Interaction between Multimarket Competition and Product Distribution Channel: Evidences from U.S. Property-Casualty Insurance Industry

Abstract

U.S. property-casualty insurers utilize a variety of distribution channels to deliver insurance products. At the same time, insurance firms using different distribution channels often compete in several product markets. This article is the first one to investigate the interaction between multimarket competition and insurance distribution channel in U.S. property-casualty insurance industry. We find that the level of multimarket contact is negatively related to insurers' direct underwriting cost in the focal product market. This result is in line with the Mutual Forbearance hypothesis. We also find that such an effect is stronger in the focal market that is important to the insurers, and more pronounced for insurers with independent agent distribution channel, who tend to forbear more to each other. Furthermore, we find that insurers react differently to rivals' multimarket competition depending on rivals' distribution channel. Insurers using independent agent distribution channel tend to avoid excess competition with each other, but compete more aggressively through increasing the direct underwriting cost with rivals using direct response distribution channel. These results imply that mutual forbearance exists between insurance companies using independent distribution channel and these insurers tend to reduce underwriting cost to avoid excess competition.

Keyword: multimarket contact, diversification, insurance distribution channel, underwriting cost

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1. Introduction

Diversified firms often compete in several markets at the same time. "Multimarket contact" (MMC) refers to a strategic situation in which rivals interact on multiple markets, and each rival can link its strategies so that outcomes in one market can influence actions on the others. In standard economic theory, multimarket contact could lead to a situation known as the "mutual forbearance hypothesis", i.e., the higher level of overlapping markets that two firms have, the larger are the benefits of collusion and the costs of deviating from collusion.

U.S. property-casualty (P/C) insurance industry provides an ideal setting for testing the economic relationship between multimarket contact and insurers' competition outcomes. First, the U.S. P/C insurance industry consist of over 2,000 active firms that compete in over 30 product markets.[1] Second, diversification is an essential part of insurance business model. Specifically, product diversification allows insurers to reduce risk and explore the scope economy. As a result, most U.S. P/C insurers are diversified insurers, e.g., insurers usually have more than 2 products in their product portfolios. At the same time, product diversification also leads to insurers' joint competitions in several markets, which fits the classic strategic situation of multimarket contact. Although insurers' product diversification decisions have been extensively explored from multiple dimensions in insurance literature (e.g., Berger et al., 2000; Elango, Ma, and Pope, 2008; Berry-Stölzle et al., 2012; Ai, Bajtelsmit, and Wang, 2016), there is little study to examine the effect of multimarket contact on insurers' product market outcome (except for Greeve (2008) and Lin and

[1] We follow the product definition in the National Association of Insurance Commissioners' annual statement.

McCathy (2018)). This study aims to fill this gap in the literature.

One unique feature in the insurance industry is the co-existence of multiple distribution channels (Berger *et al*, 1997). Insurance distribution channel is an indispensable part of insurance production. Insurance is distributed to consumers through a variety of marketing channels. Broadly, the insurance companies distribute their products through exclusive and independent agents, brokers and direct response system. Exclusive agents are contracted to sell policies for a single insurance company. On the contrary, independent agents have contractual agreements to sell policies of many different insurance companies. Brokers too may sell the products of many different companies, but have no formal contractual relationships with insurance firms. In practice, independent agents and brokers have very similar functions and we define them as independent agents throughout the following discussion. Independent agents play the role of "market maker". They own client list and have relationship with many insurers and match purchasers with the most suitable insurers with respect to underwriting capacity, financial strength etc. Their matchmaking work may help to avoid excess competition between insurers. However, exclusive agent and direct response channel may not achieve matchmaking function as independent agents do. Although there is an extensive literature aiming to explain the co-existence of multiple insurance distribution channel and their cost differentials in U.S. P/C insurance industry, no prior study has examined the strategic effect of multimarket competition to the underwriting cost of insurers utilizing different distribution channel.

This study has two research objectives. First, we examine the relationship between multimarket contact and U.S. P/C insurers' direct underwriting costs. We also examine whether and how insurers utilizing different distribution channel will respond to multimarket contact and the moderating effect due to their product market strategies. Second, we examine whether and how

insurers' intra and inter insurance distribution channel competitions will affect their direct underwriting costs.

This study contributes to the literature in several ways. First, to our best knowledge, this is the first study to examine the effect of multimarket contact on insurers' direct underwriting costs in the U.S. P/C insurance industry setting. Second, we complement extant insurance literature by examining mutual forbearance hypothesis with respect to product market strategies and different insurance distribution channel.

As a purview of our findings, we find that an insurer's level of multimarket contact with competitors having similar product market strategies is negatively and significantly related to its direct underwriting expense in the focal product market. This result provides support to mutual forbearance hypothesis, i.e., insurers tend to avoid excess competition through reducing the direct commission. Moreover, we also find that such an effect is stronger in the product market that is more important to insurers. In addition, insurers with independent distribution channel tend to forbear more to each other in their core product markets. Lastly, we find that insurers with different distribution channels react differently depending on competitors' distribution channel. Independent agent insurers tend to avoid excess competition with each other and tend to compete more aggressively with direct response insurers, when the level of multimarket contact increases.

The rest of this paper is organized as follow. In Section 2, we review related literature in multimarket contact and insurance distribution channel and develop testable hypotheses. In Section 3, we discuss the research design, construction of theoretical variables, and provide a description of the sample data. We present the empirical results in Section 4 and conclude in Section 5.

2. Research Background and Hypothesis

This study is related to two main strands of literature: multimarket competition (MMC) and insurance distribution channels. There is a large theoretical and empirical literature in economics and management which examining the strategic effect of MMC to firms' decisions and performance. See Jayachandran *et al* (1999) and Yu and Cannella (2013) for reviews of this stand of literature. The basic economic intuition of MMC is that diversified firms will not treat different market in isolation but treat all markets are inter-linked. For instance, a firm's aggressive action in one market can cause competitors' reactions only in this focal market but also in other markets that they share. The consequence of such linked competitions is formulated as mutual forbearance hypothesis (Edwards, 1955). That is, when the level of multimarket contact increases, firms tend to forbear each other from excessive competitions to avoid retaliations in both the focal and all other markets that they share. Mutual forbearance hypothesis has been tested in various industry settings, such as airline (Evans and Kessides, 1994; Gimeno and Woo, 1999; Ciliberto and Williams, 2014), banking (Pilloff, 1999; Coccores and Pellecchia, 2013), telecommunication (Parker and Roller, 1997), cement (Jans and Rosenbaum, 1997), automobile (Yu and Cannella, 2007; Yu, Subramaniam, and Cannella, 2009), and semiconductor (Chuang et al., 2018).

Strategic effect of multimarket contact on profitability and market entry decisions has been widely explored in banking literature on. For instance, Pilloff (1999) examines the relationship between multimarket contact and bank profitability (i.e., ROA) using a sample of U.S. banks between 1992-1995. He finds that bank profitability is positively related to multimarket contact. In the context of Italian banking industry, Coccorese and Pellecchia (2009) find that banks' profitability is positively related to the average number of contacts among banks. In another study focusing on geographic market overlapping among Italian banks, Coccorese and Pellecchia (2013)

find that multimarket contact is positively related to banks' market power index and banks' pricing, supporting the idea that firms with greater contact are more likely to collude.

Most banking literature finds inversed U-shape relationship between MMC and market growth and entry. Haveman and Nonnemaker (2000) examine the growth and geographic market entry for California savings and loan (thrifts) industry between 1977 and 1991. They find an inversed U-shape relationship between multimarket contact and growth and entry, i.e., multimarket banks seem to grow (and enter) markets with moderate multimarket contact and avoid those with high multimarket contact. Fuentelsaz and Gomez (2006) also find an inverted-U shape relationship between multimarket contact and new geographic market entry for a sample of Spanish savings banks between 1986 and 1999. In a more recent work, Kocak and Ozcan (2013) investigate if firms follow their rivals or avoid them when making the decision to enter a new market by empirically testing the Turkish banks. Except Islamic banks, big banks and other banks exhibit inversed U-Shaped pattern of interaction with multimarket rivals that are similar to the findings in the previous literature.

Regarding insurance literature, insurers' diversification decision and its link to performance have been extensively explored. For example, Berger *et al*. (2000) compare the efficiency of conglomerate and specialized production and explain the puzzle of why the conglomeration hypothesis dominates for some types of financial service providers and the strategic focus hypothesis dominates for other types using data on U.S. insurance companies. Using a sample of property-liability insurers over the period 1995-2004, Liebenberg and Sommer (2008) find that undiversified insurers consistently outperform diversified insurers. Berry-Stölzle *et al*. (2012) examine the relationship between product diversification and firm performance in the U.S. property–liability insurance industry and find nonlinear relationship between them. Ai *et al.*

(2016) find that the quality of an insurer's ERM is a significant determinant of its performance and insurer's product line diversification has a significant positive effect on performance.

However, study that examines the multimarket contact and firm competition outcome is rather limited in insurance literature. Li and Greenwood (2004) explore the effect of intra-industry diversification on firm performance and examine the consequence of diversification – multimarket competition in Canadian general insurance market. They find that multimarket contact with rivals per se does not improve performance and mutual forbearance cannot be assumed. However, if firms become familiar with each other, the rising familiarity will result in mutual forbearance and improve performance.

Greve (2008) formally tested the mutual forbearance hypothesis based on an imperfect observability model (Matsushima, 2001) using Norwegian general insurance industry between 1912 and 1986. He used the sales growth deviation (from the average growth rate) as a proxy for firm outcome/performance. He found that (above average) sales growth is higher for firms that do not meet many multimarket competitors in a given market. In addition, firms with higher loss ratio (e.g., financially troubled) also experience higher sales growth. In general, he claimed the empirical evidence support mutual forbearance in Norwegian general insurance industry.

More recently, Li and McCathy (2018) examine the effects of multimarket contact on health insurance price and quality using the Medicare Advantage market between 2008 and 2015. They find supports for the mutual forbearance hypothesis, e.g., prices are higher and quality are lower as multimarket contact increases among health insurers.

Some conditions may either strengthen or weaken the effects of MMC. In insurance literature, only Greve (2008) argue that there is more dispersion in the sales growth rate in growing and highly concentrated markets in their supplementary analysis. We contribute in this part by

considering product distribution channels that may strengthen/moderate the effect of multimarket contact.

This study is also related to the literature in insurance distribution channel. Insurance companies utilize various distribution channels in selling insurance products. A large literature compares costs and profitability of different distribution systems and attempts to explain the coexistence of multiple distribution channels. For instance, Joskow (1973) estimates that the expense ratios of insurers with independent agency are higher than those of insurers with exclusive agency. Cummins and Vanderhei (1979) and Barrese and Nelson (1992) use different sample periods and their findings are consistent to Joskow (1973).

Barrese *et al*. (1995) explain that the higher costs of the independent agency system are compensated by a better service quality compared to exclusive agents. Cummins and Doherty (2006) mention that the competition of insurance intermediation is based more on quality than on the price charged by the intermediary and independent intermediaries help markets operate more efficiently by reducing the information asymmetries. Regan (1997) argues that the independent agent's ownership of the customer list give agent incentive to perform some activities (e.g. screening insurers for appropriate coverages and prices). Such activities may alter insurers' competition strategies in product markets which are the motivation of our study. Hilliard *et al*. (2018) discuss whether contingent commission is able to improve insurer underwriting performance. They find contingent commissions lead to better underwriting performance.

Our study complements the related literature and examines MMC effect in the U.S. Property and Casualty insurance industry. The extant literature regarding the relationship between multimarket contact and insurance firm performance and market outcome provide evidence on mutual forbearance hypothesis. For example, Li and Greenwood (2004) find that MMC can

engender tacit collusion among firms. If the mutual forbearance hypothesis holds, insurers prefer not to intensify the competition by spending excess money (e.g. more premium-based commission to intermediaries) in producing, especially as the product market is important to the insurer. Therefore, our predictions are:

Hypothesis 1: everything else equal, insurers' direct underwriting expense in the focal product market will be negatively related to the level of multimarket contact with insurers having similar product strategy.

Hypothesis 2: the negative relationship between insurers' direct underwriting expense and the multimarket contact would be stronger if the focal market is important to insurers.

We also argue that because independent agents know insurers that are important players in certain product markets and provide important underwriting information to help insurers evaluate risk, they probably play an important role in placing business between different insurers and strengthen the mutual forbearance effect. We expect:

Hypothesis 3: the negative relationship between insurers' direct underwriting expense and the multimarket contact would be stronger if the focal market is more important to insurers utilizing independent agent distribution channel.

Especially, if both insurers utilizing independent agent distribution, we expect:

Hypothesis 4: the negative relationship between independent agent insurer's direct underwriting expense and the level of multimarket contact with other independent agent insurers will be stronger when the focal market is more important.

Exclusive agents and direct response are only responsible for a single contract insurer which are different from independent agents. They are not as flexible as independent agents and have less motivation in forbearance. Therefore, we expect insurers utilizing different distribution channels reacts differently to each other.

Hypothesis 5: insurers' direct underwriting expense in the focal market will be negatively related to the level of multimarket contact with independent agent insurers; and will be positively related to the level of multimarket contact with direct response insurers.

Hypothesis 6: independent agent insurer's direct underwriting expense in the focal market will be

negatively related to the level of multimarket contact with other independent agent insurers, and will be positively related to the level of multimarket contact with direct response insurers.

3. Research Design and Sample Data

In this section, we discuss the empirical model specification in Section 3.1. Construction of theoretical variables are described in Section 3.2. Description of sample data is provided in Section 3.3.

3.1 Empirical Model Specification

We use the panel regression model to examine the relationship between insurers' underwriting cost and multimarket competition. To test our Hypothesis 1, the baseline regression model is specified as following:

$$CP\_ratio_{im,t+1} = \alpha + \beta_1 MMCSPR_{imt} + \beta_2 X_{it} + \beta_3 MKT_{mt} + \upsilon_i + \gamma_m + \varphi_t + \varepsilon_{imt} \qquad (1)$$

where $MMCSPR_{imt}$ denotes a product portfolio similarity-based MMC measure for insurer *i* in product market *m* in year *t*, X_{it} denotes a vector of firm characteristics for insurer *i* in year *t*, and MKT_{mt} denotes a vector of market characteristics for product market *m* in year *t*. We include fixed effects of insurers, product market, and year (denoted by υ_i, γ_m, and φ_t, respectively) in order to to control for unobserved heterogeneities. In equation (1), we lag all independent variables by one year to control potential simultaneity problem between the key independent variable and the dependent variable.

To test Hypothesis 2, we introduce the interaction term between MMC measure and the importance of the focal product market to insurers, i.e.,

$$CP\_ratio_{im,t+1} = \alpha + \beta_1 MMCSPR_{imt} + \beta_2 PORT\_WEIGHT_{imt} + \beta_3 MMCSPR_{imt} \times PORT\_WEIGHT_{imt} + \beta_4 X_{it} + \beta_5 MKT_{mt} + \upsilon_i + \gamma_m + \varphi_t + \varepsilon_{imt} \quad (2)$$

where $PORT\_WEIGHT_{imt}$ is the proxy for the focal market importance for an insurer. The coefficient of the interaction term will be used to test our Hypothesis 2.

Furthermore, to test Hypothesis 3, we expand equation (2) to introduce a three-way interaction term:

$$\begin{aligned} CP\_ratio_{im,t+1} = {} & \alpha + \beta_1 MMCSPR_{imt} + \beta_2 PORT\_WEIGHT_{imt} + \beta_3 MMCSPR_{imt} \times PORT\_WEIGHT_{imt} \\ & + \beta_4 Dummy\_IA_{it} \times PORT\_WEIGHT_{imt} + \beta_5 Dummy\_IA_{it} \times MMCSPR_{imt} \\ & + \beta_6 Dummy\_IA_{it} \times MMCSPR_{imt} \times PORT\_WEIGHT_{imt} + \beta_7 X_{it} + \beta_8 MKT_{mt} + \upsilon_i + \gamma_m + \varphi_t + \varepsilon_{imt} \end{aligned} \quad (3)$$

where $Dummy\_IA_{it}$ denotes a dummy variable that equals to 1 if an insurer utilizing independent agent distribution channel and 0 otherwise. The coefficient of the three-way interaction term (e.g., β_6) will be used to test Hypothesis 3.

Lastly, the empirical models used to test Hypothesis 4 to 6 are similar to equation (1) to (3), respectively. In those models, we breakdown an insurer's multimarket contact measure into two measures to capture the product market overlapping based on insurers' distribution channel. Definition for those multimarket contact measures will be provided in the construction of independent variables.

3.2 Dependent Variable and Independent Variables

Our dependent variable, denoted by $CP\_ratio_{im,t}$, is defined as an insurer i's direct commissions paid divided by the total direct premium written in a given product market in year t. This ratio in general shall be bounded between 0 and 1. We remove the extreme observations with negative values and commission premium ratio that is larger than 1. To remove the effect of

outliers, we also winsorize the dependent variable at 99th percentile in our regression analysis.

The key independent variable included in our empirical model is product portfolio similarity weighted multimarket contact measure. For each insurer in product market m, the similarity weighted multimarket contact measure is defined by:

$$MMCSPR_{im} = \frac{\sum_{j=1, j\neq i}^{N_m} MMC_{ij} \times s_{ij}}{N_m - 1} \quad (2)$$

where MMC_{ij} denotes the number of product markets shared by insurer *i* and *j*, N_m denotes the total number of insurers operating in product market *m*, and s_{ij} denotes the similarity calculated by Sohn's (2001) method:

$$s_{ij} = \frac{\sum_{k=1}^{26} p_{ik} \times \min(p_{ik}, p_{jk})}{\sum_{k=1}^{26} p_{ik}^2} \quad (3)$$

where p_{ik} is the direct premium written of insurer *i* in the *k*th product market, p_{ik} is the direct premium written of insurer *j* in the *k*th product market. Note that this similarity index is bounded between 0 and 1, and is asymmetric, e.g., $s_{ij} \neq s_{ji}$.

Because insurers utilizing different product distribution channels can compete in the same product market, we further calculate three measures of similarity weighted multimarket contact measures for each insurer by partitioning its competitors in a given product market by their distribution channels. For instance, the similarity weighted MMC measure for insurer *i* with its competitors utilizing independent agent distribution channel in product market *m*, denoted by $MMCS\_I_{im}$, is defined as

$$MMCSPR\_I_{im} = \frac{\sum_{j=1, j\neq i, j\in I}^{N_m^I} MMC_{ij, j\in I} \times s_{ij}}{N_m^I - 1} \quad (4)$$

where $MMC_{ij, j\in I}$ denotes the overlapping product markets between insurer *i* and insurer *j* that adopts the independent agent distribution channel, and N_m^I denotes total number of insurers that utilize independent agent distribution channel in product market *m*. Similarly, we calculate the similarity weighted multimarket contact measures between insurer *i* and competitors who adopt direct response distribution channel (denoted by $MMCS\_D_{im}$) and those who adopt other distribution channel (denoted by $MMCS\_O_{im}$).[2]

We include a set of control variables that are related to insurers' firm characteristics: (1) SIZE, which is defined as the natural logarithm of the total assets; (2) LEVERAGE, which is defined as the ratio of total liabilities divided by total assets; (3) profitability, which is proxied by the return on assets (ROA); (4) product market concentration, which is measured by Herfindahl Hershman index of an insurer's direct premium written in all product markets; (5) geographic concentration, which is measured by Herfindahl Hershman index of an insurer's direct premium written in U.S. territories; (6) group affiliation, which is a dummy variable that equals to 1 if an insurer is affiliated to an insurance group and 0 otherwise; (7) organizational form, which is a dummy variable that equals to 1 if an insurer is a mutual insurer and 0 otherwise; (8) an insurer's usage of contingent commission in direct business (CONT_USAGE), which is a dummy variable that equals to 1 if an insurer pays contingent commission for its direct business underwritten and

[2] Note that the denominator in equation (3) will also depend on the distribution channel of focal insurer i. In equation (3) we assume that insurer i adopts the independent agent distribution channel, its total number of competitors in focal market will be $N_m^I - 1$. In contrast, the denominator will be N_m^I if insurer i utilizes the direct response distribution channel. We make such adjustments based on the focal insurer's distribution channel when calculating three similarity weighted multimarket contact measures.

0 otherwise; [3] (9) importance of the focal product market (PORT_WEIGHT), which is defined as the ratio of an insurer's direct premium written in a product market to its total direct premium written.

We also control for several product market characteristics: (1) market size (MKT_SIZE), which is defined as the total direct premium written in billion US dollars; (2) market intensity (MKT_INTENSITY), which is defined as the total number of insurers operating in a product market; (3) market concentration (MKT_HHI), which is measured by Herfindahl Hershman index of a product market based on insurers' direct premium written.

3.3 Sample Data

Our primary data for insurers' direct premium written in various product markets is from the annual statements of National Association of Insurance Commissioners (NAIC). The sample period is between 2004 and 2016. We require the insurers to have positive total assets, total surplus, and total direct premium written to be included in our sample. In addition, we remove the small insurers whose direct premium written is smaller than USD $1 million in any given sample year.

To identify the insurance product market, we use the product (e.g., line-of-business) classification in NAIC annual statement. Originally, NAIC defines 34 products in 2016 with available data for direct premium written and direct commission. We then perform the following aggregation: (1) we first aggregate the claim-made and occurrence-based business as one product for Medical Malpractice, Product Liability and Other Liability, respectively; (2) we aggregate Group Accident, Credit Accident, Other Accident, and Excess Workers Compensation as

[3] Note the variable CONT_UAGE is defined at the firm level because NAIC data do not allow us to identify whether an insurer pays contingent commission for its direct business written in a particular line-of-business.

Accident.[4] In total, we have 25 product markets before year 2008 and 26 product markets after year 2008, which represent 93.36% of total direct premium written of U.S. P/C insurance industry between 2004 and 2016. [5]

W use A. M. Best *Key's Ratings* to identify individual insurers' distribution channel. Based on the distribution channel information provided by A. M. Best *Key's Ratings*, we classify sampled insurers into three categories: (1) Independent agent (i.e., insurers whose main distribution channel is either independent agent or brokers); (2) Direct response (i.e., insurers whose main distribution channel is either direct response or exclusive agent); (3) Other (for insurers whose utilize a combination of distribution channels). In our sample, We have 2,240 insurers with 1,433independent agent insurers, 432 direct response insurers, and 375 insurers utilizing other distribution channels. In total, we have 143,517 firm-market-year observations in our sample.

4. Empirical Results

We begin our empirical analysis by comparing the market share and direct underwriting commission ratio between insurers utilizing independent agent distribution channel and direct response channel in Panel A and B of Table 1, respectively. Table 1 Panel A shows that direct response insurers have large market shares in certain personal lines (e.g., Private Auto Liability, Auto Physical Damage, Homeowners) and specialty lines (Mortgage Guaranty and Financial Guaranty). For example, the average aggregate market share of direct response insurers (independent agent insurers) in the market of Private Auto Liability, Auto Physical Damage,

[4] The Excess Workers Compensation was introduced in year 2009.
[5] The 26 line-of-business include Fire, Allied lines, Farmowners multiperil, Homeowners multiperil, Commercial multiperil, Mortgage Guaranty, Ocean Marine, Inland Marine, Financial Guaranty, Medical Malpractice, Earthquake, Accident, Workers Compensation, Other Liability, Product Liability, Private Auto Liability, Commercial Auto Liability, Auto Physical Damage, Aircraft, Fidelity, Surety, Burglary and Theft, Boiler and Machinery, Credit, Warranty (introduced in year 2008), and Other.

Homeowners are 0.65(0.29), 0.62(0.31), and 0.59(0.39), respectively. In contrast, independent agent insurers as a whole tend to have dominant market position in commercial lines (such Commercial Multiperil, Commercial Auto Liability, and Product Liability) and markets associated with more sophisticated risks (e.g., Ocean Marine, Fidelity, Surety, and Aircraft). Moreover, Table 1 Panel B shows that direct response insurers in general have lower direct underwriting commission ratio than that of independent agent insurers. For instance, the average direct underwriting commission ratio for direct response insurers (independent agent insurers) in the market of Private Auto Liability, Auto Physical Damage, Homeowners are 0.07(0.16), 0.07(0.15), and 0.10(0.17), respectively.

Table 2 provides the summary statistics. The sample mean of commission ratio is 0.15 (e.g., 15% of direct premium written) with a standard deviation of 0.08. The sample mean for product portfolio similarity based MMC measure (MMCSPR) is 2.24 with a standard deviation of 1.48. In addition, the sample mean for two decomposed MMC measures that capture the MMC with independent agent insurers (MMCSPRI) and MMC with direct response insurers (MMCSPRD) are 2.33 and 2.63, respectively.

Table 3 provides the linear correlation coefficients for all variables. As shown in Table 3, the linear correlation coefficient between direct underwriting commission ratio and the key independent variable MMCSPR is 0.14, which is statistically significant at 1% level. In addition, the linear correlation coefficients between direct underwriting commission ratio and two decomposed MMC measures, MMCSPRI and MMCSPRD are 0.15 and 0.11, which are both statistically significant at 1%. Lastly, the linear correlation coefficient between direct underwriting commission ratio and independent agent insurer dummy (D_IA) is positive (0.24 with p-val<0.01). In contrast, the linear correlation coefficient between direct underwriting commission ratio and

direct response dummy (D_DR) is negative (-0.32 with p-val <0.01).

Next, we begin the discussion of regression analysis. Table 4 provides the results of panel regression with firm, product market and year fixed effect. We report the Huber – White heteroscedasticity consistent standard error in all specifications. Model (1) in Table 4 shows that the coefficient of MMCSPR is -0.0007 which is statistically significant at 10% level. In terms of economic significance, increasing of MMCSPR by one standard deviation (1.48) will result in a decrease of direct underwriting commission ratio by 0.1%. This provides support for Hypothesis 1 that there is a negative relationship between an insurer's MMC and direct underwriting cost. That is, an insurer tends to compete less aggressively in the focal market when it has more contacts with other insurers with similar product market strategies. Regarding other regressors, we find that PORT_WEIGHT is negatively related to direct underwriting commission ratio with an estimated coefficient of -0.0061 (with p-value <0.01), suggesting that insurers tend to reduce underwriting costs in important product markets. Moreover, we find that larger insurers in terms of size tend to have smaller direct underwriting commission ratio. This may be due to the economy of scale. We also find that insurers with more diversified product portfolio tend to have smaller direct underwriting commission ratio. This may be due to the economy of scope. In addition, the estimated coefficients for LEVERAGE and ROA are both positive and statistically significant at 1%, suggesting that highly leveraged and profitable insurers tend to compete more aggressively in the direct market. Regarding the product market characteristics, we find that insurers tend to have smaller direct underwriting commission ratio in larger product markets in terms of their size.

Model (2) in Table 4 shows that the estimated coefficient for the interaction term, $MMCSPR \times PORT\_WEIGHT$, is -0.016, which is statistically significant at 1%. This result provides support for Hypothesis 2, e.g., the negative relationship between MMC and direct

underwriting commission ratio will be stronger in the product market that is more important to insurers. We formally test Hypothesis 3 in Model (3) in Table 4. the estimated coefficient for the three-way interaction term, $D\_IA \times MMCSPR \times PORT\_WEIGHT$, is -0.0098 (with p-value <0.01). This result provides support for Hypothesis 3 that independent agent insurers tend to have smaller direct underwriting commission ratio, or compete less aggressively, in the focal markets that have larger weights in their product portfolio when the level of multimarket contact increase.

We formally test Hypothesis 4 to 6 using panel regression and report the results in Table 5. Model (1) in Table 5 is the baseline regression model. To examine the effect of insurance distribution channel, we decompose an insurer's multimarket contact measure into two measures: MMCSPRI that captures the multimarket contact with independent agent insurers in the focal market and MMCSPRD that captures the multimarket contact with direct response insurers in the focal market.[6] The estimated coefficients for MMCSPRI and MMCSPRD are -0.0034 and 0.0027, which are both statistically significant at 1% level. These results provide support for Hypothesis 4. That is, insurers tend to behave differently depending on its competitors' distribution channel. When the level of multimarket contact with independent agent insurer increases, insurers tend to have smaller direct underwriting commission ratio. In contrast, insurers tend to have larger direct underwriting commission ratio when the level of multimarket contact with direct response insurer increases. Regarding other regressors, we find that the direction and magnitude of effects related to insurers' size, leverage, profitability, and product portfolio diversification are similar to those found in Table 4.

In model (2) in Table 5, we introduce the interaction terms between two multimarket

[6] We perform the multicollinearity test for all specifications reported in Table 5. The estimated VIF for MMCSPRI and MMCSPRD are both smaller than 5, suggesting that the multicollinearity between MMCSPRI and MMCSPRD should not be a concern.

contact measures and a dummy variable for independent agent insurers (D_IA). As shown in model (2) in Table 5, the estimated coefficient for interaction term $D\_IA \times MMCSPRD$ is 0.0038 (with p-val <0.01). On the other hand, the estimated coefficient for interaction term $D\_IA \times MMCSPRI$ is -0.0010 which is not statistically significant at 10% level. These results suggest that independent agent insurers tend to increase direct underwriting commission ratio when the level of multimarket contact with direct response insurers increase. This may be explained by independent agent insurers tend to compete with low-cost direct response insurers through improving the product and service quality leading to an increase in direct underwriting commission ratio. In short, the results of model (2) provides support for Hypothesis 5.

Lastly, we test Hypothesis 6 by introducing two three-way interaction terms, $\text{D\_IA} \times \text{PORT\_WEIGHT} \times \text{MMCSPRI}$ and $\text{D\_IA} \times \text{PORT\_WEIGHT} \times \text{MMCSPRD}$ in the regression model. We posit that when competing with other independent agent insurers and direct response insurers, independent agent insurers may adopt different marketing strategies depending on the importance of the focal market. Model (3) in Table 5 shows that the estimated coefficient for $\text{D\_IA} \times \text{PORT\_WEIGHT} \times \text{MMCSPRI}$ and $\text{D\_IA} \times \text{PORT\_WEIGHT} \times \text{MMCSPRD}$ are -0.0159 and 0.0072, respectively, which are both statistically significant at 1% level. These results suggest that independent agent insurers tend to "mutually forbear" each other as the focal market is more important to them and the level of multimarket contact increases. At the same time, when the level of multimarket contact with direct response insurers increases in the market that are important, independent agent insurers tend to differentiate themselves through increasing the direct underwriting commission ratio.

5. Conclusion

Multimarket contact among diversified firms has important implications for firms'

competitive behaviors and market outcomes. However, little is known about whether and how insurance firms with different product distribution channels will react to the multimarket competition. Neither do we know the effects of insurers' multimarket competition to their underwriting cost. This study aims to fill these gaps.

In the empirical analysis for the determinants of U.S. P/C insurers' direct underwriting costs, we find that the level of multimarket contact is negatively related to insurers' direct underwriting cost in the focal product market. We also find that such an effect is stronger in the focal market that is important to the insurers. Moreover, such a negative relationship between multimarket contact and the underwriting cost is more pronounced for insurer with independent agent distribution channel, who tend to forbear more to each other. More importantly, we find that insurers react differently to rivals' multimarket competition depending on rivals' distribution channel. For instance, insurers using independent agent distribution channel tend to avoid excess competition with each other. At the same time, they tend to compete more aggressively through increasing the direct underwriting cost when the level of multimarket contact with rivals using direct response distribution channel increases.

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Table 1: Market share and underwriting commission ratio by Distribution Channel

This table provides the average aggregate market share and average direct underwriting commission ratio (defined as the ratio of direct underwriting commission to direct premium written) for independent agent insurers and direct response insurers between 2004 and 2016 in Panel A and B, respectively. In Panel A, the average market share is calculated as the mean of annual aggregated market share of independent agent insurers and direct response insurers. In Panel B, the average commission ratio is the mean of the annual average of commission ratio of independent agent insurers and direct response insurers.

		Panel A: Average Market Share			Panel B: Average Commission Ratio		
Line ID	Line Name	Independent Agent	Direct Response	Difference	Independent Agent	Direct Response	Difference
1	Fire	0.64	0.19	0.45	0.17	0.10	0.08
2	Allied Lines	0.60	0.15	0.46	0.17	0.10	0.06
3	Farmowners	0.39	0.55	-0.15	0.18	0.12	0.06
4	Homeowners	0.35	0.59	-0.24	0.17	0.10	0.07
5	Commercial Multiperil	0.72	0.16	0.55	0.18	0.12	0.07
6	Mortgage Guaranty	0.14	0.86	-0.73	0.05	0.00	0.04
8	Ocean Marine	0.90	0.04	0.86	0.17	0.08	0.08
9	Inland Marine	0.62	0.21	0.41	0.18	0.10	0.08
10	Financial Guaranty	0.07	0.80	-0.73	0.08	0.00	0.08
11	Medical Malpractice	0.29	0.21	0.08	0.14	0.04	0.09
12	Earthquake	0.67	0.25	0.42	0.15	0.09	0.06
13	Accident	0.67	0.27	0.41	0.18	0.07	0.11
16	Workers Compensation	0.78	0.10	0.68	0.10	0.05	0.04
17	Other Liability	0.76	0.10	0.67	0.16	0.07	0.09
18	Product liability	0.73	0.08	0.66	0.17	0.10	0.07
19	Auto Liability_Private	0.29	0.65	-0.36	0.15	0.07	0.08
20	Auto Liability_Commercial	0.72	0.13	0.58	0.16	0.08	0.08
21	Auto Physical Damage	0.31	0.62	-0.32	0.16	0.07	0.08
22	Aircraft	0.80	0.08	0.72	0.14	0.14	0.00
23	Fidelity	0.85	0.08	0.77	0.18	0.08	0.10
24	Surety	0.84	0.09	0.75	0.23	0.12	0.11
26	Burglary&Theft	0.80	0.08	0.73	0.18	0.10	0.07
27	Boiler Machinery	0.64	0.07	0.57	0.16	0.10	0.07
28	Credit	0.51	0.34	0.17	0.18	0.23	-0.04
30	Warranty	0.47	0.42	0.05	0.13	0.12	0.00
33	Other	0.45	0.34	0.11	0.11	0.07	0.04

Table 2: Summary Statistics

This table reports the summary statistics for dependent variable and independent variables.

Variable	Mean	sd	Median	p10	p90
CP_ratio	0.15	0.08	0.16	0.03	0.23
MMCSPR	2.24	1.48	1.97	0.56	4.28
MMCSPRI	2.33	1.58	2.04	0.52	4.52
MMCSPRD	2.63	1.77	2.31	0.63	5.03
PORT_WEIGHT	0.15	0.24	0.03	0.00	0.48
SIZE	19.00	1.95	18.95	16.55	21.54
LEVERAGE	0.51	0.20	0.57	0.16	0.73
ROA	0.04	0.04	0.03	-0.01	0.09
Product HHI	0.38	0.22	0.31	0.17	0.71
Geo HHI	0.45	0.38	0.30	0.06	1.00
D_group	0.84	0.37	1.00	0.00	1.00
D_mutual	0.19	0.39	0.00	0.00	1.00
D_IA	0.70	0.46	1.00	0.00	1.00
D_DR	0.15	0.35	0.00	0.00	1.00
CONT_USE	0.81	0.39	1.00	0.00	1.00
MKT_INTENSENTY	790.59	323.02	837.00	307.00	1210.00
MKT_SIZE	33.31	30.73	21.49	1.76	74.41
MKT_HHI	0.03	0.02	0.03	0.01	0.07

Table 3: Linear Correlation Coefficient Matrix for Variables

This table reports the linear correlation coefficients among dependent variable and independent variables. The symbol ***, **, and * denote the statistical significance level at 1%, 5% and 10%, respectively.

	Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	CP_ratio	1																	
2	MMCSPR	0.14***	1																
3	MMCSPRI	0.15***	0.99***	1															
4	MMCSPRD	0.11***	0.86***	0.81***	1														
5	PORT_WEIGHT	-0.14***	-0.21***	-0.22***	-0.23***	1													
6	SIZE	-0.06***	-0.34***	-0.33***	-0.23***	-0.17***	1												
7	LEVERAGE	0.00	-0.11***	-0.11***	-0.07***	-0.03***	0.44***	1											
8	ROA	0.01*	-0.07***	-0.07***	-0.06***	0.01*	0.07***	-0.07***	1										
9	Product HHI	-0.10***	-0.42***	-0.42***	-0.43***	0.44***	-0.21***	-0.08***	0.02***	1									
10	GEO HHI	-0.02***	0.17***	0.15***	0.18***	0.15***	-0.47***	-0.11***	0	0.16***	1								
11	D_group	0.03***	-0.05***	-0.05***	-0.01*	-0.14***	0.28***	-0.01***	-0.04***	-0.13***	-0.31***	1							
12	D_mutual	-0.02***	0.09***	0.08***	0.14***	-0.02***	-0.03***	-0.01*	-0.03***	-0.11***	0.21***	-0.30***	1						
13	D_IA	0.24***	0.23***	0.24***	0.18***	-0.10***	-0.08***	-0.05***	0.02***	-0.14***	0.03***	0.01***	0.03***	1					
14	D_DR	-0.32***	-0.23***	-0.24***	-0.11***	0.08***	0.11***	0.00	-0.01***	0.07***	0.09***	0.01***	0.05***	-0.62***	1				
15	CONT_USE	0.17***	0.14***	0.14***	0.14***	-0.19***	0.15***	0.09***	0.04***	-0.25***	-0.18***	0.13***	0.05***	0.26***	-0.26***	1			
16	MKT_INTENSITY	-0.02***	-0.25***	-0.26***	-0.30***	0.04***	-0.15***	-0.03***	-0.02***	0.04***	0.14***	-0.04***	0.04***	-0.02***	0.01***	-0.02***	1		
17	MKT_SIZE	-0.11***	-0.20***	-0.20***	-0.26***	0.32***	-0.10***	-0.01***	-0.04***	0.06***	0.13***	-0.01**	0.01**	-0.04***	0.06***	-0.04***	0.55***	1	
18	MKT_HHI	0.05***	0.14***	0.15***	0.17***	-0.10***	0.11***	0.02***	0.01***	-0.04***	-0.09***	0.05***	-0.05***	0.00	0.02***	0.01***	-0.51***	-0.23***	1

Table 4: Results for Panel Regression with MMC Measure and Fixed Effects

This table reports the results for panel regression models with product portfolio similarity based MMC measure with year, product market and firm fixed effects. The dependent variable is direct underwriting commission ratio (CP_ratio), defined as the commission paid divided by the direct premium written in a product market. The key independent variable (MMCSPR) is a product portfolio similarity weighted MMC measure. Huber – White heteroscedasticity-consistent standard errors are reported in the parenthesis. The symbol ***, **, and * denote the statistical significance level at 1%, 5%, and 10%, respectively.

VARIABLES	(1)	(2)	(3)
MMCSPR (H1)	-0.0007*	-0.0005	-0.0042***
	(0.0004)	(0.0004)	(0.0007)
PORT_WEIGHT	-0.0061***	-0.0035**	-0.0134***
	(0.0011)	(0.0016)	(0.0027)
PORT_WEIGHT × MMCSPR (H2)		-0.0016**	0.0058***
		(0.0006)	(0.0014)
PORT_WEIGHT × D_IA			0.0145***
			(0.0033)
MMCSPR × D_IA			0.0046***
			(0.0006)
D_IA × PORT_WEIGHT × MMCSPR (H3)			-0.0098***
			(0.0015)
SIZE	-0.0024***	-0.0024***	-0.0025***
	(0.0007)	(0.0007)	(0.0007)
LEVERAGE	0.0119***	0.0120***	0.0121***
	(0.0023)	(0.0023)	(0.0023)
ROA	0.0179***	0.0179***	0.0178***
	(0.0058)	(0.0058)	(0.0058)
Product HHI	-0.0149***	-0.0149***	-0.0152***
	(0.0030)	(0.0030)	(0.0030)
GEO HHI	0.0035	0.0035	0.0037
	(0.0023)	(0.0023)	(0.0023)
D_group	0.0015	0.0015	0.0016
	(0.0013)	(0.0013)	(0.0013)
D_mutual	-0.0014	-0.0014	-0.0013
	(0.0028)	(0.0028)	(0.0028)
D_IA	0.0062**	0.0063**	-0.0035
	(0.0030)	(0.0030)	(0.0033)
D_DR	-0.0357***	-0.0357***	-0.0361***
	(0.0033)	(0.0033)	(0.0033)
CONT_USE	0.0009	0.0009	0.0009
	(0.0008)	(0.0008)	(0.0008)
MKT_INTENSITY	0.0000	0.0000	0.0000
	(0.0000)	(0.0000)	(0.0000)
MKT_SIZE	-0.0002***	-0.0002***	-0.0002***
	(0.0001)	(0.0001)	(0.0001)
MKT_HHI	0.0076	0.0073	0.0053
	(0.0307)	(0.0307)	(0.0307)
Constant	0.1945***	0.1936***	0.2010***
	(0.0157)	(0.0158)	(0.0158)
Observations	143,517	143,517	143,517
R^2	0.516	0.516	0.516
Year FE	YES	YES	YES
Firm FE	YES	YES	YES
Market FE	YES	YES	YES
Adjusted R^2	0.508	0.508	0.508

Table 5: Results for Panel Regression with Decomposed MMC Measures and Fixed Effects

This table reports the results for panel regression models with product portfolio similarity based MMC measure decomposed by competitors' distribution channels with year, product market and firm fixed effects. The dependent variable is direct underwriting commission ratio (CP_ratio), defined as the commission paid divided by the direct premium written in a product market. The independent variable (MMCSPRI) is a product portfolio similarity weighted MMC measure between an insurer and those who utilizing independent agent distribution channel. The independent variable (MMCSPRD) a product portfolio similarity weighted MMC measure between an insurer and those who utilizing direct reponse distribution channel. Huber-White heteroscedasticity-consistent standard errors are reported in the parenthesis. The symbol ***, **, and * denote the statistical significance level at 1%, 5%, and 10%, respectively.

VARIABLES	(1)	(2)	(3)
MMCSPRI (H4)	-0.0034***	-0.0027***	-0.0035***
	(0.0006)	(0.0010)	(0.0011)
MMCSPRD (H4)	0.0027***	-0.0004	0.0003
	(0.0004)	(0.0007)	(0.0007)
PORT_WEIGHT	-0.0068***	-0.0068***	-0.0108***
	(0.0011)	(0.0011)	(0.0029)
D_IA × MMCSPRI (H5)		-0.0010	0.0001
		(0.0011)	(0.0011)
D_IA × MMCSPRD (H5)		0.0038***	0.0033***
		(0.0007)	(0.0007)
D_IA × PORT_WEIGHT			0.0120***
			(0.0035)
PORT_WEIGHT × MMCSPRI			0.0179***
			(0.0025)
PORT_WEIGHT × MMCSPRD			-0.0131***
			(0.0025)
D_IA × PORT_WEIGHT × MMCSPRI (H6)			-0.0159***
			(0.0028)
D_IA × PORT_WEIGHT × MMCSPRD (H6)			0.0072***
			(0.0028)
SIZE	-0.0027***	-0.0027***	-0.0026***
	(0.0007)	(0.0007)	(0.0007)
LEVERAGE	0.0120***	0.0121***	0.0122***
	(0.0023)	(0.0023)	(0.0023)
ROA	0.0182***	0.0182***	0.0184***
	(0.0058)	(0.0058)	(0.0058)
Product	-0.0149***	-0.0156***	-0.0153***
	(0.0030)	(0.0030)	(0.0030)
GEO HHI	0.0026	0.0027	0.0026
	(0.0023)	(0.0023)	(0.0023)
D_group	0.0016	0.0017	0.0016
	(0.0013)	(0.0013)	(0.0013)
D_mutual	-0.0017	-0.0015	-0.0015
	(0.0028)	(0.0028)	(0.0028)
D_IA	0.0062**	-0.0003	-0.0012
	(0.0030)	(0.0034)	(0.0034)
D_DR	-0.0358***	-0.0361***	-0.0359***
	(0.0033)	(0.0033)	(0.0033)
CONT_USE	0.0009	0.0009	0.0009
	(0.0008)	(0.0008)	(0.0008)
MKT_INTENSITY	0.0000	0.0000	0.0000
	(0.0000)	(0.0000)	(0.0000)
MKT_SIZE	-0.0002***	-0.0002***	-0.0002***
	(0.0001)	(0.0001)	(0.0001)
MKT_HHI	0.0182	0.0162	0.0163
	(0.0308)	(0.0308)	(0.0308)
Constant	0.1997***	0.2067***	0.2035***
	(0.0158)	(0.0159)	(0.0160)
Observations	143,517	143,517	143,517
R^2	0.516	0.516	0.517
Year FE	YES	YES	YES
Firm FE	YES	YES	YES
Market FE	YES	YES	YES
Adjusted R^2	0.508	0.509	0.509