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Insurer Capital Structure Decisions and the Viability of Insurance Derivatives

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ABSTRACT

Insurance futures contracts and options on these contracts developed by the Chicago Board of Trade provide a means for insurers and reinsurers to hedge underwriting losses due to industry-wide shocks, such as natural catastrophes. In order for insurance derivatives to be viable, they must lower insurers' costs compared to other methods that mitigate the effects of correlated risk, such as holding additional equity capital and purchasing reinsurance. This article identifies the tradeoffs associated with using insurance derivatives versus alternative methods of dealing with correlated risk. Particular attention is focused on whether insurance derivatives can efficiently reduce the need for equity capital. In addition, empirical evidence is provided on the magnitude of correlated risk and the potential effectiveness of futures in hedging this risk.

Introduction

Claim costs for property-liability insurers are correlated because of common "shocks" that impact the frequency or severity of claims (e.g., catastrophes, changes in tort law, inflation). These events affect insurer profits and may also affect the price and availability of coverage. For example, large natural catastrophes can disrupt reinsurance markets, thus aggravating the effects on primary insurance markets (see Berger, Cummins, and Tennyson, 1992, and Insurance Services Office, 1994). Winter (1994), Cummins and Danzon (1994), Gron (1994), and Cagle and Harrington (1992) all present models that demonstrate how industry shocks can influence insurance prices and quantities. In

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each of these models, insurance supply is an increasing function of insurer capital, and capital market imperfections make raising new capital costly. A shock that reduces insurer capital thus causes a reduction in supply and a corresponding increase in price.

An insurer could earn higher profits if it could avoid losing capital following a shock that depletes its competitors' capital and raises industry prices. Thus, insurers have an incentive to manage correlated risks to mitigate the impact of industry shocks on their operations. Potential methods of managing correlated risk include holding additional equity capital, purchasing reinsurance, and sharing risk with policyholders.[1] This article's purpose is to examine whether insurance futures and option contracts recently introduced by the Chicago Board of Trade (CBOT) are likely to lower insurers' costs of bearing correlated risk.[2] Two separate issues are examined. First, a conceptual analysis is provided of the costs of using futures relative to alternative methods of dealing with correlated risk. Second, empirical evidence is presented on the magnitude of correlated risk and on the potential effectiveness of insurance futures in hedging correlated risk.

The conceptual analysis focuses on insurance futures and equity capital as alternative methods of managing correlated risk. This reflects, in part, the current lack of research on the tradeoffs between equity capital and futures.[3] Moreover, since correlated risk cannot be diversified within the industry, both reinsurers and primary insurers must manage correlated risk. If reinsurers have an advantage relative to primary insurers in bearing correlated risk, the advantage arises because they have lower costs of equity capital or specialized knowledge of the measurement and/or management of correlated risk.

The analysis assumes that insurers are averse to default risk because it lowers the price informed consumers are willing to pay for insurance and increases the likelihood that the insurer will lose its "franchise value" (i.e., the loss of future quasi rents from investments in reputation and building a book a business). Although holding equity capital reduces default risk, market imperfections make holding equity capital costly—for example, equityholders require compensation for tax and agency costs. These costs might be reduced by having investors provide capital only when it is needed to pay claims (e.g., following a catastrophe). Contingent capital contracts, however, can suffer from nonperformance. Investors may renege on their implicit or explicit promises to

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[1] Doherty and Dionne (1992) present a model where correlated risks are optimally shared between insurers and policyholders based on their relative risk-bearing costs.

[2] In December 1992, a futures contract based on insured losses arising from catastrophes was introduced. Put and call options on the catastrophe futures contracts also trade. The Chicago Board of Trade is also developing contracts based on losses from large pools of policies in specific lines of insurance, such as homeowners and group health insurance.

[3] Goshay and Sandor (1973) developed the idea of insurance futures contracts. Boose and Graham (1993), Cox and Schwebach (1992), D'Arcy and France (1992, 1993), and Niehaus and Mann (1992) describe and analyze the Chicago Board of Trade contract proposals. Cummins and Geman (1994) derive a contingent claim valuation model for insurance futures.

provide contingent capital because such capital may largely benefit policyholders. As explained below, because of the daily settlement (marking to market) system employed by the futures exchange, insurance derivatives represent a credible form of contingent capital that can substitute for equity capital. The analysis predicts that insurers tradeoff the marginal tax and agency costs of equity capital against the transaction costs of making derivatives a credible source of contingent capital plus any residual risk of nonperformance.

To provide evidence on the ability of insurance futures contracts to hedge correlated risk, indices are constructed based on industry incurred losses for several lines of insurance and on catastrophe losses in multiple lines. The latter index closely resembles the one used for the CBOT's catastrophe contracts. The analysis suggests that these indices have a substantial unpredictable component, a necessary condition for futures to be successful. The correlation between unexpected changes in these indices and unexpected changes in individual insurer loss ratios is also examined. This analysis extends D'Arcy and France (1992) by using a different expectations model, more indices, and a larger number of insurers. Assuming that unexpected changes in insurer loss ratios are highly correlated with unexpected changes in the economic value of insurer liabilities, the results suggest that insurance futures can be effective in hedging correlated risk. The evidence also suggests that futures contracts based on specific lines of insurance could be more effective than contracts based on catastrophe losses.

The overall analysis suggests that insurance derivatives have potential advantages. The question that naturally arises is: why are these contracts not used more extensively? Two years after their introduction, volume is modest.[4] These market conditions might reflect regulatory and accounting barriers that do not recognize that hedging can substitute for capital (D'Arcy and France, 1993), insurers' lack of understanding about derivative products, or the costs of obtaining information about the underlying index's probability distribution.

Despite these and other problems, the low trading volume does not necessarily imply that insurance futures will fail.[5] Given the infrequency with which information arises concerning the likelihood or severity of catastrophes, insurance futures contracts may trade less frequently. For example, since information about losses due to hurricanes will likely be concentrated in the third quarter of each year, trading in the "hurricane" contract (the Eastern catastrophe contract) may be concentrated during this period. Since this contract has only existed for two hurricane seasons, reports of its death would be premature.

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[4] Most of the trading has been in the option contracts, which allow sellers to limit their exposure to increases in the index. Cummins and Geman (1995) analyze the pricing of catastrophe options contracts.

[5] The Treasury bond futures contract, which is widely considered to be one of the most successful futures contracts, had low volume in its first year of trading. However, futures exchanges introduce new contracts frequently and some fail (e.g., consumer price index futures, Government National Mortgage Association Collateralized Depositary Receipt futures).

The next section develops a framework to analyze capital structure decisions of an insurer exposed to industry correlated risks. The following section presents empirical evidence relating to the viability of insurance futures contracts. A short summary concludes the article.

Insurance Derivatives vs. Equity Capital

Assumptions

This section identifies factors that affect stock insurers' and reinsurers' choices of equity capital and insurance derivative contracts in the presence of industry correlated risk. This risk exists because some shocks are large enough to affect many insurers.

The analysis is concerned primarily with insurer (reinsurer) choices at two dates: zero and one (although operations can continue beyond time one). Policies are sold at time zero and generate revenue net of expenses equal to one dollar. Policyholder losses (L) are realized at time one. The density function for L is f(L), and the expected value of L as of time zero is one dollar. The interest rate is zero. Also, the uncertainty about an insurer's losses cannot be reduced by additional pooling within the insurance industry. This assumption eliminates one motivation for reinsurance in order to focus on industry-correlated risk. The case where reinsurers provide diversification benefits is discussed below.

The analysis assumes that insolvency risk is costly to insurers. Policyholders may be willing to pay less for coverage as insolvency risk increases (Doherty and Tinic, 1981). Insolvency also imposes transaction costs on owners (Mayers and Smith, 1982, and Smith and Stulz, 1985), as well as the loss of franchise value (Munch and Smallwood, 1981; Finsinger and Pauly, 1984; and Harrington and Danzon, 1994).[6]

Insolvency risk is defined as the expected value of unpaid policyholder claims ("expected default costs"), which is denoted by C (see also Cummins, 1988). The analysis focuses on choosing among various methods of raising capital to minimize the cost of achieving a given level of C; the optimal level of C is not analyzed. Cost differences can arise among the different methods of raising capital because of transaction costs, taxes, agency costs, and asymmetric information.[7]

Ex Ante Capital

Consider a level of ex ante capital, k^*, such that if k^* is held at time zero, then expected default costs equal C. This level of capital satisfies the following equation:

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[6] Motivations for hedging exist besides reducing insolvency risk. For example, insurers may hedge to reduce expected tax payments (Smith and Stulz, 1985).

[7] Because of these costs, the Modigliani and Miller (1958) proposition that alternative methods of financing do not affect firm value does not apply.

$$C = \int_{1+k^*}^{\infty} [L - (1+k^*)]\ f(L)\ dL\ . \tag{1}$$

Default occurs when losses (L) exceed $1 + k^*$ (net revenues plus k^* of ex ante capital).

Holding ex ante capital is costly for several reasons. First, returns to equity investors in the United States are taxed at the corporate level and then again at the personal level. As a result, investment income generated by additional ex ante capital is taxed twice (Finsinger and Pauly, 1984).[8] Second, investors also require compensation for expected agency costs associated with monitoring managerial behavior (see, e.g., Jensen, 1986, and Finsinger and Pauly, 1984). Third, there are transaction costs associated with issuing new equity.

Ex Post Capital

Tax, agency, and perhaps issuance costs could be reduced if the insurer holds less ex ante capital and instead commits to raising capital at time one only if it is needed. For example, if the contingency that induces the demand for additional capital occurs with low frequency, then issuance costs may be reduced, because the costs of raising the marginal unit of capital are incurred only if the capital is needed. Moreover, investors do not contribute funds to the insurer during periods when profits are generated, thereby reducing one cost of ex ante capital—the double taxation of investment returns. Finally, by raising funds only when they are needed, the use of ex post capital reduces the funds subject to expropriation by managers.

However, if insurers choose ex ante capital equal to $k_0 < k^*$ and announce that they will raise additional capital if it is needed so as to keep ex ante expected default costs equal to C, there is a potential time inconsistency problem. If a catastrophe occurs, for example, the insurer may renege on its promise to issue ex post equity, because the price of the issue will reflect the fact that high losses have occurred. Since new capital providers will not willingly pay for past losses, old owners must bear these losses, either by contributing additional capital directly or by issuing new claims and thereby diluting old equityholders' claims to existing assets.[9]

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[8] Given the mark-up in cost basis at death, investors can avoid some of the double taxation by not recognizing any capital gains. These efforts, however, are likely to involve nontax costs (see Scholes and Wolfson, 1992).

[9] Cummins and Danzon (1994) present a model in which capital is raised following large losses, but policyholders share in the unexpected losses. The sharing takes place through higher prices on new policies (see also Cagle and Harrington, 1992). Doherty (1990) and Doherty and Dionne (1992) provide a rationale for why correlated risks might be shared between policyholders and insurance company owners. If insurance futures allow insurers to obtain contingent capital efficiently, these contracts would reduce the likelihood of ex post sharing of costs with policyholders (either through explicit ex ante arrangements or ex post market adjustments in prices).

Apart from possible price increases associated with a shock, the existing owners' decision to contribute additional capital to pay losses depends on the amount of franchise value that would be lost if the insurer defaults. If franchise value (FV) exceeds the shortfall in assets ($L - 1 - k_0$), then current owners will be willing to contribute additional capital to keep the insurer solvent. Otherwise, current owners will be unwilling to prevent default. Thus, rational policyholders and regulators realize that, ex post, the insurer will default whenever L is greater than $1 + k_0 + FV$, even if they had promised to default only if L were greater than $1 + k^*$. If $k_0 + FV$ is less than k^*, then expected insolvency costs will exceed C. That is, the commitment to raise capital ex post to achieve C ex ante is not credible.

Information asymmetries between insurance company managers and potential investors with respect to the value of policyholder losses and/or franchise value may aggravate the time inconsistency problem by causing an adverse selection problem when issuing equity at time one. Managers, acting on behalf of old owners, will issue new equity when it is overvalued. If potential investors know they are not as well informed, they will protect themselves from buying overvalued equity by lowering their offer price. If the resulting price is less than the true value of the shares, then old equityholders bear an additional cost of raising new capital (Myers and Majluf, 1984). If information asymmetries increase following catastrophes (Cummins and Danzon, 1994), then issuing ex post equity entails an additional cost that increases the likelihood that old investors will renege on their promise to raise new capital.

Despite the potential time inconsistency problem, insurance arrangements sometimes involve formal ex post capital mechanisms (e.g., assessment mutuals). Lloyd's of London uses elements of both ex ante and ex post capital. Individual investors ("names") post cash, securities, or a letter of credit equal to a percentage (e.g., 30 percent) of the premiums they wish to underwrite. Interest and dividends on these securities are paid directly to the investor, thus avoiding double taxation costs. If a syndicate at Lloyd's has insufficient funds to pay losses after liquidating the pledged securities, then the individual names can be assessed and the potential assessment is limited only by the investor's wealth. In essence, names commit to providing ex post capital. The mechanism employed by Lloyd's appears to have worked well for centuries. However, experience associated with the recent string of catastrophes and large liability claims suggests that enforcement costs associated with ex post capital are considerable. In an attempt to be relieved of the large assessments, many investors have alleged that their agents violated their legal duties. Approximately two-thirds of the over 30,000 names at Lloyd's in 1988 have participated in litigation (Shapiro, 1993).[10]

[10] The crisis has forced Lloyd's to reorganize its operations, including the admission of incorporated names with limited liability.

Contingent Capital Contracts—Reinsurance and Insurance Derivative Contracts

The advantages of ex post capital might be obtained and the time inconsistency problem avoided if an enforceable contingent capital contract is negotiated at time zero. With such a contract, investors agree to provide capital at time one if it is needed, but the terms (price) are established ex ante. In this way, the risk of unexpectedly high losses is shared with the new capital providers and old owners' incentive to walk away is reduced accordingly. If there is less information asymmetry at time zero, insurers also may be able to obtain capital at more favorable terms.

Excess loss reinsurance is an example of such a contingent capital contract.[11] If losses on policies written by the ceding insurer exceed some threshold, then the reinsurer pays the ceding insurer some percentage of the difference between actual losses and the threshold level up to some maximum limit. The ceding insurer essentially commits to raising capital ex post and the reinsurer commits to providing this capital at terms agreed upon ex ante.

Similarly, insurance futures contracts and options on futures are in essence contingent capital contracts. An index is constructed that is correlated with the losses incurred by individual insurers. Since the underlying index tends to increase when an insurer's losses increase, a long futures position will typically produce a positive payoff for an insurer when losses on its policies are high and a negative payoff when losses are low. Options on futures allow for asymmetric payoffs. A long call option on futures will have a positive payoff when losses are high and a zero payoff when losses are low. Option spread positions (buying one call and selling a call with a higher exercise price) yield payoffs similar to reinsurance contracts with limits (Cummins and Geman, 1995).[12]

Even with these contingent capital contracts (reinsurance and futures), the issue of credibility arises. The party providing the contingent capital might renege (default) on its contractual obligations. Reinsurance and insurance futures have important differences in this regard.[13]

Reinsurers face a problem similar to primary insurers: how can they credibly commit to having funds to honor their contracts following an industry shock? To bond their performance, reinsurers must hold either ex ante capital or use insurance derivatives. Assuming no differences in tax, agency, and equity issuance costs between reinsurers and insurers and assuming that uncertainty about claim costs for both reinsurers and insurers is due only to industry-wide factors (i.e., all risk is correlated risk), a reinsurer's cost of bonding

[11] Diversification opportunities, loss prevention services, and underwriting services are other important aspects of reinsurance contracts (see e.g., Gerathewohl, 1980). The focus here is on the use of reinsurance as an alternative means of raising capital. Berger, Cummins, and Tennyson (1992) also emphasize the substitutability between capital and reinsurance.

[12] In practice, insurance futures contracts have a $50,000 limit, thus producing a payoff similar to a reinsurance contract with a limit.

[13] See Cox and Schwebach (1992), D'Arcy and France (1992), and Niehaus and Mann (1992) for analyses of other differences between reinsurance and futures.

its commitment to pay claims is the same as a primary insurer's costs. Allowing insurer-specific factors to cause uncertainty about claim costs (as well as industry-wide factors) would allow reinsurers to diversify some of the risk faced by primary insurers, which in turn would allow reinsurers to provide coverage for some risks at a lower total capital cost than primary insurers.[14] Nevertheless, a key point is that the ability of reinsurers to bear correlated risk at a lower cost than primary insurers is limited since reinsurers cannot diversify away correlated risk.

Differences in the institutional features of primary and reinsurance markets could produce differences in the tax costs of bearing correlated risk. One example is that offshore reinsurers are not subject to U.S. tax laws and therefore often do not pay tax on investment earnings, thus allowing investors to avoid double taxation (Steinmetz, 1993). Thus, insurers may shift some correlated risk to offshore reinsurers because they have lower capital costs. As noted, investors at Lloyd's of London also avoid double taxation on the investment income from their pledged securities.

Costs and Benefits Associated with Insurance Derivatives

Individuals who supply contingent capital through insurance derivatives largely avoid the tax and agency costs associated with providing ex ante equity capital to insurers. Profits on futures positions are taxed directly, but there is no double taxation. Also a futures position does not require an individual to hand over funds to an intermediary with discretionary powers regarding the use of the funds—managers of an insurer—and therefore reduces potential agency costs.[15]

Although insurance futures can potentially reduce tax and agency costs, their viability depends on whether they are a credible source of ex post capital when an industry shock occurs and the costs associated with ensuring performance. Two mechanisms help guarantee performance in a futures market: the daily settlement process known as marking-to-market, and the margin or performance bond posted by those taking futures positions. When positions are marked-to-market, profits due to that day's price change are credited to traders' margin accounts and losses are debited. The margin is equivalent to a bond that guarantees that the trader will be able to pay losses that may occur during a day. If the margin account balance falls below the required level (the maintenance margin), the trader must deposit additional cash or close out the position. This system is essentially one where futures traders post a performance bond and each day their solvency is monitored.

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[14] The marginal capital costs would be the same, but reinsurers, by virtue of their greater diversification, would need less capital.

[15] Because of information costs, individuals may not be the primary parties taking insurance futures positions. The gains from specialization may make it more efficient to have an intermediary gather information and take futures positions for individuals. Investment funds can serve this purpose. Although there are potential agency costs associated with such funds, they avoid the double taxation associated with directly purchasing insurers' equity securities.

If price changes never cause losses in excess of margin, the costs of guaranteeing performance in a futures market consist of traders' margin costs and the transaction costs incurred in marking traders' positions to market. The transaction costs are paid by traders in the form of commissions. Clearing association members can post U.S. government securities to satisfy initial margin requirements. Although they earn interest on these pledged securities, an opportunity cost exists in that the pledged securities cannot be sold while serving as margin. Most other traders must put up cash to satisfy margin requirements and do not typically earn interest from the investment of margin funds. The foregone interest for these traders represents a cost of posting margin.

Futures exchanges have strong incentives to ensure the financial integrity of the system. Margin requirements are set and continuously reviewed to make nonperformance an extremely rare event. Nevertheless, futures prices could change dramatically over a short period of time engendering margin calls and possibly defaults. A recent catastrophe illustrates how this could occur.

Suppose that prior to Hurricane Andrew in the third quarter of 1992, the expected national catastrophe loss ratio was 10 percent, which is consistent with historical averages. Given a notional principal of $25,000, this implies a futures price of approximately $2,500. The Chicago Board of Trade estimates that the value for the national loss ratio for the third quarter of 1992 would have been 100 percent, implying that the national futures price would have increased from about $2,500 to $25,000. With the current margin requirements on the national contract of $1,350 (the maintenance margin is $1,000), the tenfold price change due to Hurricane Andrew would have likely triggered margin calls on the national contract. Margin calls on the Eastern contract would have been even more likely because the price change due to Hurricane Andrew was greater.[16] While the prices would have adjusted over several days, this example illustrates that daily price changes could be severe enough to cause some traders with short positions to have losses exceeding their margin.[17] The broker or futures commission merchant (FCM) used by these traders would demand payment, but collecting could prove difficult. In such a case, the FCM must pay the shortfall out of its own capital. If this causes the FCM to become insolvent, then traders (e.g., insurers) using the defaulted FCM to execute its futures trades may not receive the contingent payoffs they anticipated.[18]

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[16] The initial margin for the Eastern contract is $2,700 and the maintenance margin is $2,000. The Chicago Board of Trade estimates that the settlement value of the Eastern contract for the third quarter of 1992 is about 1.8, implying a settlement price of approximately $45,000. Assuming the price prior to the arrival of Andrew was $3,000 (consistent with a 12 percent expected loss ratio), the futures price would have changed by a factor 15 due to Andrew.

[17] The default risk associated with short futures positions helps to explain why most of the trading activity is in option spread positions which limit the maximum loss on a short position to the spread between exercise prices of the short and long call options.

[18] In 1985, Volume Investors, an FCM and clearing association member of the Commodity Exchange, defaulted on a margin call causing losses to individual traders (see Jordan and Morgan, 1990). Since the viability of futures markets depends on the perception that default risk is virtually zero, most clearing associations have guarantee funds to pay losses of insolvent members. The

Since the capital of the FCMs ultimately guarantees performance against large price changes, the expected default cost of insurers taking insurance futures positions depends on the amount of capital held by FCMs. However, the amount of capital required for FCMs to achieve a given level of expected default costs is likely to be less than the amount of ex ante capital that insurers would have to hold to achieve the same expected default costs, because the marking to market and margin system would be expected to cover almost all losses. Thus, the marking to market and margin system substitute for capital.[19]

Summary

Insurers and reinsurers can bond their performance in the presence of correlated risk by raising ex ante capital, raising ex post capital, and raising ex post capital at terms set ex ante through an insurance derivative contract. Ex ante capital suffers from tax and agency costs. Ex post capital suffers from a time inconsistency problem, insurers cannot credibly commit to raise capital. Insurance derivatives can reduce tax and agency costs. They also can reduce the capital needed to achieve a given level of expected default cost by monitoring the solvency of traders daily through the marking-to-market system. However, this system is costly to operate and some residual risk of nonperformance remains. The choice between ex ante capital and derivatives therefore will be made by balancing the marginal tax and agency costs of ex ante capital with the marginal transaction and nonperformance costs of derivatives.

Empirical Issues

Although the conceptual analysis indicates potential cost advantages of insurance futures, these advantages can only be realized if there exists substantial correlated risk that can be hedged successfully through insurance futures. This section provides evidence concerning the magnitude of correlated risks in different lines of insurance and the extent to which this risk can be hedged using futures contracts.

Index Construction

The first step in designing an insurance futures contract is to construct an index that measures correlated risk. This requires the selection of a pool of insurance contracts on which the index is based. Given that insurers can reduce risk by diversifying across lines and geographical regions, one might suppose that a national (or even multinational) multiple line index would be the best

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guarantee extends only to firms that are members of the clearing association, not to individual customers (Jordan and Morgan, 1990). Moreover, FCMs that are members of the clearing association are subject to position limits, monitoring, and minimum capital requirements enforced by the association.

[19] Also, FCMs may be able to diversify some insurance market risk because of their activities in other futures contracts.

choice. However, because the product mix of insurers varies across lines and geographical locations, many insurers may find that a menu of single line, region-specific contracts would allow for greater risk reduction.

Multiline contracts would most likely be successful when the lines included in the index are subject to common shocks. For example, if all the lines included in an index are subject to natural catastrophes, then the index could be highly correlated with different insurer's liabilities despite differences in product mix. The CBOT's catastrophe futures and options contracts are examples of multiline contracts. The CBOT's contract is based on losses from nine different lines (see Appendix A). Given that insurers specialize in different geographical regions, even multiline indices may be targeted for a specific region. The Chicago Board of Trade, for example, has Eastern, Midwestern, Western, and National Catastrophe contracts.

In order to examine the types of indices that could be useful for insurance futures contracts, six different indices were constructed. One index is similar to the index underlying the CBOT's national catastrophe contract. The other five indices measure industry loss ratios in specific lines of insurance: homeowners/farmowners, auto physical damage, commercial multiple peril, auto liability, and other liability.[20] These indices are similar to the indices the CBOT is considering using for their line-specific (e.g., homeowners) contracts.[21] The first two lines primarily cover property damage and have relatively short claim tails; whereas the two liability lines and to a lesser extent commercial multiple peril have longer claim tails.

Due to the lack of quarterly data, each index is measured annually and the data cover the period from 1972 through 1992. The catastrophe index is based on the Property Claim Service's (PCS) annual estimate of the losses incurred due to catastrophes.[22] The index value equals the dollar value of catastrophe losses divided by an estimate of the premiums earned that are subject to catastrophes. The premium estimate in the denominator is calculated using the same method as the CBOT uses for its national catastrophe contract, which is described in Appendix A. The index for each of the individual lines of insurance is the annual industry calendar-year loss ratio obtained from *Best's Aggregates and Averages: Property-Casualty Edition.* The loss ratio equals net calendar-

[20] *Best's Aggregates and Averages* separates homeowners and farmowners starting in 1980. Other liability includes medical malpractice, which was reported separately by *Best's* starting in 1980. After 1980, the loss ratios for these lines are constructed by taking a weighted average of the loss ratios for the separately reported lines, where the weights are the ratio of earned premiums in each line divided by total earned premiums in the two lines.

[21] The CBOT has investigated, but not yet introduced, contracts for homeowners and auto physical damage.

[22] This loss estimate differs from the losses actually included in the CBOT's catastrophe contract in that the CBOT does not include losses due to fire. Also, the PCS data are estimates of catastrophe losses as opposed to actual losses and PCS only records catastrophe losses in excess of $5 million after 1982.

year losses incurred during the year divided by net calendar-year premiums earned.[23]

The line-specific indices necessarily differ from those proposed by the Chicago Board of Trade. First, the indices used here are based on the industry loss ratio; the proposed CBOT's contracts are based on the loss ratios of approximately 20 reporting insurers. Given that no one insurer can contribute more than 15 percent of the policies to the CBOT's policy pool, the CBOT's proposed loss ratio index is likely to be highly correlated with an industry-wide index. Second, the proposed individual line CBOT's contracts are based on losses paid on a pool of policies that were written about the same time. In contrast, the indices used here are based on losses incurred in a given calendar year.

Calendar-year incurred losses equal the sum of incurred losses for accidents in the current year (accident-year incurred losses) and revisions during the current year of incurred loss estimates for accidents in prior years. Accident-year incurred losses, which equal losses paid plus estimated unpaid losses for accidents during the year, may be from policies written in either the present or the previous year. For lines with a short claims tail, accident-year losses paid and calendar-year losses incurred are generally highly correlated, and the use of calendar-year incurred loss ratios is unlikely to alter the conclusions.[24]

For the long-tailed liability lines, the difference between accident-year losses paid and calendar-year losses incurred could be substantial. Despite the considerable attention paid in recent years to the unpredictability of losses in liability lines, the CBOT has yet to propose contracts in any liability lines. It seems unlikely that paid losses would be used for such contracts if they are introduced. During a given time period, paid losses are unlikely to be highly correlated with changes in the economic value of insurers' long-tailed liabilities. Losses paid during the coverage period for long-tailed policies typically represent only a small fraction (e.g., 10–20 percent for other liability) of ultimate losses paid. The economic value of an insurer's liabilities could change substantially without an unexpected change in losses paid. For example, a court decision could increase expected future liability payments on a group of policies, but not change loss payments in the period in which the court decision was rendered. Thus, the contemporaneous correlation between unexpected changes in losses paid and the change in the economic value of liabilities could be quite low.[25] Indices based on incurred losses in long-tailed lines seem

[23] Prior to 1980, the industry loss ratio is a weighted average of the loss ratio for mutuals and for stocks with the weight being earned premiums. Thus, reciprocal insurers are not included in the index prior to 1980.

[24] A sufficiently long time series of accident-year loss ratios for the industry and insurer groups is not available from public sources.

[25] Part of the unexpected change in losses paid during a period could also reflect changes in the timing of loss payments that would have only a modest effect on the economic value of liabilities. A long-term futures contract (e.g., two to five years depending on the line of insurance) might circumvent these problems. With a longer horizon, the index value at expiration and thus prices for the contract prior to expiration would be more highly correlated with unexpected changes in liabilities.

more likely. Assuming unbiased reporting, the contemporaneous correlation between unexpected changes in incurred losses and changes in the economic value of liabilities would tend to be higher than that between unexpected changes in losses paid and changes in liabilities.[26]

Unpredictability in Indices

Table 1 provides summary statistics for the index values over the 1972 through 1992 period. The mean catastrophe loss ratio is 6.5 percent and the

Table 1
Summary Statistics for Index Values, 1972 Through 1992

	Index Values			*Unexpected Index Values*[a]		
Index	*Mean (%)*	*Standard Deviation*	*Range (%)*	*Mean (%)*	*Standard Deviation*	*Range (%)*
National Catastrophe	6.5	7.4	33.0	-0.3	9.0	46.5
Commercial Multiple Peril	56.3	10.2	37.7	-0.2	7.8	31.3
Homeowners/ Farmowners	65.7	12.7	58.6	0.4	13.0	62.4
Auto Physical Damage	63.0	5.9	22.8	-0.3	4.7	20.5
Auto Liability	72.4	6.7	21.8	-0.1	2.8	12.9
Other Liability	67.9	12.6	44.5	0.4	10.5	41.7

[a] The unexpected index value is the forecast error from the following model which is estimated over the 1972 through 1992 period excluding the year being forecasted:

$$INDEX_t = \alpha + \beta_1\, INDEX_{t-1} + \beta_2\, INDEX_{t-2} + \beta_3\, TREND_t + \beta_4\, TBILLRATE_t + error_t.$$

[26] A potential problem is that incurred losses might be biased. Insurer estimates of unpaid losses can be affected by desires to smooth accounting income, manage taxes, and hide poor performance (e.g., Weiss, 1985, and Petroni, 1993). Deviations of reported forecasts from unbiased forecasts would be very difficult to verify, because even unbiased forecasts often have large errors (at least for long-tailed commercial lines). Smoothing (or other forms of managing) reported incurred losses would not negate the ability of futures to reduce risk, provided traders had knowledge of the relationship between reported and unbiased forecasts. In this case, traders would simply need to adjust their futures positions to take into account the known reporting bias. Unpredictable changes in reporting bias would reduce the ability to hedge risk. Reporting insurers that trade in futures contracts also would have additional incentives to bias reported losses and to arrange their trades to increase profits in ways that would be difficult to verify. A reporting insurer that is long in the futures contract would have an additional incentive to overstate reported losses to increase profits from its futures position. Trades could be made in anticipation of overstating or understating losses. Although such incentives exist independent of whether indices are based on paid or incurred losses, altering payments to customers is likely to impose greater costs on insurers than altering reported incurred losses. Thus, the potential manipulation problem is likely to be more severe when indices are based on incurred losses.

mean loss ratios for the individual line indices range from 56.3 percent (commercial multiple peril) to 72.4 percent (auto liability). In absolute terms, the commercial multiple peril, homeowners/farmowners, and other liability indices are the most variable. However, the catastrophe index exhibits the most variability relative to its mean.

Variability can arise from two sources: the variability due to changes in expected loss ratios over time and variability due to deviations of actual loss ratios from expected loss ratios in a given year. If all of the variability is due to expected loss ratios changing from year to year, then the futures price in a given year will be constant and hedging is infeasible. Since the second source of variability is the raison d'être for insurance futures contracts, it is important to allow expectations of index values to vary over time.

A relatively simple expectations model is used to allow for time-varying expectations. Because numerous studies indicate that loss ratios can be explained by a second-order autoregressive process (see, e.g., Cummins and Outreville, 1987), the loss ratio in the preceding two years is included in the model. Since economic models of insurance pricing indicate that interest rates are inversely related to premiums and hence directly related to loss ratios, an interest rate variable also is included. Finally, the model includes a time trend variable.[27] Thus, the following expectations model is estimated:

$$\mathrm{INDEX}_t^k = \alpha^k + \beta_1^k\, \mathrm{INDEX}_{t-1}^k + \beta_2^k\, \mathrm{INDEX}_{t-2}^k + \beta_3^k\, \mathrm{TREND}_t + \beta_4^k\, \mathrm{TBILLRATE}_t + u_t^k, \quad (2)$$

where INDEX_t^k = the value of index k in year t,
TREND_t = the time trend variable,
$\mathrm{TBILLRATE}_t$ = the annual return from investing in U.S. Treasury bills in year t taken from the *SBBI 1994 Yearbook,* and
u_t^k = a mean zero disturbance.

One approach to estimating unexpected index values would be to use the prediction errors (regression residuals) from estimating equation (2) with data for the entire 1972 through 1992 period. This within-sample approach to calculating expectations can be criticized for estimating the model's parameters with data that are unknown at the time actual expectations would have been formed (including data for the year being forecasted). A possible limitation is that the variance of "within-sample" prediction errors will likely understate the variance of prediction errors that would arise in practice with true "out-of-sample" forecasts, thus understating the unexpected variability in the index. In addition, correlations between within-sample prediction errors for the industry and for individual insurer groups (see below) might be biased upward if idiosyncratic common factors that affect loss ratios in a given year have similar effects on the within-sample parameter estimates, and thus prediction errors, for both the industry and insurer group models.

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[27] Underwriting expenses trended downward relative to premiums during the sample period (*Best's Aggregates and Averages*).

Given these possible shortcomings, the model is estimated using a "jackknife" procedure; that is, the model is estimated using all observations except the year being forecasted. For example, to estimate the unexpected index value for 1980, data before and after 1980 are used to estimate the parameters of equation (2); 1980 data are excluded. The unexpected index value for 1980 is the actual index value for 1980 minus that predicted using these estimated parameters and 1980 values of the right-hand variables in equation (2). The jackknife procedure should reduce any bias associated with within-sample predictions.[28]

Table 1 presents descriptive statistics for the unexpected index values. The data suggest that loss ratios on very large portfolios of policies in a particular line of insurance have a sizable unpredictable component. The homeowners/farmowners index exhibits the greatest variation, followed by the other liability index and the catastrophe index.[29]

Correlation of Indices with Individual Insurer Loss Ratios

Insurers are most likely interested in hedging the market value of their liabilities. Since these market values are unobservable, loss ratios based on incurred losses are used. As discussed above, incurred losses are likely to be highly correlated with the economic value of liabilities for both short-tailed and long-tailed lines (assuming unbiased reporting). Although one can argue that insurers are concerned with the variability in their *total* liabilities, the analysis assumes that they are concerned with variability in each specific line of business. This ignores the reduction in risk due to diversification across lines. Hedging each line individually implies that total liabilities are also hedged, albeit perhaps at greater cost.

Annual incurred loss ratios experienced by major insurer groups in each of the five lines used above (homeowners/farmowners, auto physical damage, commercial multiple peril, auto liability, and other liability) were obtained

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[28] An alternative approach is to estimate the expectations model using past data and then use the estimated model to forecast one year ahead. The obvious advantage of this out-of-sample approach is that it uses only data to estimate the expectations model that would have been available at the time the forecast is made. However, there are two important drawbacks to this procedure in this study. First, questions of parameter stationarity arise as the sample period increases. For example, evidence exists that insurance markets in many states experienced a regime shift in the late 1960s and early 1970s from mostly regulated markets with considerable price uniformity to more competitive pricing and less price uniformity (Joskow, 1973, and Harrington, 1984). Second, the number of insurers in our sample declines substantially as we increase the length of the time series. As a check of robustness, we collected the available data for the 1960 through 1992 period and reestimated using one year ahead out-of-sample forecasts for homeowners/farmowners, auto physical damage, and commercial multiple peril. The results using this out-of-sample procedure are qualitatively the same and therefore not reported.

[29] The variability of the unexpected series is greater than the variability of the actual series for the catastrophe index and the homeowners/farmowners index. This result can occur when the predictive model has low explanatory power because of the use of the jackknife procedure to estimate the unexpected index value.

from *Best's Aggregates and Averages: Property-Casualty Edition.*[30] The insurer groups (see Appendix B) are among the 50 largest writers in each particular line during the 1972 through 1992 sample period. The loss ratios again equal losses incurred divided by premiums earned and are net of reinsurance transactions. Thus, the loss ratios already take into account insurers' attempts to reduce underwriting risk through reinsurance and therefore may understate the potential of futures to reduce underwriting risk.

Although the insurers' loss ratios generally exhibit substantial variability (not reported), some of this variability again reflects changing expected loss ratios. Thus, unexpected calendar-year loss ratios for each insurer are calculated using the jackknife approach described above for the unexpected indices. Table 2 presents means and medians across insurers of the standard deviations in unexpected loss ratios in each of the five lines of insurance. These data suggest that unexpected insurer loss ratios exhibit considerable variation. For example, for the homeowners/farmowners line, the median firm has a standard deviation of 8.2 percent. If a firm earned premiums of \$100 million, which is less than the premium volume of the thirtieth largest homeowners insurer in 1989, then a one standard deviation unexpected increase in its loss ratio would imply an unexpected decrease in underwriting profits of \$8.2 million. The other liability line has the greatest volatility as the median insurer has a standard deviation of its unexpected loss ratio equal to 20.2 percent.

Measures of Hedging Effectiveness

Consider an insurer with one dollar in premiums in line j and a position in $\Gamma_{j,k}$ futures contracts that are based on index k. Using variance as a risk measure, underwriting risk in line j is equal to $Var[ULR_{j,t} - \Gamma_{j,k}UI_{k,t}]$, where $ULR_{j,t}$ is the insurer's unexpected loss ratio in line j during year t, and $UI_{k,t}$ is the unexpected value for index k in year t. The variance-minimizing futures position is

$$\Gamma^*_{j,k} = \frac{Cov(ULR_{j,t}, UI_{k,t})}{Var(UI_{k,t})} . \tag{3}$$

With this position, the insurer's underwriting risk in line j is

$$Var(ULR_{j,t} - \Gamma^*_{j,k}\, UI_{k,t}) = Var(ULR_{j,t}) - \frac{Cov(ULR_{j,t}, UI_{k,t})^2}{Var(UI_{k,t})} . \tag{4}$$

The hedge's effectiveness is measured by the percentage change in underwriting risk when futures are used to minimize risk versus when futures are not used (see, e.g., Ederington, 1979). Thus, the hedging effectiveness of index k for line j is

[30] Following 1980, separate loss ratios for homeowners and farmowners and for other liability and medical malpractice are aggregated. Since earned premiums in each line are unavailable for each insurer group, the weights for the separate lines are based on an average of written premiums in the reporting year and the prior year.

Table 2
Standard Deviations for Insurer
Unexpected Loss Ratios,[a] 1972 Through 1992

Index	*Number of Insurers*	*Mean (%)*	*Median (%)*
Commercial Multiple Peril	26	14.4	12.3
Homeowners/ Farmowners	16	10.5	8.2
Auto Physical Damage	21	5.9	5.8
Auto Liability	23	6.6	5.9
Other Liability	19	24.7	20.2

[a] The unexpected loss ratio is the forecast error from the following model which is estimated for each insurer group over the 1972 through 1992 period excluding the year being forecasted:

$$LR_t = \alpha + \beta_1 LR_{t-1} + \beta_2 LR_{t-2} + \beta_3 TREND_t + \beta_4 TBILLRATE_t + error_t.$$

$$\frac{Cov(ULR_{j,t}, UI_{k,t})^2}{Var(ULR_{j,t})\ Var(UI_{k,t})}, \tag{5}$$

which is the coefficient of determination (R^2) between the insurer's unexpected loss ratio in line j and the unexpected value of index k.

To estimate an insurer's R^2 with a particular index, a time series regression is estimated, where the dependent variable is the firm's unexpected loss ratio ($ULR_{j,t}$), and the independent variable is the unexpected index ($UI_{k,t}$). Specifically, for each insurer the following equation is estimated:

$$ULR_{j,t} = \alpha_j + \Gamma_{j,k} UI_{k,t} + e_{j,t}, \qquad t = 1972, \dots, 1990, \tag{6}$$

where $e_{j,t}$ is a mean-zero error. The estimated slope coefficient is an estimate of the risk-minimizing number of contracts ($\Gamma_{j,k}^*$) for this particular insurer, and R^2 is an estimate of the percentage of loss ratio variance in line j that can be eliminated by the futures contract based on index k.[31]

For the lines with property exposure (homeowners/farmowners, auto physical damage, and commercial multiple peril), the hedging effectiveness of an industry index as well as the catastrophe index is examined. For example, an insurer's unexpected loss ratio for the commercial multiple peril line is re-

[31] The use of annual data implies that the hedging effectiveness of one-year hedge positions is being examined. Hedging effectiveness for other instruments is often assessed with shorter-term positions. For example, Ederington (1979) examines two- and four-week hedges. Data limitations prevent examination of shorter-term hedges here. Also, note that the CBOT is marketing "strips" that allow a trader to take a position in all four quarterly contracts for a given calendar year simultaneously and at one price. The overall payoff from a "strip" is similar to the annual contracts being examined here.

gressed against the unexpected commercial multiple peril index and also against the unexpected catastrophe index. If losses are correlated within a particular line of business solely due to catastrophes, then the line-specific index and the catastrophe index should yield similar results. Since the catastrophe index will not be effective in hedging loss ratios for auto liability and other liability, the hedging effectiveness of only the industry index is examined for these lines.

Table 3 summarizes the empirical results. Assuming that unexpected changes in reported loss ratios are correlated with changes in the economic value of liabilities, the overall results suggest that futures contracts based on losses in shorter-tailed lines have the potential to provide effective hedges for insurers. The line-specific industry indices are most effective for hedging underwriting risk for auto physical damage and commercial multiple peril. For auto physical damage, the median insurer eliminates 54.9 percent of its underwriting risk using the industry index; 20 of the 21 insurers experience a statistically significant reduction in risk using the industry index. The median underwriter of commercial multiple peril insurance eliminates 35.4 percent of its underwriting risk; 18 of the 26 insurers show a statistically significant risk reduction.

The industry indices are less effective hedges for the homeowners/farmowners line and for the liability lines. The median homeowner/farmowner insurer eliminates only 18.5 percent of its underwriting risk using the industry index and only seven of the 16 insurers show a statistically significant reduction in risk. The proportion of underwriting risk eliminated by the median other liability insurer is 16.0 percent and this proportion falls to 11.2 percent for the median auto liability insurer.

One explanation of why hedging is less effective in the liability lines is that, although they exhibit substantial risk (variability in loss ratios), the risk is not common to all insurers. Consequently, hedging using an industry index is ineffective. Another possible explanation for the poor hedging effectiveness of the industry indices relates to the longer claims tail in liability insurance and the discretion insurers have in reporting incurred losses. As a result, the effects of common shocks to liability insurers (e.g., court decisions) may be incorporated into insurers' estimates of incurred losses at different times. This variation in reporting may reduce the contemporaneous correlation between a particular insurer's incurred loss ratio and the industry incurred loss ratio.[32]

Considerable cross-sectional variation exists in the amount of risk that can be eliminated by the industry indices in all the lines. For example, even though the median auto physical damage insurer eliminates over 50 percent of its underwriting risk using the industry index, one auto insurer eliminates just 10 percent of its variability. Conversely, even though the median homeowner/farmowner insurer eliminates only 18.5 percent of its risk, there is one insurer that eliminates 72.6 percent.

[32] The use of accident-year loss ratios, if available, could mitigate this problem if accident-year incurred loss reporting is subject to less discretion than calendar-year reporting.

Table 3
R^2 from Regressing Insurers' Unexpected Loss Ratios on Unexpected Index Values, 1972 Through 1992

Line Being Hedged	*Index Used*	*Number of Insurers*	*Mean (%)*	*Median (%)*	*Minimum (%)*	*Maximum (%)*	*Number Significant*[a]
Commercial Multiple Peril	Commercial Multiple Peril	26	32.1	35.4	3.2	57.3	18
Homeowners	Homeowners	16	22.8	18.5	0.1	72.6	7
Auto Physical Damage	Auto Physical Damage	21	51.1	54.9	10.5	80.2	20
Auto Liability	Auto Liability	23	14.8	11.2	0.0	48.8	8
Other Liability	Other Liability	19	19.2	16.0	0.1	47.0	9
Commercial Multiple Peril	Catastrophe	26	23.0	17.0	0.7	73.8	12
Homeowners	Catastrophe	16	29.4	27.8	0.1	66.3	10
Auto Physical Damage	Catastrophe	21	5.4	3.7	0.1	26.1	1

[a] Significant at the 0.05 level using a two-tailed t-test for the significance of the coefficient on the index value.

The catastrophe index is most effective in hedging the homeowners/farmowners line. The median homeowners/farmowners insurer can eliminate 27.8 percent of its underwriting risk with the catastrophe index. On average, the catastrophe index provides greater risk reduction potential than the homeowners/farmowners industry index. The catastrophe index also shows potential as a hedge for commercial multiple peril underwriting risk, although it is less effective than the industry index. Almost half of the commercial multiple peril insurers have a statistically significant reduction in underwriting risk using the catastrophe index.

Conclusion

Insurance futures allow insurers to reduce the cost of managing correlated risk by shifting this risk to other parties. Stated differently, insurance futures provide a credible source of capital following an industry shock. The commitment by other parties to provide ex post capital to insurers is made credible by the design of futures markets, specifically, the margin and marking-to-market system. The alternative method of managing correlated risk is for either primary insurers or reinsurers to issue ex ante equity capital, which is costly due to double taxation and agency costs. These costs must be balanced against the costs of ensuring performance in the futures market, which are paid in the form of commissions, bid/ask spreads, and margin costs.

The empirical analysis examines the hedging effectiveness of various futures indices that are constructed to be similar to the contracts the Chicago Board of Trade has either introduced or has considered introducing. The results suggest that line-specific contracts in short-tailed lines have potential for being effective tools to manage insurer risk. The catastrophe index provides significant risk reduction potential only for homeowners/farmowners underwriting risk.

The success of insurance futures and option contracts depends on factors other than those analyzed in this article. These factors include financial regulation (including statutory accounting) and marketing/education efforts of the CBOT. Even if the current contracts do not survive, the desire to reduce capital costs and transaction costs could lead to other financial innovations that attempt to facilitate hedging through standardization of underwriting risk.

Appendix A
Description of the Chicago Board of Trade's Catastrophe Futures Contracts

The Chicago Board of Trade's catastrophe futures contracts are based on a complicated loss ratio. A contract expiring in quarter t+1 is called the t-quarter contract, because the numerator of the loss ratio is catastrophe losses from property insurance that occurred during quarter t and reported by quarter t+1, and the denominator is an estimate of the premium volume that is subject to catastrophes for quarter t.

Catastrophes are defined as all losses arising from wind, hail, earthquakes, riots, and floods in the following nine lines of insurance: homeowners, commercial multiple peril, fire, earthquake, allied lines, personal auto physical damage, commercial auto physical damage, farmowners, and commercial inland marine. The loss ratio is scaled or weighted to reflect losses for the entire industry, not just the losses and premiums of the approximately 20 insurers who actually submit data for use by the CBOT. The weighting factors are based on the percentage of business that the reporting insurers write in a particular line in each state. Thus, the weighting factors vary by line and by state. The denominator of the loss ratio index is fixed prior to trading and is an estimate of the industry's earned premium that is subject to catastrophic loss.

To be more specific, let λ index the different lines of insurance, let s index the states included in the contract, and i index the reporting insurers. Then, $L_{i,\lambda,s}$ is the catastrophe loss by reporting insurer i in line λ in state s. Similarly, $P_{i,\lambda,s}$ is premium revenue for reporting insurer i in line λ in state s. Finally, let $P_{\lambda,s}$ equal the premium revenue of all insurers (reporting and nonreporting) that is assumed to be subject to catastrophes in line λ in state s. The Chicago Board of Trade calculates $P_{\lambda,s}$ by taking the total premium earned in state s in line λ times an assumed percentage of the business in that line that is subject to catastrophic losses. For example, 40 percent of the premiums in the commercial auto physical damage line and 90 percent of the premiums in the homeowners line is assumed to be subject to catastrophes.

The loss ratio for the futures contract is

$$\text{loss ratio} = \frac{\sum_{\lambda}\sum_{s}\left(\frac{1}{w_{\lambda,s}}\sum_{i} L_{i,\lambda,s}\right)}{\sum_{\lambda}\sum_{s} P_{\lambda,s}},$$

where

$$w_{\lambda,s} = \frac{\sum_{i} P_{i,\lambda,s}}{P_{\lambda,s}}.$$

The term in parentheses is the loss experienced by all the reporting insurers in state s for the line of business λ, divided by the proportion of business the reporting insurers have in that line of business in that state, $w_{\lambda,s}$. By dividing by the weighting factor, $w_{\lambda,s}$, the losses experienced by the reporting insurers are scaled up to estimate the losses of all insurers in the state. Since the CBOT announces the premium figures (the Ps) prior to trading, the random variables are the catastrophe losses experienced by each reporting insurer in each line and in each state. In practice, the index value in equation (1) is multiplied by \$25,000. The index value is capped at \$50,000, the equivalent of a catastrophe loss ratio of two.

Appendix B
Insurers in Sample

Group Name	*Homeowners/ Farmowners*	*Auto Physical Damage*	*Auto Liability*	*Commercial Multiple Peril*	*Other Liability*
AETNA	yes	yes	yes	yes	yes
Allstate	yes	yes	yes	yes	yes
American Family		yes	yes		
Auto-Owners		yes	yes		
Chubb	yes			yes	yes
Cincinnati Fin.	yes			yes	
CNA	yes	yes	yes	yes	yes
Colonial Penn			yes		
Commercial Union	yes	yes	yes	yes	yes
Continental	yes	yes	yes	yes	yes
Crum & Forster		yes	yes	yes	yes
Firemans	yes		yes	yes	yes
General Acc		yes	yes	yes	
Hartford	yes	yes	yes	yes	
Home Ins				yes	yes
Kemper				yes	yes
Liberty		yes	yes	yes	yes
Motors Ins		yes			
Munich				yes	
Nationwide		yes	yes	yes	yes
Ohio Casualty	yes	yes	yes	yes	
Reliance				yes	yes
Royal	yes	yes	yes	yes	yes
Safeco	yes	yes	yes	yes	
Sentry		yes	yes		
Southern F B		yes	yes		
St Paul				yes	yes
State Farm		yes	yes	yes	
Swiss Reinsurance				yes	
Transamerica	yes		yes	yes	yes
Travelers	yes	yes	yes	yes	yes
USF&G	yes	yes	yes	yes	yes
Westfield	yes				
Zurich Ins				yes	yes

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