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

Abstract

Drawing 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 larger insurers have better underwriting performance and that reinsurance is associated with deteriorating underwriting performance. We conclude that our results could have potentially important commercial and/or policy implications.

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 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 have distinctive characteristics. For example, motor insurance premiums are 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 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

[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 compared with the largely bespoke nature of legal liability insurance.

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 (Harrington and Danzon, 1994). In contrast, firms operating in legal liability lines of insurance are subject to relatively less statutory compulsion, reduced competition, 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 information can enable specialist legal liability insurers to realize above average-market rates of return (i.e., 'quasi-economic rents'), especially during the 'hard' stages of the underwriting cycle [2]. Such capabilities can allow strategic risk-taking firms, such as legal liability insurers, to achieve sustainable competitive advantages by focusing in niche product-market segments (Winter, 1991, 1994).

Our study is motivated in at least three regards. First, we add to the management literature by highlighting theoretically and empirically the importance of information to insurers in strategic pricing and product positioning in different market segments, and ultimately, in realizing financial outcomes. Second, the panel-based fixed-effects 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. Third, 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

[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).

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.

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 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 the largest insurance market in Europe and the third largest in the world after the US and Japan (Association of British Insurers, 2014).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[3]. For example, the Association of British Insurers (2014) reports that overall, the UK motor insurance sector has consistently incurred underwriting losses since the mid-1990s. In 2012/13, 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 2012/13, gross annual premiums in the motor vehicle insurance line amounted to approximately £14 billion (i.e., about 28% of total annual gross property-casualty insurance market premiums of just over £50 million) compared with roughly £5 billion (i.e., approximately 10% of total annual gross property-casualty insurance market premiums)

[3] It is usual practice for motor vehicle insurance policies to include standard cover for public liability risks. However, the costs of such coverage are included in the standard premium and are dependent of the accident risk of the insured. The liability insurance component may be underwritten with liability insurance underwriters operating under a partnership agreement with the primary motor vehicle insurer.

for the liability insurance sector, with the remainder accounted for by other lines such as property insurance (Association of British Insurers, 2014).

Legal liability insurance comprises statutory minimal 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 insurance firms comprising both UK-owned operatives (e.g., Aviva plc and Hiscox plc) and UK licensed foreign insurers (e.g., Zurich and Allianz). 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).

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 many other global insurance markets the UK's 'light touch' regulatory system has fostered greater product differentiation and price competition. We consider that these institutional attributes of the UK enable us to conduct more direct tests of our research hypotheses than might otherwise be the case in many other jurisdictions.

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 to operating and investment strategies that maximize the traded value of the firm. The all-pervasiveness of risk and uncertainty in insurance markets, coupled with the importance of risk-based information and managerial discretion in improving the underwriting performance of insurance firms therefore makes the organizational economics literature 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. Therefore, the long-tail loss structure of liability insurance is likely to result in higher insurance premiums. 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.

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. 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 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.

4. Research Design

Data

Longitudinal unbalanced panel data for 1985 to 2010 covering 329 UK-based insurers (4,059 firm/year observations) operating in the motor insurance and liability insurance sectors were obtained to test our hypotheses. In our panel data set, 219 (2,396 data points) out of 329 insurance firms (4,059 data points) underwrite liability insurance, whereas 159 insurers (1,694 data points) write motor insurance. In addition, 118 insurance firms (1,309 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 stock insurers 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

We use a fixed-effects model as it controls not only for unobserved firm-specific time-invariant heterogeneity (e.g., in terms of the quality of risk management expertise), but also for time-effects (Greene, 2003). The superiority of our choice of the fixed-effects over the random-effects estimator was revealed by performing Hoechle's (2007) variant of the Hausman (1978) specification test - diagnostic that is robust to general forms of spatial and temporal dependence. However, this procedure may produce biased standard errors associated with parameter estimates as a result of heteroskedasticity and serial autocorrelation. Therefore, to counter this possibility, we follow Petersen (2009) and report results that are robust to both firm-level heteroskedasticity and serial autocorrelation. The fixed-effects model also helps control for endogeneity issues such as omitted variable bias[4]. Therefore, we estimate the following fixed-effects model:

$$UPERF_{it} = (LBT_{it}, MOT_{it}, CONTROLS_{it}) + \eta_i + \nu_t + \varepsilon_{it}$$

where $UPERF_{it}$ represents our dependent variable for insurance firm i in time t which is the annual combined ratio - a standard measure of underwriting performance in property-casualty insurance markets, and one that can be applied in assessing both aggregate and by-line underwriting performance. The combined ratio is defined as the ratio of annual incurred claims and loss adjustment costs to total net (of reinsurance) premiums earned plus annual operating expenses divided by total net (of reinsurance) premiums earned. A combined ratio of less than 1 reflects underwriting profitability and a combined ratio greater than 1 indicates underwriting losses.

To focus analysis on the two product lines of interest, two variables enter the modelling procedure - LBT_{it} is the ratio of annual net premiums written (NPW) in the liability business

[4] A common way of dealing with endogeneity is to use instrumental variable (IV) analysis. However, determining suitable instruments that do not impact on the combined ratio but concomitantly predict the proportion of business written in each line of insurance was not possible in the current study.

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. The full set of the variables used in the fixed-effects 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 (UPERF) is 101% across all 329 insurance firms in the unbalanced panel data set, suggesting that overall underwriting performance across firm/year cases is poor (i.e., more than 100%). The average combined ratio is larger than the median of 96%, suggesting that though most of the insurers manage to avoid underwriting losses, but there are a few which experienced severe losses during 1985 – 2010 period. These summary statistics reflect a generally stable, albeit lacklustre, average underwriting performance for our sample of insurers over the period of analysis.

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 UPERF, 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 UPERF (respectively SD = 0.22 and SD = 0.30) accord closely with the overall mean of 0.35.

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 based on these definitions. The first sample includes all insurers that write some business in any line of non-life insurance. Under this approach, all 4,059 firm/year observations are included in the regression, but LBT takes value 0 for firm/years (1,663 data points) where no liability insurance premiums are underwritten. Similarly, MOT is set to zero for 170 insurance firms (2,365 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 239 insurers with 2,762 observations in this sample. 219 out of these 239 insurers are liability insurers (2,396 data points) and 159 are motor insurance underwriters (1,694 data points). Thus, all the firm/year cases for which either motor or liability insurance was not written 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 1,309 firm/year observations for 118 insurers, which write both liability and motor insurance, and the corresponding sample has been labelled as the AND sample.

We also conduct regressions with samples including either liability insurance or motor insurance as the key explanatory variable. Again, these regressions use three alternative samples, namely, FULL, OR and ALL. The FULL and OR samples are as previously defined, but the ALL sample follows a different definition. All insurance firm-years in which some

liability insurance was underwritten by a given insurer are included in LBT_ALL, but all other firm/year observations of LBT_ALL are set to missing values. Applying this selection method leaves 219 insurance firms with 2,396 data points in the panel sample; however, due to incomplete panel data nine of these insurance firms were dropped during the estimation. Similarly, all 1,694 firm/year observations corresponding to 159 insurance firms, which underwrote motor insurance, are included in MOT_ALL panel sample; yet again because of incomplete panel data nine of these insurers were dropped from the estimation. Thus, LBT_ALL and MOT_ALL provide information only about the firms that were active in liability insurance and motor insurance lines respectively for the duration of our dataset.

LBT_Full and MOT_Full have 4,059 observations each corresponding to 329 insurance firms, with 12 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 2,770 observations corresponding to 247 insurance firms that were observed, on average, for 11 years. There were 219 firms writing liability insurance business leading to 2,396 observations over the full 26 years covered by our analysis, as shown by summary statistics for LBT_ALL. 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 9%. Similarly, there were 159 firms underwriting motor insurance resulting in 1,694 observations for MOT_ALL 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 28%. 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 28% 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 = 0.23) 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 £461 million and SD of £1,321 million). Again, the logarithmically transformed values for firm size in our panel do not vary much across insurers (overall SD = 1.92 versus between-firm SD = 1.73); on the other hand, individual insurance firms appear to get bigger over time (overall SD = 1.86 versus within-firm SD = 0.83). This reflects the declining number of active insurers over the 26 years from 1985 to 2010 (i.e., from 169 insurance firms in 1985/86 to 112 insurers in 2010) 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 = 0.05; 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 and overall standard deviation of 0.38 also shows similar amount of variation as investment income. 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.

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]

Table 3 reveals pair-wise correlation between UPERF and reinsurance ratio is 0.15 (at $p \leq 0.01$, 2-tail), i.e. increase in reinsurance is associated with deteriorating underwriting performance. This suggests that the ceding of reinsurance premiums can be costly to insurers, particularly in a 'hard' market. On the other hand, with correlation coefficient of -0.12 (at better than $p \leq 0.01$, 2-tail) leverage and UPERF move in opposite directions, that is, higher leverage is associated with better underwriting performance. Table 3 also reveals that association between LBT_ALL (for firms that are present in the liability insurance market) and UPERF is negative and statistically significant. MOT_ALL also has a negative and statistically significant correlation with UPERF. Similarly, UPERF has statistically significant correlation with INV and PMIX. Furthermore, we derive variance inflation factors (VIFs) for all of the independent variables that enter our regression analysis. All VIF are below 10, again indicating that bias due to multicollinearity is unlikely to be problematic when interpreting our empirical results (Kennedy, 2003).

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 and OR 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 special knowledge and experience to effectively price assumed liability risks and so realize underwriting profitability. The

coefficient estimate for LBT in our first (FULL) sample is -0.216 ($p \leq 0.05$ two tailed), which means that for a 1% increase in the proportion of liability insurance premiums, the combined ratio is expected to fall by nearly 22 basis points. A similar result is obtained for the OR sample as well, but not for the AND sample. As reported in Table 4, the AND sample is relatively small with only 118 insurance firms and 1,309 observations, which may be the reason for the LBT coefficient being insignificant for the AND sample. 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 at better than the ten per cent level of statistical significance across all samples. The coefficient estimate for MOT in our first sample is 0.143 ($p \leq 0.05$ two tailed), which means that for a 1% increase in the proportion of motor insurance premiums, a 0.14% increase in the combined ratio is expected for an insurance firm. This suggest indicates that motor insurance risks are under-priced – for example, as a result of increased market competition as suggested by recent UK insurance market surveys (e.g., Datamonitor, 2014a)[5]. The other two regressions yield coefficients estimates for MOT increasing in magnitude; thus the effect of participation in motor insurance line is consistent across differently defined samples.

Table 4 also reveals that, except for INV and PMIX, the firm-specific control variables that enter our regression analysis have either positively or negatively significant impacts on underwriting performance (at $p \leq 0.10$ or lower, 2-tail). Interestingly, the statistically significant and positive coefficient estimate for REINS in Table 4 implies that highly reinsured insurers tend to experience poor underwriting performance[6]. As noted earlier, this observation suggests

[5] 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.

[6] We further analyse this relation by replacing reinsurance ratio by its first difference, but the sign of the coefficient estimate is unchanged. This implies that an increase in the reinsurance rate is associated with deteriorating underwriting performance.

that ceding premium income to reinsurers can be costly to insurance firms, particularly during periods of economic downturn and/or in 'hard' markets of the underwriting cycle. The negative relation between reinsurance and underwriting performance could also reflect information asymmetries between primary insurers and their reinsurance partners and/or the possibility that insurers facing difficulties in effectively managing the profitability of their underwriting portfolio (e.g., due to the lack of loss experience data) tend to be more heavily reinsured (Froot, 2001).

The results presented in Table 4 also suggests that larger insurers, and highly leveraged insurers are likely to experience better underwriting results as indicated by negative but statistically significant estimated coefficients for LNSIZE and LEV (at $p \leq 0.01$, 2-tail). Compared with small insurers, large insurance firms tend to have more experienced managers and staff, and better access to better actuarial technology enabling them to better select and price risks, and so report sound underwriting performance (Shim, 2011 2003). Inconsistent with what we expected, high leverage also results in better underwriting performance. This is because leverage increases with the growth of net premiums written, and if incurred claims and expenses fall as a proportion of premiums then the combined ratio decreases and reported underwriting performance improves. We further observe that product diversification (PMIX) does not have any statistically significant effect on the underwriting performance of insurers. This result is consistent with both the correlation analysis carried out earlier (see Table 3), and 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) does not have any statistically significant direct effect on the underwriting performance of the UK insurers in our sample.

Robustness Tests

The correlation analysis presented in Table 3 indicates that a statistically significant correlation exists between LBT and MOT (at $p \leq 0.01$, two tail). Therefore, to further establish the robustness of results presented in Table 4, we conducted regressions across the three samples with either LBT or MOT present in the model at a time. The results obtained from this analysis are presented in Tables 5 (LBT) and 6 (MOT).

[Insert Tables 5 and 6 about here]

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 and segregated specifications for liability and motor insurance. 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. To ensure that our results are not driven by extreme values in either tail, we also conducted a fixed-effects panel quantile regression analysis centred at median values. The results (unreported) of the quantile estimation are in line with the fixed-effects regression results reported in Table 4.

6. Conclusion

Drawing 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. 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 a high combined ratio, 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 poor

underwriting performance, and that firm size and increased leverage can positively impact on insurers' underwriting performance. However, investment returns and product diversification do not have statistically significant effect on 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. In this regard, our research could thus help insurance regulators to design licensing rules that restrict entry to 'tight' segments of the market, like motor insurance, to insurers with the requisite business capabilities. 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, the negative impact of reinsurance on underwriting performance could highlight the cost implications of risk transfer and encourage insurance managers to focus on the ‘actuarially fair’ pricing of risks assumed rather than relying on reinsurers to share the burden of future mispriced losses. 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	Expected Sign
Dependent Variable	$UPERF_{it}$	Combined Ratio	(Annual incurred claims (& loss adj. costs) + annual operating expenses) ÷ total annual net premiums earned	
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)	+
	$PMIX_{it}$	Product mix	$\sum_{j=1}^{N} S_j^2$ Where, S_j: (annual premiums written in j*th* 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
	overall	**1.013**	**0.962**	**0.349**	**0.473**	**3.198**	**N = 4059**
UPERF	between			0.222	0.529	1.936	n = 329
	within			0.301	0.003	3.057	T-bar = 12.34
	overall	**0.105**	**0.009**	**0.205**	**0.000**	**1.000**	**N = 4059**
LBT_Full	between			0.222	0.000	1.000	n = 329
	within			0.086	-0.378	0.857	T-bar = 12.34
	overall	**0.153**	**0.061**	**0.232**	**0.000**	**1.000**	**N = 2770**
LBT_OR	between			0.252	0.000	1.000	n = 247
	within			0.094	-0.329	0.892	T-bar = 11.22
	overall	**0.177**	**0.087**	**0.241**	**0.000**	**1.000**	**N = 2396**
LBT_ALL	between			0.258	0.000	1.000	n = 219
	within			0.099	-0.305	0.916	T-bar = 10.94
	overall	**0.153**	**0.000**	**0.281**	**0.000**	**1.000**	**N = 4059**
MOT_Full	between			0.263	0.000	1.000	n = 329
	within			0.093	-0.597	0.940	T-bar = 12.34
	overall	**0.225**	**0.020**	**0.316**	**0.000**	**1.000**	**N = 2770**
MOT_OR	between			0.294	0.000	1.000	n = 247
	within			0.105	-0.526	1.011	T-bar = 11.22
	overall	**0.367**	**0.283**	**0.333**	**0.000**	**1.000**	**N = 1694**
MOT_ALL	between			0.322	0.000	1.000	n = 159
	within			0.123	-0.383	1.042	T-bar = 10.65
	overall	**0.276**	**0.215**	**0.243**	**0.000**	**0.977**	**N = 4059**
REINS	between			0.225	0.000	0.910	n = 329
	within			0.124	-0.399	1.122	T-bar = 12.34
	overall	**0.463**	**0.383**	**0.391**	**0.000**	**2.853**	**N = 4059**
LEV	between			0.349	0.000	1.986	n = 329
	within			0.199	-1.063	2.650	T-bar = 12.34
	overall	**11.258**	**11.170**	**1.959**	**5.697**	**16.649**	**N = 4059**
LNSIZE	between			1.731	6.540	15.825	n = 329
	within			0.835	6.418	15.325	T-bar = 12.34
	overall	**0.061**	**0.057**	**0.055**	**-0.605**	**0.976**	**N = 4059**
INV	between			0.047	-0.210	0.553	n = 329
	within			0.044	-0.616	0.772	T-bar = 12.34
	overall	**0.684**	**0.639**	**0.262**	**0.219**	**1.000**	**N = 4059**
PMIX	between			0.234	0.236	1.000	n = 329
	within			0.130	0.195	1.256	T-bar = 12.34

Table 3 – Correlation Analysis

This table reports correlation coefficients computed using Pearson Product Moment Correlation Analysis for all the key variables used in this study. All variables are as defined in Table 1. Superscripts *; ** and *** denote statistical significance at 10%, 5% and 1% level respectively (2-tail).

	UPERF	LBT_Full	LBT_OR	LBT_ALL	MOT_Full	MOT_OR	MOT_ALL	REINS	LEV	LNSIZE	INV
LBT_Full	-0.01	1									
LBT_OR	-0.04***	1***	1								
LBT_ALL	-0.06***	1***	1***	1							
MOT_Full	-0.02*	-0.12***	-0.29***	-0.20***	1						
MOT_OR	-0.06***	-0.29***	-0.29***	-0.20***	1***	1					
MOT_ALL	-0.06***	-0.34***	-0.34***	-0.22***	1***	1***	1				
REINS	0.15***	0.14***	0.09***	0.03	-0.19***	-0.36***	-0.31***	1			
LEV	-0.12***	-0.21***	-0.17***	-0.10***	0.06***	0.40***	0.38***	-0.39***	1		
LNSIZE	-0.02	0.06***	-0.06***	-0.09***	0.20***	0.10***	-0.13***	-0.04***	-0.19***	1	
INV	0.09***	-0.02	-0.05***	-0.07***	0.01	-0.00	-0.00	0.00	-0.02*	-0.09***	1
PMIX	-0.04***	-0.15***	0.05***	0.19***	-0.07***	0.19***	0.55***	-0.18***	0.19***	-0.43***	-0.07***

Table 4 - UK Property-Casualty Insurers, 1985-2010: Fixed-Effects Estimation

This table presents the results of the fixed effects regression estimation that tests the differences in underwriting performance of insurers across 3 alternative samples. The FULL sample includes all P&C insurers, while the OR sample includes only the insurers participating either in the motor insurance or the liability insurance product-markets. The AND sample includes insurers participating in both the liability and the motor insurance lines in a given year. All variables are as defined in Table 1. Standard errors reported in this table are robust to heteroskedasticity and autocorrelation. This table also reports results from the modified Wald test for group-wise heteroskedasticity; the Wooldridge test for autocorrelation in panel data and modified Hausman specification test of Hoechle (2007). Statistical significance levels are *** = 0.01, ** = 0.05, and * = 0.10, and they are reported at the 2-tail level.

Variables	Full		OR		AND	
	Coefficient	Rob Std Err	Coefficient	Rob Std Err	Coefficient	Rob Std Err
LBT	-0.216**	0.085	-0.266***	0.101	0.031	0.136
	(-2.53)		(-2.63)		(0.23)	
MOT	0.143*	0.076	0.242***	0.086	0.302**	0.123
	(1.88)		(2.82)		(2.46)	
REINS	0.449***	0.057	0.493***	0.078	0.453***	0.139
	(7.89)		(6.35)		(3.27)	
LEV	-0.048	0.033	-0.425***	0.065	-0.541***	0.108
	(-1.44)		(-6.55)		(-5.01)	
SIZE	-0.080***	0.013	-0.112***	0.019	-0.075**	0.035
	(-6.02)		(-5.98)		(-2.14)	
INV	0.207	0.153	0.231	0.214	0.62	0.405
	(1.35)		(1.08)		(1.53)	
PMIX	-0.08	0.049	0.035	0.066	0.028	0.106
	(-1.61)		(0.53)		(0.26)	
Year Dummies	Yes		Yes		Yes	
R-squared	0.103		0.176		0.238	
No. of obs	4059		2762		1309	
No of Firms	329		239		118	
Obs per firm:						
min	2		2		2	
avg	12.3		11.6		11.1	
max	26		26		26	
Diagnostics	Modified Wald test for groupwise heteroskedasticity					
	$\chi^2(329)$	2.00E+34	p-value	0		
	Wooldridge test for autocorrelation in panel data					
	F(1, 311)	3.25E+06	p-value	0		
	Modified Hausman test					
	F(7, 25)	6.59	p-value	0		

Table 5 - UK Property-Casualty Insurers, 1985-2010: Robustness Tests (Liability Insurance)

This table presents the results of the fixed effects regression estimation that tests the differences in underwriting performance of insurers across 3 alternative samples. The FULL sample includes all P&C insurers, while the OR sample includes only the insurers participating either in the motor insurance or the liability insurance product-markets. The ALL sample includes only the insurers participating in the liability insurance business in a given year. All variables are as defined in Table 1. LBT, the ratio of net liability insurance premiums written to total net annual premiums written is the main explanatory variable in this regression. Standard errors reported in this table are robust to heteroskedasticity and autocorrelation. Statistical significance levels are *** = 0.01, ** = 0.05, and * = 0.10, and they are reported at the 2-tail level.

Variables	Full		OR		ALL	
	Coefficient	Rob Std Err	Coefficient	Rob Std Err	Coefficient	Rob Std Err
LBT	-0.243***	0.084	-0.320***	0.099	-0.290***	0.106
	(-2.9)		(-3.24)		(-2.75)	
REINS	0.437***	0.056	0.472***	0.076	0.509***	0.088
	(7.84)		(6.2)		(5.82)	
LEV	-0.042	0.033	-0.387***	0.064	-0.554***	0.081
	(-1.27)		(-6.07)		(-6.86)	
SIZE	-0.076***	0.013	-0.107***	0.019	-0.108***	0.022
	(-5.87)		(-5.71)		(-4.83)	
INV	0.207	0.153	0.228	0.214	0.401*	0.238
	(1.35)		(1.06)		(1.68)	
PMIX	-0.074	0.049	0.063	0.065	0.042	0.072
	(-1.5)		(0.97)		(0.59)	
R-squared	0.101		0.170		0.192	
No. of obs	4059		2752		2387	
No of Firms	329		239		210	
Obs per firm:						
min	2		2		2	
avg	12.3		11.6		11.4	
max	26		26		26	

Table 6 - UK Property-Casualty Insurers, 1985-2010: Robustness Tests (Motor Insurance)

This table presents the results of the fixed effects regression estimation that tests the differences in underwriting performance of insurers across 3 alternative samples. The FULL sample includes all P&C insurers, while the OR sample includes only the insurers participating either in the motor insurance or the liability insurance product-markets. The ALL sample includes only the insurers participating in the motor insurance business in a given year. All variables are as defined in Table 1. MOT, the ratio of net motor insurance premiums written to total net annual premiums written is the main explanatory variable in this regression. Standard errors reported in this table are robust to heteroskedasticity and autocorrelation. Statistical significance levels are *** = 0.01, ** = 0.05, and * = 0.10, and they are reported at the 2-tail level.

Variables	Full		OR		ALL	
	Coefficient	Rob Std Err	Coefficient	Rob Std Err	Coefficient	Rob Std Err
MOT	0.176**	0.074	0.289***	0.083	0.200**	0.095
	(2.37)		(3.48)		(2.11)	
REINS	0.453***	0.057	0.499***	0.076	0.385***	0.103
	(8.01)		(6.53)		(3.74)	
LEV	-0.052	0.033	-0.436***	0.066	-0.286***	0.075
	(-1.56)		(-6.64)		(-3.83)	
SIZE	-0.083***	0.013	-0.115***	0.019	-0.084***	0.022
	(-6.32)		(-6.13)		(-3.75)	
INV	0.209	0.156	0.237	0.217	0.206	0.307
	(1.34)		(1.09)		(0.67)	
PMIX	-0.066	0.050	0.038	0.066	0.029	0.085
	(-1.33)		(0.58)		(0.34)	
R-squared	0.100		0.170		0.186	
No. of obs	4059		2762		1682	
No of Firms	329		239		147	
Obs per firm:						
min	2		2		2	
avg	12.3		11.6		11.4	
max	26		26		26	