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Product-Market Strategy and Underwriting Performance in the United Kingdom's (UK) Property-Casualty Insurance Market

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Abstract

Drawing on a framework from the organizational economics literature, we utilize a panel data design to examine empirically the effect of motor insurance and liability insurance business on the overall underwriting performance of insurers operating in the United Kingdom's (UK) property-casualty insurance market. We find that participation in liability insurance contributes positively to underwriting performance, whereas motor insurance is associated with inferior underwriting performance. Additionally, we find that higher reinsurance ratio is associated with better underwriting performance, but reduced profit margins. Our results show that higher leverage too is associated with better underwriting performance. We conclude that our results could have potentially important commercial and/or policy implications.

Key words: strategic finance; underwriting performance; insurance; United Kingdom.

Classification code: G22; G23; L11

1. Introduction

Insurance markets are distinguishable from many other sectors of the economy in that levels of risk and informational uncertainty, complexity of products, modes of distribution, and intensity of competition vary widely across lines of business. This is particularly the case in property-casualty (non-life) insurance with its multiple risk specialities, intrinsic uncertainties, different levels of managerial discretion, and variable availability of actuarial data and risk-based information systems (Adams and Jiang, 2016). Indeed, property-casualty insurance sector embraces a much wider range of insurance product-types than life insurance whose products tend to mainly cover mortality-type personal lines of insurance based on standardized actuarial tables. Additionally, in insurance markets, high monitoring and control costs can be incurred as a result of acute information asymmetries at the point-of-sale (i.e., adverse selection) and careless consumer behaviour ex-post (i.e., moral hazard). These imperfections have potentially important implications for product-market strategy, competition, and financial performance. Ma and Ren (2012) further note that insurers differ from non-financial firms in that they incur high operational expenditures up-front (e.g., advertising expenses and sales commissions) and after the point-of-sale (e.g., policy servicing and claims settlement costs).

Also, tough regulatory requirements (e.g., with regard to capital maintenance) and the risk of policyholders switching insurance providers impose strategic constraints on the pricing of insurance business (Harrington and Danzon, 1994). Moreover, as financial intermediaries, insurers (like banks) transform assumed risk liabilities into cash-generating assets, and therefore, they are more highly levered than general industrial firms (Mayers and Smith, 1981). Therefore, compared with their counterparts in other industrial sectors (e.g., manufacturing), insurance managers tend to have less strategic flexibility to lower prices to increase short-term product-market share. Together, these features make insurance markets potentially interesting domains for research.

Drawing a framework from the organizational economics literature, we utilize a panel data research design to examine whether underwriting performance - the core function of risk-trading insurance firms - differs between firms operating in the legal liability and motor vehicle insurance segments of the UK's property-casualty insurance market. These two product-markets that are the focus here have distinctive characteristics. For example, motor insurance in developed economies, such as the United Kingdom (UK) and United States (US), is compulsory, at least for third party risks, with premiums based on measurable factors (e.g., years driving experience, number and value of previous claims), and so motor insurance tends to be characterized by standardized policies (e.g., in terms of coverage and pricing formulae) and fairly predictable ('short-tail') risks (Li, Lin, Liu and Woodside, 2012)[1]. In addition, profit

[1] Motor insurance is a relatively more standardized product than other forms of asset insurance, such as property insurance. For example, the insurability and rates of premium for properties are dependent on a plethora of underwriting criteria such as function (e.g., commercial versus residential), scale (e.g., high-rise versus low-rise), design (e.g., conformity with different building regulations), and location (e.g., high versus low environmental risk). As a result, motor insurance is the archetypical standard insurance line. In comparison, legal liability insurance policies are usually bespoke linked to specific risk exposures (e.g., pollution damages) faced by particular commercial policyholders. Furthermore, the upper limit of liability covers within UK motor insurance policies tend to be pre-specified in policy documents, and exclude certain claims (e.g., damages for mental stress or loss of earnings). Moreover, bodily injury claims arising from motor vehicle accidents are invariably not subject to the same degree of legal dispute as more complex and higher value general legal liability claims, and therefore, usually settled in year a policy is in-force (i.e., 'short-tail'). The quantum of general legal liability claims are

margins tend to be stable over time as a result of statutory compulsion, and so motor insurance could particularly suit insurers that wish (e.g., for stock price protection purposes) to control excessive volatility on their underwriting portfolios. However, at the same time, underwriting profits tend to be modest as a result of minimal barriers to entry, price/product competition, and constant returns to scale (Towers Watson, 2013). Under such business conditions, product/process innovations, which feed an insurance firm's strategic competitive advantage, can be easily acquired and quickly replicated by rivals in the market. This often leads to firms operating in homogeneous lines of business, like motor insurance, becoming 'price takers' with high price elasticity of demand for their products (Datamonitor, 2014a). This situation can put additional downward pressure on profit margins and lower underwriting performance, particularly in periods of enhanced price and product competition and 'soft' underwriting cycles conditions (Harrington and Danzon, 1994) [2]. Laas, Schmeiser and Wagner (2016) also add that such tough environmental conditions have typified the UK and other major European motor insurance markets (e,g., Germany) in recent times.

In contrast, firms operating in legal liability lines of insurance are subject to relatively less statutory compulsion (e.g., beyond compulsory minimum levels of employers' liability - currently £5 million in the UK), less competition (e.g., due to high specialist knowledge barriers of entry), and more unpredictable ('long-tail') risks that necessitate the use of highly specialized underwriting knowledge and advanced information systems (Winter, 1991, 1994). Yet, the application of intellectual capital and the propitious use of risk-based underwriting

often subject to legal judgements not in place when policies were first underwritten and are 'long-tail' in the sense that they can take several years to resolve. Hence, our short-tail/long-tail distinction between motor and legal liability insurance generally holds.

[2] The underwriting cycle is the process by which the profit margins of property-casualty insurers fluctuate over time in response to periodical rises (e.g., as a result of unexpectedly severe losses) and falls (e.g., due to the inflow of market capital and consequential increase in market underwriting capacity) in product-market premiums (Cummins and Doherty, 2002).

information can, at least in theory, enable specialist legal liability insurers to profitably price and accurately reserve for assumed liability risks, and therefore, realize above average-market rates of return (i.e., 'quasi-economic rents'), especially during the 'hard' stages of the underwriting cycle. Such capabilities can allow strategic risk-taking firms, such as legal liability insurers, to achieve sustainable competitive advantages by focusing on niche product-market segments, and write bespoke liability coverage beyond the standardized policy forms found in routine liability insurance (Winter, 1991, 1994)[3].

Against this back-drop, our study could help highlight differences in underwriting performance in two important segments of the property-casualty insurance market, which nonetheless have intrinsically different informational and transactional characteristics. Such within-industry structural variability makes the property-casualty insurance industry a potentially interesting domain within which to conduct our comparative performance analysis. Our study is further motivated in that our empirical results could, for example, enable investors to make effective capital allocation decisions across insurance firms as well as enable regulators to better evaluate the need for differential capital maintenance and reserving requirements for firms operating in different lines of insurance business. In this regard, the results of the present study could have potentially important commercial and policy implications.

The remainder of our paper is organized as follows. Section 2 provides institutional background information on the UK's property-casualty insurance market and justifies the UK as a domain within which to focus the study. Section 3 introduces our information economics framework and develops the research hypotheses. Section 4 describes the research design

[3] Liability insurers' specialist underwriting knowledge and expertise enables them to write policies that reflect changing legal liability loss exposures across industrial sectors and over time.

employed, including a description of the data, description of the model, and definition of the variables. Section 5 discusses the empirical results, while section 6 concludes the paper.

2. Institutional Background

The UK is currently the largest (life and non-life) insurance market in Europe and the fourth largest in the world after the US, Japan, and China (Association of British Insurers, 2017a)[4].The motor vehicle and legal liability segments of the UK's property-casualty insurance market are different, with the former being relatively more open and price competitive than the latter[5]. For example, the Association of British Insurers (2017) reports that overall, the UK motor insurance sector has consistently incurred underwriting losses since the mid-1990s. Currently, approximately 60 or so insurers actively operated in each of the motor vehicle and legal liability segments of the UK's property-casualty insurance market. In 2016 annual premiums (net of reinsurance) in the UK motor vehicle insurance line amounted to approximately £9 billion (i.e., about 30% of total domestic property-casualty insurance market premiums of just over £30 billion) compared with roughly £3 billion (i.e., approximately 10% of total annual net property-casualty insurance market premiums) for the liability insurance sector, with the remainder accounted for by other lines, such as property and pecuniary insurance (Association of British Insurers, 2017b).

[4] When international syndicated insurance and reinsurance business via Lloyd's of London is taken into account, the property-casualty sector of the UK insurance market ranks third after the US and Japan generating gross annual premiums in excess of £48 billion (Caporale, Cerrato and Zhang, 2017).

[5] It is usual practice for motor vehicle insurance policies to include standard cover for public liability risks, and in the UK third party liability is a statutory minimum requirement under the Road Traffic Act (1988, section 143). However, the costs of such coverage are included in the standard premium for all motor insurance policies underwritten in the UK. The size of liability risk loading of the standard risk premium will vary between motor insurers, and across time, and be dependent on various factors, such as the underwriter's assessment of the accident risk of the insured, insurance firm-specific actuarial estimates, and the level of retained capital and reserves. The liability insurance component may also be underwritten with liability insurance underwriters operating under a partnership agreement with the primary motor vehicle insurer. In the UK, the proportion of a typical premium that covers physical vehicle damage and bodily injury is, however, not discernible from public sources.

As noted earlier, general legal liability insurance comprises statutory minimum levels of coverage (e.g., employers' public and product liabilities) as well as discretionary levels of lawsuit risk protection (e.g., professional indemnity insurance). In the UK, the legal liability segment of the insurance market is dominated by about ten or so mainly large insurance firms comprising both UK-owned operatives (e.g., Aviva plc and Hiscox plc) and UK licensed foreign insurers (e.g., Zurich and Allianz). However, there are also about 50 or so other UK-based liability insurers, including some Lloyd's of London syndicates writing legal liability insurance in niche lines of business (e.g., professional indemnity). These large property-casualty insurers also write other risk business, including motor insurance, and therefore they can realize scale and scope economies from increased premium volumes and synergies from shared intra-corporate underwriting expertise across different lines of insurance business. The combined share of annual gross premiums generated by the top-10 insurers account for approximately 70% of the liability insurance segment of the UK property-casualty market (Datamonitor, 2014b). These liability insurers also transact a significant amount of international business - approximately £1.5 billion at the Lloyd's of London insurance market, most of which is written with US clients (Lloyd's of London, 2014). In contrast, the ten or so largest (mainly UK-owned) motor insurance carriers (e.g., Admiral plc and Royal Sun Alliance plc) in total account for roughly 45% or so of product-market share in terms of annual gross premiums (Towers Watson, 2013). Indeed, Cannon, Cipriani and Bazar-Rosen (2016) report that the UK motor insurance market is competitive with the five-firm concentration ratio being only 55% in 2011 and average 2011 combined ratio of 117%, suggesting the sector suffered an underwriting loss overall. This suggests that the motor insurance segment of the UK market is relatively more competitive than its liability insurance counterpart - a feature that also characterizes other major motor insurance markets, such as the US (Desyllas and Sako, 2013). Additionally, motor insurance policies with comprehensive cover (which includes third part liability protection) accounted for 93% of the UK motor insurance market (by premiums written) in 2013, while the remainder of the policies provided protection against losses due to third party (liability)/third party fire and theft (Cannon et al, 2016).

The property-casualty insurance market in the UK is a potentially interesting environment within which to conduct this research project in that unlike many other insurance markets, the UK is, and has long been, a relatively open and less prescriptively regulated insurance market predicated on compliance with micro-prudential risk-based principles assessed by the insurance regulator at the level of the individual insurance firm. Therefore, compared with traditionally restrictive insurance markets such as the US, the UK's 'light touch' regulatory system has long fostered greater product differentiation and price competition, and encouraged international trade in insurance/reinsurance and related services. For example, unlike in the UK, many states in the US (e.g., Massachusetts and New York) impose strict regulatory constraints on motor insurance premiums. Such 'actuarially unfair' pricing could adversely affect the adequacy of loss reserves, and hence, confound analysis of financial performance (Veprauskaite and Adams, 2018). We consider that such institutional attributes of the UK enable us to conduct more direct tests of our research hypotheses than might otherwise be the case in other more regulatory interventionist jurisdictions like parts of the US.

3. Literature Review and Hypotheses

Theoretical Perspective

Insurance is a complex risk management business in which underwriting knowledge and risk-based information systems are important corporate assets (Harrington and Niehaus, 2003). In the organizational economics literature, transaction cost economics (Williamson, 1985) explicitly recognizes risk and uncertainty as important strategic issues in market exchange. As a result, transaction-specific assets (e.g., business knowledge and information systems) have to be acquired and deployed by firms to facilitate efficient and effective economic trading, and realize financial goals. However, complete contracting and efficient trading are precluded by informational constraints (i.e., 'bounded rationality') and opportunistic self-seeking behaviour by transacting parties. These market failures are mirrored in another well-known genre of the organizational economics literature, namely agency theory. For example, Garven (1987) notes that risk management strategies, such as the purchase of insurance, mitigate the risks of financial distress and bankruptcy, and binds managers in the face of unanticipated economic losses to funding operating and investment strategies that maximize the traded value of the firm.

Mayers and Smith (1981) report that to maximize firm value, yet at the same time, ensure the solvency interests of fixed claimant policyholders and others (e.g., regulators) are met, the managers of insurance firms are assigned considerable discretion (e.g., under the corporate constitution) to use their superior knowledge and technical (e.g., actuarial) expertise to make underwriting and other functional decisions that maximize financial performance under risky and uncertain market conditions. However, two all-pervasive information asymmetry problems reported in the organizational economics literature that directly affect the transaction costs of insurance are the possibility for the mis-pricing of risks ex-ante (i.e., adverse selection) and the ex-post effect of purchasing insurance on the probability of economic loss (i.e., moral hazard) (Desyllas and Sako, 2013). These twin information asymmetry problems can impact lines of insurance differently - for example, due to differences in the relative availability of experience data and effectiveness of the insurance contracting in accurately pricing selected risks. Indeed, the pricing of motor insurance risks tends to be predicated on good experience data and information sharing between insurers (Laas et al., 2016). In contrast, the financial viability of liability insurance is susceptible to the vagaries of legal judgements made long after insurance policies have been issued (Wagner, 2006). The organizational economics literature thus provides a potentially compelling framework within which to ground this study.

Information and Pricing in Insurance Markets

Cummins and Danzon (1997) posit that in perfectly competitive markets, without information asymmetries and other frictions, insurance premiums will reflect the discounted present value of claims and expenses, and so premiums reflect expected future losses. However, uncertainties regarding the timing and financial magnitude of claims associated with the long-tail loss structure of liability insurance is likely to result in higher insurance premiums and loss reserves as well as increased demand for reinsurance (Berger, Cummins and Tennyson, 1992). Fung, Lai, Patterson and Witt (1998) add that fluctuations in interest rates can create insurance pricing cycles that not only impact premiums, but also adversely affect investment yields, thus influencing the ability of insurers to vary premiums to suit market conditions and/or realize strategic goals. Moreover, the discounted value of underwriting losses is dependent on the length of claims settlement tail. This means that the underwriting performance of short-tail motor insurance and long-tail liability insurance are likely to vary as a result of their distinctive claims payment schedules and inherent differences in their respective risk profiles and actuarial pricing.

Cummins and Danzon (1997) argues that incomplete information (adverse selection and moral hazard) in insurance markets can lead to systematic mispricing and differences in insurance coverage across lines of business. Such informational inefficiency can trigger managerial ‘herding’ behaviour (e.g., as insurance firms cut prices to preserve product-market share). This means that actual insured losses can deviate adversely from expectations unless the insurer uses information: (a) to structure and price insurance contracts on an 'actuarially fair' basis ex-ante (e.g., by using experience-related bonus-malus clause contracts); and/or (b) to control and monitor the ex-post risk behaviour of policyholders (e.g., by applying loss adjustment procedures) (Jia, Adams and Buckle, 2011). Information asymmetries in insurance markets can also magnify the effects of underwriting cycles on market premiums (pricing) and increase the volatility of insurers' underwriting results, which in extreme cases can lead to financial distress and insolvency (Cummins and Doherty, 2002). However, a key empirical question is whether such market conditions differentially affect underwriting performance across segments of the insurance market. For example, the availability of claims experience data and information sharing between motor insurers enables generally short-tail vehicle accident risks to be priced on a more 'actuarially fair' basis than in liability insurance where the quantum of long-tail claims may - for example, as a result of the outcome of lawsuits - only become known several years after being incurred and reported (Berger et al., 1992).

Product-Market Strategy and Underwriting Performance

The predictability of future losses, and thus the pricing efficiency of risks underwritten by insurance firms, can vary between product-markets. For example, the greater predictability of motor vehicle accidents and the homogeneity of contractual forms tend to make motor vehicle insurance amenable to standard underwriting procedures and 'actuarially fair' pricing (Li et al., 2012). In such a contracting setting, the level of managerial discretion needed in underwriting risks is reduced. In contrast, legal liability risk exposures are generally less predictable, and so they are more likely to be subject to bespoke policy terms and premium schedules. In this situation, the degree of managerial discretion over risk selection and pricing is likely to be relatively greater (Winter, 1991, 1994). Therefore, different segments of the property-casualty insurance market require distinctive levels of intellectual capital and risk-based information to be applied in order to make the underwriting function successful. However, the costs associated with acquiring such human and technical 'specific-assets' can increase new entry costs in niche and highly specialized lines of financial services business such as liability and catastrophe insurance. High barriers of entry can often mean that the structure of such niche markets tends to be more concentrated with lower levels of product and price competition than in more standard lines of business like motor vehicle insurance. Under such market conditions, the managers of specialist legal liability insurers can use their 'asset-specific' knowledge and informational advantages to realize above market-average profits (i.e., 'quasi-economic rents') and secure competitive advantages over other insurance firms. Such 'niche sector advantages can help liability insurers attract equity capital from investors looking for expected above average returns and enhanced portfolio diversification. A situation that can further improve financial results for liability insurers by lowering the cost of capital[6]. The different technical specialities and risk knowledge needed in different lines of insurance business also means that insurers experiencing inferior underwriting performance in a particular product line, such as motor vehicle insurance, could be intrinsically constrained from moving to other potentially more profitable segments of the market. As a result:

Hypothesis 1: *Ceteris paribus*, legal liability insurers will have better underwriting performance than motor vehicle insurers.

Conversely, liability insurance is susceptible to unexpectedly severe losses (e.g., as a result of unforeseen legal judgements) as well as cyclical movements in market prices, disruptions in the supply of reinsurance, and volatile capital inflows/outflows. These macro-market effects, as witnessed in the US liability insurance crisis of the mid-1980s, can negatively impact the underwriting performance of liability insurers. This includes many UK-based

[6] External factors, such as market competition, regulation and so on, can affect the profit margins of liability insurers; but other things equal, these conditions are likely to affect to some extent all firms operating in the liability segment of the domestic insurance market. Moreover, liability insurers generally allow for higher reserve margins/contingencies in their premium rating structures than motor insurers because *a priori* they are likely to have an intrinsically high risk of unexpected economic loss (for which they will factor (load) into their premium rates). Liability insurers can also boost profit margins periodically by 'releasing' reserves, particularly in years of better than expected loss experience. However, we posit that liability insurers' key source of profitability lies in their specialist knowledge and expertise in the legal field across multiple jurisdictions. The global scope of business operations enables liability insurers to spread risks and reduce the risk of economic loss geographically (e.g., the US is widely acknowledged to be more litigious than the UK).

insurers heavily exposed to international (particularly US) legal liability risks. Harrington and Danzon (1994) hypothesize that this can result in 'price wars' and declining profit margins for legal liability insurers. This implies that insurers operating in more predictable (safer) motor vehicle insurance are likely to command higher premiums (prices) than their counterparts writing less predictable insurance such as legal liability.

Prior research (e.g., Fung et al., 1998) suggests that in the motor vehicle insurance sector, the premium-effects of the insurance underwriting cycle tend to be less volatile in comparison with liability insurance (e.g., due to greater price and product competition). Moreover, in motor vehicle insurance the supply of reinsurance is generally less constrained and less risky (and hence cheaper) than in liability (long-tail) insurance lines (e.g., due to the availability of loss experience data). In addition, the standardization of products and business processes provides opportunities for motor insurers to realize economies of scale and benefit from a 'deep-pocket' strategy of 'high volume-low price' corporate growth (Li et al., 2012). In fact, since the early 1990s some new mono-line specialist entrants to the UK motor insurance segment of the market (such as Admiral plc that entered the motor segment of the UK insurance market in 1992/3) have achieved rapid growth and consistently healthy financial performance as a result of a strategy of customer segmentation, price discrimination, and product/process innovation. Winter (1994) further argues that the ease of filing legal liability claims for economic loss and suffering in cases of personal accident, and the high verification costs associated with such claims, incentivizes policyholders to engage in moral hazard behaviour - for example, by making false or over-stated claims under insurance policies. This implies:

Hypothesis 2: *Ceteris paribus*, legal liability insurers will have worse underwriting performance than motor vehicle insurers.

Control Variables

Firm-specific factors can influence the underwriting performance of firms operating in property-casualty insurance markets. As such, we control for five such factors in our analysis and briefly motivate their inclusion below.

Reinsurance: In insurance markets, the primary risk management technique for reducing (transferring) assumed risks, improving underwriting capacity, and securing key strategic finance goals, such as enhanced solvency and tax management, is reinsurance (Abdul Kader, Adams and Mouratidis, 2010). By mitigating risk and uncertainty, increasing risk-bearing capacity, and creating other strategic benefits (e.g., reducing future taxes by stabilizing earnings), reinsurance is likely to improve underwriting performance. On the other hand, reinsurance can (e.g., due to restricted supply) be costly and/or engender excessive risk-taking leading to deterioration in underwriting performance (Froot, 2001). Thus, the effect of reinsurance on underwriting performance is ambiguous.

Firm size: Large firms can realize positive financial performance as a result of economies of scale, prominent product-market share, brand profile, and other firm-related attributes (Shim, 2011). As a result, we predict that, all else equal, large insurers are likely to have better underwriting performance than small insurers.

Investment earnings: Cummins and Grace (1994) point out that the period profitability of insurance firms is conditional on their investment earnings as well as underwriting performance. Investment earnings could also directly influence the underwriting practices of insurance managers. For example, managers could be motivated to reduce underwriting standards (lower profit margins) if the earnings on invested assets are, or expected to be, above the market average or some other strategic benchmark. As a result, all else equal, we expect that insurers with low investment earnings are likely to have higher underwriting performance than insurers with high investment earnings.

Leverage: Cummins and Doherty (2002) note that the decision to underwrite a risk at a given rate of premium depends on the financial capacity (i.e., leverage or solvency) position of the insurance firm. Therefore, prospective investors and policyholders are likely to 'shy away' from highly levered insurers in order to avoid possible bankruptcy and protect the value of their future financial claims on the firm. This means that to attract new business highly levered insurers could lower prices and standards of risk assessment with adverse effects on underwriting performance. Consequently, we predict that, all else equal, lowly levered insurers are likely to have better underwriting performance than highly levered insurers.

Product mix: Phillips, Cummins and Allen (1998) contend that product diversification provides insurance firms with opportunities for income growth, risk reduction, and increased profitability through the realization of scale and scope economies in production, and other input factor synergies (e.g., in terms of the shared use of staff resources and technology). Therefore, all else equal, insurers with a more diversified product-mix are likely to have superior underwriting performance than insurers with a more specialized product range.

Interest Rate: Since insurance contracts are essentially financial claims, their values are affected by changes in interest rates. Consequently, interest rates also impact insurers' underwriting performance (Doherty and Garven, 1995). Therefore, average annual base interest rates set by the Bank of England are used in this study to account for this effect.

Inflation Rate: Another macroeconomic variable that significantly influences insurance contracts is the inflation in the economy. Inflation influences the value of assets as well as liabilities of insurers, thus has direct bearing on the both the underwriting performance and the profitability of insurers (e.g. see Shiu (2004), Lazar and Denuit (2012) etc). To account for the effect inflation has on insurers' underwriting performance/profitability, average annual retail price inflation in each of the calendar years 1985-2010 is included in our analysis.

4. Research Design

Data

Longitudinal unbalanced panel data for 1985 to 2010 covering UK-based insurers (3,759 firm/year observations) operating in the motor insurance and liability insurance sectors were obtained to test our hypotheses. In our panel data set, 195 (1,968 data points) out of 319 insurance firms (3,759 data points) underwrite liability insurance, whereas 139 insurers (1,372 data points) write motor insurance. In addition, 96 insurance firms (979 data points) are present in both the product-markets examined. Our data derive from the *Standard & Poor's SynThesys* insurance companies' database, which is sourced (since 1985) from annual filings submitted by UK insurance companies to the insurance industry regulator (which was the Financial Services Authority (FSA) before April 2013). Also, the 26 years of time-series data used are considered long enough to account for the effects of temporal changes in market conditions on our results. The final year covered by our panel data set - 2010 - represents the last period for which complete data were available at the time the study was carried out. The data collected relate to personal and commercial motor vehicle and liability insurance underwritten by independently operating and reporting non-life insurance companies licensed by the FSA to conduct property-liability insurance business in the UK. Very small non-life insurance providers and public sector insurance arrangements are excluded from the sample either because they do not directly and/or actively write much third party insurance business and/or complete data are not available. In addition, insurance firms in our panel data set had to record positive accounting values (e.g., for gross premiums written, incurred claims, and so on) or they were excluded from the sample selection process. The vast majority of insurers in our data set (approximately 95%) are stock forms of organization of which roughly one-third are small mono-line insurers that specialize in one of either the motor or legal liability segments of the UK's insurance market. Furthermore, most (93%) of stock insurers in our panel sample are private, but not main stock exchange listed, entities. The preponderance of stock over mutual forms of organization, and non-publicly quoted stock insurers in our data set precluded us from controlling for organizational form and public/private listing status despite the possibility that incentive and control differences arising in policyholder-owned and shareholder-owned corporate structures could affect the strategic finance decisions of insurers (Mayers and Smith, 1981). Underwriting syndicates operating at the Lloyd's of London insurance market are also excluded due to the unavailability of public data, their unique (triennial) system of accounting that was in place during much of our period of analysis (up to calendar year-end 2004), and the different organizational structure of syndicates at Lloyd's compared with conventional insurance firms (e.g., Lloyd's syndicates are often owned and administered by managing agencies).

Model

Studies - for example Grace and Hotchkiss (1995) and Harrington and Yu (2003) - document that usual measures of underwriting performance, such as the combined ratio and the loss ratio, have an autoregressive dependence structure. Fenn and Vencappa (2005) report an order two autoregressive process for the UK insurance industry. Therefore, our study uses an AR(2) model of the following form to estimate the effect of the explanatory variables on the underwriting performance:

$$Y_{it} = (Y_{it-1}, Y_{it-2}, LBT_{it}, MOT_{it}, CONTROLS_{it}) + \eta_i + \nu_t + \varepsilon_{it}$$

where Y_{it} represents our dependent variable for insurance firm i at time t, which is a measure of underwriting performance in property-casualty insurance markets. Three different measures of underwriting performance, namely, the annual combined ratio (CR), the annual loss ratio (LR), and the annual economic loss ratio (ELR) are used in the study. Additionally, the annual return on assets (RoA) is used as a measure of overall firm performance. The combined ratio is defined as the ratio of annual incurred claims and loss adjustment costs to total annual gross premiums earned plus annual operating expenses divided by total annual gross premiums earned. A combined ratio of less than 1 reflects underwriting profitability and a combined ratio greater than 1 indicates underwriting losses. The loss ratio (LR) is defined as the ratio of annual incurred claims and loss adjustment costs to total annual gross premiums earned, so a higher loss ratio results in lower underwriting profits. The economic loss ratio also is similar, but is considered as a superior measure of underwriting performance because of its ability to incorporate maturity structure of cash flows. According to Winter (1994), the economic loss ratio is the present discounted value of claims as a fraction of premiums net of expenses and is defined as[7]:

$$ELR = \frac{Loss\ Ratio}{1 - Expense\ Ratio} \times D$$

where D is a discount factor. Unlike the underwriting performance ratios, RoA a positive measure of insurer performance; that is, a high RoA usually is indicative of superior underwriting performance. However, in some cases an insurer may have positive RoA even after experiencing underwriting losses, provided return on its investment portfolio more than offsets these losses. RoA is defined in this study as the ratio of total annual earnings before tax and total end year reported assets.

Since we use an autoregressive model in this study, feasible generalised least squares (FGLS) method is employed to conduct our analysis. The FGLS estimation used in our study is similar to the one used in Lamm-Tennant and Weiss (1997) and allows for varying degree of autoregressive dependence within each panel and also for heteroscedasticity across panels (Greene, 2012). To focus analysis on the two product lines of interest, two variables enter the

[7] In computing ELR, we first obtained undiscounted value of claims as a fraction of premiums net of expenses by dividing the loss ratio, LR, by 1 minus the expense ratio (ER). Next, we estimated the proportion of claims paid in each year after an insurance policy is written for each firm during the sample period. The average of the proportion in each year after an insurance policy is written are our claim payout factors. The resulting factors for eight years starting with the policy inception year are 0.449, 0.277, 0.105, 0.071, 0.056, 0.041, 0.030, 0.021 and 0.020 respectively. The discount factor (D) was then estimated by adding the discounted values of these claim payout factors. We use 6.69%, the average redemption yield on the 5-year UK government bond during 1985 – 2010 period, as the rate for discounting the claim payout factors.

modelling procedure - LBT_{it} is the ratio of annual net premiums written (NPW) in the liability business to the annual NPW at the total business level, and MOT_{it} is the ratio of the annual NPW in the motor business to the annual NPW at the total business level. The label $CONTROLS_{it}$ represents a vector of the five firm-specific control variables referred to above along with the two macroeconomic variables. The full set of the variables used in the FGLS model is defined in Table 1. Finally, the notations η_i and v_t in the above equations are unobservable firm-specific (e.g., managerial ability) and time-related (e.g., underwriting cycle) effects respectively, while ε_{it} is an error term.

[Insert Table 1 about here]

5. Empirical Analysis

Summary Statistics

Summary statistics for the variables of interest are presented in Table 2.

[Insert Table 2 about here]

Table 2 indicates that the overall average combined ratio (CR) approximately is 72% across all 284 insurance firms in the unbalanced panel data set, suggesting that overall underwriting performance across firm/year cases is reasonable (i.e., less than 100%). The average combined ratio is almost the same as the median of 73%, suggesting that most of the insurers manage to avoid underwriting losses. However, maximum of 243% suggests that there are a few insurers which experienced severe losses during 1985 – 2010 period. To graphically explore the possibility of systematic difference in the combined ratios of insurers specialising in liability insurance and motor insurance respectively, we produce a time-series plot of average annual combined ratios of the two sets of companies. The plot shown in Figure 1 reveals that, on average, insurers that specialise in liability insurance tend to have lower combined ratios than insurers specialising in underwriting motor insurance business. This figure thus supports hypothesis 1.

[Insert Figure 1 about here]

To examine the panel features of our dataset further, we also computed between-firm and within-firm descriptive statistics and report these in Table 2 alongside the overall descriptive statistics. The 'between' values measure cross-sectional firm-level differences in the variables of interest, while the 'within' values reflect temporal changes in the relevant firm-level variables. In the case of CR, we observe that the between-firm and within-firm statistics contribute proportionately to the variance of overall-firm means with different standard deviations, as ‘between’ and ‘within’ standard deviations for CR (respectively SD = 0.24 and SD = 0.19) accord closely with the overall standard deviation of 0.27. The loss ratio (LR), the economic loss ratio (ELR) and the RoA also follow similar patterns.

Descriptive statistics for our main explanatory variables, namely LBT and MOT, are also provided in Table 2. We use three alternative ways to select our sample to ensure robustness of our results. The first sample includes all insurers that write some business in any line of non-life insurance. Under this approach, all 3,233 firm-year observations are included in the regression, but LBT takes value 0 for firm-years (1,338 data points) where no liability insurance premiums are underwritten. Similarly, MOT is set to zero for 206 insurance firms (1,864 data points) that do not underwrite motor insurance in a given year, but do undertake some other non-life insurance business. This way the estimation sample size is maximized, and it contains all insurance firms whether or not they write any liability/motor business. For clarity, we label these variables as LBT_Full and MOT_Full respectively and the corresponding sample as the 'full sample'. The second approach includes all insurers that write at least one of liability and motor insurance business in a given year. There are 209 insurers with 2,240 observations in this sample, of which 193 out of the 209 insurers are liability insurers (1,895 data points) and 148 are motor insurance underwriters (1,369 data points). Thus, all the firms which did not underwrite at least one of motor or liability insurance are excluded from the estimation sample. We label these variables LBT_OR and MOT_OR and the corresponding sample as the OR sample. Finally, the third sample includes 1,052 firm-year observations comprising 110 insurers, which write both liability and motor insurance, and the corresponding sample has been labelled as the AND sample.

LBT_Full and MOT_Full have 3,233 observations each corresponding to 284 insurance firms, with 11 annual observations per insurance firm on average. Since this sample includes many insurers that are not present in one or both of these lines, the means of LBT_Full and MOT_Full are comparatively larger than their respective medians. The second sample including LBT_OR and MOT_OR has 2,240 observations corresponding to 209 insurance firms that were observed, on average, for about 11 years. There were 193 firms writing liability insurance business leading to 1,895 observations over the full 26 years covered by our analysis. Liability insurance contributes on average about 18% to total annual NPW for a firm that writes liability insurance business; however, the median contribution of liability insurance to total annual NPW is only about 10%. Similarly, there were 139 firms underwriting motor insurance resulting in 1,372 observations for MOT over 26 years. Motor insurance contributed on average about 37% to total annual NPW, whereas the median contribution of motor insurance to total annual NPW for a firm is about 30%. For each of these variables, cross-sectional differences in annual NPW were the main source of variation for the overall sample; however, the intra-firm variation was relatively small.

Table 2 shows that on average, insurers in our sample ceded 26% of gross annual premiums to reinsurance companies. However, analysis of 'between' and 'within' variation in the panel data set suggests that reinsurance varies more between insurers (between-firm SD = 0.22) than for a given insurance firm over time (within-firm SD = 0.12). These descriptive statistics hint that while insurers differ in the amounts of reinsurance purchased by individual insurance firms, the level of reinsurance buying for individual insurers tends to be stable over time.

Table 2 also shows that the average log value of insurers' total assets in the panel data set is 11.3 (with an anti-log average value of total assets for insurers in our panel of £550 million and SD of £1,494 million). Again, the logarithmically transformed values for firm size in our panel vary considerably across insurers (within SD = 0.71 versus between-firm SD = 1.74); on the other hand, individual insurance firms appear to get bigger over time (overall SD = 1.93 versus within-firm SD = 0.71). The total number of active insurers over the 26 years from 1985 to 2010 (i.e., from 163 insurance firms in 1985/86 to 119 insurers in 2010) declined as a result of market exits amongst smaller firms and increased average firm size due to merger and acquisitions. Mean value of 0.06 and standard deviations for investment earnings (between = 0.03; within = 0.04) suggest that there is substantial variation in investment earnings across insurance firms as well as temporally within insurance firms. On the other hand, leverage with a mean of 0.46, shows higher inter-firm variation than intra-firm variation. Table 2 also reports the Kenney ratio (KR), an alternative measure of leverage, again with a higher cross-sectional variation than intra-firm variation. These observations suggest that insurance firms try to achieve a target capital structure, which may be due to one or both of regulation and corporate policy. The average value of 0.68 for product mix (PMIX) reported in Table 2 indicates that most insurers in our sample are not highly diversified. The standard deviation figures further suggest that cross-sectional variation in PMIX is higher than the within firm variation over period covered in this study (i.e., between-firm SD = 0.23 versus within-firm SD = 0.13) suggesting that levels of insurers' range of products do not substantially change over time. Over the period of our analysis, the UK’s base rate of interest ranged from a high of 14% in 1990 to the low of 0.5% in 2010. Average interest rate during this period has been nearly 7%. Over the same period, the average inflation has been about 3.5%, but has swung from a low of about 1% to a high of 9%.

Correlation Analysis

To further examine the pair-wise associations between the variables of interest we conduct a correlation analysis and report the relevant statistics in Table 3.

[Insert Table 3 about here]

As expected, the CR, LR and ELR variables are strongly positively correlated with each other, while both are negatively related with RoA. Table 3 shows that increase in the share of liability insurance is negatively associated with the combined ratio, the loss ratio and the economic loss ratio. An increase in the share of motor insurance, however, is associated with an increase in the CR, LR and ELR, i.e. deteriorating underwriting performance. Interestingly, all the proxies for underwriting performance are negatively related with reinsurance ratio. This suggests that while the use of reinsurance helps insurers improve their underwriting performance, but it can also result in reduced profitability. Moreover, reinsurance ratio and LBT_Full are positively correlated, whereas the association is negative between MOT_Full and REINS. This could hint at higher usage of reinsurance among liability insurers. In addition, with a positive and statistically significant correlation coefficient, leverage and CR move in the same direction; that is, higher leverage is associated with worsening underwriting performance. Similarly, CR has statistically significant positive correlation with INV and PMIX, but both INV and PMIX are positively correlated with RoA too.

Multivariate Analysis

[Insert Table 4 about here]

The results in Table 4 support our first hypothesis as liability insurance has a statistically significant negative effect on the combined ratio (an inverse measure of the underwriting performance) for FULL sample results reported in Table 4. Thus, participation in liability insurance is associated with statistically significant positive impact on the underwriting performance of an insurer. This suggests that as suggested in prior research (e.g., Winter, 1991, 1994), liability insurers use their specialist knowledge and experience to effectively price assumed liability risks and so realize underwriting profitability. The coefficient estimate for LBT in our first (FULL) sample with ELR as the dependent variable is -0.04 ($p \leq 0.01$ two tailed). This means that for a 1% increase in the proportion of liability insurance premiums, the combined ratio is expected to fall, on average, by nearly 4 basis points. This negative (positive) effect is also consistent for regressions using other measures of underwriting performance (return on assets) as dependent variables. Further, the magnitude of coefficient estimates corresponding to LBT increases as we use OR and AND samples across all regressions when using underwriting performance ratios as dependent variables. Additionally, we find that an increasing contribution of motor insurance business to total annual NPW at the firm-level is associated with inferior underwriting performance, as seen from the estimated regression coefficients obtained using all four dependent variables. The coefficient estimate for MOT in ELR regression using full sample is 0.035 ($p \leq 0.01$ two tailed), which means that for a 1% increase in the proportion of motor insurance premiums, a 3 basis points increase in the economic loss ratio is expected for an insurance firm. This indicates that motor insurance risks are generally unprofitable for insurance firms – for example, as a result of increased market competition as suggested by recent UK insurance market surveys (e.g., Datamonitor, 2014a)[8]. Statistically significant negative effect MOT has on RoA accords with this result. These findings persist even when we use the Kenney ratio as an alternative measure of leverage, in our regressions using full sample.

[8] Heavy investment in specialist knowledge and expertise could restrict the ability of insurers to easily disengage from low margin motor insurance and enter new and potentially more profitable lines of insurance business.

Table 4 also reveals that, the AR terms in our regressions are always highly significant, which is in accordance with findings reported in prior studies. Reinsurance too has highly significant effect on all measures of underwriting performance used in this study. Negative coefficients obtained for REINS in CR, LR and ELR regressions suggest that reinsurance can be a tool for insurers to manage their underwriting risk. According to Cole Cole and McCullough (2006), the provision of risk management advice provided by reinsurers is one of the reasons for the demand of reinsurance. They add that specialized knowledge and/or economies of scale impart reinsurers with comparative advantages over primary insurers in claims handling and pricing. As a result, the use of reinsurance is often associated with superior underwriting performance. On the other hand, reinsurance can be negatively associated with insurers' RoA. There are two possible reasons for this situation. First, reinsurers' profit participation could result in reduced operating income for the cedant insurer, which in turn is manifested as lower RoA. Another reason could be due to the fact that reinsurance is included in insurers' total assets, while total assets are simultaneously used as the devisor in obtaining RoA values.

The results presented in Table 4 also suggests that larger insurers are likely to experience only marginally inferior underwriting results as indicated by positive but statistically significant estimated coefficients with small magnitude for LNSIZE (at $p \leq 0.01$, 2-tail). Inconsistent with what we expected, high leverage also results in better underwriting performance. Although counterintuitive, this result could be due to the way variables CR, LR, ELR and LEV are constructed. With high NPW, higher amount of premiums earned would be expected, which decreases the three underwriting performance ratios. On the other hand, higher NPW relative to sum of equity and reserves results in higher leverage. It follows that if leverage increases with the growth of net premiums written, but incurred claims and expenses fall as a proportion of premiums (e.g., because of sound underwriting and cost control), then the combined ratio decreases and reported underwriting performance improves[9]. The coefficient estimates corresponding to KR, our alternative measure of leverage, are however dissimilar. For the loss ratio, the estimated coefficient corresponding to KR is statistically significant, but of small magnitude. For RoA, the signs of the coefficient estimates corresponding to LEV and KR have opposite signs. Since the coefficient estimates for KR are consistently small in magnitude across alternative samples, these results could signal weak association between underwriting performance and leverage.

We further observe that product diversification (PMIX) also has statistically significant positive effect on the loss ratio of insurers according to results obtained for the regressions involving LR and RoA. This result accords with the notion that product diversification reduces the volatility of risks underwritten by insurance firms (Phillips et al., 1998). Finally, contrary to expectations, the investment income ratio (INV) has statistically significant positive effect on all dependent variables. While investment income ratio is expected to have positive association with RoA, it is perplexing that it is positively associated with CR, LR and ELR. For the three measures of underwriting performance the significance level of the coefficients changes across different samples, but for the RoA, this result is robust to alternative sample definitions used in the study. Table 4 also shows that higher interest and inflation rates are associated with lower combined ratio, loss ratio and returns on assets.

Robustness Tests

Many insurance firms in the Full sample do not underwrite either one or both of liability and motor insurance. Therefore, to establish the robustness of results presented in the preceding section, we present results of regressions conducted using differently defined samples. Table 5 presents results for the OR sample, which includes firms that were present in at least one of

[9] Winter's (1994) capital constraints hypothesis implies that highly levered insurers will raise premium rates to build reserves and meet statutory minimum levels of solvency. However, market competition and the tendency for prospective policyholders to seek out insurers with low leverage (low insolvency risk) restricts the ability of highly leveraged insurers to raise prices (Doherty and Tinic, 1981).

liability or motor insurance markets. Similarly, Table 6 presents results for the AND sample, which includes firms that were present in both these markets.

[Insert Tables 5 and 6 about here]

Most of the coefficient estimates for all the variables of interest presented in both Tables 5 and 6 are consistent with those reported in Table 4, indicating that our results are robust to the use of alternative samples. For instance, LBT is negatively associated with both CR, LR and ELR in all regressions, whereas MOT exhibits a positive association. Similarly, Reinsurance ratio and leverage (both LEV and KR) also have negative association with CR, LR and ELR across all regressions, bar one. Investment income ratio too is positively associated with RoA across all samples. Again, the results are qualitatively unchanged suggesting that our observations are not significantly affected by cyclical pricing effects in both the liability and motor segments of the UK's property-casualty insurance market.

6. Conclusion

Drawing on a framework from the organizational economics literature and utilizing a dynamic panel design on longitudinal data for 1985 to 2010 drawn from the UK's property-casualty insurance industry, we examine whether legal liability or motor insurance improves underwriting results for insurers. The approach adopted in the present study has two main benefits. First, the panel-based FGLS identification strategy that we employ captures both time-series and cross-sectional dynamics between the two main product-markets that we examine and underwriting results. This procedure allows robust and reliable statistical inferences to be drawn from our analysis. Second, intra-industry research, such as the present study, can have some important advantages over inter-industry studies - for example, in avoiding potentially confounding effects arising from differences in industrial practices and regulation. At the same time, however, the results of single industry research, such as our insurance study, can be generalized to, and stimulate future investigations in, other sectors of the economy with similar structural market features and informational uncertainties, such as the banking, life insurance and pensions industries.

Our research findings indicate that liability insurance has a statistically significant positive impact on the underwriting performance of non-life insurers. On the other hand, participation in motor insurance is associated with high combined and loss ratios, leading us to conclude that motor insurance has a negative impact on the underwriting performance of insurers. We further observe that reinsurance is associated with better underwriting performance, and increased leverage can positively impact on insurers' underwriting performance. Our results are also robust to heteroskedasticity, serial autocorrelation, and multicollinearity.

The general 'take-away' from the present study is that it is difficult to create informational and strategic economic advantages from participating in relatively more predictable product-markets, such as motor insurance; further, newer market entrants may find it difficult to survive and prosper alongside larger firms in increasingly concentrated insurance markets. We believe our study contributes to the extant literature in two main ways. First, in heavily regulated, highly competitive, but standardized lines of business, such as motor insurance, sustained competitive advantages can only be realized from lower than market average costs of production and/or the optimization of future revenue streams. These goals could be achieved through product and/or process innovations using new technology (e.g., telematics-based (pay-as-you-go) premium pricing). Second, our analysis implies that specializing in selection and pricing of risky, but profitable products may be economically beneficial for insurers. Indeed, our results show that specialist legal liability insurers realize quasi-'economic rents' from underwriting highly unpredictable and idiosyncratic litigation risks. Again, our results could lead to regulators being more embracing of new market entrants with 'growth opportunities' in particular risk specialties such as legal protection insurance. In addition, our research results could have strategic implications for other industrial sectors (e.g., banking) that operate in lines of business (e.g., deposits versus derivatives trading) that have distinctly different levels of risk and uncertainty.

We acknowledge that our study has inherent limitations such as its focus on only two (albeit important and distinctive) lines of insurance business – motor and legal liability insurance. Our results could also be driven by unobserved profitability differences in the composition of underwriting portfolios of motor and liability insurers (e.g., commercial versus personal lines). However, despite such limitations we believe our research design has merits. For example, the longitudinal and cross-sectional nature of our data and the fixed-effects panel estimation used in our study effectively accounts for changes in the UK property-casualty insurance market and controls for possible econometric problems, such as inconsistent parameter estimates in the panel data. Finally, we consider that the results of our study could help stimulate further strategic insurance research that focuses on product-market strategy, product-market competition, and the performance of firms in different industrial settings in Europe and elsewhere.

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Table 1 - Definition of Variables

This table presents the labels of the key variables used in the study together with their full descriptions. All variables are measured using accounting period year-end figures.

Variable		Representation	Description
Dependent Variables	CR_{it}	Combined Ratio	(Annual incurred claims (& loss adj. costs) + annual operating expenses) ÷ total gross annual premiums earned
	LR_{it}	Loss Ratio	annual incurred claims (& loss adj. costs) / total gross annual premiums earned
	ELR_{it}	Economic Loss Ratio	[Loss ratio / (1 – Expense Ratio)] x D, where D is a discount factor
	RoA_{it}	Return on Assets	annual earnings before tax / total assets
Main Explanatory Variables	LBT_{it}	Proportion of liability insurance premiums	Ratio of net annual premiums written in liability line to total net annual premiums written
	MOT_{it}	Proportion of motor insurance premiums	Ratio of net annual premiums written in motor line to total net annual premiums written
Control Variables	$LNSIZE_{it}$	Firm size	Natural log of (inflation-adjusted) total assets
	$REINS_{it}$	Reinsurance ratio	(annual reinsurance premiums ceded) ÷ (annual gross premiums written)
	LEV_{it}	Leverage	(Net premiums written) ÷ (equity + reserves)
	INV_{it}	Investment earnings	(annual investment earnings) ÷ (total invested assets)
	KR_{it}	Kenney Ratio (Leverage)	(Net premiums written) ÷ (Policyholders' Surplus)
	INT_{t}	Interest rate	Average annual interest in the UK
	INF_{t}	Inflation rate	Average annual inflation in the UK
	Lag 1 & 2 CR_{it}	Combined Ratio	First two lags of the Combined Ratio
	Lag 1 & 2 LR_{it}	Loss Ratio	First two lags of the Loss Ratio
	Lag 1 & 2 ELR_{it}	Economic Loss Ratio	First two lags of the Economic Loss Ratio
	Lag 1 & 2 RoA_{it}	Return on Assets	First two lags of the Return on Assets
	$PMIX_{it}$	Product mix	$\sum_{j=1}^{N} S_j^2$ where, S_j: (annual premiums written in jth line) ÷ (total annual premiums written across main groups of insurance business)

Table 2 - Summary Statistics

This table presents summary statistics of all the variables used in this study as defined in Table 1.

Variable		Mean	Median	Std. Dev.	Min	Max	Observations
CR	**overall**	**0.717**	**0.726**	**0.274**	**0.124**	**2.430**	**N = 3233**
	between			0.236	0.151	1.938	n = 284
	within			0.189	0.126	2.162	T-bar = 11.38
LR	**overall**	**0.460**	**0.438**	**0.242**	**0.005**	**2.348**	**N = 3233**
	between			0.222	0.041	1.907	n = 284
	within			0.164	-0.111	2.090	T-bar = 11.38
ELR	**overall**	**0.619**	**0.596**	**0.333**	**0.010**	**2.581**	**N = 3233**
	between			0.275	0.057	1.897	n = 284
	within			0.241	-0.229	2.251	T-bar = 11.38
RoA	**overall**	**0.044**	**0.029**	**0.102**	**-0.818**	**0.814**	**N = 3233**
	between			0.076	-0.130	0.437	n = 284
	within			0.069	-0.644	0.622	T-bar = 11.38
LBT_Full	**overall**	**0.108**	**0.013**	**0.205**	**0.000**	**1.000**	**N = 3233**
	between			0.214	0.000	1.000	n = 284
	within			0.090	-0.375	0.952	T-bar = 11.38
LBT_OR	**overall**	**0.155**	**0.065**	**0.231**	**0.000**	**1.000**	**N = 2240**
	between			0.242	0.000	1.000	n = 209
	within			0.097	-0.328	0.990	T-bar = 10.72
LBT_AND	**overall**	**0.138**	**0.092**	**0.157**	**0.000**	**0.994**	**N = 1052**
	between			0.162	0.000	0.978	n = 110
	within			0.085	-0.192	0.703	T-bar = 9.56
MOT_Full	**overall**	**0.157**	**0.000**	**0.280**	**0.000**	**1.000**	**N = 3233**
	between			0.270	0.000	1.000	n = 284
	within			0.084	-0.350	0.968	T-bar = 11.38
MOT_OR	**overall**	**0.226**	**0.024**	**0.312**	**0.000**	**1.000**	**N = 2240**
	between			0.294	0.000	1.000	n = 209
	within			0.096	-0.287	1.037	T-bar = 10.72
MOT_AND	**overall**	**0.279**	**0.247**	**0.243**	**0.000**	**1.000**	**N = 1052**
	between			0.240	0.000	0.931	n = 110
	within			0.109	-0.202	0.976	T-bar = 9.56
REINS	**overall**	**0.262**	**0.211**	**0.224**	**0.000**	**0.977**	**N = 3233**
	between			0.216	0.000	0.949	n = 284
	within			0.118	-0.275	0.965	T-bar = 11.38
LEV	**overall**	**0.459**	**0.386**	**0.383**	**0.000**	**2.961**	**N = 3233**
	between			0.355	0.000	2.251	n = 284
	within			0.169	-0.943	1.656	T-bar = 11.38

Variable		Mean	Median	Std. Dev.	Min	Max	Observations
KR	**overall**	**1.520**	**1.285**	**1.103**	**0.000**	**7.669**	**N = 3233**
	between			0.938	0.023	6.718	n = 284
	within			0.736	-1.810	7.147	T-bar = 11.38
LNSIZE	**overall**	**11.443**	**11.349**	**1.926**	**6.031**	**16.649**	**N = 3233**
	between			1.739	6.666	15.909	n = 284
	within			0.713	5.924	15.278	T-bar = 11.38
INV	**overall**	**0.061**	**0.057**	**0.052**	**-0.605**	**1.057**	**N = 3233**
	between			0.033	-0.078	0.334	n = 284
	within			0.044	-0.616	0.937	T-bar = 11.38
PMIX	**overall**	**0.674**	**0.615**	**0.261**	**0.219**	**1.000**	**N = 3233**
	between			0.233	0.239	1.000	n = 284
	within			0.126	0.164	1.269	T-bar = 11.38
INT	**overall**	**0.069**	**0.060**	**0.034**	**0.005**	**0.144**	**N = 3233**
	between			0.024	0.020	0.142	n = 284
	within			0.029	0.003	0.155	T-bar = 11.38
INF	**overall**	**0.036**	**0.029**	**0.021**	**0.007**	**0.093**	**N = 3233**
	between			0.012	0.017	0.085	n = 284
	within			0.019	-0.001	0.098	T-bar = 11.38

Table 3 – Correlation Analysis

This table reports correlation coefficients computed using Pearson Product Moment Correlation Analysis for all the key
variables are as defined in Table 1. Superscripts *; ** and *** denote statistical significance at 10%, 5% and 1% level

	CR	LR	ELR	RoA	LBT_Full	MOT_Full	REINS	LEV	KR	LNS
LR	0.84***									
ELR	0.95***	0.87***								
RoA	-0.07***	-0.14***	-0.10***							
LBT_Full	-0.12***	-0.03**	-0.11***	-0.06***						
MOT_Full	0.16***	0.24***	0.18***	-0.11***	-0.12***					
REINS	-0.58***	-0.37***	-0.49***	-0.21***	0.12***	-0.19***				
LEV	0.18***	-0.03*	0.10***	0.31***	-0.21***	0.06***	-0.38***			
KR	0.19***	0.06***	0.16***	-0.10***	-0.16***	0.21***	-0.29***	0.60***		
LNSIZE	0.08***	0.15***	0.08***	-0.13***	0.04**	0.22***	-0.07***	-0.18***	0.07***	
INV	0.07***	0.04**	0.08***	0.17***	-0.03*	0.01	0.00	-0.03**	-0.00	-0.0
PMIX	0.04**	0.00	0.02	0.19***	-0.14***	-0.09***	-0.16***	0.19***	-0.04**	-0.4
INT	0.00	0.05***	0.04***	-0.03**	-0.08***	0.00	0.07***	-0.02*	0.04***	-0.2
INF	-0.03*	-0.00	-0.00	-0.01	-0.01	0.00	0.04***	-0.02*	-0.00	-0.1

Table 4 - UK Property-Casualty Insurers, 1985-2010

This table presents the results of the generalized least squares estimation that tests the differences in underwriting pe specifications. The FULL sample used in the estimation includes all P&C insurers. All variables are as defined in Tab reported in parentheses under each coefficient. Standard errors of estimates reported in this table are robust to heteroske significance levels are *** = 0.01, ** = 0.05, and * = 0.10, and they are reported at the 2-tail level. Wald test for equa also reported.

	CR	LR	ELR	RoA	CR	LR
LBT	-0.032***	-0.007	-0.044***	0.008***	-0.024***	0.001
	(-4.35)	(-1.52)	(-5.6)	(3.68)	(-3.06)	(0.15)
MOT	0.018***	0.050***	0.035***	-0.016***	0.020***	0.044**
	(3.02)	(9.22)	(4.66)	(-6.87)	(3.35)	(7.54)
REINS	-0.286***	-0.132***	-0.304***	-0.018***	-0.264***	-0.104**
	(-39.07)	(-18.88)	(-41.02)	(-7.14)	(-31.51)	(-13.45)
LNSIZE	0	0.002***	0.002**	0	0.001	0.005**
	(-0.51)	(2.78)	(2.06)	(-1.24)	(1.07)	(5.27)
INV	0.112***	0.057**	0.163***	0.241***	0.125***	0.048**
	(6.26)	(2.3)	(8.13)	(27.11)	(7.47)	(2.01)
PMIX	-0.006	0.016***	0.003	0.015***	-0.005	0.016**
	(-0.91)	(2.63)	(0.36)	(6.69)	(-0.76)	(2.47)
INT	-0.362	-0.186	-0.73	-1.573***	-0.295	-0.136
	(-0.67)	(-0.45)	(-1.37)	(-6.62)	(-0.53)	(-0.33)
INF	-0.91	-0.860*	-1.409**	-1.048***	-0.804	-0.859*
	(-1.59)	(-1.93)	(-2.45)	(-4.05)	(-1.37)	(-1.93)
LEV	-0.033***	-0.058***	-0.060***	0.019***		
	(-8.19)	(-16.77)	(-10.8)	(9.71)		
KR					-0.002	-0.006**
					(-1.4)	(-5.31)

Table 4 – Continued

		CR	LR	ELR	RoA	CR	LI
Lag1_CR		0.632***				0.634***	
		(60.09)				(55.31)	
Lag2_CR		0.036***				0.035***	
		(3.99)				(3.63)	
Lag1_LR			0.695***				0.697**
			(78.8)				(66.97)
Lag2_LR			0.051***				0.065**
			(5.13)				(6.29)
Lag1_ELR				0.588***			
				(59.66)			
Lag2_ELR				0.054***			
				(5.3)			
Lag1_RoA					0.490***		
					(33.3)		
Lag2_RoA					0.085***		
					(5.93)		
Intercept		0.374***	0.157***	0.351***	0.054***	0.333***	0.099**
		(12.35)	(6.36)	(11.09)	(4.16)	(10.81)	(3.95)
Year Dummies		Yes	Yes	Yes	Yes	Yes	Ye
No. of obs		3233	3233	3233	3233	3233	323
No of Firms		284	284	284	284	284	28
Obs per firm:							
min		2	2	2	2	2	2
avg		11.384	11.384	11.384	11.384	11.384	11.3
max		24	24	24	24	24	24
Wald Test	**$\chi^2(1)$**	30.74	68.74	62.69	63.66	22.05	33.7
	p-val	0	0	0	0	0	0

Table 5 - UK Property-Casualty Insurers, 1985-2010: OR Sam

This table presents the results of the generalized least squares estimation that tests the differences in underwriting perf either one or both of liability and motor insurance business. All variables are as defined in Table 1. Corresponding Z-s under each coefficient. Standard errors reported in this table are robust to heteroskedasticity and autocorrelation. Statis ** = 0.05, and * = 0.10, and they are reported at the 2-tail level. Wald test for equality of coefficients of LBT and MOT

	CR	LR	ELR	RoA	CR	LR
LBT	-0.056***	-0.031***	-0.081***	0.002	-0.038***	-0.019**
	(-6.88)	(-4.16)	(-7.28)	(0.93)	(-4.54)	(-2.46)
MOT	0.018**	0.079***	0.036***	-0.014***	0.009	0.046***
	(2.3)	(11.37)	(3.61)	(-5.8)	(1.25)	(6.44)
REINS	-0.340***	-0.200***	-0.375***	-0.028***	-0.311***	-0.159**
	(-22.78)	(-18.05)	(-21.55)	(-10.89)	(-21.64)	(-14)
LNSIZE	-0.004***	0	-0.003**	-0.001*	0	0.005***
	(-3.91)	(-0.14)	(-2.16)	(-1.7)	(0.32)	(4.11)
INV	0.099*	0.093*	0.133**	0.116***	0.130**	0.109**
	(1.84)	(1.95)	(2.1)	(6.51)	(2.43)	(2.33)
PMIX	-0.016*	-0.001	-0.006	0.008***	0.003	0.022***
	(-1.88)	(-0.13)	(-0.49)	(2.95)	(0.37)	(2.6)
INT	0.278	0.035	0.236	-1.166***	0.334	-0.032
	(0.41)	(0.06)	(0.3)	(-6.64)	(0.49)	(-0.05)
INF	-0.804	-0.715	-1.01	-0.705***	-0.792	-0.922
	(-1.1)	(-1.15)	(-1.21)	(-2.88)	(-1.08)	(-1.48)
LEV	-0.081***	-0.139***	-0.125***	0.005**		
	(-8.72)	(-15.21)	(-9.88)	(2.16)		
KR					-0.004**	-0.009**
					(-2.39)	(-5.75)

Table 5 – Continued

		CR	LR	ELR	RoA	CR	LR
Lag1_CR		0.618***				0.633***	
		(42)				(40.97)	
Lag2_CR		0.028**				0	
		(1.96)				(0)	
Lag1_LR			0.612***				0.633**
			(43.02)				(42.45)
Lag2_LR			0.057***				0.045**
			(3.86)				(3.04)
Lag1_ELR				0.601***			
				(33.97)			
Lag2_ELR				0.034**			
				(2.14)			
Lag1_RoA					0.458***		
					(25.71)		
Lag2_RoA					0.086***		
					(5.14)		
Intercept		0.469***	0.282***	0.464***	0.057***	0.375***	0.157**
		(12.02)	(7.99)	(9.82)	(5.35)	(9.47)	(4.45)
Year Dummies		Yes	Yes	Yes	Yes	Yes	Ye
No. of obs		2240	2240	2240	2240	2240	224
No of Firms		209	209	209	209	209	20
Obs per firm:							
min		2	2	2	2	2	2
avg		10.718	10.718	10.718	10.718	10.718	10.7
max		24	24	24	24	24	24
Wald Test	**$\chi^2(1)$**	64.21	126.02	83.71	32.48	24.55	46.9
	p-val	0	0	0	0	0	0

Table 6 - UK Property-Casualty Insurers, 1985-2010: AND Sar

This table presents the results of the generalized least squares estimation that tests the differences in underwriting perf both liability and motor insurance business. All variables are as defined in Table 1. Corresponding Z-statistic has b coefficient. Standard errors reported in this table are robust to heteroskedasticity and autocorrelation. Statistical signifi and * = 0.10, and they are reported at the 2-tail level. Wald test for equality of coefficients of LBT and MOT is also rep

	CR	**LR**	**ELR**	**RoA**	**CR**	**LR**
LBT	-0.098***	-0.073***	-0.126***	-0.003	-0.092***	-0.040**
	(-7.39)	(-5.26)	(-6.74)	(-0.58)	(-7.07)	(-2.89)
MOT	0.023**	0.093***	0.036**	-0.012***	0.003	0.045***
	(2.03)	(9.88)	(2.25)	(-2.9)	(0.26)	(4.27)
REINS	-0.404***	-0.283***	-0.455***	-0.033***	-0.388***	-0.219**
	(-21.45)	(-19.05)	(-20.08)	(-6.18)	(-21.24)	(-14.96)
LNSIZE	0.002	0.002*	0.003	0	0.003**	0.006***
	(1.19)	(1.86)	(1.54)	(-0.72)	(2.16)	(4.51)
INV	0.125*	0.079	0.146*	0.230***	0.146**	0.111*
	(1.87)	(1.33)	(1.69)	(8.1)	(2.23)	(1.88)
PMIX	0.031**	0.016	0.034*	0.010*	0.040***	0.035**
	(2.21)	(1.18)	(1.69)	(1.77)	(3.08)	(2.4)
INT	-0.006	-0.309	0.294	-1.236***	-0.216	-0.492
	(-0.01)	(-0.64)	(0.44)	(-4.8)	(-0.37)	(-0.95)
INF	-0.368	-0.502**	0.045	-0.942***	-0.518	-0.788**
	(-0.71)	(-2.52)	(0.07)	(-3.57)	(-0.96)	(-2.79)
LEV	-0.058***	-0.161***	-0.096***	-0.011**		
	(-4.02)	(-15.14)	(-4.95)	(-2.43)		
KR					0.001	-0.006**
					(0.71)	(-4.31)

Table 6 – Continued

		CR	LR	ELR	RoA	CR	LR
Lag1_CR		0.520***				0.520***	
		(21.8)				(21.2)	
Lag2_CR		0.060***				0.054***	
		(3.33)				(3.17)	
Lag1_LR			0.491***				0.516**
			(21.13)				(21.47)
Lag2_LR			0.068***				0.077**
			(4.89)				(5.64)
Lag1_ELR				0.506***			
				(24.77)			
Lag2_ELR				0.048***			
				(2.77)			
Lag1_RoA					0.476***		
					(20.96)		
Lag2_RoA					0.112***		
					(4.77)		
Intercept		0.432***	0.339***	0.415***	0.061***	0.399***	0.212**
		(11.69)	(13.2)	(8.92)	(4.68)	(10.75)	(7.2)
Year Dummies		Yes	Yes	Yes	Yes	Yes	Ye
No. of obs		1052	1052	1052	1052	1052	105
No of Firms		110	110	110	110	110	11
Obs per firm:							
min		2	2	2	2	2	2
avg		9.564	9.564	9.564	9.564	9.564	9.56
max		24	24	24	24	24	24
Wald Test	**χ^2(1)**	77.21	142.92	70.37	2.22	48.45	35.9
	p-val	0	0	0	0.136	0	0

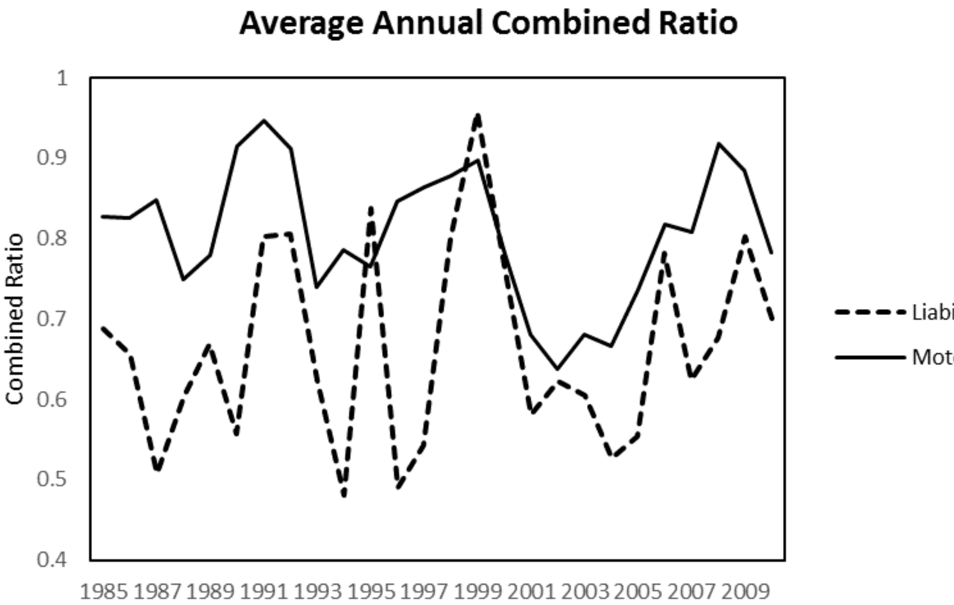

Figure 1 – Average Annual Combined Ratio

This figure shows time series of average annual combined ratio of insurers that specialise in liability insurance (dashe respectively. The dashed line depicts average annual combined ratio of insurers for whom liability insurance accounte net annual premiums written. Similarly, the solid line exhibits average annual combined ratio of insurers that speciali 50% or more of their NPWs coming from this line.