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Upreti, V. & Adams, M. (2015). The strategic role of reinsurance in the United Kingdom's (UK) non-life insurance market. *Journal of Banking & Finance, 61*, 206-219.

http://dx.doi.org/10.1016/j.jbankfin.2015.09.010

The Strategic Role of Reinsurance in the United Kingdom's (UK) Non-Life Insurance Market

Abstract

Using panel data for five main lines of insurance in the United Kingdom's (UK) non-life insurance market we demonstrate that by increasing the level of reinsurance, primary insurers increase their product-market share at the expense of less reinsured rivals. We also observe that the influence of reinsurance and other financial variables on insurers' growth in product-market share differs across lines of insurance business. We conclude that reinsurance performs an important strategic function in insurance markets through its impact on product-market outcomes in competitive insurance markets. Additionally, we find that leverage is the most important factor affecting product-market share at the aggregate business level of the insurance firm.

Key words: Reinsurance; Insurance; Strategy; United Kingdom.

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Acknowledgements:
The comments of Phil Hardwick, Joy Jia, and Hong Zou and the anonymous referee are gratefully acknowledged. The paper also benefited from the comments of participants at seminars hosted by Swansea University and Leeds University Business School. In addition, Vineet Upreti is grateful for the financial support of the Willis Research Network. Finally, the usual disclaimer applies.

I. Introduction

Recent studies reported in the finance literature demonstrate that corporate hedging decisions affect the strategic performance of firms and as a result, product-market considerations are an integral part of the corporate risk management process (e.g. Harris and Raviv, 1991; Froot, Scharfstein and Stein, 1993; Adam, Dasgupta and Titman, 2007). In the spirit of this stream of research, the present study examines the strategic role of reinsurance in influencing annual changes in product-market share in five main segments of the United Kingdom's (UK) non-life (property-liability) insurance market – motor vehicle, property, legal liability, personal accident, and miscellaneous and pecuniary loss.

Reinsurance is a conditional financial claims contract written by a third party (the reinsurer) that indemnifies the counterparty (the primary insurer) for random loss events in return for a share of annual premiums written (Doherty and Tinic, 1981)[1]. Doherty and Tinic (1981) report that reinsurance enables primary insurers to more effectively manage cash flow volatility, maintain future underwriting capacity, and reduce the probability of ruin. The strategic finance function of reinsurance is important not only because solvency risk matters to policyholders and insurance industry regulators, but also because of market imperfections (e.g., frictional costs and taxes) retaining capital can be costly for funding providers (Harrington and Niehaus, 2003). Froot and O'Connell (2008) also contend that managers of insurance firms are particularly likely to reinsure non-standardized and difficult-to-assess risk exposures (that often typify lines of non-life insurance such as legal liability). This risk-transfer/risk-sharing capability enables primary insurers to economize on the costs of financing positive NPV investments, protect cash holdings, reduce premiums (prices), and increase their market power. Jean-Baptiste and Santomero (2000) further observe that reinsurers possess proprietary advantages (e.g., superior information on emergent risks) that primary insurers can share (at cost) in order to more accurately price assumed risks and thereby secure competitive advantages over rivals.

Fresard (2010) argues that when external finance is costly, capital and liquidity management decisions can play important roles in influencing competitive outcomes for firms. Zou and Adams (2008) add that risk management decisions (such as (re)insurance) can be influenced by size-related factors such as the ability of firms to efficiently diversify and retain risks. The present study thus examines the extent to which reinsurance (as a common indemnity risk management contract in insurance markets) influences the product-market position of insurance firms while simultaneously controlling for other potentially important intervening firm-specific factors such as leverage, liquidity, and size. Our

[1] Winton (1995) points out that there are two main risk-sharing treaties between a reinsurer and insurer: proportional (e.g., quota share) treaties where losses are shared between the parties on an agreed percentage basis; and non-proportional (e.g., excess-of-loss) treaties where the reinsurance company absorbs all losses over an amount that is retained by the insurer subject to an upper limit. Adiel (1996) also notes that in insurance markets, reinsurance can also include financial (or finite) reinsurance that commonly provide an up-front capital injection or relief to reserves (surplus) linked to the net present value (NPV) of liabilities with the level of ceded premiums linked to the value of future claims and profit emergence. However, data on different risk-sharing reinsurance treaties and financial reinsurance arrangements were not publicly available for the full period of our analysis (1987-2010).

research is motivated in four key regards. First, insurance product-markets are becoming more price competitive in developed economies such as the United States (US) and UK, particularly in the wake of the recent global economic crisis (Doherty and Lamm-Tennant, 2009; A. M. Best, 2012). This has heightened the importance for empirical research on how reinsurance can be used to secure strategic competitive advantages - for example, by allowing insurers to reduce prices but at the same time maintain solvency and sufficient holdings of cash (liquidity) for investing in positive NPV projects. Second, indemnity contracts, such as reinsurance, are pure hedge instruments that cannot be used for speculation (Doherty, 2000; Aunon-Nerin and Ehling, 2008). This means that by acting as a pure hedge against claims volatility, reinsurance enables primary insurers to more effectively plan and price new products and to ensure sufficient risk capacity for such new lines of business. Therefore, risk financing impacts on primary insurers' marketing strategies and the micro-structure of insurance markets, which in turn directly influences the product-market share of insurance firms. Such perspectives are likely to be of commercial, regulatory and policy interest. Third, our single country/single industry focus 'naturally' controls for biases (e.g., due to differences in risk management practices and product-market structure) that can arise in cross-industry and/or transnational research. At the same time, the results of the present study could be generalized to other industrial sectors (e.g., banking) that also use hedging tools to grow their business and maximize the value of the firm. Fourth, our study provides insights on the product-market linkages between reinsurance, and capital and liquidity management decisions in insurance firms. For example, Zanjani (2002) argues that the ability of insurers to differentiate product prices, and so influence their competitive position in markets, can be related to their marginal costs of capital, liquidity position, and ability to transfer assumed (extreme) risks through the purchase of reinsurance. However, this strategic dimension of reinsurance has neither been given sufficient emphasis nor fully investigated in previous empirical studies of insurance markets. In this respect, our research adds to the extant literature on the impact of capital, liquidity and risk management on the product-market position of firms and the shaping of market structure.

In summary, our results indicate that increasing the level of reinsurance allows primary insurers to grow their product-market share at the expense of less reinsured rivals. We also observe that the influence of reinsurance and other financial variables on insurers' growth in product-market share varies between lines of insurance business. Additionally, financial leverage is an important factor affecting product-market share at the aggregate business level of the insurance firm.

The remainder of our paper is structured as follows. Section II provides institutional background information on the UK's non-life insurance market. In Section III we review the relevant strategic finance literature and develop our primary research hypothesis. Section IV describes our research design, including an outline of the modelling procedure employed, definition of the variables used, and a description of the data. Section V analyses and discusses the empirical results. Finally, Section VI concludes the paper.

II. Institutional Background

The UK's non-life insurance market comprises about 360 or so locally licensed and active domestically-owned and foreign-owned companies, subsidiaries and branches of varying size, ownership structure, and product-mix[2]. The market currently generates approximately £47 billion (US$76 billion) in net (of reinsurance) annual premiums (Association of British Insurers, 2011)[3]. In addition, 87 Lloyd's syndicates currently underwrite non-life premiums of roughly £24 billion (US$39 billion) mainly in marine, aviation and transport (MAT) lines of insurance (A.M. Best,

[2] Additionally, 548 non-life insurers licensed by European Economic Area (EEA) member states are permitted to conduct business in the UK under the 1992 Third European Insurance Directive (Financial Services Authority, 2013). However, these non-life insurance firms are not regulated by the UK insurance industry regulator and so they are outside the scope of this study.

[3] Approximately 150 or so inactive (and mainly small) non-life insurance funds were also authorized to operate in the UK as at the end of 2010. Furthermore, about 600 EU-based insurance carriers are currently permitted to transact insurance business in the UK under various promulgations of the EU's Third Non-Life Insurance Directive. In addition, the relative proportion of total annual premiums currently written (plus the approximate number of firms) in the five main lines of business examined in the present study are: motor vehicle – 37% (n~50); property – 30% (n~70); legal liability – 11%; (n~60); personal accident – 14% (n~45); and miscellaneous and pecuniary loss – 8% (n~60)(Association of British Insurers, 2011).

2012). By this standard, the UK is the largest insurance market in Europe and the third largest in the world after the US and Japan (Shiu, 2011). The annual value of non-life reinsurance premiums in the UK (including Lloyd's) is about £23 billion (US$37billion) with approximately 70% of annual market reinsurance premiums transacted with global reinsurance corporations such as Munich Re and Swiss Re (Data Monitor, 2011). The UK's non-life insurance and reinsurance markets are relatively unregulated with regard to the quantum of losses that can be covered, indemnity terms, type of contract permitted, and so on (Shiu, 2011). In many ways, reinsurers operating in the UK are regulated on much the same basis as primary insurers (Abdul Kader, Adams and Mouratidis, 2010). For example, insurance and reinsurance companies operating in the UK have to be approved and licensed by the insurance industry regulator [4]. The regulator is, amongst other things, responsible for monitoring and reviewing the capital adequacy (including reinsurance arrangements) of insurance and reinsurance companies doing business in the UK. Since 2007, UK-based reinsurers are also subject to the European Union's (EU's) Reinsurance Directive which aims, amongst other things, to ensure consistency in reinsurers' reserving practices, standards of capital maintenance, and solvency reporting (Abdul Kader et al., 2010).

The UK's non-life reinsurance market is a potentially interesting environment within which to conduct this research project for three main reasons. First, as in other developed insurance markets such as the US, reinsurance is becoming an increasingly important capital and risk management device in the UK as a greater range of potentially high value and difficult to predict risk exposures emerge (Froot, 2001). Reinsurance is also likely to become a particularly salient strategic issue for UK insurers following the implementation of the European Union's (EU) new risk capital (Solvency II) requirements on 1 January 2016 (Abdul Kader et

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[4] During the period of our analysis (1987- 2010) UK insurance companies were regulated first by the Department of Trade and Industry (DTI) and from 2001 by the Financial Services Authority (FSA). From 1 April 2013, the statutory supervision and regulation of UK insurance companies has been conducted by the Prudential Regulation Authority (PRA) while insurance market practices and consumer issues have been regulated by the Financial Conduct Authority (FCA). Both regulatory bodies are subsidiaries of the Bank of England.

al., 2010). Second, property-casualty lines of insurance in the UK tend to be supplied by a small number of composite insurers (e.g., Aviva and Royal Sun Alliance) (A.M. Best, 2011). However, EU-induced deregulation since the 1990s, business opportunities at the Lloyd's of London insurance market, and extensive and varied distribution networks have increased price and product-market competition in the domestic market, particularly in personal lines and motor insurance. These developments have combined to make the UK the most competitive insurance market in the EU (Hardwick and Dou, 2006). Thus our study provides evidence on the strategic dimension of the reinsurance–market share relation in competitive insurance environments. Third, unlike in the US where many State-based insurance regulators impose higher capital maintenance requirements on foreign (so-called 'alien') reinsurance companies than US-owned reinsurers (Weiss and Chung, 2004); UK regulations do not discriminate between reinsurance companies according to their domicile of origin. Again unlike the US, the UK is also a unitary fiscal environment and does not impose regulatory limits on premiums as do some states in the US (e.g., New York). These institutional differences are important as reinsurance, taxes, and premium rates directly influence underwriting capacity and product-market strategies. Therefore, compared with the US, the purchase of reinsurance and product-market decisions of UK insurers is less likely to be affected by regulation-induced market disequilibria such as constrained supply and price distortions. These institutional features thus enable us to conduct a potentially more robust test of the linkage between reinsurance and the strategic objectives of primary insurers, and so build on the extant literature.

III. Literature Review and Hypothesis Development

In this section we review the relevant theoretical and empirical literature linking the financial and risk management of firms with their competitive position in the product-markets that they operate. We then put forward the main research hypothesis that directs our empirical tests.

Towards a Strategic Theory of Reinsurance

The trading of insurance risks in secondary reinsurance markets enables the managers of insurance firms to realize important strategic objectives such as meeting statutory minimum levels of solvency, increasing underwriting capacity, and increasing firm value (e.g., by reducing future taxes and agency costs) (Mayers and Smith, 1990). These financial and risk management attributes of reinsurance can have a direct impact on the product-market share of insurance firms – for example, by helping them provide enhanced surety to policyholders, brokers and regulators and so attract more new business and increase product-market share (Doherty and Tinic, 1981). The product-market position of primary insurers can be further enhanced by reinsurers as a result of their provision for ancillary business advice and the effective monitoring of reinsurance arrangements. These attributes can help insurers to increase outputs, reduce prices and so grow product-market share and increase their market value. These aspects of the strategic marketing function of reinsurance in insurance markets and their link with other financial management aspects of corporate strategy are examined further below.

Market Imperfections and Strategic Behavior

Campello, Lin, Ma, and Zou (2011) demonstrate that in the presence of agency costs and information asymmetries, capital structure and associated risk hedging decisions have a favorable effect on the cost of borrowing and investment restrictions. This enables them to make competitive gains at the expense of rivals by reducing costs (e.g., lower debt expenses) and/or increasing revenues (e.g., from new positive NPV projects).

Brander and Lewis (1986), Bolton and Scharfstein (1990), and Opler and Titman (1994), amongst others, note that in competitive environments, such as the UK's insurance market[5], highly levered firms are frequently at risk of predation from lowly levered firms as the former are often more cash constrained than the latter[6]. This situation limits the

[5] Global insurance markets are generally recognized as being competitive in terms of the range and type of insurance products available to buyers. As noted earlier in section II, the London insurance market (of which Lloyd's of London is an important part) is particularly noted for its innovative and competitive nature (A.M. Best, 2012).

ability of cash constrained firms to optimize their investment opportunity sets and compete effectively in product-markets. In other words, predation risk arises when financially superior (low levered and/or cash unconstrained) firms operating in competitive markets influence the product-market (e.g., pricing and entry/exit) and investment decisions of rivals (Adam, 2009)[7]. Brander and Lewis (1986) argue that because shareholders only hold residual claims to free cash flows, efforts to maximize firm value are particularly sensitive to the debt-to-equity ratio. Therefore, to compete successfully with rivals the managers of highly levered firms will seek to reduce debt levels, and the associated agency costs of debt, and so improve their competitive product-market positions using risk transfer techniques such as reinsurance. However, Campello (2006) argues that increased leverage can actually improve the competitive positions of firms in product-markets. This is because under Jensen's (1986) 'free cash flow' hypothesis, the repayment obligations contained in debt covenants reduces agency costs without the need for firms to make big investments in risk management, and motivates them to generate free cash flows by increasing product-market share through investment in productive assets. Bolton and Scharfstein (1990) highlight that in competitive product-markets predation risk arises from market failure (e.g., agency problems and imperfect information). They further argue that costly contracting solutions (such as reinsurance) that are designed to mitigate information asymmetries between highly indebted firms and their creditors can exacerbate liquidity constraints and so stimulate predatory behavior by more lowly levered and cash-rich firms.

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[6] Bolton and Scharfstein (1990) define predation risk as the risk that cash-rich firms drive their financially constrained competitors out of business by reducing their rivals' free cash flows – e.g., by under-cutting market prices.

[7] Reinsurance purchases by incumbent non-life insurance firms can also influence the strategic decisions and growth opportunities of rivals (e.g., new entrants) that may not have the same access to levels of reinsurance coverage and/or reinsurance prices (e.g., due to adverse selection issues). Such financial advantages of reinsurance partnerships confer competitive advantages on established non-life insurers unless rivals can also secure risk transfer/risk-sharing arrangements with reinsurers. Data limitations precluded empirical tests on this aspect to be carried out here. However, casual observation suggests that reinsurance is critical to the successful entry and survival in insurance markets. For example, Admiral plc entered the UK motor insurance market in 1992/3 with substantial reinsurance backing from Munich Re (i.e., with 75% of gross annual premiums written being reinsured). Admiral plc is now one of the UK's leading motor insurer with roughly 15% of market share in terms of annual written premiums.

Myers and Majluf, (1984) posit that a firm's performance in competitive product-markets depends on its ability to realize growth opportunities and increase size. However, protecting liquidity levels and raising external debt and equity finance can concomitantly increase agency costs such as those arising from the underinvestment and asset substitution incentives and managerial entrenchment (Myers, 1977). Zou and Adams (2008) show that indemnity contracts (in their case, property insurance) can lower agency and frictional market costs of capital thereby reducing the risks (costs) of financial distress and/or bankruptcy for firms. Mayers and Smith (1990) also argue that reinsurance reduces agency and other costs of contracting that can arise in highly levered primary insurers in post-loss states when external financing costs tend to be high. Therefore, reinsurance is expected to be strategically important to cash constrained insurance firms as it not only helps them reduce the costs of external finance in imperfect markets but also increases their capacity to grow new business premiums by increasing underwriting capacity and/or diversifying assumed risks. In turn, this capability enables primary insurers to invest in positive NPV projects and compete effectively with market rivals.

Rochet and Villenueve (2011) demonstrate that when liquidity and (re)insurance decisions are simultaneously determined, cash-rich firms are likely to improve their financial performance to a greater degree relative to cash-poor firms. Rochet and Villenueve (2011) contend that in the face of financing imperfections and high risk volatility in product-markets, (re)insurance allows firms to build-up cash reserves, stabilize investment spending, and lower market costs of capital. However, Gamba and Triantis (2008) show that the level of a firm's cash holdings and leverage position are not equivalent when future cash flow streams are uncertain, which can be the case following a severe but under-(re)insured loss event. Therefore, different combinations of cash, debt, and reinsurance could have different effects on firms' strategic competitive product-market positions (e.g., see Fresard, 2010).

Research Hypothesis

The key research question that emerges from the above literature review is: What is the product-market outcome of the purchase of reinsurance after controlling for insurers' leverage, cash position, and size? We consider this issue to be an empirical question of some importance. For example, low leverage without reinsurance could be viewed by investors, regulators, and others not as a 'positive signal' (e.g., indicating an insurer has low insolvency risk) but rather as a 'negative signal' (e.g., indicating that an insurer has limited capability to generate future new business at an affordable cost of capital). Doherty, Lamm-Tennant and Starks (2003) emphasize the solvency management role of reinsurance in enabling insurance firms to retain, regain or grow their product-market share in post-crisis situations (such as after the terrorist events of 9/11). Regulatory intervention can create a negative signal to prospective policyholders and investors as to the future financial viability of insurance firms and as a result, lead to a loss of business and decline in product-market share. Doherty et al. (2003) and Doherty and Lamm-Tennant (2009) also emphasize that, as noted earlier, reinsurance allows primary insurers to increase their underwriting capacity, diversify assumed risks, and realize potentially profitable investment opportunities in times of uncertainty. Moreover, the financial ratings of insurance firms are largely voluntary (Adams, Burton and Hardwick, 2003) and so do not apply to all insurers in the market. As such, reinsurance provides a more comprehensive and easily accessible source of information on insurers' prospects for interested parties. These strategic advantages of reinsurance are expected not only to reduce the costs of capital for insurers but also to increase product-market share and associated free cash flows by assuring prospective policyholders, brokers, and industry regulators as to the future going concern of the insurance provider. The foregoing analysis thus leads us to hypothesize that:

H: Reinsurance enables insurers to increase their product-market share.

IV. Research Design

In this section we describe our research design including the specification of the modelling procedure, description of the data, and definition of the variables used.

Baseline Model and Main Variables

The baseline specification that we employ in the present study is similar to that used in prior studies examining the linkage between capital structure and product-market behavior (e.g., see Opler and Titman, 1994; Campello, 2006; Fresard, 2010). Here we use one-step System Generalized Method of Moments (GMM-SYS) estimation procedure to estimate the dynamic relation between reinsurance and the product-market share growth of UK non-life insurers over the 24 years 1987 to 2010. The GMM-SYS specification has been shown to be efficient when there is temporal persistence in the endogenous series and unobserved heterogeneity in cross-sectional/time-series firm-level data. To the extent that unobserved heterogeneity represents missing and/or non-constant firm/time conditions (e.g., the possibility that new products launched by a firm under varying market states may affect the intensity of reinsurance over time) then GMM-SYS goes some way to mitigating the challenging issue of omitted variable bias (Arellano and Bover, 1995; Blundell and Bond, 1998; Bond, 2002). To control for potential endogeneity (e.g., between an insurer's current product-market share and past years' product-market performance and levels of reinsurance held), we use orthogonal deviations as instruments for the levels equation to maximize the number of observations utilized in the regression model (Wintoki, Linck and Netter, 2012)[8]. In addition, to minimize the number of GMM-style instruments we use a collapsed form of the instrument matrix in our estimation (Roodman, 2009a). The maximum lag-depth of untransformed variables utilized as GMM-style instruments for each product-market has been kept approximately equal to the average number of observations per firm. This approach helps keep the instrument count low and so

[8] Wintoki et al. (2012) point out that attempts to mitigate endogeneity through the use of instrumental variables can be challenging due to the difficulty of identifying suitable instruments. However, in sensitivity tests we use developed losses as an instrument for reinsurance ratio as prior studies (e.g. Cole and McCullough, 2006) suggest that it directly influences the level of reinsurance.

maintain the power of the Hansen test of over-identifying restrictions (Roodman, 2009b). Our GMM-SYS model is thus:

$$\Delta PMSHARE_{i,t} = \alpha(\Delta PMSHARE_{i,t-1}) + \beta(zREINS_{i,t-1}) + \delta(LEV_{i,t-1}) + \phi(LIQ_{i,t-1}) + \lambda(SIZE_{i,t-1}) + \varphi(SEXP_{i,t-1}) + \gamma(PROFIT_{i,t-1}) + \eta_i + \upsilon_t + \varepsilon_{i,t}$$

To mitigate the potentially confounding effects of idiosyncratic firm-effects affecting the coefficient estimates, we adjust all firm-specific variables to their industry-year mean. This gives a more precise indicator of an insurer's product-market position in a given year relative to its rivals (e.g. see Campello, 2006). We further expect that the annual amount of reinsurance purchased will vary across business lines in accordance with intrinsic differences in risk profiles and rates of new business growth[9]. Therefore, following Campello (2006) we standardize the ratio of annual reinsurance premiums ceded to gross annual premiums written (hereafter referred to as the 'reinsurance ratio') for each firm-year across all product-markets. This approach further enhances the ability of the variable *REINS* (named *zREINS* after standardization) to more precisely measure an insurance firm's product-market position relative to that of its competitors. This arises as any competitive advantage to an insurer imparted by a higher reinsurance ratio depends on the dispersion of that ratio across the cross-sectional sample for a particular year in each line of business[10].

In our model, the dependent variable $\Delta PMSHARE_{it}$ represents year-on-year growth in product-market share for insurance firm 'i', where the product-market share of firm 'i' for a given year in a particular line is calculated as the ratio of net premiums written by the firm to total net

[9] For example, John, Litov and Yeung (2008) note that corporate risk-taking, and hence the level of risk hedging (reinsurance spending), could be greater in lines of business with relatively high rates of growth. As a result, reinsurance and product-market growth trends could be driven by latent variables.

[10] For standardization to be viable it is a requisite that the distribution of the reinsurance ratio is uni-modal and not highly skewed. To alleviate the potentially confounding effects of outliers we winsorize our variables at the 5% level at each tail.

premiums written at the industry level[11]. Our model also contains a lag of the dependent variable ($\Delta PMSHARE_{it-1}$) to account for recent firm-specific initiatives (e.g., the adoption of new technology) that might influence an insurer's product-market performance.

The main explanatory variable of interest in our model is $zREINS_{i,t-1}$ which gauges the impact of reinsurance on *ΔPMSHARE*. To alleviate the possibility that the relation between product-market share and growth in the amount of reinsurance purchased by insurance firms may be endogenous we regress growth in product-market share on the reinsurance ratio (the level of reinsurance). Such an approach is useful because the reinsurance ratio represents the cumulative effects of reinsurance decisions taken in past periods, which reduces the potential for reverse causality between *ΔPMSHARE* and *zREINS.* We acknowledge that *ΔPMSHARE* may not adjust instantaneously to changes in the amounts of reinsurance purchased each year. Consequently, we use the first-lag of *zREINS* to allow for an insurer's product-market share to adjust to annual changes in the amount of reinsurance purchased[12]. This procedure also captures the impact of multi-period arrangements that often characterize non-life reinsurance treaties, and further reduces the possibility of endogeneity between the dependent variable and the reinsurance ratio. In our model, we also control for five other firm-specific factors – leverage, liquidity, firm size, profitability, and selling expenses - that could influence the product-market performance of an insurer. Our motivation for entering these explanatory variables into our regression analysis is outlined briefly below.

Control Variables

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[11] Net written premiums represent firm/industry turnover (price x quantity of risk coverage) and so represents a standard measure of productive activity in insurance markets. However, an insurer can increase its premiums by increasing risks assumed at higher prices rather than increasing the volume of new business sales per se. This raises the possibility of omitted variable bias. Therefore, in sensitivity tests we use the change in by-line claims incurred to total incurred claims as an alternative proxy of firm/market output. However, this measure may also be an imprecise proxy due to delays in reporting the quantum of losses particularly in so-called long-tail lines such as legal liability insurance. In the event, the two measures of product-market share were positively correlated and the empirical results qualitatively unchanged. Therefore, we conclude that omitted variable bias is not a significant issue in the present study.

[12] The change in the level of reinsurance purchased each year can either increase upwards (e.g., in anticipation of a more risky environment) or downwards (e.g., in periods of cash constraint).

To capture capital structure-effects on the product-market performance of insurance firms, we include leverage (*LEV*), as a control variable in our specification (e.g., see MacKay and Phillips, 2005; Campello, 2006). *LEV* is calculated as the annual ratio of net total liabilities (difference between total assets and policyholders' surplus)[13]. Capital constrained insurance firms are likely to be at greater risk of financial distress and/or bankruptcy and as such, they are likely to have greater difficulty in attracting new customers and grow product-market share than insurers that are in a stronger financial condition (Zanjani, 2002).

Liquidity could also affect the product-market performance of firms (Fresard, 2010). However, as noted earlier, Gamba and Triantis (2008) note that a firm can retain a healthy stock of cash even if it is highly levered (e.g., in order to make future debt repayments). Therefore, highly levered insurers could generate free cash flows by increasing new business premiums. Therefore, a positive association can arise between the level of liquidity and leverage position of insurance firms. As a result, we control for the level of cash holdings (*LIQ*) in our model and measure *LIQ* as the ratio of year-end values of cash (and cash equivalents) to total net provisions.

Additionally, size could impact on an insurer's ability to grow product-market share irrespective of the amount of reinsurance purchased – for example, big insurance firms tend to be naturally more diversified and have higher franchise values than small insurance firms (Zanjani, 2002). However, we expect liquidity to be decreasing in proportion with increased firm size as large firms are relatively less likely than small firms to rely on accumulated cash reserves to realize future growth options – for example, due to their ability to generally raise external finance at lower costs. Therefore, to capture the effect of firm size on product-market performance as well as its interaction with other variables, we include firm size (*SIZE*) as a control variable in our model. *SIZE* is

[13] This variable is computed using all the values aggregated at the total business level as data on the by-line segregation of assets and surplus are not publicly available.

calculated as the natural log of total assets as the size of the firms in the insurance industry tends to be log-normally distributed.

The product-market share of an insurance firm can also be directly influenced by prior years' sales enhancing measures such as commissions paid to distributors and resources invested in internet technology (Brown and Goolsbee, 2002). Therefore, to account for interactions between these new business acquisition expenditures and an insurer's product-market performance, we include previous year's sales and advertising expense ($SEXP_{i,1-t}$) as a control variable in our specification. We define *SEXP* as total selling and advertising expenses incurred in acquiring new business scaled by the gross premiums written, where total selling expenses are the sum of sales commissions incurred (paid and payable) plus other new business acquisition costs.

The generation of period earnings enables insurers to innovate and increase strategic investments in positive NPV projects. This attribute cansignal future financial strength to insurance markets and allow profitable insurers to command higher prices, which in turn leads to more profits, and growth of product-market share. In our model, $PROFIT_{i,t-1}$ is represented by the return on assets for each year and is calculated as the ratio of annual total pre-tax profit to total assets. A lagged variable is used as higher profits in a given period can enhance an insurance firm's ability to finance infrastructural initiatives to increase future product-market share (Campello, 2006).

Additional Control and Instrument Variables

Besides the control variables included in our baseline specification, few other variables may also have an effect on the product-market share growth of insurers. For example, Garven and Loubergé (1996) point out that reinsurance can be transacted in international reinsurance markets and/or internally via the reinsurance subsidiaries of conglomerate insurance groups. Garven and Loubergé (1996) report that both ways of transacting reinsurance can have economic advantages that can help primary insurers grow product-market share. For example, external reinsurers can provide ceding insurers with valuable risk management advice, whilst internal reinsurance can help insurers realize economic benefits from savings in frictional costs. As a result, we model the effect of the use of external and internal reinsurance by incorporating a dummy variable ($GROUP_{i,t-1}$), which equals 1 where an insurer is a member of a conglomerate, and 0 otherwise.

As with size, we expect more diversified insurers to have a greater capacity to underwrite new business and thus achieve a higher growth in product-market share. Highly diversified insurers are also more likely to have greater access to various distribution channels that allow them to reach a larger number of potential customers, resulting in a higher growth in product-market share. Therefore, we use the line of business Herfindahl index as a measure of diversification. The line of business Herfindahl index is calculated as sum of square the share of individual lines in the total premiums written by an insurer in a given year. As mentioned in footnote 8, we test the sensitivity of our results using developed losses as an instrument for reinsurance in a two-stage IV estimation. Previous studies on determinants of reinsurance, such as Cole and McCullough (2006) use developed losses as one of the determinants of the reinsurance. Moreover, developed losses from prior years are unlikely to have a direct bearing on product-market share growth; however, they are expected to directly affect the level of premiums ceded by the primary insurers to their reinsurers. This makes developed losses a valid instrument for our study. We therefore define $DEVLOS_{i,t-1}$ as the ratio of developed losses (for the past year) to total annual reserves. All the variables that enter our regression analysis are summarized in Table I

[Insert Table I here]

Firm/Time-Specific Effects

The notations η_i and v_t in our model represent unobserved firm-specific and time-specific effects respectively. Due to the presence of both mono-line as well as multi-line insurers of varying sizes and ownership structures (e.g., management-owned) in our dataset, we expect there to be firm heterogeneity; hence the variable η_i is included in the model to account for it. Additionally, to control for time effects which are likely to be present over a period of 24 years in an industrial sector that is well-known to be cyclical (Cummins and Danzon, 1997), we include time (year) dummies in our regression.

Data Description

We fit our GMM-SYS model to unbalanced (1987-2010) panel data for insurance firms operating in five main lines of non-life insurance business, namely: motor, property, legal liability, personal accident, and miscellaneous and pecuniary loss insurance. We also estimate the same regression at the total business level of the insurance firm to investigate the cumulative effect of reinsurance on overall annual changes in product-market share. The five product-markets analyzed comprise approximately 95% of insurance underwritten in the UK's non-life insurance sector. All data relate to UK non-life insurers taken from the Standard and Poor's Synthesys insurance companies' database for the 24 years, 1987 to 2010 – a period when UK non-life insurers were in varying states of financial condition. The financial data that we use are sourced from the regulatory returns submitted annually by UK insurance companies to the insurance industry regulator - the FSA. The selected period of analysis represents the earliest and latest years for which complete data were available at the time our study was carried out. Also, we consider that the duration covered by our data set is sufficiently long to account for the possible effects of insurance underwriting cycles on our results.

Our data set includes independently operating and reporting non-life insurance companies licensed by the FSA to conduct property-liability insurance business in the UK.[14] Very small non-life insurance providers (including mutual fire insurance pools) and public sector insurance arrangements are excluded from the sample either because they do not directly and/or actively write much insurance business and/or complete

[14] The annual statutory returns do not provide consolidated financial statements for insurance groups and so we cannot conduct detailed tests on an intra-group basis. However, affilates/subsidiaries of insurers operating in the UK tend to have considerable discretion over reinsurance decisions in order to respond to prevailing product-market conditions and realize economic (e.g., tax) benefits as well as local regulatory (e.g., capital) requirements .

data are not available. Furthermore, the vast majority of insurers in our data set (approximately 95%) are stock forms of organization, and the majority of these are non-publicly listed entities [15]. Underwriting syndicates operating at Lloyd's 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 [16], 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).

Firm-years for which any one or more of equity, assets or reserves were reported as negative are also excluded from our data set. Moreover, in the interest of preserving the panel structure of our data, firms without two complete sets of observations are left out of the estimation sample. There are a handful of insurance firms in our sample that have been involved in mergers and acquisitions during our period of analysis. Some of them are key players in the UK insurance market and excluding them from our study could bias our results. Consequently, to circumvent this problem, we treat these conglomerate insurance groups as two separate entities – i.e., pre-and-post merger and/or acquisition. We further test for outliers in the lower and upper tails of the distribution of our data set and find that *ΔPMSHARE* and *PROFIT* have the highest number of outliers at 689 and 836 outliers respectively. In order to minimize the effect of these extreme values, we winsorize all the variables used in estimations at top and bottom five percentile of observations in order to root-out extremities in the data[17]. In the next section, we briefly describe the key summary statistics for our sample that are reported in Table II.

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[15] The preponderance of non-publicly listed stock insurers precludes the need for us to control for both organizational form and listing status in the present study.

[16] Lloyd's moved from a three years to annual system of accounting based on UK generally accepted accounting principles (GAAP) on 1 January 2005.

[17] Alternative tests to control for the potentially confounding effects of extreme values (e.g., using logged values) did not yield intuitively meaningful results. Therefore, we consider winsorization to be the best way to control for extremities in our data set. In sensitivity tests conducted using the Generalized Method of Moments (GMM) at the total business level and Generalized Second-stage Least Squares (G2SLS) instrumental variable procedure, we use variables winsorized at the first percentile of each tail. However, the results are qualitatively unchanged.

[Insert Table II here]

V. EMPIRICAL RESULTS

In this section of the paper we present and analyze our empirical results.

Summary Statistics

Table II indicates that the size of insurance firms in our sample does not vary much by product-market, though there is some observable variation in sample sizes across market segments. This feature indicates that not all insurers in our data set serve all five insurance segments that are the focus of the present study. Average growth in product-market share (winsorized) for the five lines examined over the period of analysis range from 8% to 14%, although at the total business level it trails-off to an overall average of 6%. Similarly, standard deviations relative to the respective mean values across different lines suggest consistent rates of growth across the entire property-liability insurance market. Maximum values of by-business market share are also large relative to the corresponding average values. This could be due to the new entry of more (price and product) competitive insurers that make gains in product-market share in the early years of operation as the result of the adoption of new technology and/or other innovative business strategies (Brown and Goolsbee, 2002).

Table II indicates that average reinsurance ratios show more variation across segments of the non-life insurance market compared with rates of product-market share growth. Also, average levels of reinsurance to gross premiums written across the panel sample range from 15% in motor insurance to over 30% in property, liability, and miscellaneous and pecuniary lines of business. This observation further hints that insurers operating in different lines of business tend to have inherently different risk profiles and hence different demand profiles for reinsurance. Indeed, our expectation is that, all else equal, insurers underwriting standard and predictable risk business (e.g., motor insurance) are likely to have less need for reinsurance than their counterparts underwriting more complex and unpredictable risk business (e.g., legal liability and catastrophe risks) (e.g., see Froot, 2001; Froot and O'Connell, 2008; Ibragimov, Jaffee, and

Walden, 2009). This view tends to be borne out by Table II, which illustrates that the average by-line reinsurance ratio ranges from 14% to 38%, with motor (a fairly predictable risk line) and miscellaneous and pecuniary loss (a relatively less predictable line) recording the lowest and highest values respectively. The average levels of leverage winsorized at 5% (in both tails) range from 13% for motor insurance to 17% for the miscellaneous and pecuniary loss line of insurance. Such a fairly uniform distribution of financial structure across segments of the market could highlight the fact that insurance is largely a solvency-regulated business where maintaining a consistent and moderate leverage ratio is of paramount importance to industry regulators (Mayers and Smith, 1990). A similar logic seems to apply to the dispersion of leverage as standard deviations across all lines as well as at the total business level takes a value of approximately 0.11. Average liquidity levels in our sample also appear to be highly variable across product-markets with values respectively ranging from 0.41 to 0.87 for motor and personal accident lines of business. Moreover, lines of insurance showing the greatest gains in product-market share tend to have higher liquidity levels, suggesting that as Rochet and Villeneuve (2011) argue, strategic capital, risk and liquidity management decisions tend to closely mirror growth opportunities in product-markets.

Table II reveals that a potentially key determinant of product-market share growth - selling expenses - varies across different lines of insurance business. Interestingly, this variable also tracks the average level of share growth across different market segments such that lines experiencing high rates of product-market growth tend to incur high selling costs. Average selling expenses for our sample range from 18% of gross premiums written in case of standard motor insurance to 31% in case of the more specialized miscellaneous and pecuniary loss line of insurance business. However, at the total business level the mean annual value of selling expenses drops sharply to about 9% of gross premiums written. This trend implies that selling expenses rise when managers target lines of risk business that have sound strategic growth prospects such as miscellaneous and pecuniary loss products (e.g., financial and trade guarantee insurance). However, average profitability for all the insurers in our data both by-line and aggregate business level is modest - ranging from 2% to 4% of total assets. This result suggests that over the period of our analysis non-life insurance was generally not a high margin business.

Line of business Herfindahl Index (*HHI*) and the group membership identifier (*GROUP*) are the additional control variables that are used in robustness tests. The vast majority of observations in our sample correspond to insurers with presence in more than one line of insurance. Liability insurance business has the lowest proportion of mono-line ("pure-play") insurers (only 2.5%), whereas personal accident business has the highest proportion with approximately 12% of firm/year observations. Overall the nearly 20% of firm/year observations belong to mono-line companies. This also indicates that most of the firms in our estimation sample are multi-line insurers with a mean *HHI* of 0.62 at the total business level. Average *HHI* varies slightly among the product markets with liability insurers being the most diversified with a mean HHI of 0.45 and miscellaneous and pecuniary loss line having the highest mean of 0.54. Similarly most of the companies in our estimation sample are affiliated to a group with only about 15% of observations relating to firms with no group affiliation. The proportion of observations corresponding to non-group companies range from a low of about 12% for personal accident insurance business to a high of approximately 17% for liability insurance business.

We turn next to the correlation coefficient analysis. As different regressions are run for different product-markets, we compute correlation coefficients for nine sets of key variables. Whereas the same values of *LIQ*, *LEV*, *SIZE*, *SEXP*, *PROFIT, HHI and GROUP* are used in all the regressions; values of *ΔPMSHARE*, *zREINS and DEVLOS* change by line of insurance. Correlation coefficients corresponding to respective product-markets and total business level are reported in panels A to F in Table III.

[Insert Table III here]

Table III shows a weak, but statistically significant and positive correlation (at the 1% level, two-tail) between the dependent variable (*ΔPMSHARE*) and main explanatory variable *zREINS*. Table II indicates consistent correlation coefficients of approximately 0.15 across all product-markets except at the total business level, where the coefficient drops down to 0.08. However, the association between the dependent variable and its lag is not consistent across different lines of insurance and statistically significant at conventional levels only for three product-markets (motor, property, and personal accident) and at the total business level. Furthermore, the correlation coefficient ranges from 0.10 for personal accident insurance to 0.15 for motor insurance. These relatively low correlations suggest that product-market growth momentum over time is weak – for example, as a result of growing competition. In addition, *ΔPMSHARE* is significant and negative, but weakly correlated (at the 5% level or better, two-tail) with *SIZE* across all lines of business with the degree of correlation being similar for all lines. This result indicates that large insurers tend to find it difficult to sustain high levels of product-market share growth year-on-year. That is, the same absolute value of growth translates into a lower percentage for larger insurance firms relative to smaller insurance firms.

In our dataset, moderate and statistically significant correlation coefficients (at the 1% level, two-tail) are observed between *zREINS* and *LEV* with coefficients ranging from 0.29 to 0.46 across different product-markets. This observation accords with some prior studies (e.g., Shiu, 2011) and suggests that highly levered insurers tend to buy more reinsurance than lowly levered insurance firms. Table III further indicates negative and statistically significant correlations (at the 1% level, two-tail) between firm size and the reinsurance ratio indicating that compared with small insurers, large insurers are likely to be relatively less reliant on reinsurance – for example, because they tend to be more naturally diversified. Moreover, larger insurers generally have greater access to capital markets than small insurers, and as such, they have relatively more options to raise risk finance (Jarzabkowski, Bednareh, Burke, Cabantous and Smets, 2012). Moderate but statistically significant inverse correlations (at the 1% level, two-tail) between firm size and liquidity reported in Table III also implies that large insurers tend to hold proportionately fewer liquid assets than their smaller counterparts, and rely more on future cash flows from in-force business to maintain future solvency levels and underwriting capacity.

HHI has a strong negative correlation with size and the group identifier across all the lines of insurance. This is expected as larger insurers are usually more diversified firms, and they also tend to be part of a conglomerate group. Similarly, there is a negative correlation between *HHI* and *zREINS* for some lines as more diversified insurers (lower *HHI* score) tend to cede a lower proportion of their premiums compared with their less diversified counterparts. As expected, *DEVLOS* variable is statistically significantly correlated with *zREINS* thereby supporting its use as an instrument for the reinsurance ratio.

Multivariate Results

GMM Diagnostics

As noted earlier, one-step GMM-SYS is used to test the research hypothesis put forward in section II. Although the two-step GMM-SYS estimator is asymptotically superior, the finite sample properties of the one-step GMM-SYS estimator are more useful than two-step estimator. For instance, Bond, Hoeffler and Temple (1998, p.18) state that " . . . in finite samples, the asymptotic standard errors associated with the two-step GMM estimators can be seriously biased downwards, and thus form an unreliable guide for inference". Blundell and Bond (1998) also suggest that apart from being asymptotically robust to heteroskedasticity, finite sample estimates of the one-step system estimator are more reliable and consistent. To minimize the risk of biased standard errors due to heteroskedasticity and autocorrelation between firm/years, our regression is estimated using robust standard errors. We run our baseline specification individually for each line of insurance business and present the consolidated results in Table IV.

[Insert Table IV here]

To check the validity of our model's specification and instruments used in the GMM-SYS estimation, the Hansen test of over-identifying restrictions, and the Difference-in-Hansen test of exogeneity of GMM-style instruments are reported in Table IV. The results of Hansen test of over-identifying restrictions given in Table IV indicate that our GMM-SYS specification is not over-identified. Furthermore, the Hansen test for exogeneity of GMM-style instruments does not reject the null hypothesis of instrument validity and so indicates that the instrument set used is suitable in context of our specification. Moreover, in accordance with our expectations, AR(1), AR(2) and AR(3) statistics reported in Table IV above confirm the presence of first-order autocorrelation in error term in differences (significant at the 1% level, two-tail) across all the business lines; while second order autocorrelation too is statistically significant at 10% level (two-tail) in the case of property insurance. Our dataset admits lags equal to or higher than two as GMM–style instruments for all the product-markets investigated. Hence, we estimate our specification using lags ranging from second lag to the twelfth lag in our estimations. As discussed in section III (A), the upper limit of lag depth is set approximately equal to the average number of observations per group for each product-market examined. The instrument count reported for each line of business also remains at an acceptable range, i.e., below the number of firms included in the estimation for each segment of the non-life insurance market examined.

Main Results

Consistent with what was hypothesized our main explanatory variable - *zREINS* - has a statistically significant and positive impact on *ΔPMSHARE* at the 10% level (two-tail) or better across all lines of insurance business. However, the influence of *zREINS* on *ΔPMSHARE* shows slight by-line variation with the greatest impact being experienced in the property insurance sector. This reflects the exposure of property to increased catastrophe risks such as flooding and storm damage as a result of factors such as lax development controls and climate change (e.g., see Browne and Hoyt, 2000). Our results establish economic significance of reinsurance as a strategic tool as after controlling for five control variables, one standard deviation increase in the reinsurance ratio from the industry-year mean leads to product-market share growth (above their line-year mean) in the range of 13% in motor insurance to 21% in property insurance[18].

Contrary to what was expected, Table IV shows that $\Delta PMSHARE_{i,t-1}$ does not influence insurers' ability to realize growth in all product-markets except for property insurance where the lagged dependent variable is significant (at the 5% level, two-tail). The lagged dependent variable is, however, statistically significant (at the 1% level, two-tail) at the total business level. The economic effect gleaned from Table IV is that a standard deviation increase in the product-market share growth from industry-year mean in year t-1 grows product-market share by 7.8% points in year t. These results could reflect a 'momentum-effect' in the rate of growth in the product-market share of insurance firms as a result of past investment (e.g., in new technology). Similarly, the coefficient estimate for $LEV_{i,t-1}$ is only negative and statistically significant in the case of property insurance and at the total business level (at the 10% and 1% levels two-tail, respectively). At the total business level, a standard deviation reduction in leverage below the product-market year average leads to a 6.5% points gain in product-market share in the next year.

Prior research (e.g., Campello, 2006) predicts that high leverage levels in the past can lead to a current loss of product-market share for firms because of the heightened effects of financial distress and insolvency. Consequently, an increase in insurers' leverage, particularly in competitive sectors, such as property insurance, could be perceived by brokers/agents and policyholders as increasing the probability of ruin. This could trigger a 'flight to quality' and a consequential loss of product-market share for highly levered insurance firms operating in competitive segments of the market. However, as previous studies (e.g., Doherty and Tinic, 1981; Doherty et al., 2003; Weiss and Chung, 2004) point out, reinsurance can be used to mitigate the risk of financial distress and/or bankruptcy for highly levered insurance firms and so enable them to

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[18] The economic significance is computed as follows: for example, for motor insurance 2.6% points = 0.20 (standard deviation per Table II) x 0.13 (coefficient estimate per Table IV).

assure prospective policyholders and so grow product-market share in competitive lines of insurance business[19].

Table IV illustrates that $LIQ_{i,1-t}$ has a statistically significant effect on product-market share growth for two lines – personal accident and legal liability insurance (at the 10% and 5% levels two-tail, respectively). Not surprisingly, these two lines also show the highest variation in levels of liquidity (i.e., in terms of the high standard deviation relative to the mean value of liquidity). Hence, firms with high liquidity ratios relative to their rivals tend to have competitive advantages in personal accident and legal liability lines of insurance. However, the economic significance of the 'liquidity effect' is modest in that a unit increase in the liquidity ratio above the product-market year mean improves product-market share by roughly 10% to 11% points for personal accident and legal liability insurance. One plausible explanation for this observation is that indemnity contracts such as reinsurance can help insurers protect their cash resources against depletion as a result of greater than anticipated loss events. This attribute can help primary insurers not only to protect their solvency margins but also enable them to realize positive NPV projects in their investment opportunity sets (Doherty, 2000). The cash protection facility of reinsurance could become more important for UK (and indeed, EU) insurers as a result of the more stringent capital maintenance and risk management rules of Solvency II that are due to be implemented after 1 January 2016. It is possible that the statutory solvency monitoring regulations that characterize the UK, and other insurance markets could help explain the apparent inconsistency with regard the liquidity findings of recent cross-sectional research (e.g., Fresard, 2010). This research suggests that cash rich firms are likely to secure product-market share gains at the expense of cash constrained rivals, particularly after macroeconomic shocks such as the recent global financial crisis.

[19] As was noted earlier in section V, a direct association between *zREINS* and *LEV* is observed in our estimation sample across all product-markets. Therefore, to test the robustness of our estimates to multicollinearity that may arise due to high correlation between the regressors, we re-estimated our model using an alternative specification that excluded *LEV*. The results obtained from these estimations are qualitatively similar to those reported in this paper. We also re-estimated our model with annual sales growth as the dependent variable. Annual sales growth is defined as the annual change in net premiums written. Again, the coefficient estimates are similar to those originally estimated, and so in the interest of brevity they are not reported here.

With regard to firm size, we observe that product-market share growth does not respond consistently to variations in size across all product-markets. The coefficient estimate for $SIZE_{i,t-1}$ is statistically significant and negative for two lines of business, namely motor insurance and miscellaneous and pecuniary loss (at the 1% and 5% levels, two-tail, respectively). This finding suggests that over the period of analysis, small insurers operating in these two segments of the market have increased new business at the expense of larger competitors – for example, as a result of product innovation and/or the use of new technology [20]. Additionally, in such niche segments of the non-life insurance market the real advisory services of reinsurers could provide another competitive benefit to small but innovative niche players (e.g., see Jean Baptiste and Santomero, 2000)[21].

Prior studies (e.g., MacKay and Phillips, 2005; Adam et al., 2007; Campello et al., 2011) make clear that compared with small firms large entities are often better placed to use their brand profile and stock of cash resources to improve their market share through geographical as well as product-market diversification. However, in the present study the observed relation is reversed for the lagged value of firm size, suggesting that the effect of 'firm size inflation' in the past years could result in a loss of product-market share in the future as large insurance firms lose their competitive edge to smaller rivals operating in niche segments of the market. This might be due to combination of factors – for example, managerial inertia in the case of larger insurers and/or the possibility that new entrants in a product-market grow very fast in the early years as a result of competitive pricing, more innovative products, and/or providing better quality customer services.

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[20] For example, Direct Line is a typical example of a relatively small (in terms of assets-in-place) but specialist UK-based insurer operating in the motor insurance segment of the non-life insurance market.

[21] Since the size of an insurer tends to correspond closely with its age, we include firm age as an explanatory variable to test the robustness of our results to the length of time an insurer has been operating in the respective product-markets that are the focus of the present study. We find that whereas age is a statistically significant predictor for motor insurance line (at $p \leq 0.1$, two tailed), the same is not true for other lines. However, the interpretation of our results remains largely unchanged after inclusion of the firm age variable.

Table IV reveals that the lagged values of new business acquisition expenses to gross premiums written (sales) ratio (i.e., $SEXP_{i,1-t}$) does not have the expected positive effect on the product-market share growth of insurance firms. This observation therefore suggests that overall, the UK's non-life insurance market has for many years been operating at, or close to, saturation point with limited scope for new business growth. Furthermore, $Profit_{t-1}$ (return on assets) does not have any discernible effect on the product-market performance of UK non-life insurers except for those operating in the motor insurance sector. It is therefore likely that due to the lower barriers of entry and competitive nature of the motor vehicle insurance segment of the market more efficient and profitable firms experience higher market share growth as well. Such efficiency enhancements may be the result of investments in new technology and/or business processes which come as a consequence of highly profitable operations.

Robustness Tests

We test the sensitivity of our baseline results reported above using an instrumental variable (IV) estimator based on the G2SLS approach. The model we use is essentially a random-effects estimator that instruments the reinsurance ratio by developed losses, and includes additional control variables $GROUP_{i,t-1}$ and $HHI_{i,t-1}$. Since *GROUP* is a time invariant variable for all the firms in our sample, the use of a fixed-effects estimator is ruled out. Moreover, our data being derived from a single industry, it is likely to meet the assumptions of the random-effects model, which allows us to include the group identifier in our estimation. We further assume that firm-specific effects in our data are random realizations of a data generating process common to all insurers. Table V reports the second-stage results from this estimation. The equation is exactly identified as only one instrument has been used for the reinsurance ratio, the main endogenous variable. There is a slight difference in the sample sizes between our baseline and IV estimates because the number of observations available for estimation in IV regressions is dependent on the availability of observations of the instrument. The IV estimation includes two more variables than the baseline model, namely *HINDX* and *GROUP*, which is likely to result in coefficient estimates that are different from the baseline model. Moreover, in the case of the IV estimates, the winsorization has been done at first percentile at each tail, which results in a larger variation in values of our variables. Furthermore, based on the minimum covariance determinant of Rousseeuw (1985), approximately 10% of total observations remain influential after winsorization at the 1st and 99th percentiles at the lower and upper tails respectively. The difference in coefficient estimates of Tables IV and V appears to be the cumulative effect of these extreme values.

[Insert Table V here]

The estimates at the total business level are in agreement with the baseline estimates. The coefficient estimates for the property insurance business are also similar in sign and significance to the baseline estimates, though differ in magnitude[22]. To examine further the time-sensitivity of our results to changing macro-economic and insurance market conditions we conducted a sensitivity test for the effects of the 2007/8 global financial crisis using a dummy variable - $CRISIS_{it}$ - that represents 1 before 2008, and 0 otherwise. However, our results (unreported) indicate that the variable $CRISIS_{it}$ does not have any statistically significant effect on market share growth in any of the lines investigated. Moreover, the estimates produced by these regressions are in line with those produced by IV regressions.

Test for Non-linearity

Although the aforementioned analysis reveals that there is a positive relation between the reinsurance ratio and market-share growth, there is still a possibility that this relation is non-monotonic. To investigate this possibility, we conducted further regressions after parsing

[22] Some of the coefficients in Table V are quite large in magnitude and we suspect that few influential values of respective variables drive these results. Owing to this limitation, we do not attach economic significance to these results and present them here only as tests for direction of relations rather than as predictive estimates. To investigate the possibility whether the magnitudes of coefficients are influenced by the magnitude of observations, we investigate the effect of the variation in cession rates on market share growth in the following section.

the dataset into four subsets based on quartiles of lagged value of *zREINS*.

[Insert Table VI & Figure 1 here]

Table VI reports the results of these regressions, which reveal that though the relation between the reinsurance ratio and the market share growth is positive for all the subsets of observations, it is statistically significant only for observations corresponding to higher than the median reinsurance ratio. It can also be observed that the magnitude of coefficient estimates corresponding to varying level of reinsurance ratio vary from one quartile to another. As shown by Figure 1, this outcome suggests that the firms with higher than median reinsurance ratio experience higher product-market share growth than their less reinsured rivals adding weight to conclusions drawn using preceding analyses. This also hints at a piecewise linear relation between the dependent and the main explanatory variable.

VI. Conclusions

Utilizing a one-step dynamic panel data design (GMM-SYS) on data gathered from five main segments of the UK's non-life insurance market for 1987 to 2010 we find that overall reinsurance plays an important role in enabling insurers to realize gains in product-market share. Specifically, we observe that an increase in reinsurance leads to significant gains in product-market share for insurers at the expense of insurers that are less reinsured. However, the extent of the realized gain in product-market share differs across business lines as a result of variations in the type and scale of risks insured as well as by-line differences in the use of reinsurance.

We also find that the effect of reinsurance in securing growth in product-market share is amplified for highly levered insurers at the total business level but not at the individual product-market level, with the exception of property insurance. Similarly, insurers' liquidity levels do not influence growth in product-markets except in two lines – personal accident and legal liability insurance. This could reflect 'liquidity convergence' among insurers as a result of statutory minimum solvency requirements. Indeed, this process could be exacerbated after 2016 with the implementation of the EU's new Solvency II risk-based capital maintenance rules. Furthermore, the sensitivity of the rate of product-market share growth to changes in leverage varies across business lines. However, possible negative impacts on product-market share growth due to past increases in insurers' leverage levels could be mitigated by purchasing reinsurance.

Surprisingly, except for motor vehicle and miscellaneous and pecuniary loss lines of insurance, firm size does not appear to be a vital factor in driving growth in product-market share. In these business lines small (niche) insurance firms appear to have captured relatively more gains in product-market share from using reinsurance than large insurers. This observation further suggests that the risk management and other real advisory services provided by reinsurers could help smaller innovative players in these market segments to mitigate inherent advantages bestowed by larger firm size such as brand-name recognition and ability to effectively diversify risks underwritten.

Our research results could have potential commercial and/or public policy implications. For example, managers of highly levered insurance firms could purchase reinsurance to increase future cash flows from opportune infrastructural/new technology investments that grow product-market share at the expense of competitors. This attribute could provide comfort to investors, policyholders, industry regulators, and others as to the probability of highly levered insurance firms remaining as going concerns. In addition, our observation that reinsurance enables small (niche) insurers to improve their position in competitive product-markets, such as motor insurance, suggests that it enhances consumer choice and lowers prices. This attribute is likely to be of policy relevance to industry regulators, legislators, consumer groups, amongst others that have an interest in the efficient and effective operation of insurance markets.

Finally, the strategic impact of risk management techniques, such as reinsurance, is an important but relatively under-researched area in the finance literature. We believe that the results of this study could help spawn some interesting future strategic risk finance research from insurance markets in other (e.g., developing) countries as well as different industrial sectors of the economy (e.g., banking).

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Table I
UK Property-Liability Insurers, 1987-2010: Definition of Variables

This table presents the labels of the key variables used in the study together with their full description.

Variable	Represents	Description
$\Delta PMSHARE_{i,t}$	Product-market share growth	$PMSHARE_{it}$ is the by-line amount of annual growth in net premiums written (NPW). $\Delta PMSHARE_{i,t}$ is calculated as $PMSHARE_{i,t}$ minus $PMSHARE_{i,t-1}$ divided by $PMSHARE_{i,t-1}$, minus the industry/line year mean.
$zREINS_{i,t}$	Level of reinsurance ceded	By-line amount of reinsurance premiums ceded in year t divided by the gross insurance premiums written in year t.
$LIQ_{i,t}$	Level of cash holdings	Ratio of cash (& cash equivalents) to net provisions and reserves in year t.
$LEV_{i,t}$	Leverage	Difference between total assets and total surplus (sum of Equity and Reserves) scaled by total assets in year t
$SIZE_{i,t}$	Firm size	Natural log of total assets in year t.
$SEXP_{i,t}$	Business acquisition expenses	Total selling and advertising expenses (total of commissions paid/payable to distributors plus other acquisition costs) scaled by the gross premiums written in year t.
$PROFIT_{i,t}$	Return on assets	Ratio of earnings before tax to total assets in year t.
HHI	Line of business Herfindahl-Hirschman Index	Sum of square of share of each line in a firm's annual premiums written.
GROUP	Group membership	Takes value 1 if insurer is part of a group and 0 otherwise.
DEVLOS	Developed loss ratio	Developed losses over the past year scaled by total surplus.

Table II
UK Property-Liability Insurers, 1987-2010: Descriptive Statistics

This table reports the overall (winsorized at 5% level at each tail (except for *HHI* and *GROUP*)) descriptive statistics of the estimation sample by line of insurance business for the entire period of analysis. All variables are as defined in Table I.

Variable	Statistic	Motor	Property	Legal Liability	Pers. Acc.	Misc. & Pecuniary	Total Business
ΔPMSHARE	*Mean*	0.08	0.12	0.10	0.13	0.14	0.06
	Std. Dev.	0.41	0.54	0.53	0.65	0.66	0.39
	Min	-0.66	-0.75	-0.76	-0.76	-0.79	-0.74
	Max	1.51	1.82	2.04	2.48	2.55	1.53
	No. of Obs.	1159	2401	1716	1410	1899	2613
REINS	*Mean*	0.15	0.38	0.32	0.24	0.38	0.33
	Std. Dev.	0.20	0.28	0.28	0.26	0.29	0.25
	Min	0.01	0.03	0.02	0.00	0.01	0.01
	Max	0.97	0.98	1.00	0.97	0.99	0.93
	No. of Obs.	1159	2401	1716	1410	1899	2613
LEV	*Mean*	0.13	0.16	0.15	0.17	0.17	0.16
	Std. Dev.	0.10	0.11	0.11	0.11	0.12	0.11
	Min	0.02	0.02	0.02	0.02	0.02	0.02
	Max	0.46	0.46	0.46	0.46	0.46	0.46
	No. of Obs.	1159	2401	1716	1410	1899	2613
LIQ	*Mean*	0.41	0.74	0.51	0.87	0.80	0.77
	Std. Dev.	0.67	1.23	0.85	1.52	1.29	1.27
	Min	0.03	0.03	0.03	0.03	0.03	0.03
	Max	8.15	8.29	8.15	8.19	8.28	8.06
	No. of Obs.	1159	2401	1716	1410	1899	2613
SIZE	*Mean*	12.50	11.69	12.05	11.86	11.67	11.64
	Std. Dev.	1.61	1.81	1.65	1.78	1.77	1.80
	Min	8.15	7.36	7.36	7.36	7.36	7.37
	Max	14.49	14.49	14.49	14.49	14.50	14.47
	No. of Obs.	1159	2401	1716	1410	1899	2613
SEXP	*Mean*	0.18	0.28	0.24	0.31	0.31	0.09
	Std. Dev.	0.08	0.12	0.12	0.18	0.19	0.08
	Min	0.05	0.05	0.04	0.04	0.04	0.00
	Max	0.43	0.57	0.52	0.73	0.82	0.30
	No. of Obs.	1159	2401	1716	1410	1899	2613
PROFIT	*Mean*	0.02	0.03	0.02	0.03	0.04	0.03
	Std. Dev.	0.07	0.07	0.06	0.07	0.07	0.07
	Min	-0.14	-0.14	-0.14	-0.14	-0.13	-0.14
	Max	0.22	0.22	0.22	0.22	0.22	0.22
	No. of Obs.	1159	2401	1716	1410	1899	2613
HHI	*Mean*	0.49	0.51	0.45	0.53	0.54	0.62
	Std. Dev.	0.24	0.23	0.20	0.26	0.25	0.28
	Min	0.16	0.16	0.16	0.17	0.16	0.16
	No. of Obs.	1193	1910	1238	1430	1657	2922
GROUP	*0*	145	252	211	170	206	428
	1	1048	1658	1027	1260	1451	2494

Table III

UK Property-Liability Insurers, 1987-2010: Correlation Coeffic

This table presents the correlation coefficient matrix for the main variables examined in this study. Correlation co Product Moment Correlation Analysis for each line of insurance business detailed in panels A to F below. All Superscripts *; ** and *** denote statistical significance at 10%, 5% and 1% level respectively (two-tail).

Panel A: Motor Insurance

	ΔPMSHARE	*ΔPMSHARE$_{t-1}$*	*zREINS$_{t-1}$*	*LEV$_{t-1}$*	*LIQ$_{t-1}$*	*SIZE$_{t-1}$*	*SEXP$_{t-1}$*
ΔPMSHARE$_{t-1}$	0.15***						
zREINS$_{t-1}$	0.14***	0.02					
LEV$_{t-1}$	-0.02	-0.05*	0.31***				
LIQ$_{t-1}$	0.08**	0.06*	0.13***	0.03			
SIZE$_{t-1}$	-0.14***	-0.16***	-0.26***	0.07**	-0.38***		
SEXP$_{t-1}$	-0.04	-0.19***	0.31***	0.19***	0.03	-0.06**	
PROFIT$_{t-1}$	0.01	-0.12***	-0.03	0.06**	0.10***	0.09***	-0.11***
HHI$_{t-1}$	-0.00	0.02	0.03	-0.24***	0.08***	-0.50***	0.02
GROUP$_{t-1}$	0.02	0.03	0.05*	0.13***	-0.00	0.11***	-0.03
DEVLOS$_{t-1}$	-0.08***	-0.07**	0.02	-0.22***	-0.10***	-0.20***	-0.10***

Panel B: Property Insurance

	ΔPMSHARE	ΔPMSHARE$_{t-1}$	zREINS$_{t-1}$	LEV$_{t-1}$	LIQ$_{t-1}$	SIZE$_{t-1}$	SEXP$_{t-1}$
ΔPMSHARE$_{t-1}$	0.06***						
zREINS$_{t-1}$	0.15***	-0.07***					
LEV$_{t-1}$	-0.02	-0.01	0.33***				
LIQ$_{t-1}$	0.03*	0.05**	0.22***	0.14***			
SIZE$_{t-1}$	-0.04**	-0.04*	-0.20***	-0.03	-0.39***		
SEXP$_{t-1}$	0.02	-0.13***	0.32***	0.10***	0.06***	-0.02	
PROFIT$_{t-1}$	0.03	-0.03	-0.02	0.11***	0.13***	-0.03	-0.09***
HHI$_{t-1}$	0.04**	0.02	-0.16***	-0.03*	0.09***	-0.50***	0.11***
GROUP$_{t-1}$	0.05**	0.05**	0.09***	0.02	0.00	0.11***	0.00
DEVLOS$_{t-1}$	-0.10***	-0.08***	-0.19***	-0.02	-0.09***	-0.25***	-0.04*

Panel C: Legal Liability Insurance

	ΔPMSHARE	ΔPMSHARE$_{t-1}$	zREINS$_{t-1}$	LEV$_{t-1}$	LIQ$_{t-1}$	SIZE$_{t-1}$	SEXP$_{t-1}$
ΔPMSHARE$_{t-1}$	0.03						
zREINS$_{t-1}$	0.16***	0.01					
LEV$_{t-1}$	0.04	0.02	0.40***				
LIQ$_{t-1}$	0.10***	0.08***	0.16***	0.12***			
SIZE$_{t-1}$	-0.09***	-0.10***	-0.24***	0.01	-0.35***		
SEXP$_{t-1}$	0.05*	-0.10***	0.35***	0.16***	0.12***	-0.09***	
PROFIT$_{t-1}$	0.01	-0.01	-0.07***	0.03	0.05**	0	-0.02
HHI$_{t-1}$	0.03	0.03	-0.00	-0.18***	0.14***	-0.44***	0.09***
GROUP$_{t-1}$	0.03	-0.00	0.11***	0.18***	-0.01	0.24***	0.00
DEVLOS$_{t-1}$	-0.06**	-0.05**	-0.05**	-0.19***	-0.07***	-0.16***	-0.06**

Panel D: Personal Accident

	ΔPMSHARE	*ΔPMSHARE*$_{t-1}$	*zREINS*$_{t-1}$	*LEV*$_{t-1}$	*LIQ*$_{t-1}$	*SIZE*$_{t-1}$	*SEXP*$_{t-1}$
ΔPMSHARE$_{t-1}$	0.10***						
zREINS$_{t-1}$	0.17***	0					
LEV$_{t-1}$	0.01	-0.01	0.30***				
LIQ$_{t-1}$	0.02	0.02	-0.01	0.18***			
SIZE$_{t-1}$	-0.06**	-0.10***	-0.13***	-0.14***	-0.44***		
SEXP$_{t-1}$	0.05*	-0.07**	0.30***	0.10***	0.06**	-0.07***	
PROFIT$_{t-1}$	-0.06**	-0.09***	-0.11***	0.09***	0.33***	-0.16***	0.04
HHI$_{t-1}$	0.01	0.02	-0.24***	-0.02	0.12***	-0.48***	0.09***
GROUP$_{t-1}$	0.01	0.03	0.12***	0.11***	0.03	0.00	0.10***
DEVLOS$_{t-1}$	-0.05**	0.00	-0.14***	0.04*	-0.06***	-0.31***	0.03

Panel E: Miscellaneous and Pecuniary Loss Insurance

	ΔPMSHARE	*ΔPMSHARE*$_{t-1}$	*zREINS*$_{t-1}$	*LEV*$_{t-1}$	*LIQ*$_{t-1}$	*SIZE*$_{t-1}$	*SEXP*$_{t-1}$
ΔPMSHARE$_{t-1}$	0.03						
zREINS$_{t-1}$	0.14***	-0.07***					
LEV$_{t-1}$	0.01	-0.01	0.33***				
LIQ$_{t-1}$	0.04*	0.05**	0.09***	0.25***			
SIZE$_{t-1}$	-0.07***	-0.07***	-0.14***	-0.16***	-0.42***		
SEXP$_{t-1}$	-0.02	-0.18***	0.14***	0.07***	0.07***	0.07***	
PROFIT$_{t-1}$	-0.06**	-0.07***	-0.09***	0.17***	0.27***	-0.18***	0.01
HHI$_{t-1}$	-0.00	-0.00	-0.23***	0.07***	0.09***	-0.55***	0.10***
GROUP$_{t-1}$	0.03	0.03	-0.00	0.03	-0.02	0.11***	0.07***
DEVLOS$_{t-1}$	-0.02	-0.03	-0.13***	0.10***	-0.02	-0.29***	-0.00

Panel F: Total Business

	ΔPMSHARE	*ΔPMSHARE$_{t-1}$*	*zREINS$_{t-1}$*	*LEV$_{t-1}$*	*LIQ$_{t-1}$*	*SIZE$_{t-1}$*	*SEXP$_{t-1}$*
ΔPMSHARE$_{t-1}$	0.14***						
zREINS$_{t-1}$	0.08***	-0.09***					
LEV$_{t-1}$	-0.05**	-0.06***	0.46***				
LIQ$_{t-1}$	0.06***	0.04**	0.16***	0.11***			
SIZE$_{t-1}$	-0.05***	-0.03*	-0.22***	-0.03*	-0.40***		
SEXP$_{t-1}$	-0.02	-0.10***	0.04**	0.07***	0.11***	-0.25***	
PROFIT$_{t-1}$	0.02	-0.03*	-0.06***	0.10***	0.13***	-0.041**	0.03
HHI$_{t-1}$	0.00	0.00	-0.24***	-0.04**	0.08***	-0.50***	0.08***
GROUP$_{t-1}$	0.02	0.04**	0.07***	0.08***	0.02	0.08***	-0.00
DEVLOS$_{t-1}$	-0.05***	-0.08***	-0.17***	-0.18***	-0.17***	0.15***	-0.07***

Table IV
UK Property-Liability Insurers, 1987-2010: GMM Resu

This table presents the results of the one-step system GMM regression estimation that tests the effects of the rein market share in each of the five respective product-markets examined in this study. The product-markets examine personal accident, and miscellaneous and pecuniary loss insurance. Also reported are the results of tests condu validity of the specification and instruments is reported using Hansen test of over-identifying restrictions and Dif AR(1) and AR(2) report the results of the Arellano-Bond test in first-differences to test for autocorrelation in the variables are as defined in Table I. Superscripts *; ** and *** denote statistical significance at 10%, 5% and 1% parentheses adjacent to test statistics AR(1), AR(2), AR(3), Hansen test and Difference-in-Hansen te

ΔMKTSHARE	**Motor**		**Property**		**Legal Liability**		**Pers. Acc.**		**Misc. &**
	Coeff.	Robust Std. Err.	Coeff.	Robust Std. Err.	Coeff.	Robust Std. Err.	Coeff.	Robust Std. Err.	Coeff.
ΔPMSHARE $_{t-1}$	0.08	0.063	0.09**	0.040	-0.04	0.068	0.05	0.045	-0.02
zREINS $_{t-1}$	0.13**	0.054	0.21***	0.045	0.15**	0.072	0.14*	0.072	0.15**
LEV $_{t-1}$	0.34	0.328	-0.41*	0.249	-0.42	0.329	-0.09	0.474	-0.09
LIQ $_{t-1}$	-0.01	0.049	-0.02	0.026	0.12**	0.058	0.07*	0.042	0.06
SIZE $_{t-1}$	-0.17***	0.051	0.01	0.055	-0.02	0.068	-0.03	0.071	-0.19**
SEXP $_{t-1}$	-0.2	0.512	-0.21	0.287	-0.81	0.594	-0.1	0.243	-0.2
PROFIT $_{t-1}$	0.67*	0.343	0.11	0.248	0.25	0.366	-1.62	1.025	-0.62
Firm fixed effects	Yes		Yes		Yes		Yes		Yes
Time effects	Yes		Yes		Yes		Yes		Yes
AR(1)	-6.39	(0.00)	-8.29	(0.00)	-4.87	(0.00)	-6.76	(0.00)	-5.07
AR(2)	1.04	(0.30)	1.92	(0.06)	0.41	(0.68)	0.57	(0.57)	1.53
AR(3)	-0.46	(0.65)	-0.57	(0.57)	-1.52	(0.13)	-0.38	(0.70)	-0.59
Hansen Test	69.36	(0.27)	79.68	(0.40)	75.16	(0.32)	56.33	(0.71)	79.13
Difference-in-Hansen Test	6.67	(0.46)	4.44	(0.73)	10.77	(0.15)	7.09	(0.42)	9.97
Observations (N)	1159		2401		1716		1410		1899
Firms (N)	116		219		173		162		193
Instruments (N)	94		108		101		94		108
Lag range used	2 - 10		2 - 12		2 - 11		2 - 10		2 - 12

Table V

UK Property-Liability Insurers, 1987-2010: IV Estimates using Random Eff

This table presents the results of the two-stage random effects regression estimation that tests the effects of the r in market share in each of the five respective product-markets examined in this study. The product-markets liability, personal accident, and miscellaneous and pecuniary loss insurance. Developed losses are used as the i first-stage (not reported) regressions. The variables used are winsorized at 1% level on both tails. Year-dummie specific effects. All variables are as defined in Table I. Superscripts *; ** and *** denote statistical significance a (two-tail).

ΔMKTSHARE	Motor		Property		Legal Liability		Pers. Acc.		Misc.
	Coeff.	Robust Std. Err.	Coeff.	Robust Std. Err.	Coeff.	Robust Std. Err.	Coeff.	Robust Std. Err.	Coe
ΔPMSHARE $_{t-1}$	0.044	0.033	0.112***	0.019	0.071	0.061	0.024	0.021	0.034
zREINS $_{t-1}$	-1.187	0.73	0.758***	0.17	4.339	3.423	2.274***	0.809	1.071
LEV $_{t-1}$	3.075	1.929	-1.661***	0.42	-4.531	3.499	-2.787**	1.308	-2.089
LIQ $_{t-1}$	0.05***	0.013	-0.005***	0.002	-0.002	0.003	-0.002	0.002	-0.001
SIZE $_{t-1}$	-0.171**	0.069	0.067***	0.022	0.133	0.137	0.076	0.075	0.017
SEXP $_{t-1}$	-0.555**	0.252	0.447***	0.106	0.116	0.102	1.242***	0.229	0.304
PROFIT $_{t-1}$	-0.524	0.599	0.671**	0.301	1.618	1.408	0.267	0.867	-0.784
GROUP $_{t-1}$	0.214*	0.124	0.07	0.08	-0.448	0.679	-0.377	0.36	0.479
HHI $_{t-1}$	-0.194	0.181	0.793***	0.188	0.168	0.521	1.155*	0.613	1.229
Constant	2.103	0.592	0.05	0.182	0.826	1.035	0.802	0.581	-0.11
Time dummies	Yes		Yes		Yes		Yes		
Observations (N)	1193		1910		1238		1430		1657
Firms (N)	113		173		128		143		159
Min obs per firm	2		2		2		2		2
Avg obs per firm	10.558		11.04		9.672		10		10.42
Max obs per firm	24		24		24		24		24

Table VI

Non-linearities in reinsurance ratio – market share growth int

This table synthesizes the impact of reinsurance ratio on product market performance (*ΔPMSHARE*) at varying leve to cession rates at the total business level and the regressions employ our baseline SYS-GMM model describ estimates corresponding to reinsurance ratio – the explanatory variable of interest are reported. Columns 2 a standardized reinsurance ratio used to group the data into respective sets. The values in parentheses report the c of the reinsurance ratio. Last column reports coefficients obtained for $zREINS_{t-1}$ in each of the data-subsets using th in the square brackets are the corresponding robust standard errors. The variables used are winsorized at 1% lev year-dummies to account for time specific effects. All variables are as defined in Table I. Superscripts *; ** and 10%, 5% and 1% level respectively (one-tail).

	$zREINS_{t-1}$ ($REINS_{t-1}$)		
	Lower Bound	**Upper Bound**	**Coeff. Est.**
Very Low *zREINS*	-1.38	-0.88	0.19
	(0.00)	(0.07)	[0.21]
Low *zREINS*	-0.88	-0.25	0.018
	(0.07)	(0.25)	[0.15]
High *zREINS*	-0.25	0.71	0.23**
	(0.25)	(0.52)	[0.12]
Very High *zREINS*	0.71	2.63	0.44**
	(0.52)	(1.00)	[0.25]

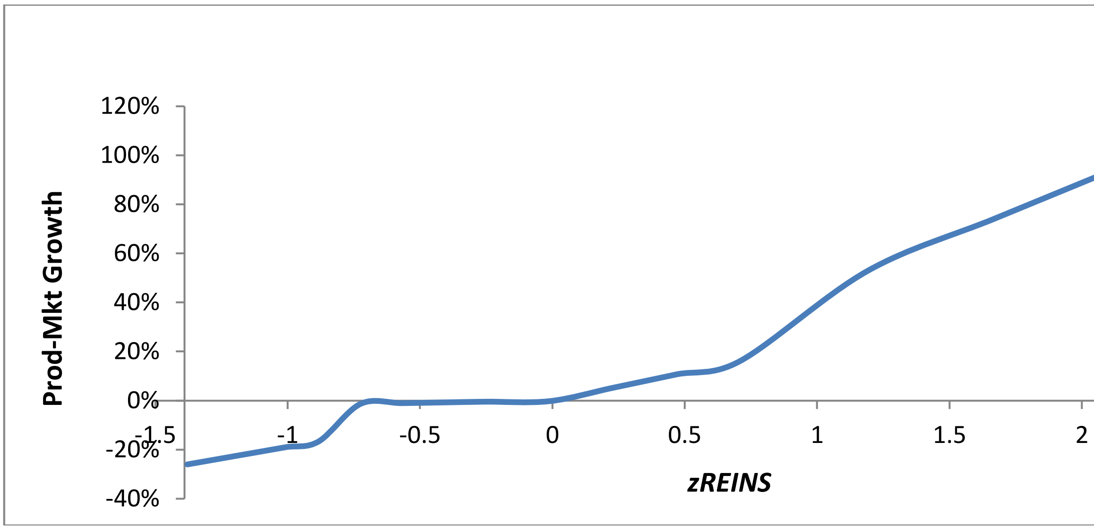

Figure 1. Premium growth response to reinsurance at varying levels

This figure displays the estimated response of product-market share growth (*ΔPMSHARE*) to the lagged normaliz
different segments of the normalized leverage: [-1.38, -0.88); [-0.88, -0.25); [-0.25,0.71); [0.71,2.63). The slop
using the baseline model as reported in Table VI. The estimated response is conditional on other variables being eq