

## Derivatives in the P&C Industry

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Article abstract

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# Derivatives in the P&C Industry

by

Kenneth G. Hague\*

*« Produits dérivés », ce terme financier peu compris a connu un usage croissant par le public après les débâcles vécues par Barrings Bank à Singapour et Orange County en Californie. Ces instruments d'investissement, qui dérivent leur valeur selon le mouvement du prix ou de la mesure d'un produit sous-jacent, sont reconnus comme outil efficace pour atténuer certains risques financiers par les marchés capitaux (tous ceux impliqués dans le commerce de bons, de valeurs et de produits reliés). Depuis 15 ans, l'utilisation des produits dérivés a augmenté énormément et les marchés capitaux cherchent toujours de nouveaux chemins d'expansion. Reconnaisant leur longue relation avec l'industrie d'assurance par voie de la gestion des actifs, les marchés explorent les méthodes permettant de gérer également l'autre côté des bilans, c'est-à-dire les responsabilités (les passifs) jusqu'à présent contrôlées par la réassurance traditionnelle.*

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As a reinsurance broker trying to explain to someone outside the industry exactly what I do for a living, I sometimes used the analogy of a stockbroker who, in simple terms, is offering a participation in the financial fortunes of his client. The comparison was very broad; however it seemed appropriate when I considered that my market (reinsurance companies) finances insurers over varying periods of time by means of a wide array of products while the stockbroker also provides financing to his clients, albeit under a completely different set of parameters and using instruments that are very different from

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\* Senior vice president, B E P International.

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mine. I probably used this explanation for the first time in the mid 1980s when the subject of the stock market was common dinner table conversation and most people could identify more readily with this high profile arena than they could with the world of insurance. I didn't realize then that the two domains were even more closely related than I had imagined and were destined to move more closely together within the next decade.

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When I became a reinsurance broker nearly twenty-five years ago, I recall hearing again and again that our basic product had not changed in fifty years and that any innovation was simply a variation of already established methodology. For many years this seemed to be true until necessity (i.e. intense competition and poor results by the insurers triggering reinsurance capacity reduction and high prices) forced the collective mindset to expand the role that reinsurance played beyond the confines of the liability side of an insurer's balance sheet. The concepts of financial reinsurance and then finite reinsurance, both of which took into consideration the management of the entire balance sheet, were introduced routinely to insurers. At the same time, the profile of the reinsurance buyer began to change. Whereas the responsibility for reinsurance outlays had been confined to an insurance company chief executive officer or his designated reinsurance specialist, the tendency to transfer this function to the chief financial officer's unit became more routine. When this happened, it also brought the dual functions of insurance company asset management and liability management one step closer together. In doing so, it also meant that the worlds of the stock broker (assets) and the reinsurance broker (liabilities) now had a common link, if not an integrated role. The stage had therefore been set for the next leap forward and the catalyst was not long in coming.

The capital markets (i.e. those involved in the trading of stocks, bonds, and related financial instruments) in general and the *derivatives* sector in particular, have undergone an incredible evolution as information technology has enabled the gathering, manipulation, and dissemination of data and the transfer of

capital resources at an unprecedented level. Broadly defined, a derivative is a financial instrument whose worth is derived from the value of an underlying product. One of the earliest derivatives was money, which for hundreds of years derived its value from the gold for which it could be exchanged. Commercial derivatives have existed since at least the 12th century when they were used by Flemish traders. In the 17th century, they were commonly used in the financial capital of Amsterdam and in Osaka's rice markets. Most people are aware (if not in total understanding) of the simplest forms of derivatives trading such as hedges on grain crops by farmers or stock portfolios by stock holders by means of the trading of futures and options. The term derivatives did not receive widespread public usage until the early 1990s and became a household term when the Barings Bank collapsed at the beginning of 1995. In capital market circles however, new forms of derivatives (the financial variety) and their trading have been growing exponentially for the past fifteen years. The Chicago Mercantile Exchange began trading financial derivatives in 1972 with the listing of currency futures however it was the policy of the U.S. Federal Reserve regarding inflation in the 1980s and the resultant fluctuation in interest rates that spawned tremendous growth in this sector.

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Derivatives trading thrives in an environment of measurable volatility so the arena of interest rates worldwide and eventually stock indices, in addition to currencies and commodities, gave the capital markets a global platform for the creation of increasingly sophisticated trading vehicles. It is useful at this point to make the differentiation between exchange traded products and private placements. The former consist of futures and options on the underlying instruments, namely interest rates, currencies, stock indices, and commodities. Although private placements or over-the-counter (OTC) products are not dealt on any recognized exchange (i.e. no central clearing mechanism), they are extremely flexible and can be effected on any agreed underlying instrument, amount, contract term, and settlement date. Private transactions also have

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two basic forms (forwards and options) and the terms used to describe them are swaps, caps, floors, collars, and, of more recent innovation, currency adjusted securities, compound options, difference options, exotics, look backs, and average price options. Whether the instigator of the transaction uses an exchange traded product or a private placement, the goal is the same, to make an outcome that is subject to the vagaries of market forces slightly more predictable.

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Derivatives transactions in the capital markets can range from the straightforward, such as an investor selling an option at a pre-determined price on a stock he owns (writing a covered call) to the complex whereby the performance of the contract is dependent on the outcome of two or more unrelated scenarios. It is the complexity of these instruments or their improper use that has produced unexpected outcomes, sometimes with devastating consequences (e.g. Daiwa Bank, Orange County). Generally speaking however, the sophisticated investor has come to realize that they are, in one form or another, a very practical risk management tool whose boundaries can be expanded to almost any financial scenario which is measurable or quantifiable using recognized and reliable indices.

Turning once again to the insurance industry, there was a growing trend to integrate the management of assets and liabilities, which have hitherto been treated quite separately except in the largest, most sophisticated organizations. In very general terms, an insurer's main preoccupation is cash management and the control of the various exposures contributing thereto or arising therefrom. Asset management, by its very nature, has been handled in the capital markets. Liability management has traditionally involved policy form, risk management, claims handling, and reinsurance. Both involve payment streams, albeit controlled by different mechanisms and using the resources of different markets. At the same time, the very premise on which the insurance industry is based, that is the law of large numbers and its statistical treatment from the point of view of insurance exposure, was attracting the attention of capital markets looking for new avenues of expansion for the

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derivatives products. The move to develop a product for an industry with whom they were already so closely related and for which industry data abounded was logical and must have been irresistible. The stumbling block was perceived to be the insurance industry's innate and necessary conservatism, bearing in mind the implicit mandate given them by their policyholders. The key then was the development of practical insurance instruments that provided the insurance industry, as well as the capital markets, with a transparent vehicle for exchanging insurance exposure back and forth between the two with a reasonable expectation of profit by both parties. From the point of view of the insurers, it required one further element, that being the necessary catalyst to generate sufficient interest in alternative forms of balance sheet protection as to make them viable.

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This catalyst, not surprisingly, was an abnormal (as compared with the past anyway) succession of natural catastrophes worldwide in the late 1980s and early 1990s and the growing perception that environmental factors coupled with increasing population densities in catastrophe prone areas made this phenomenon more likely than not to recur. The capital markets quickly focused on catastrophes as the basis for an insurance derivatives product, launched by the Chicago Board of Trade (CBOT) in December 1992; however it was not until the insurance industry had fully digested the consequences of these losses, that they started to give credence to the theory that a bridge to the resources of the capital markets had to be built. Even that process was somewhat roundabout in that capital markets, seemingly impatient with the slow acceptance of their own product, committed billions of dollars to finance traditional reinsurance companies specializing in catastrophe coverage. Most of this activity took place in the latter half of 1993 and saw major Wall Street investment banks (Merrill Lynch, Morgan Stanley, Goldman Sachs, J.P.Morgan, etc.) collaborating with prominent forces in the insurance industry (e.g. AIG, Swiss Re, Marsh McLennan, General Re) to create a new reinsurance market in Bermuda virtually overnight. The fact that these new companies were able to attract sufficient capital and expertise to

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develop collectively or individually into serious competitors to the long-standing traditional markets in the U.S., Europe, and at Lloyd's simply emphasized the capital market's potential contribution to the liability side of the insurance industry. The insurance industry as a whole finally began to take serious note of this potential, not because a partial solution had been found to growing catastrophe capacity problems but because it had been found with such rapidity and with such apparently ready access to capital amounts that could not be generated easily by the insurance sector alone. Having established that context, I will backtrack to the introduction of the CBOT insurance futures and continue to describe the evolution of derivatives in the insurance industry.

On December 11, 1992, the trading of catastrophe insurance futures and options contracts started at the Chicago Board of Trade. The pricing of the contracts was based on the movement of an index tracking the catastrophe losses of twenty-five insurers whose combined premium income totalled roughly one quarter of the U.S. property insurance industry. The data underlying the index was to be compiled by ISO, an independent agency, to whom the insurers report their figures directly. At the time, only the Eastern, Midwestern, Western and National contracts were available. The insured perils taken into account for the compilation of the ISO catastrophe data and the resulting indices were hail, wind, earthquake, flood, and riot. Certain lines were excluded from the various perils, such as commercial multi peril from earthquake and homeowners from riot and flood. The minimum unit of trading for a futures contract was \$25,000 and the value of each unit was calculated by multiplying \$25,000 by the incurred/earned catastrophe loss ratio. Contracts were traded for each calendar quarter and the settlement value of the contract was based on catastrophe losses incurred during the quarter and reported up until 90 days following the close of the quarter. Cash settlement of the contracts took place a further 90 days thereafter.

The simplest transaction for an insurance company was a futures hedge. If, for example, an insurer was concerned about its

exposure to hurricanes along the east coast in the third quarter of a given year, it would buy a quantity of the September Eastern catastrophe futures contracts in July. The quantity would be determined by the insurer's exposed premium income (divided by \$25,000) and adjusted in accordance with a factor equalling the anticipated percentage of incurred losses reported during the six month period to the final incurred total. A company with \$50 million of exposed income might purchase 3,333 contracts if it feels that only 60% of the incurred loss will be reported prior to December 31st for a September occurrence. The price for each contract would be set in July based on the projected third quarter catastrophe activity and would be higher or lower at settlement date depending on the variance of the actual losses from the statistical projection. If the contract was sold at \$7,500, indicating an expected 30% loss ratio, and the loss ratio was actually 50%, then the contract would be sold by the insurer for \$12,500 at settlement date and the insurer would use the net proceeds of \$5,000 per contract (\$16,665,000) to pay for the unexpected catastrophe losses that it presumably sustained. A 200% loss ratio ceiling was placed on each contract i.e. the maximum recovery per contract was capped at \$50,000. This upper limit was established following simulations of Hurricane Hugo in 1989 and Hurricane Andrew in 1992 which, based on insured losses of \$5 billion and \$16 billion respectively, generated settlement ratios of 48.3% and 178.9%

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The options contract was more complex in terms of the underlying mechanics; however it was the vehicle used to create a product called synthetic reinsurance because of its resemblance to a traditional stop loss cover. Suppose the insurer has \$100 million of exposed property premium and wants to establish a position by means of options contracts that will be the equivalent of a 20% excess of 40% stop loss reinsurance. The insurer would execute a so-called bull call option spread i.e. the simultaneous purchase of 40% strike call options and the sale of 60% strike call options. The investor assumes the opposite position and, through a bid/offer process, a price for the spread is agreed. If the price is 5% and the ultimate loss ratio is 50%, the insurer



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receives a net benefit of 5% (10% recovery less 5% premium) while the investor sustains a 5% loss. Based on a \$25,000 contract multiplier, the insurer would have executed 4,000 spreads for \$20 million coverage, paying \$5 million (4,000 multiplied by 5% of \$25,000) and ultimately receiving \$10 million.

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In transactions such as the foregoing, the investor taking the opposite position to that of the insurer could be someone whose other financial interests would benefit from a catastrophe, such as a contractor or lumber supplier, or simply an investor wishing to diversify his portfolio. With respect to the latter, one of the appealing features of the catastrophe futures and options is that they are deemed to be zero-beta assets; that is, the general correlation between the performance of these assets (triggered by catastrophic events) and those based on the economy is close to zero. Analysis of the movement of the S&P 500 index since 1949 demonstrated no link to catastrophic events occurring during the same period.

Despite the recent occurrence of Hurricane Andrew, the costliest insurance loss in history, and the comparisons by the Chicago Board of Trade of the launching of the catastrophe insurance futures to other milestones in financial derivatives history (T-Bill futures-1976, stock index futures-1982, Eurodollar contracts-1984), the insurance industry's reception to the new initiative in December 1992 was lukewarm. It was felt that the futures were too complicated, were unproven as a hedge against catastrophes, would certainly not be acceptable to the regulators as reinsurance, and might not even be permitted as an investment vehicle in some states. Notwithstanding the very light trading activity at the end of 1992, the suggestion was made that the CBOT contracts could be seen as part of a general business trend toward securitization of assets, similar to mortgage backed securities in certain respects even though the insurance policies underlying the futures contracts are not directly involved in the transaction.

During 1993, interest in insurance derivatives was focused on the CBOT futures, with the discussion increasingly turning to the imperfections in these contracts as being the reason for the non-acceptance by the industry. CBOT officials were, on the other hand, maintaining that the occurrence of a catastrophe and a demonstration by a reinsurer that the contracts had improved its bottom line in the aftermath would encourage more buyers to test the product. The catastrophe was not too long in coming and it served to show that industry concerns were largely justified. Apart from questions on regulatory issues, insurance companies debated whether the futures contract provided a truly parallel hedging mechanism to the insurers' catastrophe exposures (i.e. did the limited reporting period or an insurer's variance from the profile of the companies making up the index invalidate the futures contract's response to its real loss) and whether the necessary expertise and capacity could be developed to make their usage more widespread. It was however thought that reinsurers would likely make the attempt to use these instruments due to the severe shortage of retrocessional capacity.

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The Northridge earthquake occurred in the first quarter of 1994 and ultimately became the second costliest catastrophe loss in history, the insured loss currently sitting at \$12.5 billion. The CBOT Western March futures contract settled at only 105.8%, i.e. returning \$26,450 per \$25,000 contract purchased. As the actual loss from the companies making up the ISO index likely increased at least twofold (the total industry figure tripled) between June 30th, the last reporting day for the March contract, and the present, a serious flaw in the contract mechanism was demonstrated. Coincidentally, the money funnelled by Wall Street into the Bermuda reinsurers was depleted to a very minor extent, due to the fortuitous timing of their entry into the market more than anything else. These circumstances led to some basic conclusions by insurance industry observers; namely, the CBOT contracts would have to change if they were to survive, the Wall Street investors had proven they could weather a catastrophe and still generate a satisfactory return, and most importantly, the capital markets were finally forefront "players", for better or

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worse, in the risk bearing side of the insurance industry, a position from which it did not appear likely they would ever retreat.

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As the capital markets moved steadily towards the insurers, risk managers and insurance companies started to exhibit signs of lateral thinking that had them casting themselves in the mold of investment bankers. Alternative risk financing options, ranging from self-insured retentions to captives to finite risk products were being increasingly scrutinised from the point of view of more exactly growing assets to meet future liabilities. There was perceived to be a blending of the functions of portfolio management and risk management, that is a more holistic approach to money management more akin to that traditionally used by banks and financial institutions. The wall between the asset side and the liability side was coming down. American International Group, usually a harbinger of market trends, formed a subsidiary in early 1994 whose mandate was to hedge financial and insurance risks for large corporate clients by means of financial derivatives and traditional insurance.

On another front, the concept of a catastrophe risk exchange made its debut in New Jersey in the summer of 1994. The primary architect was Samuel Fortunato, a former New Jersey insurance commissioner. The proposal would allow for the exchange or "swap" of units of property insurance coverage between insurers on a "risk for risk" basis as opposed to the "risk for money" basis characterizing the exchange between the investor and the insurer under the CBOT futures contract. The units would consist of frequency/severity weighted benchmarks which would be used to establish the equivalency of a swap. For instance, a California insurer might trade 4 units of earthquake coverage worth \$3,000,000 for 3 units of windstorm coverage worth the same amount from a Florida company. Although this concept was not entirely original (reciprocal exchanges between international insurers to mitigate the downswings in local insurance portfolios and currency fluctuations had been a thriving practice for decades and only tapered off in the 1980s), it would provide industry insiders with a very specific instrument

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with which to hedge their catastrophe exposure, using other insiders as opposed to non-insurance investors as the counterparts. Apart from the fact that the capital markets would be excluded from participating in these contracts, the contracts themselves represent private placement financial derivatives.

Towards the end of 1994, the insurance industry seemed to be maintaining a watching brief on the CBOT contracts, generating enough buy requests for option spreads that CBOT officials were encouraged that a permanent market could be developed within a five year period. The investors (sellers) however remained unconvinced that insurers would not be able to take advantage of insider knowledge to manipulate the contracts in their favour. While a level of comfort by both buyer and seller was going to be a long time in coming, insurance trade journals were beginning to highlight statements to the effect that the use of financial derivatives to hedge insurance risk and the securitization of insurance risk was inevitable. There was a perception that, in certain scenarios, the insurance industry lacked sufficient capital to cover its exposures, while in others it suffered from inherent inefficiencies which reduced cost effectiveness. It was suggested that securitization or bundling could be applied to not only catastrophe risk but also to lines such as crop insurance or medical benefits. At the same time, the banks were taking this line of thought seriously enough that the derivatives units of Bankers Trust, Chase Manhattan, and Citibank (in addition to Goldman Sachs and J.P.Morgan, mentioned earlier) had designated insurance or reinsurance teams.

1995 witnessed the first public debate on the meaning and efficacy of regulations governing the use of derivatives by insurance companies. In Europe, companies looked towards the EU Third Insurance Directives (as interpreted by the Department of Trade and Industry in the U.K.), which provided a framework for derivatives use. In the U.S., each state's investment laws coupled with the applicable insurance code would guide the legality of a transaction and, in the absence of a developed statutory/regulatory framework in a state, recourse could be

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made to the NAIC's Accounting Manuals and their Model Investment Law. The conclusion was that caution should be the watchword until the regulations are tested and clarified. Against this backdrop, an alliance of some importance was announced at the beginning of the year when Swiss Re and Credit Suisse First Boston joined forces to develop reinsurance derivatives products as well as products common to both companies' clients. Of equal interest was the idea that Lloyd's, which has different regulatory restrictions than the London company market, might be an ideal centre for an over-the-counter insurance derivatives exchange, using indices generated by the traditional insurance transactions already conducted within its framework. The whole topic of insurance derivatives had in fact by this time been sufficiently legitimized that seminars were being organized to spread the knowledge that had been circulating amongst a fairly small group of practitioners, regulators, and academics.

Ideas that had been discussed in theoretical terms now seemed to assume an air of practicality, tempered nonetheless by a high regard for regulatory issues and the need for "transparent" communication between the insurance and capital markets. With this in mind, liability swaps, loss ratio swaps, financial instruments triggered by insurance results, insurance products geared to financial market fluctuations, insurance derivatives clearing houses, and exchange traded insurance indices for commercial, homeowners and auto lines were put forth as eventual alternatives for the insurance and reinsurance industry. The rationale for this thinking was that the capitalization of the insurance industry (\$225 billion in the U.S.) is dwarfed by that of the capital markets (\$16 trillion in the U.S.) and that insurers and reinsurers would both benefit from access to that market by means of hedging techniques that would allow them not only to transfer risk into a much larger capital resource base but also to revise their own financial management strategies in the face of an evolving insurance market. One of the publicized examples of the coming together of the two markets was Nationwide's agreement to sell up to \$400 million in surplus notes to Morgan Guaranty Trust (J.P.Morgan and Salomon Brothers led the

offering) if the proceeds are needed to pay for a catastrophe loss. This stand-by financing complemented Nationwide's existing reinsurance program, which had exhausted the reinsurance market's affordable capacity without covering all of Nationwide's potential exposures. Although the convertible debt arrangement would not enhance Nationwide's earnings as would reinsurance, the insurer would not be forced to liquidate investments unprofitably to maintain adequate cash flow. In this situation, where the contract has been designed to repay the entire principal, the investors are assuming a credit risk (i.e. that Nationwide will default) and thereby are not generating new capacity as would insurance risk transfer.

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Developments were also taking place in New York. The Catastrophe Risk Exchange (Catex), referred to earlier, received a licence as a reinsurance intermediary, encouraging its backers (Science Application Corp. of California) to finish developing the catastrophe risk trading technology in conjunction with the marketing of the service to potential subscribers. Another reinsurance broker, Guy Carpenter, announced plans to create its own catastrophe index as well as the formation of a subsidiary (registered with the National Association of Securities Dealers) which would offer catastrophe risk investment products, such as an "act of God " bond designed to restore an insurer's capital after its depletion due to a catastrophe loss. Meanwhile, the Chicago Board of Trade was introducing new catastrophe options contracts based on a different index.

While the original ISO-based CBOT products would continue to be offered, trading had dropped off considerably in anticipation of the Property Claims Services (PCS)-based options for six regions (National, Eastern, Northeastern, Southeastern, Midwestern, and Western) and three states (Florida, Texas, and California). The reporting period is optionally six months or twelve months after the close of the loss period i.e. three to nine months longer than the ISO contracts. The Western and California PCS options are available only as annual contracts, given the non-seasonal nature of the prime exposure (earthquake). PCS develops total industry estimates

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using a combination of procedures, including the polling of companies representing at least 70% of the market. The PCS index rises to 500, representing a \$50 billion market loss or \$100 million per 1% of loss ratio. A distinction is made between "small cap" options (under \$20 billion or 200 on the index) and large cap options (\$20 billion to \$50 billion, 200 to 500 on the index). Each point on the index equals \$200 cash value per contract. The investment strategy, whether buying or selling the option spreads, remains the same; however the widened parameters provide a greater opportunity for correlation between the movement of the index and the insurer's own reality. The basis risk i.e. the risk of non-correlation between the insurer's portfolio and the PCS index still exists but to a lesser extent given the greater diversity in the options contracts, the longer development period, and the wider statistical base. The PCS catastrophe insurance options were launched on September 29th, just five days prior to Hurricane Opal which caused an immediate flurry of activity.

The Chicago Board of Trade had at the same time been moving forward on another front, introducing a pilot project for the trading of Iowa corn yield insurance futures and options on June 2, 1995. The results were such that formal trading began on January 19, 1996 and the specified areas were expanded to include Illinois, Indiana, Nebraska, Ohio, and the entire U.S. Of particular interest is the fact that these instruments are being marketed not only to producers but also to crop insurers and reinsurers as a quantity (as opposed to price) driven hedge against yields reduced by inclement weather. (At least one major crop reinsurer is using this tool to offset its exposures and others are preparing to follow suit.) This was therefore the first time that a derivatives product had been designed for use by all the participants in the insurance chain, from the insured farmer through the insurer to the reinsurer. Impetus for these instruments was provided by changes legislated in the Federal Crop Insurance Reform Act of 1994, which shifted more of the insurance burden from the federal government to the private sector. It is anticipated that futures contracts for wheat and

soybeans will be introduced later this year. From a Canadian perspective, these developments are important in that organizations such as the Kansas Farm Bureau are studying the degree of correlation between crop yields in the southern Canadian provinces and those in the U.S. states. It has been demonstrated that there is a likely match between the southern Saskatchewan and the U.S. wheat yields which could result in a new risk transfer vehicle for Canadian producers and insurers by means of access to the capital markets.

Since then, most articles I have read seem to agree that derivatives will at some point in time revolutionize the insurance and reinsurance industry. The capital markets will enhance risk transfer process, lending some of the \$125 billion daily deviation in the value of U.S. stocks and bonds to an industry that feels it might be severely crippled by one annual occurrence worth half that much.