]			
SPOWERsq				−0.001			
				[0.001]			
GOVINT					0.333***		
					[0.089]		
GOVINTsq					−0.008***		
					[0.002]		
ACCAUD						0.909	
						[0.601]	
ACCAUDsq						−0.040**	
						[0.019]	
SREPORT							1.824
							[4.048]
SREPORTsq							−0.057
							[0.141]
Constant	−3.319***	3.562***	4.144	1.369	−1.964*	−4.040	−13.276
	[0.936]	[0.742]	[4.296]	[0.948]	[1.014]	[4.468]	[28.786]
Random effects parameters							
St. dev. [Country-level]	0.879	0.727	0.820	0.648	0.822	1.065	0.717
	[0.226]	[0.159]	[0.186]	[0.168]	[0.178]	[0.231]	[0.162]
St. dev. [Firm-level]	2.049	2.030	1.972	2.039	2.040	2.034	2.039
	[0.044]	[0.044]	[0.046]	[0.043]	[0.043]	[0.044]	[0.043]
St. dev. [residual]	1.058	1.061	1.060	1.068	1.055	1.052	1.068
	[0.011]	[0.011]	[0.012]	[0.011]	[0.011]	[0.011]	[0.011]
LR test Estimated Model vs. Linear regression	5361.75***	5447.11***	4319.01***	5259.29***	5385.92***	5546.51***	5400.99***
No. of yearly observations	5744	5622	4783	5744	5744	5622	5744
No. of firms	1276	1251	1060	1276	1276	1251	1276
No. of countries	18	17	17	18	18	17	18

Table A7
Insurance firms' performance and regulations: controlling for market development (dependent variable: Sharpe ratio).
Notes: Restricted maximum likelihood estimates from a multilevel model with fixed and random components; Standard errors in brackets; *** Statistically significant at the 1% level. ** Statistically significant at the 5% level. * Statistically significant at the 10% level. The dependent variable is the Sharpe ratio, a firm-specific indicator of risk-adjusted returns. AFFIL is a firm-specific indicator of an insurer's group structure. LIFE and COMP are firm-specific proxies of business activity, indicating life insurers and composite insurers, respectively. MUTUAL is a firm-specific indicator of organizational form. EQAS is the equity to assets ratio. SIZE is the natural logarithm of total assets (in thousands of US dollars). MCAP is the country-level ratio of stock market capitalization to GDP. CAPRQ is a country-level index of capital requirements in the insurance sector. TPROV is a country-level index of insurance regulations related to technical provisions. INVEST is a country-level index of requirements related to insurers' investments. SPOWER is a country-level index of the power of insurance supervisors. GOVINT is a country-level corporate governance and internal control index for the insurance sector. ACCAUD is a country-level index of disclosures and auditing in the insurance sector. SREPORT is a supervisory reporting index for the insurance sector. sq denotes the squared term of the corresponding variable.

Fixed effects							
AFFIL	0.120	0.032	0.221	0.102	0.100	0.043	0.101
	[0.133]	[0.134]	[0.145]	[0.133]	[0.132]	[0.134]	[0.132]
LIFE	−0.379**	−0.345**	−0.485***	−0.649***	−0.663***	−0.668***	−0.645***
	[0.163]	[0.169]	[0.173]	[0.157]	[0.157]	[0.157]	[0.157]
COMP	−0.256	0.134	−0.048	−0.377**	−0.387**	−0.448**	−0.362**
	[0.185]	[0.209]	[0.199]	[0.181]	[0.181]	[0.184]	[0.181]
MUTUAL	−1.114***	−1.1125***	−1.109***	−1.102***	−1.098***	−1.123***	−1.109***
	[0.161]	[0.160]	[0.168]	[0.161]	[0.161]	[0.160]	[0.161]
EQAS	0.381*	0.323	0.518**	0.362*	0.310	0.318	0.355*
	[0.206]	[0.208]	[0.223]	[0.206]	[0.205]	[0.207]	[0.207]
SIZE	0.113***	0.119***	0.048	0.113***	0.115***	0.117***	0.110***
	[0.026]	[0.026]	[0.031]	[0.026]	[0.026]	[0.026]	[0.026]
MCAP	−0.485***	−0.497***	−0.413***	−0.546***	−0.478***	−0.453***	−0.549***
	[0.052]	[0.052]	[0.053]	[0.051]	[0.052]	[0.052]	[0.052]
CAPRQ	0.937*						
	[0.541]						
CAPRQsq	−0.066						
	[0.073]						
TPROV		−0.979***					
		[0.211]					
TPROVsq		0.070***					
		[0.016]					
INVEST			−0.633				
			[1.033]				
INVESTsq			0.029				
			[0.057]				
SPOWER				0.061			
				[0.094]			
SPOWERsq				−0.002			
				[0.002]			
GOVINT					0.384***		
					[0.091]		
GOVINTsq					−0.009***		
					[0.002]		
ACCAUD						0.775	
						[0.663]	
ACCAUDsq						−0.034	
						[0.211]	
SREPORT							3.908
							[4.750]
SREPORTsq							−0.124
							[0.166]
Constant	1.710*	3.827***	4.828	0.811	−2.391**	−2.913	−29.219
	[1.000]	[0.686]	[4.514]	[1.210]	[1.024]	[4.941]	[33.834]
Random effects parameters							
St. dev. [Country-level]	1.040	0.913	0.971	1.003	0.990	1.240	0.895
	[0.243]	[0.204]	[0.217]	[0.243]	[0.214]	[0.267]	[0.204]
St. dev. [Firm-level]	2.046	2.033	1.972	2.041	2.041	2.035	2.041
	[0.043]	[0.044]	[0.046]	[0.043]	[0.043]	[0.044]	[0.043]
St. dev. [residual]	1.047	1.049	1.051	1.053	1.044	1.042	1.053
	[0.011]	[0.011]	[0.012]	[0.011]	[0.011]	[0.011]	[0.011]
LR test Estimated Model vs. Linear regression- chi2	5423.47***	5542.31***	4367.31***	5335.51***	5485.12***	5580.03***	5634.79***
No. of yearly observations	5732	5610	4771	5732	5732	5610	5732
No. of firms	1276	1251	1060	1276	1276	1251	1276
No. of countries	18	17	17	18	18	17	18

Table A8
Insurance firms' performance and regulations: controlling for legal origins (dependent variable: Sharpe ratio).
Notes: Restricted maximum likelihood estimates from a multilevel model with fixed and random components; Standard errors in brackets; *** Statistically significant at the 1% level. ** Statistically significant at the 5% level. * Statistically significant at the 10% level. The dependent variable is the Sharpe ratio, a firm-specific indicator of risk-adjusted returns. AFFIL is a firm-specific indicator of an insurer's group structure. LIFE and COMP are firm-specific proxies of business activity, indicating life insurers and composite insurers, respectively. MUTUAL is a firm-specific indicator of organizational form. EQAS is the equity to assets ratio. SIZE is the natural logarithm of total assets (in thousands of US dollars). BRIT, FRENCH, SCAND are country-level dummy variables that indicate the legal origin. CAPRQ is a country-level index of capital requirements in the insurance sector. TPROV is a country-level index of insurance regulations related to technical provisions. INVEST is a country-level index of requirements related to insurers' investments. SPOWER is a country-level index of the power of insurance supervisors. GOVINT is a country-level corporate governance and internal control index for the insurance sector. ACCAUD is a country-level index of disclosures and auditing in the insurance sector. SREPORT is a supervisory reporting index for the insurance sector. sq denotes the squared term of the corresponding variable.

Fixed effects							
AFFIL	0.179	0.085	0.268*	0.152	0.154	0.087	0.164
	[0.133]	[0.134]	[0.145]	[0.133]	[0.132]	[0.134]	[0.132]
LIFE	−0.265	−0.187	−0.426**	−0.588***	−0.610***	−0.623***	−0.579***
	[0.163]	[0.169]	[0.173]	[0.157]	[0.157]	[0.157]	[0.157]
COMP	−0.171	0.274	0.046	−0.271	−0.291	−0.369**	−0.246
	[0.183]	[0.208]	[0.199]	[0.181]	[0.181]	[0.184]	[0.181]
MUTUAL	−1.098***	−1.107***	−1.107***	−1.095***	−1.086***	−1.115***	−1.096***
	[0.161]	[0.160]	[0.168]	[0.161]	[0.161]	[0.161]	[0.161]
EQAS	0.268	0.202	0.425*	0.225	0.193	0.206	0.222
	[0.207]	[0.209]	[0.224]	[0.208]	[0.206]	[0.208]	[0.208]
SIZE	0.076***	0.081***	0.011	0.070***	0.078***	0.083***	0.066**
	[0.026]	[0.026]	[0.031]	[0.026]	[0.025]	[0.026]	[0.026]
BRIT	4.046***	1.216	1.081	1.057	1.692	1.797	1.558
	[1.470]	[1.363]	[1.398]	[1.362]	[1.417]	[2.176]	[1.346]
FRENCH	−0.185	0.108	−0.015	0.119	0.275	0.317	0.141
	[0.537]	[0.551]	[0.562]	[0.510]	[0.531]	[0.774]	[0.482]
SCAND	−0.850	−0.647	−0.790	−0.394	−0.666	−0.873	−0.666
	[0.732]	[0.718]	[0.810]	[0.746]	[0.735]	[1.076]	[0.672]
CAPRQ	1.927***						
	[0.473]						
CAPRQsq	−0.183***						
	[0.063]						
TPROV		−0.993***					
		[0.210]					
TPROVsq		0.070***					
		[0.016]					
INVEST			−1.255				
			[1.042]				
INVESTsq			0.062				
			[0.058]				
SPOWER				0.021			
				[0.081]			
SPOWERsq				−0.001			
				[0.001]			
GOVINT					0.349***		
					[0.090]		
GOVINTsq					−0.009***		
					[0.002]		
ACCAUD						1.279	
						[0.804]	
ACCAUDsq						−0.052**	
						[0.026]	
SREPORT							4.763
							[3.898]
SREPORTsq							−0.159
							[0.136]
Constant	−3.566***	3.896***	7.805*	1.278	−2.043*	−6.505	−34.300
	[1.027]	[0.804]	[4.638]	[1.040]	[1.115]	[6.254]	[27.738]
Random effects parameters							
St. dev. [Country-level]	0.788	0.7143	0.831	0.727	0.785	1.087	0.674
	[0.196]	[0.178]	[0.202]	[0.208]	[0.194]	[0.260]	[0.170]
St. dev. [Firm-level]	2.047	2.034	1.973	2.040	2.040	2.035	2.034
	[0.043]	[0.043]	[0.046]	[0.043]	[0.043]	[0.044]	[0.043]
St. dev. [residual]	1.057	1.061	1.061	1.067	1.054	1.052	1.068
	[0.011]	[0.014]	[0.012]	[0.011]	[0.011]	[0.011]	[0.011]
LR test Estimated Model vs. Linear regression- chi2	5303.67***	5314.30***	4352.04***	5244.04***	5157.21***	5359.14***	5354.35***
No. of yearly observations	5744	5622	4783	5744	5744	5622	5744
No. of firms	1276	1251	1060	1276	1276	1251	1276
No. of countries	18	17	17	18	18	17	18

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