

The Winner's Curse in Insurance and Underwriting Cycles

Zhiqiang Yan and Charles Pryor

Abstract

In this paper, we develop a simple economic model to explain how an entrant insurer may suffer the winner's curse in the sense that the entrant insurer's risk pool is less profitable than that of an incumbent insurer. In addition, we exploit the strategic interactions and the pricing dynamics between entrant and incumbent insurers to describe the formation of an insurance underwriting cycle. Empirical tests based on the predictions of our economic models are conducted in the homeowners and product liability insurance markets for the period 1995-2001. We find that (1) the winner's curse is present in the product liability insurance market, but not in the homeowners insurance market; and that (2) larger insurers tend to be more profitable in underwriting than their smaller competitors.

I. Introduction

The insurance underwriting cycle has attracted great attention from both academia and practitioners due to its detrimental impact on the stability of insurance markets. However, prevailing theories on the underwriting cycle mainly focus on the "hard market" stage of the cycle, while the "soft market" stage is largely ignored. In this paper, we develop a simple economic model to explain how an entrant insurer may suffer the winner's curse in the sense that the entrant insurer's risk pool is less profitable than that of an incumbent insurer, on condition that the entrant mimics the pricing structure of incumbent insurers. In addition, we exploit the tit-for-tat pricing dynamics between entrant and incumbent insurers to describe the formation of a soft market. Empirical tests based on the predictions of our model will be conducted lastly.

I.1. Winner's Curse

The term "winner's curse" is widely known in the literature of auctions. In a common value auction with incomplete information, the value of the auctioned item is roughly the same to all bidders, but none of the bidders know exactly what the value is when they bid. Each bidder independently estimates the value of the item based on his private information before bidding. The bidder who submits the highest bid wins the auctioned item. However, if, on average, bidders estimate the value of the item correctly, the winner, by submitting the highest bid, is likely to be cursed by paying too much for the auctioned item.

the property/liability insurance market (Harrington and Danzon 1994), and the life insurance settlement market (Tu 2010). In this article, we investigate whether new entrant insurers take market share at the cost of lower underwriting profitability than incumbent insurers. In other words, we'd like to know if new entrants to insurance markets suffer from the winner's curse.

I.2. Underwriting Cycles

Property-liability insurance markets are widely believed to be cyclical, which is viewed as being detrimental to the soundness and stability of insurers in these markets. The typical description of these cycles, which are known as underwriting cycles, generally includes four stages: a soft market period, a hard market period, and two transitional periods in between. During a soft market period, price and profitability are observed to be stable or falling and insurance coverage is readily available to customers; while in a hard market period, price and profitability increase abruptly and dramatically, but less insurance coverage is available to customers. The two transitional periods are marked by the persistence of certain characteristics of soft or hard markets, while gradual changes to the next stage are on the way.

Thanks to severe hard markets in 1985-1986 across many lines of property-liability insurance, underwriting cycles caught the public's attention, which not only led many states to enact tort reforms but also spawned an extensive study of the phenomenon. In the literature, explanations for the underwriting cycle mainly fall into three categories: the arbitrage theory, the capacity-constraint theory and the cash flow underwriting. The arbitrage theory explains the presence of underwriting cycles as the result of institutional and regulatory lags, and accounting practices (Cummins and Outreville 1987). However, this theory does not allow insurers to learn from their mistakes. The capacity constraint model (Gron 1994) explains underwriting cycles as the natural outcome of shocks to insurers' capital. The capacity constraint theory is intuitively appealing, but it leaves some important issues unanswered. For example, why the insurance demand is not elastic enough to allow insurers to replenish their capital with an increase of price and decrease of coverage? The third theory views underwriting cycles as resulting from the practice of cash flow underwriting (Feldblum 1992). This theory says that insurers underwrite policies at a loss in order to generate cash flows of premiums for investment when interest rates are high. This is too simplistic in current market conditions to explain underwriting cycles, since the time value of money is a major factor in determining insurance premiums nowadays.

In the literature, people have largely ignored the interactions among market participants in interpreting underwriting cycles. In this paper, we hypothesize that strategic interactions among rational insurers, especially between new entrant insurers and incumbent insurers, can generate underwriting cycles.

II. Barriers to Entry in Insurance Markets

In standard industrial organization theories, four major elements of market structure may serve as barriers to entry: economy of scale (such as fixed costs), absolute cost advantages, product-differentiation advantages, and capital requirements. However, due to unique market characteristics, these barriers to entry are ineffective in insurance markets.

Economy of Scale. Economy of scale refers to a minimum efficient scale in a market. In industries/markets such as cable service and automobile manufacturing, a huge amount of fixed investment is required for any new entrant, which may deter potential entrants into these industries. However, this is not the case in the insurance industry, where limited fixed startup capital is needed and is unlikely to form effective barriers to entry.

Absolute Cost Advantages. If incumbent firms have developed superior production techniques, they can reduce their cost of production and maintain market price at such a level that the market is unprofitable for new entrants. These firms are said to have absolute cost advantages. In the insurance industry, the main outputs are risk sharing and risk pooling, which may be represented by expected loss. Incumbent insurers may acquire superior underwriting techniques through their experience, but this expertise is essentially embodied in human capital, which cannot be effectively protected by patents or laws. Because human capital is easily transferable, it may be fairly easy for a new entrant to have access to the same level of underwriting expertise by hiring talents from incumbents. Besides, the distribution system of independent agents and the assistance of reinsurers through reinsurance agreements may help facilitate an entrant to screen types of risks and reduce their cost of production. Consequently, absolute cost advantages also do not form effective barriers to entry in insurance markets.

Product-Differentiation Advantages. If incumbent firms have patented product innovations or have otherwise won consumer loyalty, they can enjoy product-differentiation advantages that effectively protects their market share. For example, different brands of automobiles are designed to cater to the tastes of different groups of customers, and thus this branding creates a sort of market monopoly to some extent. However, most insurance policies are indistinguishable to an average consumer, and this is especially true in personal lines of insurance which means that product differentiation is also not an effective barrier to entry in insurance markets.

Capital Requirement. Lastly, the capital requirement argument says that new entrants to a market may have trouble finding financing for their investments because of the risk to creditors. However, given the low fixed cost and the relatively low statutory capitalization requirements in the insurance industry, the capital requirement too is unlikely to be a major barrier to entry.

III. A Simple Economic Model

None of the four theoretical barriers of entry into new markets are likely to be effective in the market for insurance due to unique characteristics of the industry. It is therefore hard for incumbent insurers to bar new insurers from entering the markets. In this section, we investigate how the entrance of new insurers affects the underwriting profitability of incumbent insurers. Our framework builds on the work of Shaffer (1998).

Consider a market with N potential customers and n insurers. Customers are of two types of risk: “good” and “bad”. A “good” customer files a claim with probability θ_G on average, while a “bad” customer files a claim with probability θ_B on average. We assume that each customer’s type is unknown to insurers, and that $0 < \theta_G < \theta_B < 1$. However, it is common knowledge that a fraction of these N potential customers, denoted by α , are the good risk type. For simplicity, we assume that insurers charge R per unit of insurance coverage, which is fixed and exogenous, the expected loss per unit of insurance is normalized to be unity, and the discount factor is unity. Under these assumptions, an insurer earns a profit of $R - \theta_G$ on each dollar of insurance coverage sold to a good customer, and $R - \theta_B$ on each dollar of insurance coverage sold to a bad customer. To rule out the trivial equilibrium that no insurer would bother to screen potential customers, we also assume that $\theta_G < R < \theta_B$.

An insurer observes a noisy signal of each customer’s type and underwrites if and only if the signal indicates that the customer is of good risk type. Signals are assumed to be independent

across insurers. The signal corresponds to the true type with probability p_{gG} for good types and p_{bB} for bad ones, that is, $\text{prob}(\theta_G | \theta_G) = p_{gG}$ and $\text{prob}(\theta_B | \theta_B) = p_{bB}$. Because an uninformative signal would have $p_{gG} = p_{bB} = 1/2$, We assume that $1/2 < p_{gG} < 1$ and $1/2 < p_{bB} < 1$, so that the signals are not perfect but informative.

III.1. Insurance Market with One or Two Insurers

If there is only one insurer in the market (i.e., a monopolist), all customers have to purchase insurance from the monopolist. The insurer deems $p_{gG} \alpha N + (1 - p_{bB}) (1 - \alpha) N$ customers as good risk types and underwrites insurance to them, which yields an expected profit of $p_{gG} \alpha N (R - \theta_G) + (1 - p_{bB}) (1 - \alpha) N (R - \theta_B)$. Hence, the insurer's expected claim rate, or the number of claims per policy sold on average, is $[p_{gG} \alpha \theta_G + (1 - p_{bB}) (1 - \alpha) \theta_B] / [p_{gG} \alpha + (1 - p_{bB}) (1 - \alpha)]$. Here, we assume that a rejected customer is recorded on file and will be rejected subsequently by this insurer.

Now, consider the case of two insurers with equal size (i.e., duopolists). We assume that half of the customers contact one insurer, and the remaining customers reach the other insurer for insurance. Then each insurer underwrites insurance to half as many customers as the monopoly insurer does, that is, $p_{gG} \alpha N/2 + (1 - p_{bB}) (1 - \alpha) N/2$, and earns half of the expected profit, which is $p_{gG} \alpha N (R - \theta_G)/2 + (1 - p_{bB}) (1 - \alpha) N (R - \theta_B)/2$.

We assume that insurers don't share information about their rejection of insurance applicants, therefore, an insurer can't distinguish whether an applicant has ever been rejected or not by the other insurer, and thus a rejected applicant will subsequently contact the other insurer. Therefore, each insurer additionally faces $(1 - p_{gG}) \alpha N/2 + p_{bB} (1 - \alpha) N/2$ applicants, and each will additionally sell insurance policies to $p_{gG} (1 - p_{gG}) \alpha N/2 + (1 - p_{bB}) p_{bB} (1 - \alpha) N/2$ applicants who previously have been rejected by the other insurer. Now, the aggregate policies sold by each insurer is $p_{gG} (2 - p_{gG}) \alpha N/2 + (1 - p_{bB}) (1 + p_{bB}) (1 - \alpha) N/2$. It is obvious that more policies are sold in the duopolistic market than in the monopolistic market. The expected profit for each insurer is $p_{gG} (2 - p_{gG}) \alpha N (R - \theta_G)/2 + (1 - p_{bB}) (1 + p_{bB}) (1 - \alpha) N (R - \theta_B)/2$, and the expected claim rate is $[p_{gG} (2 - p_{gG}) \alpha \theta_G + (1 - p_{bB}) (1 + p_{bB}) (1 - \alpha) \theta_B] / [p_{gG} (2 - p_{gG}) \alpha + (1 - p_{bB}) (1 + p_{bB}) (1 - \alpha)]$.

III.2. Insurance Market with n Identical Insurers

Suppose now there are n identical insurers in the market and all potential customers randomly select an insurer to purchase insurance until one insurer accepts him or all insurers reject him. The number of potential customers faced by each insurer is given by

$$(\alpha N / n) \sum_{m=1}^n (1 - p_{gG})^{m-1} + (1 - \alpha) (N / n) \sum_{m=1}^n p_{bB}^{m-1} \text{ and the number of policies underwritten by each insurer}$$

is:

$$(p_{gG} \alpha N / n) \sum_{m=1}^n (1 - p_{gG})^{m-1} + (1 - p_{bB}) (1 - \alpha) (N / n) \sum_{m=1}^n p_{bB}^{m-1} .$$

The total number of policies underwritten is: $(p_{gG} \alpha N) \sum_{m=1}^n (1 - p_{gG})^{m-1} + (1 - p_{bB}) (1 - \alpha) N \sum_{m=1}^n p_{bB}^{m-1}$

Since $1 - p_{gG} > 0$ and $p_{bB} > 0$, it is obvious that total number of policies sold increases as the number of insurers in the market increases. That is, as more insurers are in the market, fewer potential customers are ultimately unable to obtain insurance. At the extreme, when n approaches infinity, the aggregate number of policies sold is N , that is, every applicant is insured.

The expected claim rate is given by:

$$\frac{p_{gG}\alpha\theta_G \sum_{m=1}^n (1-p_{gG})^{m-1} + (1-p_{bB})(1-\alpha)\theta_B \sum_{m=1}^n p_{bB}^{m-1}}{p_{gG}\alpha \sum_{m=1}^n (1-p_{gG})^{m-1} + (1-p_{bB})(1-\alpha) \sum_{m=1}^n p_{bB}^{m-1}} = \frac{\alpha[1-(1-p_{gG})^n] + (1-\alpha)(1-p_{bB}^n)}{\alpha\theta_G[1-(1-p_{gG})^n] + (1-\alpha)\theta_B(1-p_{bB}^n)}$$

As the number of insurers decreases from n to $n-1$, the change in the expected claim rate is

$$\begin{aligned} & \frac{[p_{gG}\alpha\theta_G \sum_{m=1}^n (1-p_{gG})^{m-1} + (1-p_{bB})(1-\alpha)\theta_B \sum_{m=1}^n p_{bB}^{m-1}]}{[p_{gG}\alpha \sum_{m=1}^n (1-p_{gG})^{m-1} + (1-p_{bB})(1-\alpha) \sum_{m=1}^n p_{bB}^{m-1}]} \\ & - \frac{[p_{gG}\alpha\theta_G \sum_{m=1}^{n-1} (1-p_{gG})^{m-1} + (1-p_{bB})(1-\alpha)\theta_B \sum_{m=1}^{n-1} p_{bB}^{m-1}]}{[p_{gG}\alpha \sum_{m=1}^{n-1} (1-p_{gG})^{m-1} + (1-p_{bB})(1-\alpha) \sum_{m=1}^{n-1} p_{bB}^{m-1}]} \\ & = - \frac{\{(1-p_{gG})^n p_{bB}^n [p_{gG} - (1-p_{bB})] + (1-p_{gG})p_{bB} [p_{bB}^{n-1} - p_{gG}(1-p_{gG})^{n-1}] + (1-p_{bB})p_{bB}^n\} (1-\alpha)\alpha(\theta_B - \theta_G)}{\{\alpha[1-(1-p_{gG})^n] + (1-\alpha)(1-p_{bB}^n)\} \{(1-p_{gG})(1-\alpha)(p_{bB}^n - p_{bB}) + \alpha p_{bB} [(1-p_{gG})^n - (1-p_{gG})]\}} \end{aligned}$$

Since $0 < \theta_G < \theta_B < 1$, $\frac{1}{2} < p_{gG} < 1$, $\frac{1}{2} < p_{bB} < 1$ and $0 < \alpha < 1$, it is easy to show that the change in the expected claim rate is positive. In other words, the expected claim rate monotonically increases with the number of insurers in the market.

The expected profit for each insurer is

$(p_{gG}\alpha N/n)(R-\theta_G) \sum_{m=1}^n (1-p_{gG})^{m-1} + (1-p_{bB})(1-\alpha)(N/n)(R-\theta_B) \sum_{m=1}^n p_{bB}^{m-1}$, and the change in expected profit for each insurer when the number of insurers increases from $n-1$ to n is

$$(p_{gG}\alpha N/n)(R-\theta_G) \sum_{m=1}^n (1-p_{gG})^{m-1} + (1-p_{bB})(1-\alpha)(N/n)(R-\theta_B) \sum_{m=1}^n p_{bB}^{m-1} - [p_{gG}\alpha N/(n-1)](R-\theta_G) \sum_{m=1}^{n-1} (1-p_{gG})^{m-1} - (1-p_{bB})(1-\alpha)[N/(n-1)](R-\theta_B) \sum_{m=1}^{n-1} p_{bB}^{m-1} . \text{ The sign of}$$

the change in expected profit per insurer depends on the parameters, and it can increase or decrease as n increases.

III.3. Entry of a New Insurer

Suppose a new insurer enters a market with n insurers. The number of uninsured good type customers in the residual market is $\alpha N - (p_{gG}\alpha N)\sum_{m=1}^n (1-p_{gG})^{m-1} = \alpha N(1-p_{gG})^n$, and the number of uninsured bad type customers is $(1-\alpha)N - (1-p_{bB})(1-\alpha)N\sum_{m=1}^n p_{bB}^{m-1} = (1-\alpha)N p_{bB}^n$. Assume that the new insurer uses the same screening technology, that is, $\text{prob}(\theta_G | \theta_G) = p_{gG}$ and $\text{prob}(\theta_B | \theta_B) = p_{bB}$, and he sells policies if and only if he believes that a customer's type is good. The number of policies sold by the entrant is $p_{gG}\alpha N(1-p_{gG})^n + (1-p_{bB})(1-\alpha)N p_{bB}^{m-1}$ and the expected profit for the new insurer is $p_{gG}\alpha N(R-\theta_G)(1-p_{gG})^n + (1-p_{bB})(R-\theta_B)(1-\alpha)N p_{bB}^{m-1}$.

Comparing the entrant with an incumbent insurer, the difference in their expected profits is

$$\begin{aligned} & [p_{gG}\alpha N(R-\theta_G)(1-p_{gG})^n + (1-p_{bB})(R-\theta_B)(1-\alpha)N p_{bB}^n] \\ & - [(p_{gG}\alpha N/n)(R-\theta_G)\sum_{m=1}^n (1-p_{gG})^{m-1} + (1-p_{bB})(1-\alpha)(N/n)(R-\theta_B)\sum_{m=1}^n p_{bB}^{m-1}] \\ & = (p_{gG}\alpha N/n)(R-\theta_G)[n(1-p_{gG})^n - \sum_{m=1}^n (1-p_{gG})^{m-1}] + (1-p_{bB})(1-\alpha)(N/n)(R-\theta_B)[np_{bB}^n - \sum_{m=1}^n p_{bB}^{m-1}] \end{aligned}$$

Since $\frac{1}{2} < p_{gG} < 1$, $\frac{1}{2} < p_{bB} < 1$, it is obvious that the terms in the brackets are negative.

Hence, the expected profit for a new insurer is lower than that of an incumbent insurer. In addition, the difference in the expected claim rate is

$$\begin{aligned} & \frac{p_{gG}\alpha\theta_G(1-p_{gG})^n + (1-p_{bB})(1-\alpha)\theta_B p_{bB}^n}{p_{gG}\alpha(1-p_{gG})^n + (1-p_{bB})(1-\alpha)p_{bB}^n} - \frac{p_{gG}\alpha\theta_G\sum_{m=1}^n (1-p_{gG})^{m-1} + (1-p_{bB})(1-\alpha)\theta_B\sum_{m=1}^n p_{bB}^{m-1}}{p_{gG}\alpha\sum_{m=1}^n (1-p_{gG})^{m-1} + (1-p_{bB})(1-\alpha)\sum_{m=1}^n p_{bB}^{m-1}} \\ & = \frac{\{p_{gG}(1-p_{bB})[(p_{bB}^n - (1-p_{gG})^n) + \dots + p_{bB}^{n-1}(1-p_{gG})^{n-1}(p_{bB} - (1-p_{gG}))]\}(1-\alpha)\alpha(\theta_B - \theta_G)}{[1-\alpha(1-p_{gG})^n - p_{bB}^n(1-\alpha)][p_{gG}\alpha(1-p_{gG})^n + (1-\alpha)p_{bB}^n - (1-\alpha)p_{bB}^{n+1}]} \end{aligned}$$

Since $0 < \theta_G < \theta_B < 1$, $\frac{1}{2} < p_{gG} < 1$, $\frac{1}{2} < p_{bB} < 1$ and $0 < \alpha < 1$, the expression above is positive, indicating that the expected claim rate of the new insurer is higher than that of an incumbent insurer. This result is also intuitively appealing. Suppose there are $n-1$ insurers in the market initially. The ratio of good type to bad type customers within the residual pool is $\alpha(1-p_{gG})^{n-1}/(1-\alpha)p_{bB}^{n-1}$. However, if there are n incumbent insurers in the market, the ratio of good to bad type customers within the residual pool now becomes $\alpha(1-p_{gG})^n/(1-\alpha)p_{bB}^n$, which

is less than $\alpha(1-p_{gG})^{n-1}/(1-\alpha)p_{bb}^{n-1}$ for any n , since $\frac{1-p_{gG}}{p_{bb}} < 1$. That is, the risk of the residual pool continues to get worse as the number of incumbent insurers in the market increases. Therefore, a new insurer faces a worse mix of customers, and suffers a higher expected claim rate than an incumbent insurer even when using the same screening technology as the incumbent insurer. In other words, an entrant insurer suffers from the winner's curse.

Hypothesis 1: *If signals about customer type received by an entrant insurer follow the same probability distribution as they do for incumbent insurers, the entrant insurer will suffer a higher claim rate than incumbent insurers.*

III.4. Insurance Market with Heterogeneous Insurers

For simplicity, we assume now there are two insurers with heterogeneous sizes in the market. For concreteness, suppose that the size of insurer 1 is twice as large as insurer 2. All potential customers randomly contact with each firm, and if a customer is rejected by one firm, he will contact another insurer subsequently. Therefore, the number of policies that insurer 1 initially sells is $\frac{2}{3}p_{gG}\alpha N + \frac{2}{3}(1-p_{bb})(1-\alpha)N$, and the number of policies that insurer 1 subsequently sells

is $\frac{1}{3}p_{gG}(1-p_{gG})\alpha N + \frac{1}{3}p_{bb}(1-p_{bb})(1-\alpha)N$, and the total number of policies sold by insurer 1 is

$p_{gG}(1-\frac{1}{3}p_{gG})\alpha N + (1-p_{bb})(1-\alpha)(\frac{2}{3} + \frac{1}{3}p_{bb})N$. Therefore, the claim rate for insurer 1 is $\frac{p_{gG}(1-\frac{1}{3}p_{gG})\alpha\theta_G + (1-p_{bb})(1-\alpha)(\frac{2}{3} + \frac{1}{3}p_{bb})\theta_B}{p_{gG}(1-\frac{1}{3}p_{gG})\alpha + (1-p_{bb})(1-\alpha)(\frac{2}{3} + \frac{1}{3}p_{bb})}$. On the other hand, the total number of policies

sold by insurer 2 is $p_{gG}(1-\frac{2}{3}p_{gG})\alpha N + (1-p_{bb})(1-\alpha)(\frac{1}{3} + \frac{2}{3}p_{bb})N$, and the claim rate for insurer

2 is $\frac{p_{gG}(1-\frac{2}{3}p_{gG})\alpha\theta_G + (1-p_{bb})(1-\alpha)(\frac{1}{3} + \frac{2}{3}p_{bb})\theta_B}{p_{gG}(1-\frac{2}{3}p_{gG})\alpha + (1-p_{bb})(1-\alpha)(\frac{1}{3} + \frac{2}{3}p_{bb})}$. It is obvious that the total number of

policies sold in the market is the same as that in a market with two equally sized insurers, that is, $p_{gG}(2-p_{gG})\alpha N + (1-p_{bb})(1-\alpha)(1+p_{bb})N$. However, the claim rate of insurer 1 is higher than that of insurer 2, and the difference in the claim rates between insurer 1 and 2 is

$$\frac{p_{gG}(1-\frac{1}{3}p_{gG})\alpha\theta_G + (1-p_{bb})(1-\alpha)(\frac{2}{3} + \frac{1}{3}p_{bb})\theta_B}{p_{gG}(1-\frac{1}{3}p_{gG})\alpha + (1-p_{bb})(1-\alpha)(\frac{2}{3} + \frac{1}{3}p_{bb})} - \frac{p_{gG}(1-\frac{2}{3}p_{gG})\alpha\theta_G + (1-p_{bb})(1-\alpha)(\frac{1}{3} + \frac{2}{3}p_{bb})\theta_B}{p_{gG}(1-\frac{2}{3}p_{gG})\alpha + (1-p_{bb})(1-\alpha)(\frac{1}{3} + \frac{2}{3}p_{bb})}$$

$$= \frac{3\alpha p_{gG}(1-p_{bb})(1-\alpha)(p_{gG} + p_{bb} - 1)(\theta_B - \theta_G)}{[2 - (1-\alpha)p_{bb}^2 - (1-\alpha)p_{bb} - \alpha(p_{gG}^2 - 3p_{gG} + 2)][2(1-\alpha)p_{bb}^2 - (1-\alpha)p_{bb} + \alpha(2p_{gG}^2 - 3p_{gG} + 1) - 1]}$$

Since $0 < \theta_G < \theta_B < 1$, $\frac{1}{2} < p_{gG} < 1$, $\frac{1}{2} < p_{bB} < 1$ and $0 < \alpha < 1$, the above expression is negative. Therefore, the larger insurer enjoys a lower claim rate. It reflects that the larger insurer faces less risk and it can diversify his underwriting risks more efficiently.

Hypothesis 2: Larger insurers enjoy a lower claim rate than their smaller competitors, holding other things equal.

IV. Data Description and Variable Development

IV.1 Data Description

Insurers' annual firm-level data are collected from the National Association of Insurance Commissioners (NAIC) Property and Casualty Database in the lines of homeowners and product liabilities for the period 1994 through 2006. To obtain an appropriate sample for this study, the following sample selection criteria are applied:

1. The firm must report to be active and file its annual statement individually;
2. The firm must report positive numbers for direct written premiums, both for the entire firm and for the line of business under study;
3. The policyholders surplus and total admitted assets must be greater than \$250,000;
4. The firm must be classified either as a stock, a mutual or a reciprocal exchange;
5. The firm must survive for an additional five years after the observation.

The final data sample contains 4,130 firm-year observations in the homeowners insurance and 1,689 firm-year observations in the product liability insurance.

IV.2 Variable Development

In this section, we describe the dependent and independent variables used in the empirical analysis. A summary of the definitions of these variables are provided in Table 1.

Loss Ratio. Loss ratio is commonly used in the literature to measure an insurer's underwriting performance. Therefore, for each line of insurance, we compute the loss ratio of direct and assumed business, which is defined as the ratio of total direct and assumed losses incurred, as of year $t+5$, for accidents in year t to total direct and assumed premiums earned in year t . The five-year developed losses are used to reduce potential biases due to managerial loss management (Petroni 1992; Eckles and Halek 2010).

Entry. Hypothesis 1 suggests that new entrants tend to face a worse risk pool of customers and thus are more likely to have worse underwriting loss experience. Similar to Harrington and Danzon (1994), two binary indicators of new entrants are included to test for Hypothesis 1. The *line-of-business (LOB) entrant* variable indicates a recent entrant to a line of insurance business under study with experience in other lines. It equals one if the insurer did not write in the line of insurance in question but had positive net premiums written in other lines five years ago (in year $t-5$). The *insurance industry entrant* variable equals one if the insurer had zero net premiums written in all lines of property and liability insurance five years ago but has positive net premiums written in the line of insurance in question in year t .

Firm size. Hypothesis 2 suggests that larger insurers tend to be more profitable than their smaller competitors, everything else equal. Hence, we include the natural logarithm of total admitted assets as the measure of firm size to test this hypothesis.

Organizational characteristics. Two binary variables of insurers' organizational characteristics are included to control for idiosyncratic features of insurers. The binary variable called *mutual* equals one if the insurer is either a mutual insurer or a reciprocal exchange and zero if the insurer is a stock company. Mutual and reciprocal exchange insurers tend to be more conservative in risk-taking than stock insurers (Mayers and Smith 1990) because of managers' and policyholders/owners' aversion to financial distress and the limited ability to raise capital. However, stock insurers may be better managed because managers and stockholders/owners' interests are better aligned via stocks and stock options. The binary variable called *distribution system* equals one if the insurer is a direct writer and zero if the insurer utilizes other distribution methods such as agency or brokerage. Direct writers tend to do businesses with small to medium-sized companies, while insurers with an agency or brokerage distribution system generally specialize in large commercial accounts. However, we have no strong predictions with regard to these two binary variables of organizational characteristics.

Leverage. A firm achieves the minimum cost of capital at its optimal capital structure, which generally demands a certain level of financial leverage. Beyond this level, an increase in financial leverage can not only increase the firm's cost of capital but also raise its probability of bankruptcy. Therefore, up to some level, increased leverage could discourage firms with high bankruptcy costs from risk-taking in order to protect their tangible and intangible capital. However, for those firms with low bankruptcy costs who typically have little tangible and intangible capital, high leverage could induce more aggressive risk-taking or produce go-for-broke behavior (Harrington and Danzon 1994). Two proxies for financial leverage are included. The ratio of total liabilities to total admitted assets are included to measure overall financial leverage. However, insurers could utilize reinsurance to transfer their liabilities to reinsurers or to conceal their excessive risk-taking behavior. Thus, we include the ratio of reinsurance recoverable to total admitted assets to measure the effect of reinsurance on financial leverage.

Premium growth. Rapid growth in premiums written may result from an insurer's unintentionally low pricing due to over-optimism or inexperience in the case of new entrants. It can also be due to an insurer's intentional aggressive underwriting strategies to enter a new market or to gain market share over a short period of time. Regardless of cause, rapid growth in premiums written typically generate more volatile underwriting results and eventually lead to worse loss experience. We include the percentage growth in premiums written both at the firm level and at the level of line of business (LOB). The firm growth rate is defined as the percentage growth in the direct and assumed premiums written at the firm level, while the LOB growth rate is the percentage growth in the direct and assumed premiums written in the line of business under study.

LOB concentration. If a certain line of business accounts for a larger proportion of an insurer's underwriting risks, the insurer may have underwriting expertise in this line of business or may be more conservative in underwriting to reduce the impact of unfavorable underwriting results of this particular line on the entire firm. For each line of business, LOB concentration is defined as the ratio of premiums written in a line of business to the total premiums written.

Loss Reserve Error. As a major liability item on an insurer's statutory balance sheet, loss

reserve tends to be underestimated especially by financially weak insurers (Petroni 1992) or be manipulated by insurance firm managers to maximize their compensation (Eckles and Halek 2010). Hence, we include the variable of loss reserve error to account for this phenomenon. Loss reserve error in year t is defined as the difference between the actually developed incurred losses as of year $t+5$ and the originally reported incurred losses in year t . A five-year development period is used since a high percentage of losses are settled during this period (Weiss 1985). If an insurer has a positive loss reserve error, it implies that the losses and loss adjustment expenses actually developed in the future are higher than initially reported by the insurer, and it is evidence of under-reserving.

Coastal States. Insurers in hurricane-prone states are likely to suffer greater underwriting losses in the homeowners insurance market. To control for this heterogeneity, we include the binary variable, *coastal states*, in the empirical analysis on the homeowners insurance market. It takes a value of 1 if an insurer is domiciled in one of the following hurricane-prone states according to the Landscape of Natural Disasters of USATODAY.com: Alabama, Arkansas, Connecticut, Delaware, Florida, Georgia, Louisiana, Maine, Maryland, Massachusetts, Mississippi, New Hampshire, New Jersey, New York, North Carolina, Pennsylvania, Rhode Island, South Carolina, Texas, Vermont, and Virginia, and 0 otherwise.

V. Estimation Procedure and Empirical Results

V.1 Estimation Procedure

We use annual firm-level data for the years 1995 through 2001 for homeowners insurance and product liability insurance to test our hypotheses, respectively. The variable of loss reserve error is only available for firms that survive through year $t+5$, which requires us to collect data for the years 2002 to 2006 to construct it. In addition, data for the year 1994 are collected to construct the variables of premium growth rate. The fixed effects model is chosen over the random effects model based on the Hausman specification test, and robust standard errors are estimated to control for heteroscedasticity. The econometric specification on the loss ratio is as follows:

$$\text{Loss Ratio}_{i,t} = \alpha + \beta_1 \text{Firm Size}_{i,t} + \beta_2 \text{LOB Entrant}_{i,t} + \beta_3 \text{Industry Entrant}_{i,t} + \gamma X_{i,t} + \varepsilon_{i,t},$$

where $X_{i,t}$ is a vector of control variables including line of business premium growth rate, firm premium growth rate, loss reserve error, the ratio of total liabilities to total admitted assets, the ratio of reinsurance recoverable to total admitted assets, line of business concentration, the binary variable of mutual, the binary variable of direct, the binary variable of coastal states for the line of homeowners insurance, and the binary variables for the years 1996 through 2001.

V.2 Empirical Results

Table 2 reports the empirical estimation for the homeowners insurance and the product liability insurance. Overall, the results are consistent with our two hypotheses that new entrants suffer from higher loss ratio and that larger insurers boast of lower underwriting losses.

Specifically, in the line of homeowners insurance, the estimated coefficient for firm size is negative and significant at the 10 percent level. This result suggests that larger insurers tend to have more favorable underwriting results than smaller insurance companies. The coefficients for new entrants are not statistically significant at the conventional levels, indicating that new entrants and incumbent insurers do not differ systematically in underwriting performance. Insurance

companies with faster growth rate of premiums written in the line of homeowners insurance tend to have lower loss ratios, while insurers with higher growth rate of premiums written at firm level suffer from poorer underwriting results. This implies that the loss experience of homeowners insurance is more favorable comparing to other lines of business over the periods of 1995 to 2001. Other factors such as financial leverage and organizational characteristics appear to have no significant impact on insurers' underwriting performance.

In the line of product liability insurance, the coefficient for firm size is negative as expected but not statistically significant at the conventional levels. The results for new entrants generally support our hypothesis 1 that new entrants are less profitable in underwriting comparing to incumbent insurers. Specifically, the estimated coefficient for LOB entrant is positive as predicted but not statistically significant, whereas the coefficient for insurance industry entrant is positive and significant at the 5 percent level. This finding suggests that new entrants into the product liability insurance with limited or no underwriting experience in other lines of business, though they may gain market share over a short period of time, will suffer worse realization of claim costs comparing to incumbent insurers. In this sense, we say that these new entrants suffer winner's curse.

A positive and significant coefficient on loss reserve error indicates that insurers with more optimistic private information on future claim costs will experience worse underwriting results. Similar to the findings in the homeowners insurance, financial leverage does not appear to be of important determinants of insurers' underwriting performance. Mutuals and direct writers sustain worse underwriting results over this period, although we do not have any strong prediction related to these organizational characteristics. Another striking finding in the product liability insurance is that the loss experience in this line of business has been deteriorating over the years 1995 through 2001, which is not observed in the homeowners insurance market.

VI. Discussion: The Winner's Curse and Underwriting Cycle

Property-liability insurance markets are widely believed to be cyclical. In the literature, explanations for the underwriting cycle mainly fall into three categories: the arbitrage theory, the capacity-constraint theory and the cash flow underwriting. However, people have largely ignored the interactions among market participants in interpreting underwriting cycles. We have shown evidence of the winner's curse in the insurance markets, i.e., new entrants may gain markets relatively quickly in a short time period at the cost of worse underwriting experience. In this section, we relax the assumption of exogenous insurance price in the economic model in Section 3. We hypothesize that strategic interactions among rational insurers, especially between new entrant insurers and incumbent insurers, can generate underwriting cycles.

VI.1. Strategies of Entrants

Since barriers to entry into the insurance industry are low, it is a common phenomenon that a new insurer is established or an existing insurer ventures into new insurance markets. However, the timing of entry may heavily depend on market conditions. Specifically, when the insurance industry boasts of a higher rate of return than many other industries, we expect a large number of entrants into the insurance industry, intending to share the higher profitability in this industry. Since insurance products are quite homogeneous, at least in personal lines, product differentiation

is not an effective strategy for a new entrant to gain businesses over a short period of time. Therefore, price competition is the commonly-adopted strategy for new entrants.

There are several reasons for a new entrant to do so. First, undercutting competitors is an effective method to gain business quickly and may not result in retaliation by incumbent insurers. This strategy may succeed because a new entrant is usually fairly small, and thus the effect of his price-cutting behavior may go unnoticed by most incumbent insurers. Second, an entrant usually holds a very optimistic attitude towards its new insurance businesses; otherwise it will not venture into this market. However, the optimistic attitude, which justifies the entrant's low-price strategy, may result in underestimation of the expected losses of underwriting. Third, a rational entrant may realize that the risk pool of customers it faces is worse than the population, which will result in higher expected losses than incumbent insurers. Hypothesis 2 above illustrates this point. By offering lower price, the new entrant may expect to attract customers from those incumbent insurers, which may help to improve the risk pool and thus reduce the expected losses. Lastly, if buyers are insensitive to insurer's default risk, which is likely true in short-tail personal lines of insurance such as homeowners insurance, a new entrant or a small incumbent insurer may offer a much lower price compared to sound, large incumbents. The buyers' indifference to an insurer's default risk may be due to the existence of state insurance guaranty funds. An insurer's willingness to incur default risk depends on the value of tangible and intangible capital at stake if it goes bankrupt (Harrington and Danzon 1994). Intangible capital mainly includes goodwill and the client list, which may generate above-normal profit in the future. For a new entrant or a small insurer, both their tangible and intangible capital is usually minimal, thus they have fewer solvency concerns. Therefore, these insurers can earn profit in the case of favorable claims outcomes, and go broke in case of bad outcomes from loss claims and leave the state insurance guaranty fund to hold the bag. This is the moral hazard hypothesis tested by Harrington and Danzon (1994).

VI.2. Strategy of Incumbent Insurers

Facing a few aggressive but small entrants, large incumbent insurers may still maintain their prices and not respond to the entrants' aggressive price-cutting behavior, since the loss of their market share is fairly small and their profitability won't be affected too much. Also, because of their relatively large size, any aggressive pricing behavior won't go without notice in the market, and may trigger similar price-cutting behavior by other incumbent insurers to protect their own market shares. Therefore, large incumbent insurers are hesitant to respond to the aggressive behavior of a few small entrants. However, if a large number of entrants enter the market with aggressive pricing strategies, market shares for incumbent insurers may decrease significantly. Since the loss of market share is very hard to regain, incumbent insurers will respond to the aggression of those new entrants by cutting prices. Another incentive for incumbent insurers to cut price is to keep their expected, long-run profits from renewal business. *“Renewal business is generally more profitable than new business, and insurers strive to maintain policyholder loyalty. An incumbent insurer may reduce its own rates to avoid the loss of profitable renewal business to a competitor.”* (Feldblum 1993) To do so, they may have lower profitability or even incur losses for a short period of time. However, this strategy can protect their hard-won market share, prevent potential new entrants from successfully entering this market. Therefore, strategically speaking, this strategy is a rational choice between short-term losses and long-term profitability.

If a large incumbent insurer starts price cutting in response to the pricing strategy of new entrants, it may result in a self-perpetuating tit-for-tat (Fudenberg and Tirole 1991) response from

other insurers in the market. In other words, once a large incumbent insurer defects from his current pricing scheme in response to new entrants, it also undercuts other incumbents, which may trigger the tit-for-tat strategy where other incumbents follow suit. Therefore, an industry-wide price cut ensues and insurers' profits drop. This is the soft market condition in an underwriting cycle. Many new entrants and even small incumbent insurers can hardly maintain their businesses, due to the extended low insurance price levels and underwriting losses, and have to withdraw from the market. After a period of time when the threat of aggressive entries is mitigated, some major insurers jack up their price to increase their profitability, other incumbents follow suit to prevent a prolonged price war. At the same time, as the fight for market share among insurers eases, insurers will be more prudent in underwriting insurance business, and many people, who are regarded by insurers as high risk, may have great difficulty in obtaining insurance coverage. This is the hard market condition in an underwriting cycle.

VII. Conclusions

In this article, we set out to investigate the existence of the winner's curse in the homeowners insurance and product liability insurance markets. We build a basic economic model to examine how the entrance of new insurers affects the underwriting profitability of incumbent insurers. The model predicts that entrant insurers suffers from the winner's curse and large insurers experience better underwriting results.

Our empirical analysis uses loss ratios for homeowners insurance and product liability insurance during 1995-2001 to test the two hypotheses generated from our basic economic model. In the case of homeowners insurance, we fail to find evidence that new entrant insurers are less profitable in underwriting than incumbent insurers. However, we do find evidence that larger insurers tend to be more profitable in underwriting than their smaller competitors, which provides support to our second hypothesis.

As for product liability insurance, new entrants without any prior underwriting experience in property and liability insurance suffer worse underwriting results, whereas new entrants with expertise in underwriting other lines of insurance do not differ systematically in underwriting profitability. This finding suggests that the first type of new entrants succeed in gaining market share but at the cost of higher underwriting losses in the product liability insurance market. In this sense, we say that the first type of new entrants suffers the winner's curse. We also find weak evidence that larger insurers may enjoy more favorable realization of claim costs, but the evidence is not statistically significant.

Moreover, we discuss how the strategic interactions between new entrants and incumbent insurers not only can result in the winner's curse but also may generate underwriting cycles in the insurance market. However, a theoretical analysis of the formation of an underwriting cycle demands a multi-period dynamic economic model, and this is left for future research.

Table 1: Variable Definitions

Variable	Definition
Loss Ratio	total direct and assumed losses incurred / total direct and assumed premiums earned; line-specific

LOB Entrant	a dummy variable equals one if the insurer did not write in the line of insurance in question but had positive net premiums written in other lines five years ago; line-specific
Industry Entrant	a dummy variable equals one if the insurer did not write in the line of insurance in question and had zero net premiums written in other lines five years ago; line-specific
Firm Size	natural logarithm of total admitted assets; firm-specific
Mutual	a dummy variable equal to one if it is a mutual or reciprocal insurer
Direct	a dummy variable equal to one if the insurer is a direct writer
Leverage 1	total liabilities / total admitted assets; firm-specific
Leverage 2	reinsurance recoverable / total admitted assets; firm-specific
LOB Concentration	premiums written in a certain line / total premiums written of the insurer; line-specific
LOB Growth Rate	(premiums written in a certain line in year t / premiums written in the same line in year t-1) – 1; line-specific
Firm Growth Rate	(premiums written in year t / premiums written in year t-1) – 1; firm-specific
Loss Reserve Error	(losses as actually developed as of year t+5 - originally reported incurred losses in year t) / originally reported incurred losses in year t; line-specific
Coastal States	dummy variable equal to one if the insurer is domiciled in a hurricane-prone state; firm-specific

Table 2: Fixed-Effects Model with Robust Standard Errors

Dependent Variable: Loss Ratio				
Independent Variables	Homeowners		Product Liability	
	Coeff.	t-Stat	Coeff.	t-Stat
Intercept	357.16	1.71*	10.97	0.92
Firm Size	-20.55	-1.67*	-0.46	-0.70
LOB Entrant	-17.89	-1.08	1.19	1.53
Industry Entrant	8.58	0.56	0.34	2.32**
LOB Premium Growth Rate	-3.78	-3.47***	0.00	0.00
Firm Premium Growth Rate	3.56	3.45***	0.19	0.73
Loss Reserve Error	0.41	0.78	0.03	3.69***
Liabilities / Assets	34.33	1.13	-2.08	-0.92

Reinsurance Recoverable / Assets	92.42	1.02	1.51	0.70
LOB Concentration	-13.37	-0.41	-2.55	-0.78
Mutual	3.56	1.01	0.65	2.01**
Direct	-4.02	-1.50	0.89	2.57***
Coastal States	17.07	1.15		
year1996	-1.91	-1.57	0.33	2.09**
year1997	1.57	0.86	0.41	3.57***
year1998	5.92	1.86*	0.73	2.30**
year1999	12.01	1.36	0.89	3.29***
year2000	3.83	0.91	1.06	3.74***
year2001	0.95	0.32	0.93	2.58***
<hr/>				
R ² (within)		81.41%		11.47%
N		4130		1689

^aThe t-statistics are calculated with White standard errors, which are corrected for cross-sectional heterogeneity.

^b***Significant at 1% level; **significant at 5% level; *significant at 10% level.

VIII. References

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