

Innovation in Crop Insurance: The Price-Flex® Story

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Starting in 2012 and continuing for several years since, I have been witness to a burst of innovation in the seemingly staid world of crop insurance, which is too often dismissed as an obscure backwater of the U.S. insurance industry. 2012 was the year that Hudson Insurance Group teamed up with leading crop insurance agency Silveus Insurance Group and economic consulting firm Watts and Associates to introduce a new supplemental crop insurance product called Price-Flex®.¹ As chief risk officer of Odyssey Re, Hudson's parent, I was called upon to vet the pricing engine that had been developed by Watts; and thus began a collaboration with Watts, which has expanded to include innovative *loss ratio hedging*, that continues through today.

To understand the nature of the innovation I am going to discuss, it will be helpful to know a little about the Federal Crop Insurance Program, which is administered by the Risk Management Agency (RMA) of the U.S. Department of Agriculture (USDA) on behalf of the Federal Crop Insurance Corporation (FCIC). The RMA has developed a suite of Multiple Peril Crop Insurance (MPCI) policies for sale to American farmers by a limited number of approved insurance providers (AIPs), each of which is eligible for reinsurance protection provided by the FCIC.² The RMA has developed both the policy language and the rates for the various MPCI coverages, and under the terms of their agreement with the RMA, the AIPs are not permitted to deviate from either those standard policy terms or rates. In addition, the RMA has imposed restrictions on commissions paid to agents. In other words, the AIPs cannot compete with each other on the basis of coverage or price, nor are they entirely free to compete for agents by paying higher commissions. As a result, competition in the U.S. crop insurance market turns on service, both to agents and farmers, and also on private crop insurance products, which are supplemental coverages outside the RMA's standard MPCI suite (and thus not reinsured by the FCIC). These private supplemental coverages are subject to RMA (as well as state insurance department) approval. While RMA rules prohibit tying the sale of private products to the sale of an MPCI policy, as a practical matter most farmers find it more convenient to buy all of their coverage from a single AIP. As a result, many AIPs find that offering their own suite of private supplemental policies with attractive characteristics in terms of coverage and/or price is an effective way to compete for the pockets of MPCI business they find most attractive.

¹ Price-Flex is a registered trademark of Watts and Associates, Inc., Billings, MT.

² As of January 2016 there were 17 AIPs, including Hudson, eligible to provide MPCI coverage under the Standard Reinsurance Agreement with the FCIC.

The most popular MPCCI policies in recent years, comprising about 80% of total premiums, have been those providing *revenue protection*, which the RMA describes as follows:

Revenue Protection policies insure producers against yield losses due to natural causes such as drought, excessive moisture, hail, wind, frost, insects, and disease, and revenue losses caused by a change in the harvest price from the projected price.³

These revenue protection (RP) policies put a floor under a farmer's revenue, defined as yield per acre × crop price × acreage. A farmer can typically buy protection up to 85% of projected revenue (effectively a 15% deductible), where the projected revenue per acre is equal to the yield per acre times the *higher of* the projected price and the harvest price. There is a claim under the revenue policy if, and to the extent that, actual revenue falls below the guaranteed level.

Years ago, in order to facilitate efficient and transparent administration of MPCCI policies, the RMA introduced a standardized approach to determining the projected and harvest prices used in establishing coverage and adjusting claims for each crop. Under that approach, the actual price received by a farmer at his local elevator is ignored, and instead, for coverage and claim purposes *all* farmers within specified regions are *deemed* to receive the *same* harvest price for their crops.

This deemed harvest price is the one-month average daily price of a specified futures contract. To illustrate, for policies covering corn in most parts of the Upper Midwest, the harvest price is defined as the October average daily price on the corn futures contract for December delivery; for policies covering soybeans in the same region, the harvest price is equal to the October average daily price on the soybeans futures contract for November delivery. October is said to be the *price discovery period* for determination of the harvest price.

The projected price is established in similar way. For example, for most parts of the Upper Midwest the projected price for corn is the February average price on the December futures contract, and for soybeans it is the February price on the November futures contract. February is said to be the price discovery period for determination of the projected price.

The use of standardized crop prices not only streamlines administration but also simplifies the pricing of the MPCCI policies (though that is a task left to the RMA) as well as supplemental private products such as Price-Flex. Rather than having to try to estimate the prices actually received by each farmer, the pricing model can focus on just the relevant futures prices.

As mentioned earlier, under an MPCCI revenue protection policy the farmer's revenue guarantee is based on the higher of the projected price and the harvest price, both of which are determined by reference to average futures prices during specified price discovery periods. Price-Flex is supplemental crop insurance that expands the basic coverage provided by MPCCI revenue protection

³ <http://www.rma.usda.gov/policies/>

and similar policies⁴ by allowing the farmer to add one or more additional price discovery periods to the formula for determining the revenue guarantee. The Price-Flex revenue guarantee is based on the highest of the projected price, harvest price and the prices emerging from the additional Price-Flex price discovery periods.

While all MPCCI policies for a given crop and region have a common anniversary date, typically a few months before planting begins, Hudson begins selling Price-Flex policies nearly a year earlier. For example, for corn in most parts of the Upper Midwest, the common anniversary date (or sales closing date) for crop year 2016 MPCCI policies is March 15, 2016; in contrast, Hudson offered 2016 Price-Flex coverage starting in April 2015.

Because futures prices are used directly in the determination of coverage and claims, Hudson's Price-Flex pricing framework uses the latest available futures price as a rating variable, both in order to rate policies more accurately and, importantly, to avoid the risk of adverse selection associated with using stale prices. As a consequence, the rate paid by a farmer today, with the corn futures price at \$3.93 a bushel, would be different from the rate he would have paid yesterday with corn futures at \$3.87. Underwriters of most other types of property-casualty insurance rarely have the opportunity to price their policies with such up-to-date information.

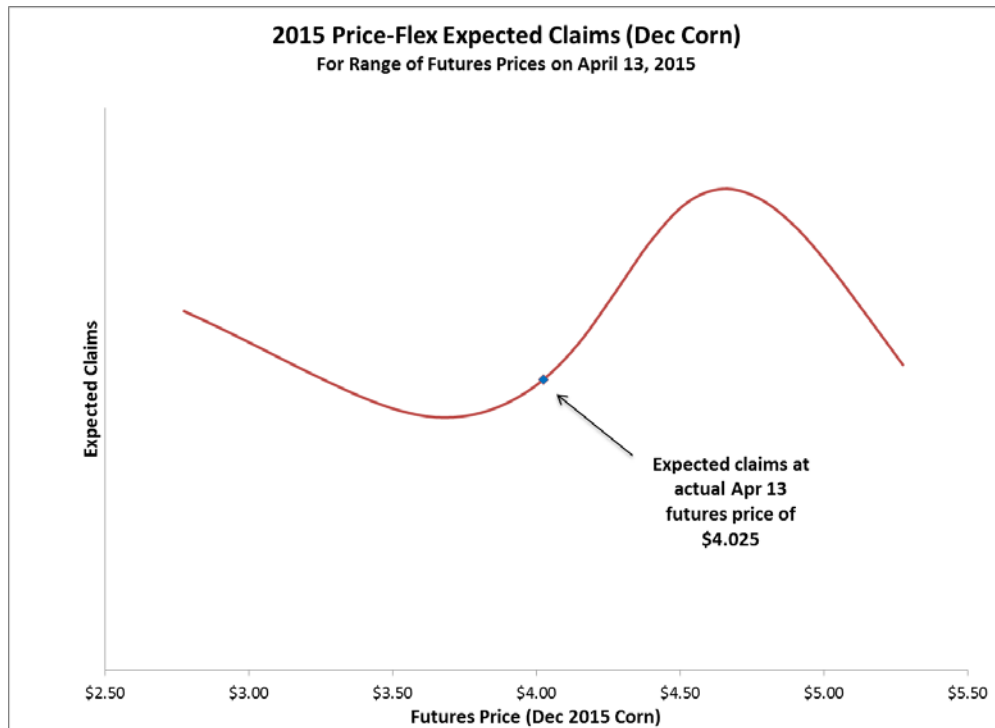
Hudson can use this latest crop price information for pricing Price-Flex because

- The latest futures price is both relevant and observable,
- Regulators have been willing to approve its use as a rating variable, and, critically,
- Through its partnership with Watts and Associates, Hudson can efficiently handle the required quoting, policy issuance and administration.

Thanks to the efficient IT infrastructure and data collection systems, the *entire portfolio* of Price-Flex policies in force can be “repriced” every day using the latest futures price information to provide an updated estimate of the expected portfolio claim costs.

In addition, the pricing model can also be applied to the portfolio on a daily basis to determine the effect of a range of “as-if” futures prices on projected claim costs, as illustrated graphically below for the April 13, 2015 valuation of Hudson's 2015 portfolio of Price-Flex policies linked to the December corn futures contract.

⁴ In addition to RP policies protecting a farmer directly, there are similar policies based on county level data.



Since the impact of a futures price movement on expected claims can be predicted using the pricing model, that predictable effect can be offset by taking a suitable position in the underlying futures contract.⁵ In other words, that portion of the risk in Price-Flex claims related to crop prices can be hedged, at least over very short periods of time. That last qualification is critical. This is not a static hedge that can be put in place and then forgotten. Instead, the hedge has to be reviewed frequently and adjusted to reflect changes in the portfolio and/or in expected portfolio claims as a function of the current futures price.

From a risk management perspective, the prospect of hedging Hudson's Price-Flex crop price risk was intriguing. Back-testing of the hedging algorithm over the period 1990-2012 revealed that it would have substantially reduced the variability of the Price-Flex loss ratio for policies linked to December corn and November soybeans, bringing the hedged loss ratio in most years much closer to the target loss ratio.⁶

However, as a new and unusual idea for a property-casualty company, there was skepticism at the group level about using derivatives to hedge insurance risk. After all, weren't many supposedly sophisticated players in the financial markets badly burned during the financial crisis by derivatives? How realistic and reliable was the back-testing? What experience did Hudson or Odyssey Re have in

⁵ The size of the position and whether it is long or short is related to the slope of the curve representing expected claims as a function of the futures price.

⁶ The effect of the hedging algorithm is generally to reduce loss ratios that would in the absence of hedging be above the target loss ratio and increase those that would otherwise be below the target.

derivatives trading? These questions and others led Hudson to put the hedging idea aside temporarily.

Over the course of more than a year, the ERM team at Odyssey Re modeled the effect of hedging on Hudson's Price-Flex portfolio using as-if "paper trades" instead of real ones. That exercise provided further evidence that the risk mitigation effects of employing the hedging algorithm were real.

The strength of that analysis, together with other supporting material, addressed the roots of the original skepticism, and this time a new proposal to begin hedging Hudson's Price-Flex risk was approved. I am happy to say that the live hedging program using actual trades has proved as effective as the paper exercise had suggested it would be.

In summary, the Price-Flex story at Hudson is one of innovation on several levels. First, unlike most traditional property-casualty ratemaking, the Price-Flex pricing model had to be developed to cope with not only fairly conventional insurance variables like crop yields but also the modeling of futures prices. Second, because Hudson wanted to avoid being confined to a common anniversary date for policy sales, it was necessary to build a pricing model dynamic enough to be able to incorporate daily futures prices, both to maximize pricing accuracy and to avoid adverse selection. Finally, to manage the commodity price risk inherent in the Price-Flex product, the pricing model was extended to devise a portfolio loss ratio hedging algorithm that may be the first of its kind in the property-casualty industry.

Apart from the personal thrill I have experienced in witnessing this innovation, I am also seeing for the first time the outlines of potential disruption of the traditional insurance industry. As a veteran of traditional insurance, I find it difficult to see how an insurance version of *Uber* or *Airbnb* could usurp traditional homeowners or car insurance, much less commercial insurance. However, taking a page from the RMA's book, which decided years ago to standardize the crop prices used in crop insurance by using reference prices instead of the actual ones the farmer receives, what if a new, non-traditional insurer emerged to offer streamlined first party coverages, perhaps including some totally new ones, using observable reference prices to establish coverage amounts and/or to value claims? We all know that insurance industry expense ratios are high, and if there were a way to reduce costs substantially by eliminating underwriting and claims administration costs, it might just take the insurance industry by storm. Food for thought!