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FACULTEIT ECONOMIE EN BEDRIJFSWETENSCHAPPEN

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Are the Trade-off and Pecking Order Theory Relevant?

Sam Schruers
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In samenwerking met Benoit Madoe

Masterproef aangeboden tot het behalen van de graad

Master in de toegepaste economische wetenschappen:
Handelsingenieur
Major Accountancy en Financiering

Promotor: Prof. Dr. Cynthia Van Hulle
Werkleider: Matthias Saerens

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The Capital Structure of European Insurers:
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Abstract

Two important capital structure theories have emerged from the general corporate finance literature: the trade-off and the pecking order theory. In previous research financial firms are typically excluded from the sample. The aim of this paper is to determine whether the capital structure decisions made by European insurers can be explained by these traditional frameworks. We systematically apply the arguments of both theories to the specific nature of the insurance business. Then, the Difference GMM estimator is used to test whether evidence in support of both theories can be found in our sample of 1,539 life insurers and 1,913 non-life insurers over a 21-year period dating from 1992 to 2012. Our empirical findings reveal that neither the trade-off nor the pecking order model that we use is able to account for the evolution of the capital structure of the insurers in our sample.

1. Introduction

Although capital structure decisions are a frequently studied subject in the corporate finance domain, firms in the financial sector are often excluded from the sample. The reasons are that capital structures of these firms are not comparable to those in non-financial industries and that they are highly regulated. Furthermore, insurers, on which the focus will be in this paper, dispose of policyholders' premiums as an additional source of funding. Clearly, this is an inherently different financing method than retained earnings, debt or equity. To the best of our knowledge, no research exists that systematically applies the reasoning of these theories to insurers and then empirically tests their relevance in a European context. This paper seeks to provide a first step towards filling that void.

Many daily activities that are taken for granted involve some risk of loss and might not be performed were it not for insurance, since in this case the potential financial costs that people would be exposed to would be too great. It is fair to say that modern society would not be able to function as it does today without insurance. Given this economic and social function, regulation of insurance is important to ensure a stable, well-functioning system and a competitive insurance market. By giving an insight into the behavior of insurers regarding capital structure, our paper, together with other insurer literature and future research, contributes to regulators' understanding of the topic, allowing them to better predict the potential consequences of new rules. This might be of particular interest given the anticipated introduction of the EU's new Solvency II framework, which is expected to have a devastating impact on the industry.

Since the introduction of the irrelevance theory by Modigliani and Miller (1958), many theories have been suggested to explain the financing behavior of firms and many papers have been written on the subject (Frank and Goyal (2007) and Harris and Raviv (1991a) provide an extensive overview and discussion). In a particularly influential treatment of the problem, Myers (1984) describes the trade-off theory and the pecking order theory, which are currently still the two dominant approaches to understanding a firm's capital structure decisions. The capital structure irrelevance theorem of Modigliani and Miller (1958) is based on the assumption of perfect market condition. However, real life capital markets are far from perfect and market imperfections in the form of transaction costs, taxes, costs of financial distress and subsidies exist. The trade-off theory suggests that firms choose their capital structure by balancing the advantages of leverage with its costs. This theory assumes the existence of a target capital structure which maximizes firm value and towards which firms continuously adjust, a phenomenon also known as mean-reversion. Yet, this target adjustment behavior is only explicitly accounted for in the dynamic version of the trade-off theory, where adjustments take place when the cost of adjustment toward the target is lower than the cost of deviating from the target (Fischer, McCall, & Morch, 1989). The pecking order theory denies the existence of a target capital structure and posits that, due to information asymmetry between managers and external investors, firms follow a financing hierarchy where internal funds would be preferred to debt and equity issuance.

Despite the fact that quite some literature is directly or indirectly related to insurers' capital structure, many of these studies shine a light on the dynamics behind the capital structure of insurers, but do not test whether the trade-off or pecking order theory are applicable. Rather, they implicitly or explicitly assume that one of both theories holds. From that perspective, our research will not only be complementary to these prior studies but will also provide a view on the appropriateness of the assumptions made in those papers. Cummins and Sommer (1996) assume the application of the trade-off theory when analyzing the relation between risk and capital. The same can be said about Harrington and Niehaus (2002) in their tests concerning differences between mutual and stock insurance companies. De Haan and Kakes (2010) use elements of both the pecking order theory and the trade-off theory when they investigate risk-based capital requirements. We believe that up to this very moment, the article most comparable to ours in the existing insurance literature is Cheng and Weiss (2012), henceforth C&W (2012). Nevertheless, there remain some important differences between their paper and ours.

First of all, we provide a much more elaborate theoretical rationale for why the theories could possibly be relevant for insurers. By illustrating how the pecking order and trade-off theory can be thought of in this peculiar setting, the theoretical exposition allows for a more transparent evaluation of their relative merits. Also, this theoretical underpinning could serve as a source of inspiration for models in future papers that apply the two theories to insurers. Second, to test whether the predictions of the theories are carried out by the data, C&W (2012) use two models. First, they estimate a trade-off model. Then, in order to determine whether the trade-off theory dominates its pecking order rival, they use a model that contains elements of both theories. This way, however, the pecking order theory receives a second-class treatment from the outset. In contrast, in this paper we will apply a more complete approach by using a separate, full-fledged, regression model for both the trade-off and the pecking order theory. Next, while C&W (2012) focus on the American property-liability market, this paper focuses on European insurers active in a broader set of business lines, across the life and non-life segment. The difference in geographical focus is potentially important, as the US differs from the EU in terms of for instance players, regulation, insurance markets and capital markets. Another important divergence relates to the econometric techniques applied. Both papers make use of instrumental variable estimation to solve the problem of endogeneity of one or more of the explanatory variables. Where C&W (2012) make use of a two-stage least squares (2SLS) estimator, a special case of the Generalized Method of Moments (GMM), we use a different GMM implementation, the Aranello-Bond estimator, also known as Difference GMM. In a nutshell, this is the estimation technique of our choice because its characteristics and assumptions are a very good fit for the dynamic models and panel data in this paper (Roodman, 2009a). Finally, crucial to emphasize are the disparate conclusions of both papers. Where C&W (2012) find that the trade-off theory plays an important role and dominates the pecking order theory, our results suggest that none of the traditional capital structure theories are able to explain the observations in the sample.

More precisely, when the trade-off model is confronted with the data, it turns out that for most of the variables which can a priori be expected to have an important impact on the optimal capital structure no significant relation is found. For others, the sign of their estimated coefficient is contrary to what the trade-off theory would predict. For the pecking order model, a significant effect of the financing deficit (which plays a crucial role in the pecking order theory (cfr. infra)) on the capital structure is found when the fixed effects estimator is used as a first approximation. Yet, very specific assumptions are needed to reconcile the estimated negative sign of the coefficient with the pecking order theory. Moreover, when instead the Difference GMM estimator is used, it turns out that the relation no longer holds. Even though a negative effect is still found in some cases, the result is clearly not robust to the choice of instruments. These findings suggest that neither theory can account for the observed capital structure decisions in our sample. It must be underscored that the results pertaining to both models in general survive several robustness checks. Not only do we use two different estimation techniques, we also vary the instruments used with the Difference GMM estimator and use two capital structure measures. Both models are also tested for the whole sample and for the subsample of observations after the introduction of Solvency I in 2004.

The remainder of this paper is organized as follows. Section 2 concisely introduces the most relevant characteristics of the insurance business. In the subsequent section, the trade-off and pecking order theory are first explained in general terms, then it is shown how they could be interpreted in an insurance environment. The section also introduces our hypotheses. Section 4 introduces the data, explains the models and justifies the adopted econometric approach. Then, in Section 5 the estimation results are reported and interpreted. Section 6 concludes.

2. The Insurance Business

This section highlights some of the main characteristics of the insurance business. Along this path, the points on which insurers differ considerably from firms in other industries will become apparent. Not only will this underscore why studying the capital structure theories specifically for insurers is an interesting endeavour, it will also facilitate the understanding of the application of these theories to insurers in the next section.

The basic principle on which the insurance business is build is risk aversion. As individuals and businesses generally have a preference for reduced uncertainty about their financial future, they are willing to pay a premium to an insurer in return for a promise of a future pay-out if a certain adverse event takes place. Insurers pool a large number of risks and manage these professionally such that the premium they have to charge to carry these risks safely is lower than the maximum premium an individual or business would be willing to pay. This way insurers add value for their clients (De Weert, 2011). If in a given year an insurance undertaking's premium revenue is larger than the sum of the claim expenses, the net change in technical provisions and the underwriting expenses it realizes an underwriting profit.[1]

One unique feature of the insurance industry that is contained in the previous paragraph deserves further attention. In insurance the client pays upfront for a service that will be rendered at some point in the future. As a result, between the collection of premiums and the pay-out of claims a time lag exists. Therefore, insurers temporarily invest part of the money received from policyholders. Returns on these investments provide the insurer with a second source of earnings, called the investment income. The assets to invest in are selected in such a manner that sufficient funds are available when needed for claim settlements. This process of matching assets and liabilities, known as asset liability management (ALM), is crucial for the long term viability of an insurance undertaking (Doff, 2011). Duration matching is a particularly important part of this. For instance, life insurance policies typically have longer time horizons than their non-life counterparts. Consequently, life insurance premiums are invested in assets with longer durations. To guarantee that policyholders' claims can be met, insurance carriers adopt a very conservative investment approach, with a large majority of their funds invested in marketable fixed income securities. In other words, the insurer's liabilities, representing its promises to policyholders, dictate its assets (De Weert, 2011). This is in stark contrast with other industries, where typically the liabilities are chosen to support the firm's operating activities which are reflected in its assets. A part of the premiums received is, rather than invested in assets, passed on to reinsurance companies. In return, the latter takes over part of the burden of covering future losses. This way reinsurers assist primary insurers in keeping their overall risk level within acceptable limits (Doff, 2006).

The two most important risk categories for insurers are investment risk and underwriting risk. The former is related to adverse developments in the value of the assets in the investment portfolio. Sound asset liability matching combined with the conservative investment approached highlighted above allow insurers to keep this risk within boundaries. Underwriting risk refers to the risk of loss resulting from a deviation between actual claim payments and the ex-ante expected amount (De Weert, 2011). If this happens, premiums charged previously will probably be insufficient, resulting in an underwriting loss. The precise nature of underwriting risks depends on the line of insurance. The

[1] The claim expenses include payments of claims, as well as the costs incurred in the claim settlement process, for instance, wages of claim adjusters and fees paid to experts. Underwriting expenses are expenses incurred in the underwriting process, such as commissions for brokers or agents, costs of a review of the loss history and various administrative expenses.
Some claims that are reported in a given year are only settled one or more years later. By including the net change in technical provisions in the calculation of underwriting profit, these claims affect the financial result of the year in which they are reported. This way the matching principle is followed.

lines of business in which insurers are active can be divided into two categories: life and non-life. Life insurance provides long-term financial stability and security to policyholders by covering risk of death, disability or longevity as well as, in some cases, investment risk.[2] Non-life insurance protects policyholders against unfortunate events with negative financial consequences. This is a very broad residual category. Any policy concerning a risk not covered by life insurance products can be included. Examples include property, liability, car and health insurance.[3]

The promises granted by insurers are reflected on its balance sheet by technical provisions (De Weert, 2011). For non-life insurance, the amount of these liability items must reflect the expected future expenses on claims related to current policies that can reasonably be foreseen. When a claim is reported or when the insurer deems it likely that a claim will be reported in the near future, the provisions are increased. The final payment of a claim or the revision downwards of an expected claim reduces the level of the provisions. A net increase in the technical provisions translates into a lower underwriting profit, and vice versa. For life insurance products, the insurer does not wait until a claim is reported. Instead, a provision is already created upon policy issuance (Simonet, 1998, 2000). As estimating the value of future claim settlements always involves some degree of judgment, it is clear that insurers have considerable leeway to manage their earnings actively.

Premiums form the largest source of funding for insurance undertakings. Consequently, technical provisions are usually by far the largest item on an insurer's balance sheet. A second, much smaller but nevertheless essential, source of financing is equity capital, often referred to as the insurer's surplus. No matter how well the provisions are calculated, the risk of claims exceeding these estimates cannot be fully eliminated. The equity of an insurance company serves as a buffer against this risk (Doff, 2011).[4] Apart from that, the surplus also provides a cushion against negative shocks on the asset side. Thus, the amount of equity capital held in proportion to its activities, is a crucial determinant of an insurer's solvency. The use of regular debt is rather limited. Most of insurers' debt consists of subordinated liabilities, as these instruments, conditional on certain requirements, are recognized as part of an insurer's regulatory capital. Figure 1 provides a schematic view on the typical insurer balance sheet structure, with median percentages based on our sample, described in a later section. Technical provisions constitute a greater part of the balance sheet total for life than for non-life insurers, which should not be surprising given that, as noted above, life insurers create a technical provision at the start of a contract and hold

[2]Longevity risk is the risk of living longer than can be sustained by one's own financial assets.

[3]Note that health insurance is sometimes seen as a separate, third, category.

[4]In this context it should be noted that in the past, the technical provisions included a prudence margin such that the technical provisions were highly likely to be sufficient to cover the future claims. In other words, the technical provisions were set at a level above their expected value. Today, insurers typically use the fair value paradigm in appraising the majority of provisions. That is, the provisions are equal to the expected value of future policyholder claims. The cushion function of equity has thus increased in importance due to this shift (Doff, 2011). In the future, when Solvency II enters into force, the calculation of technical provisions will change considerably. Yet, as this development is not relevant for the sample we study, we do not expand on this issue.

this until the end date, whereas non-life insurers wait for claims to become apparent.

Almost all major European insurers are organised as either a common stock or a mutual insurance company. Stock insurers are owned by their shareholders, as is the case for most firms in other industries, whereas in a mutual insurance company no shareholders exist. In the latter case, policyholders own and control the firm. Similar to a dividend payment to shareholders, a mutual insurer can distribute profits to its policyholders.

3. Literature and Hypotheses

The foundations of capital structure theory were laid by Modigliani and Miller (1958). They concluded that, given a number of non-trivial assumptions, capital structure is irrelevant. In their model, financing decisions can only influence the division of the generated value among investors. The value creation itself purely depends on the firm's operational activities. Subsequent research has yielded many insights by relaxing a subset of the assumptions employed by Modigliani and Miller (1958). The introduction of bankruptcy costs, agency costs and the tax shelter provided by interest payments lead to the establishment of the trade-off theory. For the pecking order theory, the main ingredient was the introduction of asymmetric information between managers and outside investors. In this section, first, both theories are described in general terms. The reader who has a profound knowledge about these theories can easily skip this subsection. Then, they are applied to the specific situation of insurance companies and our two hypotheses are presented.

3.1 General Versions of the Theories

3.1.1 Trade-off Theory

Under the trade-off theory firms are assumed to balance the costs and benefits of leverage in order to determine the optimal capital structure, i.e. the capital structure that maximizes the value of the firm. As a firm takes on more debt relative to equity, it gains a tax advantage because the interest payments on the debt obligations lower the taxable income, unlike dividends paid to shareholders (Modigliani & Miller, 1963). On the other hand, more leverage will also lead to an increase in the probability that the company will experience financial difficulties. As this means that it becomes more likely that costs of financial distress will be incurred, firm value is reduced (Kraus & Litzenberger, 1973). These costs consist of both direct costs, such as legal fees, and indirect costs, such as loss of customers, loss of valuable employees and reputation loss.

Apart from the tax shelter and the costs of financial distress, agency cost considerations can play a role in determining the optimal capital structure as well. Two relevant categories of agency problems can be identified: those between managers and shareholders and those between shareholders and bondholders.

The first kind, usually referred to as agency costs of equity, results from conflicts of interest between managers and shareholders (Jensen & Meckling, 1976). When a manager does not own all the shares of the company he runs, he will not always take decisions that maximize the value of the enterprise. This sub-optimal behaviour can take several forms. The manager might, for instance, appropriate corporate resources in the form of perquisites, invest in value-reducing projects that increase the size of the firm or refrain from pursuing risky but value-adding projects.[1] Of course, shareholders can foresee all of these suboptimal actions. Consequently, they will try to control the behaviour of the manager by methods such as formal control systems, contractual limitations on the manager's decision power and incentive compensation systems that aim to align the manager's incentives with those of the shareholders (Jensen & Meckling, 1976). The agency costs consist of, on the one hand, the costs entailed by these control measures and, on the other hand, the costs of the remaining suboptimal behaviour by the manager.[2]

Secondly, an agency conflict between shareholders and bondholders exists, leading to agency costs of debt. The residual nature of shareholders' claims can lead to circumstances under which their incentives are no longer aligned with the maximization of enterprise value. When leverage is sufficiently high it can be optimal for shareholders to undertake risky but negative net present value (NPV) projects. These over-investment problems are designated as asset substitution. Shareholders' residual claims can be mimicked by an option contract with as underlying asset the whole company and the exercise price equal to the face value of the firm's debt. The life of the option corresponds to the life of the debt. If at the maturity date the enterprise value surpasses the face value of debt, the difference between the two is what the shareholders receive. In the other case, if the value of the firm is lower than what is owed to creditors, shareholders receive nothing and are protected by their limited liability. Option pricing models tell us that the value of this option can be increased by stepping up the volatility of the underlying asset (Black & Scholes, 1973).[3] When the firm is highly indebted and a positive NPV project is available, another shareholder-bondholder conflict arises. Shareholders would not be willing to invest in the project if the returns would be largely collected by the creditors. This is an under-investment problem resulting from debt overhang (Myers, 1977). Bondholders, anticipating this behaviour which reduces

[1]The reason why the last one might be optimal from the manager's point of view is that by limiting the riskiness of the firm's activities he attempts to safeguard his executive position from which he is assumed to reap personal benefits such as prestige and a high wage.

[2]Jensen and Meckling (1976) call the costs entailed by the control measures *the monitoring and bonding costs*. They also show that, in general, at the optimal level of control measures some opportunities remain for the manager to pursue his own interests rather than those of the equity holders. In other words, it is usually not optimal to exercise full control. This second cost is called the *residual loss*.

[3]The fact that increased volatility of the underlying asset increases the value of the option can also be understood intuitively. For the option holder the downside risk is limited. In our application, shareholders are protected by limited liability. The worst that can happen is that they receive nothing. The upside potential, on the contrary, is unlimited. Shareholders receive the residual value, no matter how large this is. An increase in volatility means that the probabilities of very favourable as well as unfavourable evolutions of the underlying asset's value increase. Therefore, a more volatile enterprise value, or, equivalently, an increase in the risk of the firm's activities, is beneficial for the owner of the option, i.e. the shareholder.

their wealth, will use covenants to restrain shareholders' possible actions. Yet, as with the agency costs of equity, a residual loss will remain, in this case translating into a higher interest rate on its debt. Thus, the agency costs of debt include the costs resulting from the covenants as well as the higher interest rate.

The degree to which both of the explained kinds of agency costs are present depends, amongst others, on the capital structure. When leverage increases, the agency costs of equity decrease. The greater interest and principal payments reduce the amount of cash managers can spend at their own discretion (Jensen, 1986). Also, when the firm is more leveraged, the manager can more easily own a large part of the equity, thereby reducing the agency problems (Jensen & Meckling, 1976). At the same time, more debt will obviously increase the agency costs of debt. This is because of more leverage per se and because of the heightened risk of bankruptcy.

The static trade-off theory refers to this act of balancing costs and benefits of leverage such that the value of the firm is maximized. In reality, the factors determining the target leverage ratio will not be constant. Fluctuations of these will cause the optimal leverage to change over time. Moreover, the firm's actual capital structure is not stable either. Regular leverage adjustments are hence necessary if the firm wishes to stay at its optimum. If these modifications were costless, we would expect deviations from the optimum to be rather short-lived. However, adapting the capital structure can reasonably be assumed to engender some transaction costs.[4] Because of that, for some deviations from the static optimum it is better not to adjust immediately because the adjustment cost would outweigh the added benefit of being at the static optimum. Some persistence of shocks to the capital structure can thus be expected. At a certain point, of course, the firm will eventually move towards the target leverage ratio again. When and how this happens depends on the structure of the adjustment costs. For instance, Leary and Roberts (2005) point out that with a strictly convex transaction cost function firms adjust continually, whereas fixed or proportional costs induce rather irregular and larger adjustments. The dynamic trade-off theory takes these inter-temporal factors explicitly into account (Frank & Goyal, 2007).

3.1.2 Pecking Order Theory

According to the pecking order theory companies prefer internal financing to external financing and, when external funds are needed, debt is preferred to equity (Myers, 1984). This hierarchy results from asymmetric information between managers and outside investors about the value of the firm's current assets and growth opportunities (Myers, 1984; Myers and Majluf, 1984). When managers decide to issue new shares, potential investors have to estimate their true values. In doing so they take into account that managers, which are assumed to maximize the wealth of the current shareholders, are more likely to issue shares when the firm's stocks are overvalued in the market than when they are undervalued.

[4]Transaction costs can include, amongst others, fees paid to bankers when the firm taps the capital market. We might also think of information asymmetries leading to the emission of securities below their fundamental value, the main building block of the pecking order theory, as a source of transaction costs.

Suppose that a firm eyes a potential investment project with a high NPV and that it can only finance this project by selling shares. Because of the dynamics outlined above, it can be expected that the shares can only be sold at a discount to their true value. If this discount is sufficiently large, management will decide to drop the investment as the value loss to existing shareholders due to the discount will offset the value generated by the project.

Managers can then be expected to build up internal capital in case of a financial surplus in a given year. This way they try to prevent ending up in the situation where the firm must forgo a profitable project because it has to rely solely on selling shares to the public. When retained earnings do not suffice to cover investments, a firm will first issue debt before moving to the last resort of raising capital. As the value of debt is less sensitive to inside information than the value of equity, debt can be assumed to rank between equity capital and retained earnings (Myers, 1984).

In contrast to the trade-off theory, the pecking order theory does not assume a target capital structure. Instead, it predicts that leverage changes can be explained by the financing deficit, which is defined as the difference between the external and internal cash flow.[5] In case of a negative financing deficit, i.e. if internal cash flow exceeds external cash flow, the pecking order theory predicts that firms build up financial slack, leading to a decrease in leverage. A positive financing deficit, on the contrary, would induce firms to increase their leverage. In the latter case they would either use up part of the financial resources set aside in the past, or, when that option is exhausted, they would borrow from an external party. Finally, when the limits of their borrowing capacity are reached, they would emit new shares (Lemmon & Zender, 2010). The latter would, however, only happen sporadically and under rather extreme conditions (Fama & French, 2005).

3.2 Theories Applied to Insurers

In this section we apply the trade-off and pecking order theory to the particular situation of insurers. We already pointed out that premiums received in the context of insurance policies are the main source of funding for insurance companies, with the technical provisions as the corresponding liabilities. From a capital structure perspective, insurance policies share some characteristics with debt instruments such as bonds. The policyholder pays a certain amount to the insurer, either at once or periodically, in exchange for the promise that a sum will be paid out in accordance with the terms of the policy agreement. In other words, it is as if the insurer borrows from the policyholders (Cummins & Lamm-Tennant, 1994; Staking & Babbel, 1995).[6] Therefore, we will treat an increase in policies, which should

[5] More precisely, external cash flow is equal to the sum of dividends, net investments and changes in working capital. Internal cash flow equals the operating cash flow after deduction of interest payments and taxes (Frank & Goyal, 2003).

[6] To complete the analogy between an insurance policy and a bond: the policyholders act as the lenders, the insurer acts as the borrowing entity, the premiums paid constitute the amount lend by the policyholders and the claim payments are comparable to the refund of the principal plus the coupon payments. It should be stressed that we refer to the policyholders as a whole, not individual policyholders. An individual

eventually translate into larger technical provisions, as an increase in leverage. Yet, it should be stressed that insurance policies still differ significantly from debt instruments. Most importantly, while for debt securities the principal is a fixed amount to be paid at a predetermined date, for an insurance policy it is highly uncertain whether the contractual conditions for a pay-out will be met. Moreover, in the latter case the size and the timing of the potential payment are uncertain. Another important difference is that insurance policies are not only a source of funding. Underwriting insurance contracts is the centrepiece of the industry and can generate earnings for the firm. Debt financing, in contrast, is in itself not profitable. We will now interpret the two major capital structure theories, allowing for the fact that the main source of leverage is now the issuance of insurance policies rather than debt.

3.2.1 Trade-off Theory for Insurers

In line with the general version of the trade-off theory, we now focus on costs and benefits of leverage and weigh them against each other. The fact that insurance policies can lead to an underwriting profit is clearly an important benefit in comparison with equity capital. Next, the tax shelter provided by increased leverage applies to insurance liabilities as well. Paying out claims or reserving funds for future claim settlements reduces the taxable profit. Dividends clearly do not have this feature.[7] Furthermore, an additional benefit of the increased use of policies as a source of funding, is that this way the insurer can exploit the law of large numbers to a greater extent and that it can further diversify its risks.[8] This allows the insurer to estimate the required premium level more accurately and decrease the overall risk level of the insurer's portfolio, resulting in more profitable operations in the long run.

Also in line with the general explanation in the first section, when leverage increases, or equivalently, the surplus shrinks in relative terms, the risk of financial distress increases. The negative effect of this risk on the insurer's value can, however, be expected to be more severe than for firms in most other, non-financial industries. In insurance, and by extension in financial industries in general, trust in the solvency of the institution is

policyholder often does not receive a repayment of the premiums he contributed, i.e. no covered claim occurs, and if he does receive a repayment, the amount often greatly exceeds the sum of the premiums he paid. For policyholders as a whole the comparison to borrowing makes more sense, as the amount paid out for claims approaches total premium payments. Of course, when the insurer realizes an underwriting profit the latter will be larger than the former.

[7] One might object that these first two benefits of insurance liabilities contradict each other. Yet, the two should be taken separately. When interpreting insurance policies as a source of funding, the claim payments should be interpreted as the remuneration of the providers of financing. This form of remuneration is tax-deductible, while compensation of shareholders is not. This results in a tax benefit. Apart from that, insurance contracts offer the opportunity of an underwriting profit. From the financing perspective, it is as if the borrowing entity, the insurer, only has to pay back part of the funds borrowed from policyholders, leading to a profit. This potential of a profit resulting directly from the source of funding does not exist for equity capital. The only exception would be if the firm would be able to issue overpriced shares.

[8] The law of large numbers is a theorem stating that when an experiment is repeated a larger number of times, the average of the results will approach the expected value more and more. Consequently, when an insurer issues more policies, it will be able to predict the total future claim payments more accurately. As a result, the level of premiums needed can be determined more precisely.

of major importance. It has been shown that default risk is negatively correlated with insurance prices (Cummins & Danzon, 1997; Sommer, 1996). Also, when the surplus of an insurer relative to its total assets is reduced below a certain level, regulatory action will be triggered. In that case, some constraints will usually be imposed on the firm which might reduce the value of the company by limiting its discretion. The threat of insolvency could also necessitate some emergency measures such as selling off investments before maturity at a value below par or raising capital at a low issue price.

We now turn to the agency conflict considerations. The conflict of interest between the manager and the shareholders can be understood in the same way as in the general case. Given the time lag between collection of premiums and payment of claims, we know that insurance managers always have significant amounts of cash they have to invest. Therefore, we could expect that they are, compared to their peers in other industries, better able to maximize their personal utility through the choice of investments. However, matching assets to liabilities plays an important role for insurers (cfr. Section 2). The degree to which managers have the ability to choose assets according to their personal preference is thus not necessarily greater than in other industries. Of course, many other possibilities exist for management to optimize their own situation while not necessarily acting in the best interest of shareholders. Identical to what was written above, shareholders can expect to incur some agency costs resulting from the conflict. Whereas an increase in debt clearly reduces these costs, the effect of more insurance liabilities is ambiguous. More policies will lead to greater claim expenses in the future, which one could interpret as reducing the cash available for discretionary spending by managers. Nevertheless, if an insurer is able to gain an underwriting profit on the additional policies, i.e. the premium revenue exceeds the claim expenses, then its profit would increase. Consequently, managers could actually have more funds available to spend. Mayers and Smith (1994) argue that the manager-shareholder conflict is more severe for firms active in lines of insurance that require significant managerial discretion. This is typically the case when policies are non-standardized and actuarial tables are of poor quality. It can also be expected that mutuals' owners, the policyholders, will find it more difficult to mitigate this agency conflict because they usually have less control over their managers' behaviour (Mayers & Smith, 1988, 1994).

Insurers' use of pure debt is minimal. Accordingly, although still valid, the agency conflict between shareholders and bondholders is of little importance. Yet, a very similar, but much more important, kind of agency conflict exists between shareholders and policyholders. Stockholders have a residual claim on the firm, i.e. they have a claim on the value of the firm that remains after policyholders (and debt holders) have been paid. Therefore, the argument of the preceding section still holds. Under certain circumstances it will be optimal for the shareholders to increase the risk of the firm's activities or investments after insurance policies have been issued. Stepping up the level of risk can, for instance, be achieved by engaging in more risky lines of insurance, investing the premiums in speculative assets or using less reinsurance. Potential policyholders will take this possibility into account when they choose an insurance provider because it would increase the risk of their claims not being paid. This will translate into lower prices for those insurers which are expected to change their risk level, such that the owners of the firm bear the costs of this agency conflict. By holding more capital the insurer can reduce its incentives to shift risks ex-post, thereby reducing the agency costs (Cummins, 1988; Cummins & Nini, 2002; Staking & Babbel, 1995). The problem described in this paragraph does not apply to mutual insurers because its policyholders are in fact themselves the owners of the firm.

It is tempting to add another benefit of issuing more insurance policies. The amount set aside under the form of technical provisions to cover future claim expenses can to some extent be manipulated. This grants managers a method to smooth earnings. For outsiders, this form of earnings management is very difficult to detect, as it requires specialized actuarial skills as well as knowledge about the characteristics of the pool of covered risks. The more insurance underwritten, the greater the ability, in absolute terms, to smooth earnings through this route. Yet, the increased size would also expand the total profit number. The ability to manage earnings, in relative terms, would therefore only increase if we would assume that credibly under- or overstating expected claims is easier when the total amount of insurance underwritten is larger. We judge this to be a non-trivial assumption. Moreover, claiming that the ability to smooth earnings has a positive effect on shareholders' wealth requires that this effectively increases the market value of the firm. The empirical literature is, however, non-conclusive on this matter (e.g. Bao & Bao, 2004; Michelson, Jordan-Wagner, & Wootton, 1995, 2000; Allayannis & Simko, 2009). For these two reasons, we do not include earnings smoothing as a benefit of insurance liabilities in the context of the trade-off theory. Yet, this flexibility of the technical provisions can potentially yield an additional tax benefit. If we assume that insurers can consistently overestimate their technical provisions, then with an increasing amount of insurance underwritten the overestimation allows to systematically delay tax payments.[9]

Up to now we focused on insurance liabilities as the source of leverage. However, we already indicated that a limited amount of debt is observed in insurers' capital structures as well. A great variety of instruments with divergent characteristics belongs to this category. We will therefore refer to these as 'other liabilities'. In general, roughly the same factors as mentioned above for regular debt can be applied. Most of the instruments will indeed result in a tax benefit and increase the risk of financial distress. Moreover, agency costs of equity can be expected to decline when more other liabilities are used, while agency costs of debt would increase, for the same reasons as those put forward for pure debt instruments.

In the subsequent sections we will focus on testing the relevance of the trade-off and pecking order theory. Our first hypothesis thus is:

[9] An over-appraisal of technical provisions in one year will result in a reduced taxable profit in that year. At some point in the future, when the claim is settled at a cost below the corresponding provision, the taxable profit is increased. Yet, with growth in the insurance underwritten and a fixed proportional overestimation, the taxable profit will still be reduced as long as the growth continues.

Hypothesis 1 *The trade-off theory is capable of explaining the evolution of the capital structure of the insurers in our sample.*

3.2.2 Pecking Order Theory for Insurers

The pecking order theory is build on the notion of asymmetric information. Thus, in order to properly apply this theory to the situation of insurers, it is natural to only take this aspect into account and leave aside any other considerations.

Both premiums from policyholders and funds obtained through other liabilities clearly are forms of external financing. Accordingly, the pecking order theory would predict that they are more expensive than internal funds because external parties do not have full knowledge about the insurer's situation. In particular, potential policyholders are uncertain about the future ability of the firm to cover their claims. As outsiders, it is generally very difficult for them to judge the adequacy of the technical provisions and the capital buffer. Insurers do not disclose detailed information about the risks they are covering and policyholders usually lack the required specialized actuarial skills.[10]

Insurance liabilities have legal priority over debt. In case of bankruptcy or liquidation, the latter will only be paid after all insurance liabilities have been settled. As a result, investors holding debt should be more interested in the fundamental value of the insurer than policyholders. The pecking order theory would thus state that debt instruments are more expensive sources of funds than insurance policies, because of their greater sensitivity to inside information. For stock insurers another possibility to gain financing is issuing new shares. However, according to the pecking order theory, insurers would prefer the previous two possibilities, as the residual nature of equity holders' claims results in the largest information sensitivity.

To sum up, the pecking order theory posits that insurers will build up financial slack whenever they can. When, on the contrary, they face a financing deficit, they will first use the internal funds available to them. Then, they would turn to external financing. First, by underwriting insurance policies, second, by issuing (subordinated) debt and, finally, by emitting new shares.

We formulate the following straightforward hypothesis that will be tested in the next sections:

Hypothesis 2 *The pecking order theory is capable of explaining the evolution of the capital structure of the insurers in our sample.*

[10] Insurers do disclose some information about their solvency. The granularity is, however, rather limited. In the future, under the Solvency II framework, more external reporting on the solvency of insurers will be required. By improving transparency regulators hope market discipline will increase the incentive for insurers to maintain a solid position. In other words, the information asymmetry between insiders and outsiders will be reduced.

4. Method

In this section, a description of the data is given, followed by a discussion of the models applied to test the trade-off and pecking order theories. Concerning the trade-off theory, the variables expected to be associated with the target capital structure that are included in the model are interpreted. The section concludes with the treatment of the estimation techniques applied.

4.1 Data

Annual data for the period 1992 through 2012 are retrieved from the ISIS Database (Bureau van Dijk). Unconsolidated data are used since current supervision is focused on individual insurers rather than groups.[1] The sample only includes insurers located in the EU. Insurers based in non-EU European countries are eliminated because the regulation to which they are subjected often differs significantly from that of the EU. Nevertheless, one needs to be aware that even within the EU, significant differences in regulation may exist. Since part of the sample period is before the introduction of the Euro and since not all EU countries use the common currency, all data are converted to US Dollars (USD) to obtain comparable amounts.[2] Given the equations to be estimated, at least two years of consecutive data are required for a firm to be included in the sample. Further, insolvent insurers are excluded from the sample, since their behavior can be expected to be significantly different from that of others. Also, insurers that are organized as mutuals are excluded. The reasons are that their behavior is typically expected to be considerably different from that of stock insurers (C&W, 2012; Mayers & Smith, 1988; Harrington & Niehaus, 2002). This way a sample of 10,089 firm-year observations from 1,539 life insurers and 16,902 firm-year observations from 1,913 non-life insurers is obtained. Given that the introduction of the Solvency I regulatory framework in 2004 could have altered insurers' behavior, we test all of our models both for the whole sample and for the part of the sample after 2004. To minimize the potential impact of outliers all variables are winsorized at the 1st and 99th percentile. From Tables 1 and 2 it can be observed that the results will be largely driven by insurers based in France, Germany, Italy, Spain and the United Kingdom. Tables 4 and 5 provide summary statistics. An overview of the correlations between the variables used in the empirical models is provided in Tables 6 and 7. None of the variables display a strong correlation between them.

[1] With the introduction of Solvency II, expected in 2016, supervisors will be required to supervise groups holistically to provide a clearer picture of the risks to which the group as a whole is exposed. However, there is no need to take this into account since our sample runs only until 2012.

[2] Our choice to convert to the USD instead of the Euro stems from the fact that only the USD exchange rate was available in the database.

4.2 Models

To test capital structure theories for life and non-life insurers, the ratio Liabilities/Total Assets (L/TA) is used as the primary leverage measure. This ratio is the conventional one used in corporate finance literature. As explained before, liabilities include both technical provisions reflecting the policies underwritten by the insurer and different forms of debt.[3] A robustness check is conducted with the ratio Net Premium Written/Surplus (NPW/S), which is used by C&W (2012). Figures 2 and 3 show the evolution both capital structure measures. Both suggest some mild changes in the capital structure of non-life insurers around the introduction of Solvency I in 2004.[4] For life insurers this effect is less apparent. The graphs also illustrate that the two measures do not always evolve in the same way. Thus, it can be expected that the estimation results using the two measures will differ to some degree. To study the empirical significance of the trade-off and pecking order theory, two separate models are build, based on Shyam-Sunder and Myers (1999). Table 3 shows what each of the variables used mean and how they are calculated.

4.2.1 Trade-off Model

To test the trade-off theory, a partial adjustment model is used, modeling the actual leverage change as a proportion of the desired change towards the target. Formally, the model is specified as:

$$Lev_{i,t} - Lev_{i,t-1} = \lambda(Lev^*_{i,t} - Lev_{i,t-1}) + \epsilon_{i,t}$$

$$\epsilon_{i,t} = \eta_i + \nu_{i,t} \tag{4.1}$$

$Lev_{i,t}$ being the actually observed leverage of firm i in year t, and $Lev^*_{i,t}$ the associated unobserved target. λ represents the speed of adjustment, which is, according to the trade-off theory, expected to lie between the two extremes λ=0 and λ=1. The latter is true because every insurer is likely to close every time period a proportion λ of the gap between its desired and its actual leverage ratio. Indeed, if λ=1, the company's capital structure immediately adjusts to its target value, implying that real leverage coincides with the objective. If λ=0, the observed leverage ratio at t+1 is the same as the one at t. Further, $\epsilon_{i,t}$ represents the error-term with η_i the unobserved individual firm fixed-effects, driven by unobserved constant firm characteristics, and $\nu_{i,t}$ the idiosyncratic error component.

Since the target leverage in (4.1) is unobservable, it is proxied by a set of firm-fixed effects and firm characteristics which potentially determine the target capital structure (Flannery & Rangan, 2006). The firm's target leverage can thus be modeled as:

$$Lev^*_{i,t} = \alpha_i + \beta X_{i,t} \tag{4.2}$$

[3]Thus, this implies that Total Assets - Liabilities = Surplus

[4]One would of course expect a gradual adjustment around the introduction of the new framework rather than a sudden change, as insurers typically make sure they comply with new rules before they effectively come into force.

with α_i representing the firm fixed effects and $X_{i,t}$ a vector of insurer characteristics. Substituting (4.2) into (4.1) and reorganizing the terms yields the reduced form partial adjustment model:

$$Lev_{i,t} = (1 - \lambda)Lev_{i,t-1} + \lambda\alpha_i + (\lambda\beta)X_{i,t} + \epsilon_{i,t} \tag{4.3}$$

In order to estimate equation (4.3), the factors affecting insurers' capital structure, included in the vector of firm characteristics $X_{i,t}$, have to be chosen. Prior literature indicates that a wide set of factors affects an insurer's capital structure choices. Listed below are the variables included in the regression model as well as their a priori expected sign, based on the trade-off theory.

Size It is generally accepted that size is positively associated with leverage. One reason is that larger firms are usually more diversified and the more diversified an insurer, the less relative capital it requires to operate (C&W, 2012). Also, as argued above, larger insurers can make better use of the law of large numbers in predicting future claims. For this reasons size, typically measured as the logarithm of total assets (LOGTA), is included in the regression model. The trade-off theory clearly predicts a positive sign of the coefficient.

Reinsurance Usage Since reinsurance allows an insurance company to reduce or even eliminate its exposure to particular risks, a greater use of reinsurance reduces the overall risk-level of the insurer. Therefore, a positive relation can be expected between reinsurance usage and leverage (C&W, 2012). In the empirical model, reinsurance usage is measured by the ratio Premium Ceded/Gross Premium Written (REIN).

Profitability According to the trade-off theory, the more profitable an insurer is, the more leveraged it should be in order to shield the profits from agency abuse and taxation (Niu, 2008). Thus, the expected relation between profitability and leverage is positive. We use separate measures for the profitability of the two kinds of insurers' activities. Profitability of the investment activities is measured by the investment yield (IY), while for the profitability of the underwriting activities, the combined ratio is used (CR). CR is a typical insurance-specific variable, defined as the sum of incurred claim and operating expenses measured as a percentage of the earned premiums.[5] Since a lower CR represents a higher profitability of underwriting activities, the expected sign for this variable is negative, whereas for IY we expect a positive coefficient.

Apart from the reasoning developed in prior literature to predict a positive relation between profitability and leverage for firms in general, such as the agency argument above, an insurance-specific reason for this prediction exists as well. One of the benefits of leverage for an insurer identified in the third section is that it provides the opportunity to generate an underwriting profit. This benefit is obviously more important when the underwriting

[5]Premium Earned is the part of the Gross Premium Written that relates to the expired part of the policy term. Typically premiums are received in advance of the period during which a risk is covered. As the term of the policy advances, the premium gradually becomes earned.

activities are more profitable, reflected by a lower CR. Hence, this supports the expectation of a negative coefficient for the CR.

Risk Obviously, risk is an extremely important concern for an insurer. We include a proxy for the riskiness of both underwriting and investment activities in our model. Rather than using one composite risk variable, such as the standard deviation of the return on assets, we opt to distinguish between these two sources of risk. This way we allow for the possibility that both relate to the capital structure in different ways. Risk of underwriting activities is measured as the rolling standard deviation of the combined ratio over the last 3 years (STDCR). Similarly, risk of investment activities is measured as the rolling standard deviation of the investment yield over the last 3 years (STDIY).

Intuitively, a negative relationship between risk and leverage can be expected. When its activities are more volatile, this of course increases the overall risk the insurer is subject to. The trade-off theory predicts that a firm's capital structure takes into account the idea that more leverage, apart from other benefits and drawbacks, increases the firm's risk of bankruptcy. Extending this notion, one can expect that more risk resulting from other factors than the financial structure would induce insurers to cut back on their use of leverage, to keep their insolvency risk to the desired level. A similar reasoning lies at the basis of the models developed by Cummins and Sommer (1996), Niu (2008) and Titman and Wessels (1988). Cummins and Sommer (1996) provide evidence that the US-based property-liability insurers in their sample act in accordance with this idea. To sum up, the expected sign for the risk proxies is negative.

Group Affiliation To capture the possibility that belonging to a group may have an influence on the optimal capital structure, we include a dummy variable in our model that indicates whether the insurer is a member of a group (=1) or not (=0) (GRO). Affiliation with a business group may have implications on capital structure in several ways. First, insurers that are part of a group might be able to operate with relatively lower capital levels thanks to their possibility of diversifying risks within the group through intra-group reinsurance (C&W, 2012). Second, group members are likely to cross-subsidize among each other and help each other cover debt obligations. This is especially true in the case of the potential default of one member since other group members are worried about the group's reputation (Chang & Hong, 2000). As a result, the potential cost of financial distress is lower for group affiliated firms. Because of these two reasons, the expected relationship between group affiliation and leverage is positive.

Countries Finally, dummy variables for the country of origin of the insurer are included. As already mentioned, within the EU differences in regulation and supervision across countries still exist. Moreover, there is quite some variation in the characteristics of different member states' insurance markets, for instance in terms of competition, popular products and common policy terms and conditions. Possibly these and other country-specific factors have an impact on the target capital structure.

4.2.2 Pecking Order Model

Our model starts from the one developed by Shyam-Sunder and Myers (1999). They posit that the pecking order theory predicts a positive one-to-one relation between net debt issues and the financing deficit (cfr. infra). Given the exposition in the third section that applied the theory to insurers and given our definition of liabilities, in the current context this would translate into the expectation of a one-to-one relation between the financing deficit and liabilities. However, to make sure the pecking order and trade-off model are at least to some degree comparable, the ratio L/TA is used as the dependent variable in stead of liabilities. Accordingly, we use Financing Deficit/Total Assets (FD/TA), as the regressor. Of course, as a robustness check the model is also applied with the alternative leverage measure NPW/S. Together, the model then is the following:

$$Lev_{i,t} - Lev_{i,t-1} = \delta(FD/TA)_{i,t} + \epsilon_{i,t} \tag{4.4}$$

The strong pecking order hypothesis, such as the one used by Shyam-Sunder and Myers (1999), is that δ=1 when L/TA is used as dependent variable. However, sometimes the approach is followed that a parameter δ close to one and significantly different from zero already supports the pecking order theory, considering that for some reasons such as financial flexibility considerations and a debt capacity constraint, firms may find it necessary to issue equity (Myers & Majluf, 1984; Fama & French, 2005). We will allow for this possibility in the interpretation of the results. When the alternative leverage measure NPW/S is used, the predicted value of the coefficient is not straightforward. Yet, if the pecking order is valid one should at least observe a significantly positive coefficient.

To calculate the financing deficit, we follow Frank and Goyal (2003) in using the following definition:

$$(Financing\ deficit)_{i,t} = (External\ cash\ flow)_{i,t} - (Internal\ cash\ flow)_{i,t} \tag{4.5}$$

$$(Financing\ deficit)_{i,t} = (Div_{i,t} + I_{i,t} + \Delta W_{i,t}) - Oper\ CF_{i,t} \tag{4.6}$$

$Div_{i,t}$ being the dividends, $I_{i,t}$ the net investment, $\Delta W_{i,t}$ the change in net working capital and $Oper\ CF_{i,t}$ the operating cashflow after interest and taxes, for insurer i in year t. For the reason that only the dividends were given directly in the ISIS database, an approximation for the other components was required. The approach followed in this paper consists of the following equations:

$$I_t + \Delta W_t = Total\ assets_t - Total\ assets_{t-1} - (Current\ liab_t - Current\ liab_{t-1})$$

$$Oper\ CF_t = CF\ underwriting\ activities_t + CF\ investment\ activities_t$$

The cash flows from underwriting and investment activities are obtained from eliminating certain non-cash items from the respective accounting profits.

$$\begin{aligned} CF\ underwriting\ act_t = {} & Underwriting\ result_t \\ & +(Net\ techn\ reserves_t - Net\ techn\ reserves_{t-1}) \\ & -(Insurance\ debtors_t - Insurance\ debtors_{t-1}) \end{aligned}$$

$$CF\ investment\ activities_t = Investment\ income_t - Unrealised\ gain_t$$

4.3 Estimation Techniques

A straightforward Ordinary Least Squares (OLS) estimation is not appropriate for our dynamic panel data model. OLS does not properly take into account the panel structure of the data and, as a result, the Gauss-Markov conditions which guarantee the OLS estimators to be the best linear unbiased estimators do not hold.[6]

One OLS variant that does take into account the specific structure of the data is the fixed effects estimation. Yet, applying this technique to the dynamic model is not free of problems either. To be precise, the correlation between the lagged dependent variable and the disturbance term leads to inconsistent results (Nickell, 1981).[7] Nevertheless, we choose to adopt the fixed effects estimator as a first, rough approximation because its simplicity and straightforward application is a clear virtue compared to our main estimation technique, the Arellano-Bond estimator (1991).

Several techniques employing instrumental variables allow to avoid the dynamic panel bias. Amongst the possibilities, an implementation of the Generalized Method of Moments (GMM) proposed by Arrellano and Bond (1991), Difference GMM, stands out as the natural candidate for our purpose. In short, the technique differences all variables in the model and uses lagged values as instruments. Difference GMM is well-suited for panels with a short time dimension and a large number of firms and does not require panels to be balanced. Also, contrary to some alternative instrumental variable techniques such as the Anderson-Hsiao estimator (1981), Difference GMM is capable of estimating models in which certain regressors are endogenous (cfr. infra). The firm-specific patterns of heteroskedasticity and autocorrelation in the idiosyncratic disturbances, which can be expected to be present in our data, also pose no problem for the Arellano-Bond estimator.[8] Correlation across

[6] First, under these circumstances the expected value of the error term will in general not be zero, because of the insurer-specific fixed effects. Second, homoskedasticity can also not be guaranteed, as the variance of the residuals might differ from insurer to insurer. Third, given the dynamic nature of the model, autocorrelation in the error terms is highly likely. Lastly, the residuals cannot be assumed to be independent from the explanatory variables, in part because of the correlation between the lagged dependent variable and the error term (Verbeek, 2004). Moreover, the simultaneity of certain regressors (cfr. infra) also results in such a correlation.

[7] The issue, commonly referred to as the dynamic panel bias, diminishes when the panel length increases, but even for a relatively long panel of 20 periods the bias remains sizeable (Judson & Owen, 1999).

[8] An idiosyncratic disturbance refers to the part of the error term that remain after subtracting the firm fixed effect.

insurers of this part of the error term is, however, not allowed under Difference GMM. Fortunately, this can be achieved by adding year dummy variables. Another restriction the technique imposes is that there should be no second order serial correlation in the idiosyncratic disturbances. Flannery and Hankins (2013) show that Difference GMM performs well even when this condition is violated. Therefore, the possibility of second order serial correlation does not appear to be a great threat to the consistency of the estimates.

When applying Difference GMM one has to make certain implementation decisions that require further consideration.[9] First of all, for each regressor it has to be decided whether to treat it as exogenous, predetermined or endogenous. The lagged dependent variable should always be treated as predetermined (Roodman, 2009a).[10] FD/TA, STDCR, STDIY and CR are considered to be endogenous because of the potential for simultaneity. A greater amount of leverage will, ceteris paribus, increase the periodical interest payments which are, contrary to dividend payments, non-discretionary. Thus, at least some influence of the financial structure on an firm's financing deficit can be expected. As discussed above, leverage increases the insurer's risk of insolvency. It should then be obvious that decisions regarding risk-taking in investment and underwriting activities are intertwined with those pertaining to capital structure. Lastly, the negative relation between demand for insurance and an insurer's default risk, demonstrated by Cummins and Danzon (1997) and Sommer (1996), suggests that the amount of leverage will have an impact on the profitability of the underwriting activities, measured by CR. The remaining regressors are all treated as exogenous variables.

Next, we have to choose between the one-step and two-step estimator. The main difference is that the latter is more efficient, yet results in a downward bias of the standard errors. We choose the two-step estimator in combination with the Windmeijer correction which eliminates the bias (Windmeijer, 2005). It is also important to limit the number of instruments used when applying Difference GMM. This is necessary, first, because a too great instrument count generates a bias in the estimated coefficients and, second, because it weakens the Hansen test of the instruments' joint validity (Roodman, 2009b). One can either impose restrictions on which lags can be used as instruments or use all candidates but combine them into smaller sets. Results for several possible instrument choices are reported. Our notation will be such that, for instance, *lag 2 4* means that from the second to the fourth time-lags are included. When instruments are combined into smaller sets the term *collapsed* will be used.

[9]The STATA function *xtabond2* is used for implementing the Difference GMM estimation.

[10]Indeed, the lagged dependent variable fits the definition of a predetermined variable well: it is independent of current error terms, but clearly influenced by those of the past.

5. Results

5.1 Trade-Off Model

Table 8 displays the estimation of the trade-off model using the fixed effects estimator. LOGTA is significant for life and non-life insurers, regardless of whether the whole sample is included or the pre-Solvency I period is left out. The sign of the relation is, as predicted by the trade-off theory, positive. For non-life insurers CR is significant for both samples as well. Yet, it is important to remark that the latter, which is inversely related to the profitability of the underwriting activities, has a positive coefficient. This contradicts what would be expected from insurers that behave in line with the trade-off theory. For both groups of insurers IY is also found to have a significantly negative impact on leverage, at least when we focus on the post-Solvency I subsample. Again, this goes against what the trade-off theory would predict. Previous studies often find a negative relation between profitability and leverage as well (Myers, 1993; Fama & French, 2002; Welch, 2004). It should be noted that for life insurers the coefficient for CR does have the expected sign. Yet, when the post Solvency I data is used, the effect is no longer significant. STDCR has a significantly negative relation with leverage for non-life insurers, in line with the trade-off theory. When, alternatively, NPW/S is applied as the dependent variable, the results are roughly the same (Table 9).[1] Interestingly, LOGTA is now no longer significant for non-life insurers. No immediate interpretation for this divergence can be thought of. Ignoring for a moment the bias from which the fixed effects estimations potentially suffer, we conclude that the trade-off theory is not unequivocally supported by these results. Many of the variables that for an insurer that trades off the benefits and costs of leverage would be expected to be important are not found to have a significant effect on the sample insurers' capital structure. For those variables for which we do find a significant relation, the sign is often not as predicted by the trade-off theory.

The results from our main estimation technique, Difference GMM, are shown in Tables 10 and 11. LOGTA is still significant, except for life insurers after the introduction of Solvency I. CR is still found to be positively related to leverage for non-life insurers when one looks at the whole sample. Zooming in on the post Solvency I period, however, it looses its significance. One estimation even finds an opposite relation, though this finding is not confirmed when different instruments are used. The significance of IY only survives for the sample of non-life insurers. Its sign is still contrary to trade-off predictions. STDCR looses its capital structure relevance completely when Difference GMM is used. Changing the dependent variable to NPW/S illustrates that those effects that survived the introduction of our more advanced method are not robust with regard to the capital structure measure

[1] Note that when NPW/S is used as the dependent variable, the ratio Premium Ceded/Gross Premium Written (REIN), which measures the reinsurance usage, is left out of the model. Given that Net Premium Written = Gross Premium Written - Premium Ceded, this variable would always have a highly significantly negative coefficient, without this representing any economically interesting relation.

used (Tables 12 and 13). Again, and now even more outspokenly, the significance of an insurer's size evaporates when the alternative measure is used.

As the reader will have noticed, the Difference GMM results are even less in favour of the trade-off theory than those from the fixed effects estimations. STDCR, which was one of the rare variables for which our evidence was in line with the trade-off theory, is no longer significant. Furthermore, no new evidence in support of the trade-off theory is found. LOGTA then is the only factor with estimated coefficients that confirm the trade-off theory, even if this result is not completely robust. Evidently, claiming that the significance of this variable proves that the trade-off theory is relevant for European insurers would be premature. One could construct quite some other theories that would predict the same relation. These findings further reinforce our preliminary conclusion above. Our trade-off model cannot explain the evolution of the capital structures of the insurers in our sample. Thus, Hypothesis 1 is not supported by our evidence.

As a side note, it is interesting to observe that in many instances the results obtained from the full sample differ considerably from those based on the post Solvency I period. This suggests that the introduction of Solvency I did provoke some change in insurers' capital structure behavior.

5.2 Pecking Order Model

Even though the fixed effects estimator delivers biased coefficients, we use it as a first cut. The results are reported in Table 14. For life insurers, FD/TA has a significantly negative effect on leverage. Clearly, this goes against our expectations. Nevertheless, under certain less likely circumstances, the pecking order theory can explain a negative coefficient as well. If we assume that firms have exhausted their ability to borrow and underwrite policies, we would indeed expect financing deficits to result in net equity issues, such that the firm's leverage is reduced. In that case, however, one would expect the absolute value of the coefficient to be much greater than estimated. No significant impact can be detected for non-life insurers. These findings hold both for the whole sample and for the post Solvency I subsample. When NPW/S is used as dependent variable instead of L/TA, a significant effect for life insurers is still observed. Yet, now we also find a significant relation for non-life insurers when the whole sample period is used (Table 15). Again, the negative sign of the estimated coefficients contradicts the standard pecking order expectations. The same story as before could be told to reconcile this finding with the pecking order theory. Yet, with this dependent variable there is no clear prediction regarding how large the coefficient should be. All things considered, even if we take the evidence presented in this paragraph at face value and ignore the problematic features of the fixed effects estimator, the case for the pecking order theory seems rather weak.

We now move on to the results from our main estimation technique, Difference GMM. Using this more accurate, yet more complicated method, the effect of FD/TA on leverage for life insurers is in some estimations still significantly negative (Table 16). However, the effect clearly is not robust with regard to the instruments used. Table 17 shows that in the case of non-life insurers, there still is no significant effect of the pecking order variable in most of our tests of the model. One estimation does find a negative relation, but only at the 10 percent level. It should be noted that in Table 16 the estimates in the fifth column should be interpreted with care because of the weak instruments. A similar caution should be exercised when looking at the first and sixth column of Table 17 because the Hansen test only narrowly fails to reject the null hypothesis of jointly valid instruments. Another potential issue is that in Table 17 the hypothesis of no second order serial correlation is often rejected. As already noted, however, we can expect the estimations not to be too severely affected by this (Flannery & Hankins, 2013). Using the alternative leverage measure and Difference GMM, FD/TA never obtains a coefficient significantly different from zero (Tables 18 and 19).

It can be concluded that our Difference GMM estimations reject the results that were obtained with the fixed effects estimator. Moreover, as already mentioned, these fixed effects results required a rather peculiar story to interpret them in line with the pecking order theory. In sum, our pecking order model is not able to account for the evolution of the capital structure of the insurers in our sample. In other words, Hypothesis 2 is not supported by our results.

5.3 Interpretation and further remarks

The results presented in the two previous subsections show that neither our pecking order nor our trade-off model do a good job at explaining the capital structures of the European insurers in our sample between 1992 and 2012. Yet, this does not suffice to completely dismiss the two theories that lie at the root of these models. In other words, our hypotheses, as formulated in Section 3, cannot be falsified right away.

Suppose for a moment that all the insurers in our sample lived by the rules of the pecking order theory, but that some of them still have quite some room to further increase their leverage, whereas others are for some reason constrained in their ability to issue more debt and underwrite more policies. The coefficient for FD/TA would then be positive for the former and negative for the latter. Merging these two groups into one sample could result in our coefficient not being significantly different from zero, even though the pecking order theory in that case would clearly be relevant. Lemmon and Zender (2010) develop an approach that explicitly takes into account this notion of a firm's debt capacity. Applying a similar model to the specific situation of insurers could be an interesting subject for future research. Of course the theoretical underpinning as well as the empirical model they use would have to be adapted to some extent to make it compatible with the insurance setting.

Some side notes regarding our tests of the trade-off theory are needed as well. Frank and Goyal (2007) highlight the non-negligible differences in results obtained from using different econometric techniques to estimate a target adjustment model. Even though we did use two different estimation procedures, which both led us to the same general conclusion, it cannot be excluded that other estimators, with their own benefits and drawbacks, would yield different results.

A more serious issue is that our trade-off model does not incorporate all factors that could potentially play a role in determining the target capital structure because of a lack of available data to measure them. For instance, it would be interesting to include certain measures related to the composition of an insurer's portfolio of underwritten policies. Different lines of business are typically associated with different levels of volatility. Furthermore, a greater diversification in terms of product type and geography could allow the insurer to diversify its risks more effectively. Thus, in short, the character of the policies underwritten by an insurer could influence its target leverage ratio (C&W, 2012). Some other interesting factors require the availability of data on market values, which we do not have access to in our database. The degree to which the company has opportunities to grow in the future are a typical example of those.[2] A richer model, with a broader and stronger set of target capital structure determinants, could provide a better opportunity for the trade-off theory to prove its merits. Our theoretical exposition in Section 3 could serve as a source of inspiration for researchers who wish to further investigate the relevance of the theories.

Another concern is related to the adjustment towards the target leverage ratio. Some trade-off models allow for heterogeneity in the pace of this adjustment process. C&W (2012) do this by distinguishing insurers based on their Risk Based Capital (RBC) ratio. They posit that differences in insurers' financial strength, as measured by the RBC ratio, lead to diverging speeds of adjustment. Another, more fundamental, approach is proposed by Dang, Kim, and Shin (2012). They use firm characteristics to proxy for differences in adjustment costs and thus in the optimal path of adjustment. Applying such a more advanced framework to the insurance industry would be an interesting endeavour for future studies and would possibly allow to shed more light on the relevance of the trade-off theory for insurers.

Even though the remarks above are certainly important and merit attention in future research in order to provide a clearer view on whether the two major capital structure theories are relevant for the insurance industry, we can interpret our results as preliminary indications that neither of them is. If that finding were to be confirmed in research to come, perhaps this should be seen as a clear signal that the intrinsic complexities of an insurer's capital structure cannot be captured properly by rather generic theories of capital structure such as those considered in this paper. It seems that the kind of models on which the insurance literature has hitherto focused its attention, such as those by Cummins and Sommer (1996), Cummins and Danzon (1997), Harrington and Niehaus (2002) and de Haan and Kakes (2010), to only name a few, in which capital structure figures as one

[2]Note that C&W (2012) use the year-on-year change in net premium written as a substitute measure for growth opportunities. We judge this to be a far to cluttered proxy, given the peculiar accounting treatment of acquisition expenses. As C&W (2012) explain, as a result of this accounting practice future growth opportunities could result in an increase in net premium written as well as a decrease.

element of a broader framework together with, for instance, regulatory and insurance market considerations, are in the end more meaningful.

6. Conclusions

The insurance industry is obviously of crucial importance for a well-functioning economy. Many economically important activities, whether it is buying a car, building a house or starting a business, involve some degree of risk. By allowing individuals and enterprises to limit their risk exposure, insurers reduce the likelihood that economic agents shy away from these activities altogether because of fear for financial losses. Moreover, the premium revenue collected by insurers in return for covering risks is temporarily invested elsewhere in the economy, thus contributing to the financing of other value-creating activities. Solid, well-capitalized insurers that are able to safely carry the risks they underwrite are, therefore, in the general interest. Hence, the capital structure of an insurer is an important subject. Not surprisingly, it plays a pivotal role in many of the models developed in prior insurance literature. On the other hand, there is a great amount of research pertaining to the capital structure of firms in general from which two theories have emerged as the main contenders: the trade-off theory and the pecking order theory. However, most of these studies exclude insurers and other financial firms from their sample. The potential relevance of these theories for insurers has been practically ignored so far, with the exception of C&W (2012).

In the first part of this paper some important characteristics of insurers are highlighted and it is shown that both the trade-off and pecking order theory can be interpreted from the perspective of an insurance company. Providing this theoretical underpinning is indispensable for adapting the existing empirical trade-off and pecking order models in a meaningful way to the insurance industry.

We apply these empirical models to a sample of 1,539 life and 1,913 non-life insurers based in the EU. Given that we use dynamic panel data models, we adopt the Arellano-Bond estimator, also known as Difference GMM. Alternatively, fixed effects estimations are used as well, because of their relative econometric simplicity. Neither the trade-off nor the pecking order model are able to explain the observations in the sample. Rather than interpreting this as conclusive evidence that the theories can be completely dismissed in an insurance setting, we deem our results preliminary. Further, interesting research could apply adapted versions of the more advanced trade-off and pecking order models to insurers. Promising examples include frameworks that incorporate the potential for heterogeneity in firms' speed of adjustment, such as for instance the one by Dang et al. (2012) or pecking order models that explicitly reckon that insurers might have some form of debt capacity (Lemmon & Zender, 2010). Also, a more extensive dataset, including in particular more variables specifically related to the insurance business and stock market data, could allow to build more realistic empirical models.

Appendix

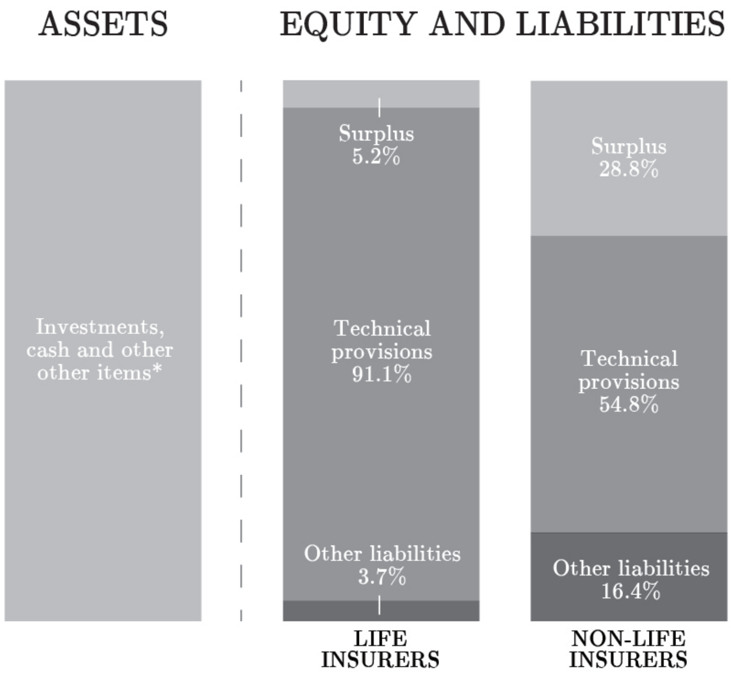
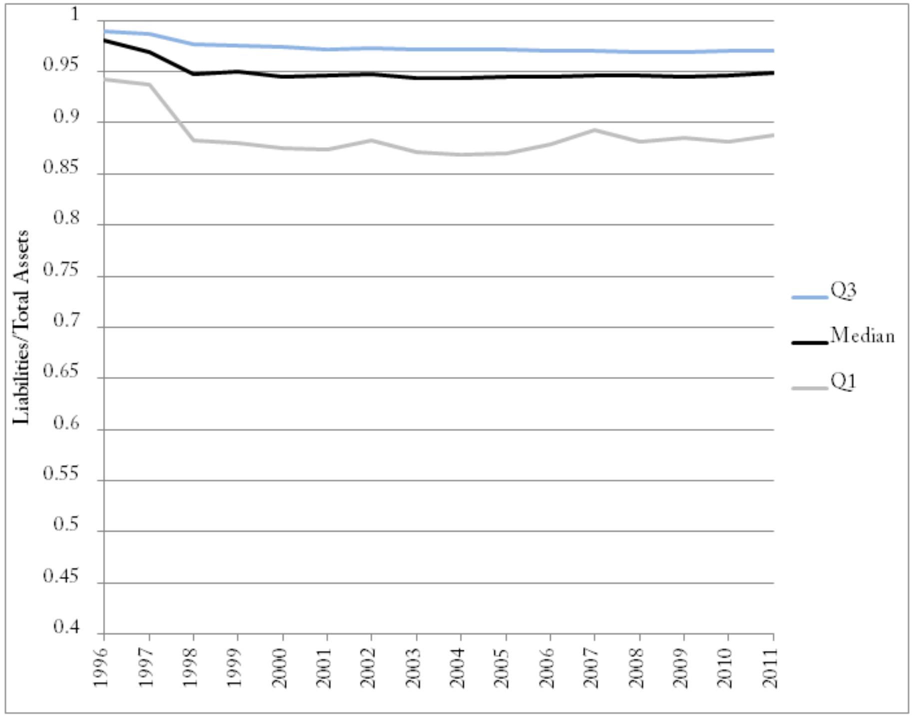
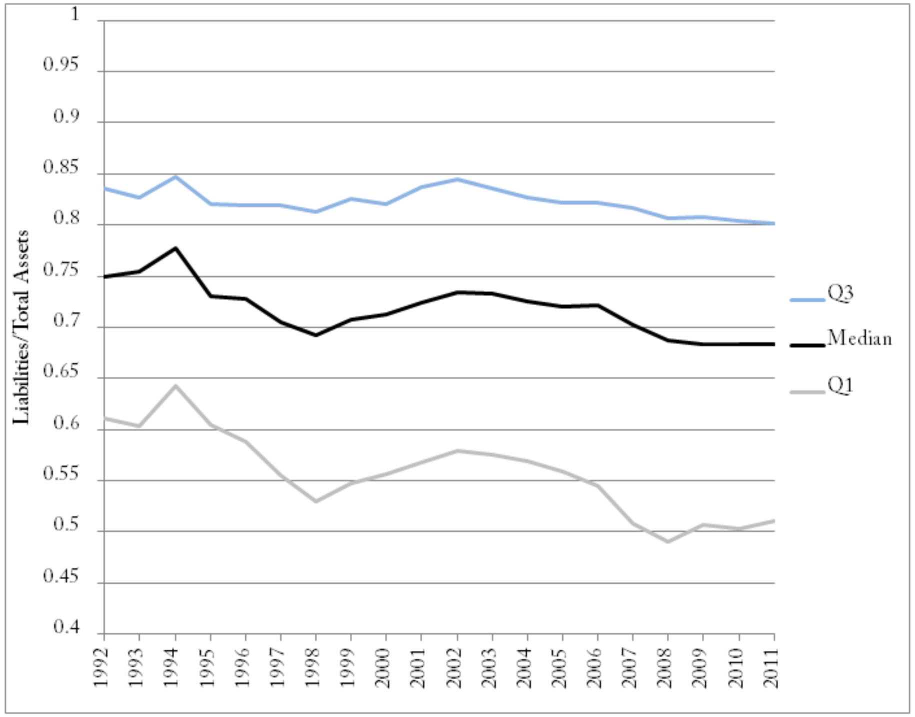


Figure 1: Summary of typical insurer's balance sheet. Percentages based on median values over whole sample period. *No appropriate data available in dataset to provide precise view on typical asset side percentages.

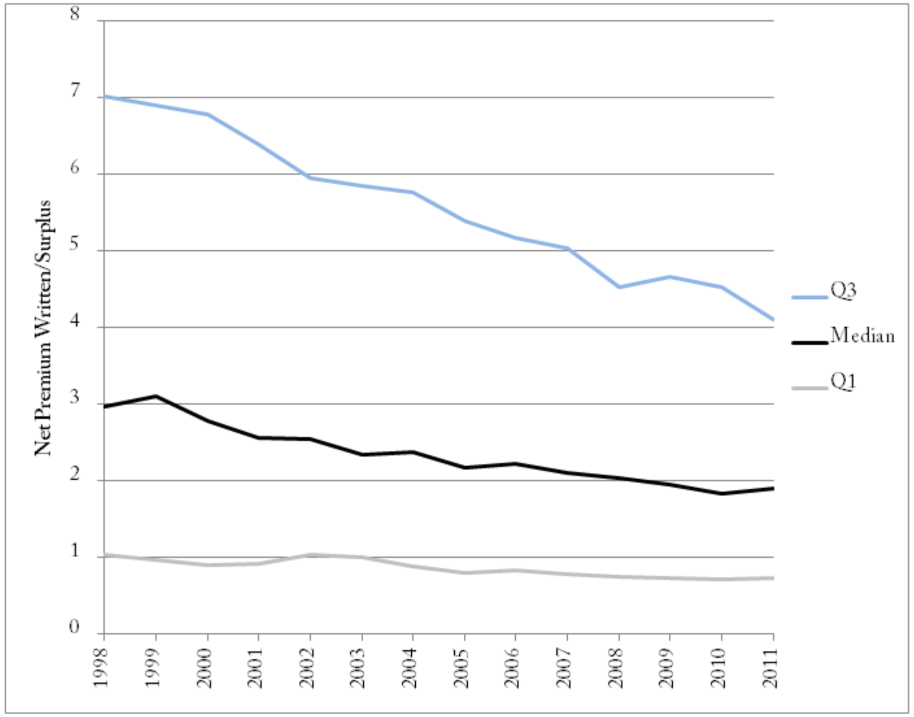


(a) Life Insurers

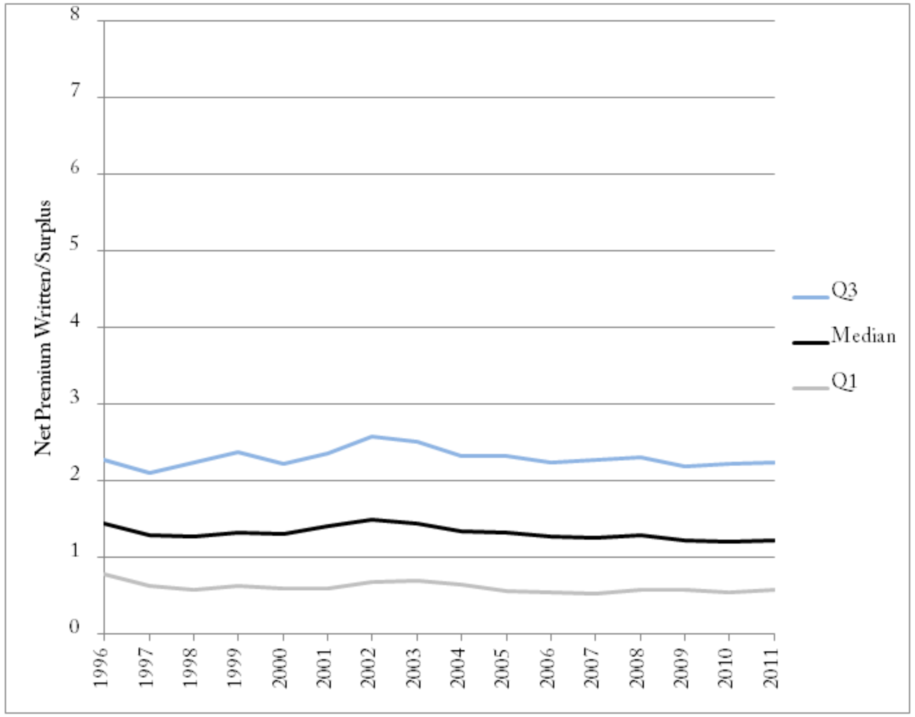


(b) Non-Life Insurers

FIGURE 2: Evolution of Liabilities/Total Assets



(a) Life Insurers



(b) Non-Life Insurers

Figure 3: Evolution of Net Premium Written/Surplus

Table 1: Overview of origin: Life Insurers

	Insurers		Observations	
Country	Number	Share of Total	Number	Share of Total
Austria	37	2.4%	295	2.9%
Belgium	50	3.2%	326	3.2%
Bulgaria	16	1.0%	57	0.6%
Croatia	13	0.8%	31	0.3%
Cyprus	1	0.1%	5	0.0%
Czech Republic	23	1.5%	175	1.7%
Denmark	38	2.5%	270	2.7%
Estonia	10	0.6%	45	0.4%
Finland	12	0.8%	87	0.9%
France	144	9.4%	908	9.0%
Germany	347	22.5%	3299	32.7%
Greece	14	0.9%	45	0.4%
Hungary	24	1.6%	138	1.4%
Ireland	59	3.8%	273	2.7%
Italy	124	8.1%	969	9.6%
Latvia	7	0.5%	18	0.2%
Lithuania	9	0.6%	54	0.5%
Luxembourg	34	2.2%	234	2.3%
Malta	3	0.2%	6	0.1%
Netherlands	50	3.2%	238	2.4%
Poland	15	1.0%	80	0.8%
Portugal	38	2.5%	196	1.9%
Romania	11	0.7%	37	0.4%
Slovakia	19	1.2%	61	0.6%
Slovenia	7	0.5%	29	0.3%
Spain	204	13.3%	885	8.8%
Sweden	36	2.3%	155	1.5%
United Kingdom	194	12.6%	1173	11.6%
Total	1,539	100%	10,089	100%

Table 2: Overview of origin: Non-Life Insurers

	Insurers		Observations	
Country	Number	Share of Total	Number	Share of Total
Austria	42	2.2%	523	3.1%
Belgium	86	4.5%	806	4.8%
Bulgaria	20	1.0%	105	0.6%
Croatia	16	0.8%	72	0.4%
Cyprus	3	0.2%	14	0.1%
Czech Republic	25	1.3%	266	1.6%
Denmark	41	2.1%	374	2.2%
Estonia	14	0.7%	71	0.4%
Finland	10	0.5%	84	0.5%
France	198	10.4%	1648	9.8%
Germany	300	15.7%	4195	24.8%
Greece	9	0.5%	42	0.2%
Hungary	12	0.6%	105	0.6%
Ireland	61	3.2%	476	2.8%
Italy	138	7.2%	1410	8.3%
Latvia	18	0.9%	109	0.6%
Lithuania	8	0.4%	76	0.4%
Luxembourg	21	1.1%	169	1.0%
Malta	10	0.5%	51	0.3%
Netherlands	110	5.8%	729	4.3%
Poland	22	1.2%	180	1.1%
Portugal	41	2.1%	325	1.9%
Romania	17	0.9%	104	0.6%
Slovakia	10	0.5%	63	0.4%
Slovenia	12	0.6%	65	0.4%
Spain	366	19.1%	1983	11.7%
Sweden	44	2.3%	324	1.9%
United Kingdom	259	13.5%	2533	15.0%
Total	1,913	100%	16,902	100%

Table 3: Definition of Variables

Variable	Calculation	Abbreviation
Leverage Measure	(Technical Reserves + Other Liabilities)/Total Assets	L/TA
Alternative Leverage Measure	(Gross Premium Written - Premium Ceded)/Surplus	NPW/S
Financing Deficit	(External Cash Flow - Internal Cash Flow)/Total Assets[1]	FD/TA
Size	Logarithm of Total Assets	LOGTA
Combined Ratio	(Claims Paid + Operating Expenses)/Premium Earned[2]	CR
Investment Yield	Investment Income/Investments	IY
Underwriting Risk	Rolling Standard Deviation of Combined Ratio (3 years)	STDCR
Investment Risk	Rolling Standard Deviation of Investment Yield (3 years)	STDIY
Reinsurance Usage	Premium Ceded/Gross Premium Written	REIN
Group Affiliation	1 if Yes, 0 if No	GRO

[1] Calculation of External and Internal Cash Flow is described under 4.2.2. [2] Premium Earned is the part of the Gross Premium Written that relates to the expired part of the policy term. Typically premiums are received in advance of the period during which a risk is covered. As the term of the policy advances, the premium gradually becomes earned.

Table 4: Summary Statistics: Life Insurers

Variables	Average	Std. Dev.	Minimum	Quartile 1	Median	Quartile 3	Maximum
L/TA	0.8920	0.1500	0.1215	0.8818	0.9477	0.9727	0.9976
NPW/S	4.4110	5.9920	0.0114	0.8672	2.4050	5.7534	42.3834
FD/TA	0.1900	3.9870	−15.6670	−0.1348	−0.0578	0.0040	31.3026
LOGTA	5.7560	1.1540	1.8244	5.1010	5.9453	6.5829	7.7765
CR	0.9290	0.7880	0.0398	0.5062	0.7608	1.0600	5.1271
IY	0.0390	0.0440	−0.1534	0.0256	0.0406	0.0581	0.1613
STDCR	0.2010	0.3290	0.0047	0.0397	0.0896	0.2053	2.0410
STDIY	0.0260	0.0370	0.0005	0.0041	0.0106	0.0290	0.1924
REIN	0.0890	0.1600	−0.0110	0.0581	0.0220	0.0868	0.8410
GRO	0.7340	0.4420	0.0000	0.0000	1.0000	1.0000	1.0000

Based on 10,089 observations from 1,539 life insurers.

Table 5: Summary Statistics: Non-Life Insurers

Variables	Average	Std. Dev.	Minimum	Quartile 1	Median	Quartile 3	Maximum
L/TA	0.6640	0.2100	0.0613	0.5460	0.7124	0.8215	0.9714
NPW/S	1.7310	1.6610	0.0030	0.6122	1.3284	2.3065	10.1680
FD/TA	−1.2280	8.5740	−75.8929	−0.0589	−0.0083	0.0455	0.6046
LOGTA	11.4710	2.8320	3.3220	10.0458	11.7736	13.3616	16.9526
CR	1.0380	0.3280	0.3276	0.9131	0.9974	1.0933	3.1019
IY	0.0450	0.0300	−0.0166	0.0275	0.0400	0.0584	0.1800
STDCR	0.1050	0.1740	0.0037	0.0254	0.0514	0.1060	1.2076
STDIY	0.0110	0.0160	0.0003	0.0032	0.0062	0.0119	0.1077
REIN	0.2780	0.2490	0.0000	0.0714	0.2022	0.4388	0.9625
GRO	0.7120	0.4530	0.0000	0.0000	1.0000	1.0000	1.0000

Based on 16,902 observations from 1,913 non-life insurers.

Table 6: Correlation Table: Life Insurers

Variables	L/TA	NPW/S	FD/TA	LOGTA	CR	IY	STDCR	STDIY	REIN	GRO
L/TA	1.0000									
NPW/S	0.3420***	1.0000								
FD/TA	−0.0450***	−0.0200**	1.0000							
LOGTA	0.4540***	0.1930***	−0.1160***	1.0000						
CR	−0.0460***	−0.2160***	0.0400***	−0.0250**	1.0000					
IY	0.0530***	0.0090	0.0240**	−0.0080	0.0420***	1.0000				
STDCR	−0.1060***	−0.1050***	0.0390***	−0.1120***	0.5600***	−0.0130	1.0000			
STDIY	0.0370***	0.1100***	0.0400***	−0.0900***	0.1350***	0.1390***	0.2090***	1.0000		
REIN	−0.1810***	−0.1630***	0.0080	−0.1830***	0.1300***	−0.0300***	0.1430***	0.1080***	1.0000	
GRO	0.0280***	0.0500***	−0.0010	0.0240**	−0.0400***	0.0110	−0.0420***	−0.0620***	−0.0000	1.0000

Based on 10,089 observations from 1,539 life insurers. *** p<0.01, ** p<0.05, * p<0.1.

Table 7: Correlation Table: Non-Life Insurers

Variables	L/TA	NPW/S	FD/TA	LOGTA	CR	IY	STDCR	STDIY	REIN	GRO
L/TA	1.0000									
NPW/S	0.4700***	1.0000								
FD/TA	0.0700***	0.0220***	1.0000							
LOGTA	0.3900***	0.0700***	0.1820***	1.0000						
CR	0.0300***	−0.0540***	−0.0310***	−0.0410***	1.0000					
IY	−0.0080	0.0220***	−0.0410***	−0.0490***	−0.0290***	1.0000				
STDCR	−0.1880***	−0.2190***	0.0560***	−0.1510***	0.5000***	−0.0290***	1.0000			
STDIY	−0.1020***	−0.0200**	−0.0000	−0.0470***	0.0630***	0.2770***	0.0920***	1.0000		
REIN	−0.1860***	−0.3140***	−0.0310***	−0.1830***	0.1030***	0.0100	0.2760***	0.0190*	1.0000	
GRO	0.1530***	−0.0350***	0.0490***	0.2710***	0.0090	0.0030	−0.0530***	0.0210**	−0.0860***	1.0000

Based on 16,902 observations from 1,913 non-life insurers. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 8: Trade-Off. Fixed Effects Estimation. (L/TA)

	Life Insurers		Non-Life Insurers	
Explanatory variable	(1)	(2)	(1)	(2)
$(L/TA)_{t-1}$	0.6190 ***	0.4620 ***	0.6240 ***	0.4350 ***
	0.0359	0.0411	0.0172	0.0334
L/TA	0.0395 ***	0.0896 **	0.0218 ***	0.0382 ***
	0.0107	0.0366	0.0036	0.0075
CR	−0.0079 ***	−0.0038	0.0430 ***	0.0339 ***
	0.0023	0.0024	0.0059	0.0099
IY	−0.0118	−0.0330 **	−0.0553	−0.2030 **
	0.0210	0.0152	0.0546	0.0957
STDCR	0.0050	0.0028	−0.0301 ***	−0.0301 **
	0.0043	0.0040	0.0090	0.0120
STDIY	0.0030	0.0454 *	−0.0285	−0.1010
	0.0425	0.0273	0.0714	0.1370
REIN	−0.0289	−0.0408	−0.0057	−0.0261
	0.0281	0.0418	0.0099	0.0162
GRO	0.0028	−0.0011	−0.0006	−0.0009
	0.0028	0.0016	0.0031	0.0052
Constant	0.1100	−0.0618	−0.0504	−0.1120
	0.0782	0.2120	0.0416	0.0964
Number of observations	6,237	3,090	10,465	4,514
F	44.1800 ***	26.0000 ***	119.2000 ***	29.8300 ***
Adjusted R^2	0.5480	0.4650	0.4920	0.2670

Standard errors below the estimated coefficients. *** p<0.01, ** p<0.05, * p<0.1.
(1) Pre and Post Solvency I; (2) Post Solvency I.
Both firm and year dummies are included.

Table 9: Trade-Off. Fixed Effects Estimation. (NPW/S)

	Life Insurers		Non-Life Insurers	
Explanatory variable	(1)	(2)	(1)	(2)
$(NPW/S)_{t-1}$	0.4660 ***	0.2450 ***	0.4440 ***	0.1450 ***
	0.0441	0.0901	0.0289	0.0522
LOGTA	1.2320 ***	2.4330 ***	0.0488	−0.0087
	0.4600	0.8280	0.0304	0.0811
CR	−1.4550 ***	−1.2130 ***	0.1400 ***	0.0834
	0.1990	0.2000	0.0519	0.0826
IY	−0.5060	0.0957	−0.1320	−0.4440
	1.4060	1.4300	0.5210	0.8640
STDCR	−0.3070	−0.0958	−0.3150 ***	−0.1100
	0.2910	0.2850	0.0902	0.1660
STDIY	4.2050 *	3.7020	0.9020	−1.1720
	2.3680	2.9440	0.7130	1.0800
GRO	−0.0553	−0.1440	−0.0744	−0.2040 **
	0.1180	0.1720	0.0461	0.0862
Constant	−3.9990	−10.8200 **	0.1980	1.6270
	2.6520	4.7260	0.3720	1.0260
Number of observations	7,506	3,878	11,211	4,826
F	34.7900 ***	17.7700 ***	27.3400 ***	5.5160 ***
Adjusted R^2	0.3520	0.1700	0.2350	0.0331

Standard errors below the estimated coefficients. *** p<0.01, ** p<0.05, * p<0.1.
(1) Pre and Post Solvency I; (2) Post Solvency I.
Both firm and year dummies are included.

Table 10: Trade-Off: Life Insurers. (L/TA)

	Pre and Post Solvency I			Post Solvency I		
Explanatory variable	(1)	(2)	(3)	(1)	(2)	(3)
$(L/TA)_{t-1}$	0.6040 ***	0.5510 ***	0.6390 ***	0.6060 ***	0.7030 ***	0.6240 *
	0.0586	0.0678	0.1060	0.1790	0.2100	0.3660
LOGTA	0.0290 ***	0.0382 ***	0.0334 *	0.0292	0.0443	0.0549
	0.0107	0.0133	0.0182	0.0280	0.0389	0.0508
CR	−0.0010	0.0008	−0.0040	0.0126 **	0.0121	0.0012
	0.0034	0.0031	0.0125	0.0059	0.0087	0.0143
IY	−0.0010	−0.0060	0.0133	0.0086	0.0073	−0.0220
	0.0125	0.0117	0.0161	0.0189	0.0231	0.0314
STDCR	−0.0054	−0.0068	−0.0174	−0.0128	−0.0034	−0.0112
	0.0073	0.0084	0.0130	0.0097	0.0307	0.0212
STDIY	−0.0450	−0.0292	0.0427	0.0308	0.0048	−0.0275
	0.0465	0.0487	0.0997	0.0394	0.0686	0.0983
REIN	0.0147	0.0401	−0.0055	0.0272	0.0481	0.0478
	0.0356	0.0388	0.0631	0.0635	0.0884	0.0736
GRO	−0.0003	−0.0002	0.0015	0.0000	0.0000	−0.0008
	0.0017	0.0018	0.0027	0.0020	0.0027	0.0029
Number of observations	5,212	5,212	5,212	2,333	2,333	2,333
Number of instruments	79	74	26	33	28	18
Hansen test (p-value)	0.7600	0.7950	0.5310	0.4710	0.8100	0.4940
Arellano-Bond test (p-value)	0.7680	0.7780	0.8190	0.6110	0.7930	0.6470

Standard errors below the estimated coefficients. *** p<0.01, ** p<0.05, * p<0.1. Null hypothesis of Hansen test is jointly valid instruments. Null hypothesis of Arellano-Bond test is no second order serial correlation. Year dummies are included. Country dummies and cash deposits were dropped because of collinearity. Instruments used: (1) lags 3 and further, collapsed; (2) lags 4 and further, collapsed; (3) lags 3 and 4, collapsed.

Table 11: Trade-Off: Non-Life Insurers. (L/TA)

	Pre and Post Solvency I			Post Solvency I		
Explanatory variable	(1)	(2)	(3)	(1)	(2)	(4)
$(L/TA)_{t-1}$	0.7780 ***	0.9980 ***	0.6840 ***	0.4190 ***	0.6740 ***	0.5160
	0.0722	0.0945	0.0808	0.1280	0.2560	0.3230
LOGTA	0.0158 ***	0.0089 **	0.0200 ***	0.0233 ***	0.0288 ***	0.0330 **
	0.0043	0.0044	0.0049	0.0067	0.0071	0.0139
CR	0.0686 ***	0.0680	0.0708 ***	−0.0557 **	−0.0644	0.1050
	0.0208	0.0443	0.0175	0.0227	0.0403	0.1870
IY	−0.0777	−0.0462	−0.0909	−0.2130 **	−0.0886	−0.3390 *
	0.0618	0.0635	0.0734	0.1060	0.1180	0.2030
STDCR	−0.0064	0.0561	−0.0405	−0.0041	0.0548	−0.3050
	0.0304	0.0358	0.0497	0.0516	0.0605	0.5190
STDIY	−0.0124	−0.1450	−0.0764	−0.3740	−0.5660	1.0990
	0.2140	0.2120	0.4460	0.3610	0.4310	1.7420
REIN	0.0039	0.0267	0.0118	−0.0517	0.0657	0.2020
	0.0321	0.0363	0.0371	0.1030	0.1570	0.3290
GRO	−0.0020	−0.0040	−0.0014	0.0028	0.0053	−0.0040
	0.0033	0.0037	0.0034	0.0064	0.0071	0.0122
Number of observations	8,815	8,815	8,815	3,423	3,423	3,423
Number of instruments	97	26	92	32	15	15
Hansen test (p-value)	0.1130	0.6330	0.1170	0.2290	0.2180	0.5010
Arellano-Bond test (p-value)	0.0882	0.1030	0.1160	0.0573	0.1340	0.6620

Standard errors below the estimated coefficients. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Null hypothesis of Hansen test is jointly valid instruments. Null hypothesis of Arellano-Bond test is no second order serial correlation. Year dummies are included. Country dummies and cash deposits were dropped because of collinearity. Instruments used: (1) lags 3 and further, collapsed; (2) lags 3 and 4, collapsed; (3) lags 4 and further, collapsed; (4) lags 4 and 5, collapsed.

Table 12: Trade-Off: Life Insurers. (NPW/S)

	Pre and Post Solvency I			Post Solvency I		
Explanatory variable	(1)	(2)	(3)	(1)	(2)	(3)
$(NPW/S)_{t-1}$	0.7480 ***	0.9060 ***	1.0560 ***	0.5190 *	0.9240 ***	0.7970 ***
	0.0934	0.0828	0.1590	0.3080	0.2990	0.2600
LOGTA	0.4750	0.2070	0.9080	−1.2190	−0.7180	1.1210
	0.5030	0.4350	0.8100	2.3600	1.2730	2.0280
CR	−0.4990	1.1590	0.9050	−0.3410	−2.8820	−3.2710
	0.6780	1.1370	1.6400	1.3180	2.9190	3.2540
IY	0.2650	0.5500	−0.6540	1.8370	0.5310	−1.2910
	1.5580	1.7740	2.4650	2.8280	3.7210	4.3520
STDCR	1.5280	1.1380	7.9960 *	−5.0730	3.3760	8.0050
	1.4700	1.0860	4.5810	6.9880	3.7940	8.8050
STDIY	1.6370	−0.2320	9.1490	8.8450	2.3230	4.2830
	4.3710	8.6300	18.2100	12.1600	8.5170	9.6120
GRO	−0.0285	−0.0379	0.1020	−0.0856	−0.0848	−0.0552
	0.1270	0.1310	0.2110	0.2510	0.1650	0.1570
Number of observations	6,221	6,221	6,221	2,905	2,905	2,905
Number of instruments	62	28	24	24	20	16
Hansen test (p-value)	0.1380	0.3500	0.7390	0.7620	0.5620	0.7320
Arellano-Bond test (p-value)	0.2070	0.2120	0.2540	0.4470	0.3670	0.4940

Standard errors below the estimated coefficients. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Null hypothesis of Hansen test is jointly valid instruments. Null hypothesis of Arellano-Bond test is no second order serial correlation. Year dummies are included. Country dummies and cash deposits were dropped because of collinearity. Instruments used: (1) lags 4 and further, collapsed; (2) lags 3 to 5, collapsed; (3) lags 4 and 5, collapsed.

Table 13: Trade-Off: Non-Life Insurers. (NPW/S)

	Pre and Post Solvency I			Post Solvency I		
Explanatory variable	(1)	(2)	(3)	(1)	(2)	(4)
$(NPW/S)_{t-1}$	0.4420 ***	0.5300 ***	0.6560 ***	−0.2110	−0.1140	0.4210 ***
	0.1010	0.0734	0.0634	0.6180	0.3510	0.0820
LOGTA	0.0742 **	0.0578	0.0544	0.1530	0.1260	0.1230
	0.0374	0.0360	0.0525	0.1590	0.1290	0.0819
CR	−0.1600	−0.1190	0.1780	−0.5140	−0.5540	0.8720
	0.2530	0.1840	0.3360	0.9330	0.9620	0.6120
IY	−1.7540	−0.8040	−0.3910	0.1060	0.2220	−0.6700
	1.3030	0.8960	0.8590	2.3870	1.7290	1.0710
STDCR	0.2580	0.1130	0.3180	3.3410	2.7560	0.8050 *
	0.5050	0.4210	0.8360	2.4730	2.2580	0.4760
STDIY	17.0400	7.6810	4.5060	−11.7500	−12.7700	−3.3670
	11.2100	7.0170	5.7670	17.9700	15.1600	3.0040
GRO	−0.0643	−0.0575	−0.0522	−0.2190	−0.1910	−0.2350 **
	0.0516	0.0471	0.0447	0.1430	0.1260	0.0929
Number of observations	9,452	9,452	9,452	3,655	3,655	3,655
Number of instruments	72	76	24	20	24	13
Hansen test (p-value)	0.2330	0.1200	0.3490	0.5120	0.3400	0.7600
Arellano-Bond test (p-value)	0.1910	0.0669	0.0358	0.7410	0.8770	0.0138

Standard errors below the estimated coefficients. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Null hypothesis of Hansen test is jointly valid instruments. Null hypothesis of Arellano-Bond test is no second order serial correlation. Year dummies are included. Country dummies and cash deposits were dropped because of collinearity. Instruments used: (1) lags 5 and further, collapsed; (2) lags 4 and further, collapsed; (3) lags 4 and 5, collapsed; (4) lags 2 and 3, collapsed.

Table 14: Pecking Order. Fixed Effects Estimation. (L/TA)

	Life Insurers		Non-Life Insurers	
Explanatory variable	(1)	(2)	(1)	(2)
$(L/TA)_{t-1}$	0.6660 ***	0.5690 ***	0.6490 ***	0.4490 ***
	0.0330	0.0364	0.0145	0.0254
FD/TA	−0.0005 ***	−0.0005 **	−0.0030	−0.0240
	0.0002	0.0002	0.0138	0.0175
Constant	0.3000 ***	0.3870 ***	0.2310 ***	0.3580 ***
	0.0304	0.0328	0.0098	0.0165
Number of observations	8,395	4,579	14,374	6,499
F	62.4400 ***	56.9900 ***	151.8000 ***	119.5000 ***
Adjusted R^2	0.5250	0.4200	0.4700	0.2320

Standard errors below the estimated coefficients. *** p<0.01, ** p<0.05, * p<0.1.
(1) Pre and Post Solvency I; (2) Post Solvency I.
Both firm and year dummies are included.

Table 15: Pecking Order. Fixed Effects Estimation. (NPW/S)

	Life Insurers		Non-Life Insurers	
Explanatory variable	(1)	(2)	(1)	(2)
$(NPW/S)_{t-1}$	0.4350 ***	0.2050 **	0.4610 ***	0.1740 ***
	0.0510	0.1020	0.0239	0.0381
FD/TA	−0.0258 **	−0.0292 **	−0.2930 **	−0.5210
	0.0106	0.0148	0.1240	0.3300
Constant	2.0070 ***	2.7690 ***	0.8100 ***	1.3460 ***
	0.2040	0.3850	0.0396	0.0647
Number of observations	8,303	4,492	14,268	6,432
F	22.7500 ***	10.6700 ***	47.0600 ***	17.1400 ***
Adjusted R^2	0.2250	0.0614	0.2470	0.0506

Standard errors below the estimated coefficients. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.
(1) Pre and Post Solvency I; (2) Post Solvency I.
Both firm and year dummies are included.

Table 16: Pecking Order: Life Insurers. (L/TA)

	Pre and Post Solvency I			Post Solvency I		
Explanatory variable	(1)	(2)	(3)	(1)	(2)	(3)
$(L/TA)_{t-1}$	0.7960 ***	0.7790 ***	0.7810 ***	0.5410 ***	0.7440 ***	0.4890 ***
	0.0714	0.0485	0.0689	0.1630	0.1020	0.1360
FD/TA	−0.0007	−0.0013 *	0.0007	0.0074	−0.0013 ***	0.0039
	0.0018	0.0007	0.0019	0.0168	0.0005	0.0044
Number of observations	7,085	7,085	7,085	3,501	3,501	3,501
Number of instruments	16	64	18	8	24	10
Hansen test (p-value)	0.5190	0.2450	0.1770	0.3920	0.0118	0.4070
Arellano-Bond test (p-value)	0.8780	0.8820	0.7990	0.3850	0.3000	0.1220

Standard errors below the estimated coefficients. *** p<0.01, ** p<0.05, * p<0.1. Null hypothesis of Hansen test is jointly valid instruments. Null hypothesis of Arellano-Bond test is no second order serial correlation. Year dummies are included. Instruments used: (1) lags 2 and 3, collapsed; (2) lags 2 and 3; (3) lags 3 and further, collapsed.

Table 17: Pecking Order: Non-Life Insurers. (L/TA)

	Pre and Post Solvency I			Post Solvency I		
Explanatory variable	(1)	(2)	(3)	(1)	(2)	(3)
$(L/TA)_{t-1}$	0.8170 ***	0.8100 ***	0.6670 ***	0.5020 ***	0.4680 *	0.0203
	0.0540	0.0596	0.0725	0.1330	0.2400	0.6430
FD/TA	−0.0119	−0.0777	−0.0801 *	−0.0394	−0.0845	−0.0900
	0.0462	0.0489	0.0465	0.0504	0.0611	0.0826
Number of observations	12,301	12,301	12,301	4,893	4,893	4,893
Number of instruments	87	49	47	27	13	11
Hansen test (p-value)	0.1170	0.2710	0.4530	0.1300	0.2950	0.1030
Arellano-Bond test (p-value)	0.0351	0.0418	0.0556	0.0703	0.0762	0.3790

Standard errors below the estimated coefficients. *** p<0.01, ** p<0.05, * p<0.1. Null hypothesis of Hansen test is jointly valid instruments. Null hypothesis of Arellano-Bond test is no second order serial correlation. Year dummies are included. Instruments used: (1) lags 2 and 3; (2) lag 3; (3) lag 4.

Table 18: Pecking Order: Life Insurers. (NPW/S)

	Pre and Post Solvency I			Post Solvency I		
Explanatory variable	(1)	(2)	(3)	(1)	(2)	(3)
$(NPW/S)_{t-1}$	0.7800 ***	0.7330 ***	0.9030 ***	0.7290 ***	0.4220	0.9810 ***
	0.0648	0.0965	0.0786	0.1530	0.3080	0.2230
FD/TA	−0.2300	−0.0174	−0.1130	0.3070	−0.0202	0.4990
	0.1540	0.0125	0.1100	0.3250	0.0308	1.6150
Number of observations	7,007	7,007	7,007	3,432	3,432	3,432
Number of instruments	16	63	18	8	23	10
Hansen test (p-value)	0.1240	0.4550	0.5700	0.1160	0.3760	0.5670
Arellano-Bond test (p-value)	0.4230	0.4310	0.4140	0.9730	0.8930	0.9650

Standard errors below the estimated coefficients. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Null hypothesis of Hansen test is jointly valid instruments. Null hypothesis of Arellano-Bond test is no second order serial correlation. Instruments used: (1) lags 2 and 3, collapsed; (2) lags 3 and 4; (3) lags 3 and 5, collapsed.
Year dummies are included.

Table 19: Pecking Order: Non-Life Insurers. (NPW/S)

	Pre and Post Solvency I			Post Solvency I		
Explanatory variable	(1)	(2)	(3)	(1)	(2)	(3)
$(NPW/S)_{t-1}$	0.5330 ***	0.7580 ***	0.5590 ***	0.4060 ***	0.2910 *	0.4510 ***
	0.1090	0.0539	0.0936	0.1130	0.1740	0.1070
FD/TA	4.5280	−0.9190	3.4380	0.0659	−0.5600	−0.2110
	4.0580	0.8570	3.1840	1.8380	1.1660	1.6350
Number of observations	12,210	12,210	12,210	4,838	4,838	4,838
Number of instruments	17	49	19	5	13	7
Hansen test (p-value)	0.2110	0.1710	0.2880	0.3570	0.5450	0.4820
Arellano-Bond test (p-value)	0.0234	0.0369	0.0160	0.0522	0.1700	0.0623

Standard errors below the estimated coefficients. *** p<0.01, ** p<0.05, * p<0.1. Null hypothesis of Hansen test is jointly valid instruments. Null hypothesis of Arellano-Bond test is no second order serial correlation. Year dummies are included. Instruments used: (1) lags 2 and 3, collapsed; (2) lag 3; (3) lags 2 to 4, collapsed.

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