

## Systematic Risk and Crop Insurance in Retrospect and Prospect

*By Harun Bulut, Frank Schnapp, and Keith Collins, NCIS*

Systematic risk has been an appealing concept for justifying government involvement in crop insurance markets. It is also the basis for the design of alternative plans of insurance and farm programs. This article revisits the concept by reviewing the related agricultural economics literature. The review focuses on the period since the Federal Crop Insurance Act of 1994 when the crop insurance program went through major changes such as increased participation, the adoption of biotechnology, rating and data improvements and the introduction of revenue plans in crop insurance and farm programs.

In the financial economics literature, systematic risk is defined as the portion of a company's risk that is associated with the market portfolio (or risk-pool) and the remaining portion of the risk is defined as the idiosyncratic risk. Systematic risk is also known as un-diversifiable risk or market risk. Such a risk may arise due to monetary policy of the Federal Reserve Bank or macroeconomic conditions. On the other hand, idiosyncratic risk is known as diversifiable risk, residual risk, or company-specific risk (Fabozzi and Modigliani). An example may be the unique risk associated with a particular stock in an industry. Investors can diversify or hedge against this risk by holding stocks from another uncorrelated or negatively correlated industry in their portfolio.

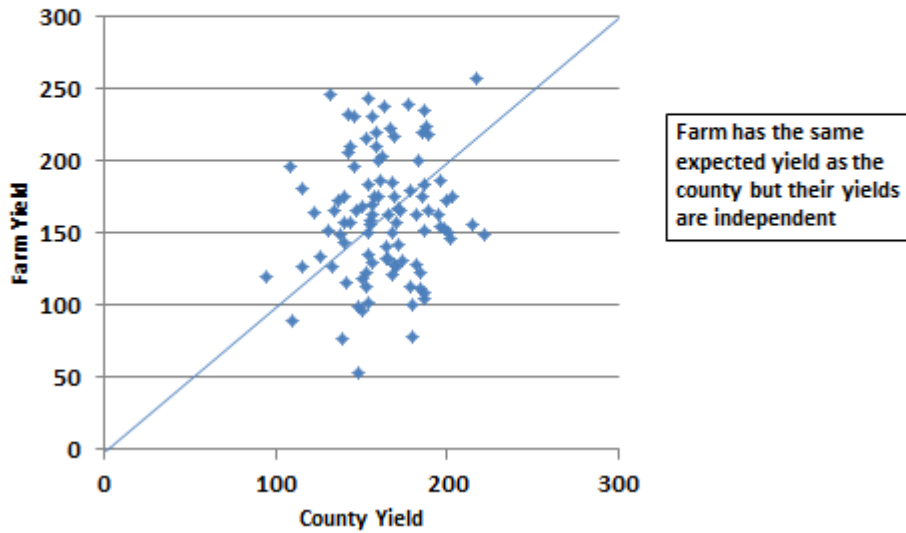
In crop insurance literature, the term systematic risk (or catastrophic risk) is typically understood as the common portion of underlying risk when losses among insurance units are positively and spatially correlated.<sup>1</sup> Figures 1-3 illustrate no correlation, partial positive correlation and perfect positive correlation between a farmer's and a county's yield. Depending on the level and distribution of positive correlation, a relatively large segment of the insured units may be affected by a common cause of loss, such as widespread adverse weather effects of drought, flood and freeze, as opposed to almost mutually independent events seen in other lines of insurance, such as auto accidents (Miranda and Glauber, 1997; Skees and Black, 1997; Duncan and Myers, 2000; and Chambers and Quiggin, 2002). Price risk also contributes to the insurer's systematic risk due to the high correlation across producers of the same crop. Despite the natural hedge between yield and price movements, in some years, such as 2008, a sharp reduction in price at harvest without major production loss can result in losses on a large number of crop insurance revenue protection policies at the same time.

In the next two sections, systematic risk is first considered from the perspective of Approved Insurance Providers (AIPs or insurers) and then from the perspective of farmers. The last section provides concluding comments.

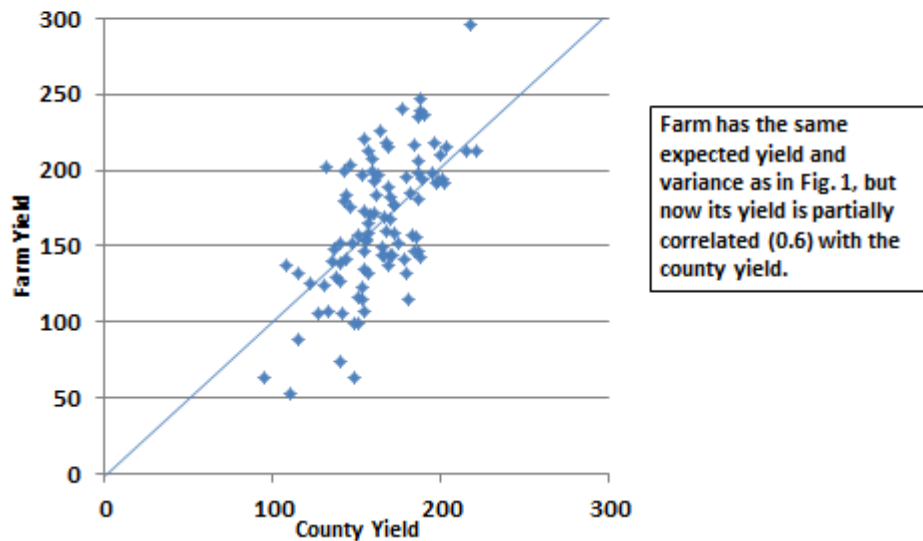
---

<sup>1</sup> The terms "systematic risk" or "systemic risk" have been interchangeably used in the literature. In recent years, "systemic risk" has commonly been used to refer to events that are so severe that they can potentially devastate the entire economy – such as a financial meltdown in 2008. In referring to non-diversifiable risk, Fabozzi and Modigliani use the term systematic risk, whereas Miranda and Glauber; Mason, Hayes and Lence; Skees and Black use the term "systemic risk." Duncan and Myers adopt the term "catastrophic risk" instead of the term "systemic risk." In this article, we choose to use the term "systematic risk."

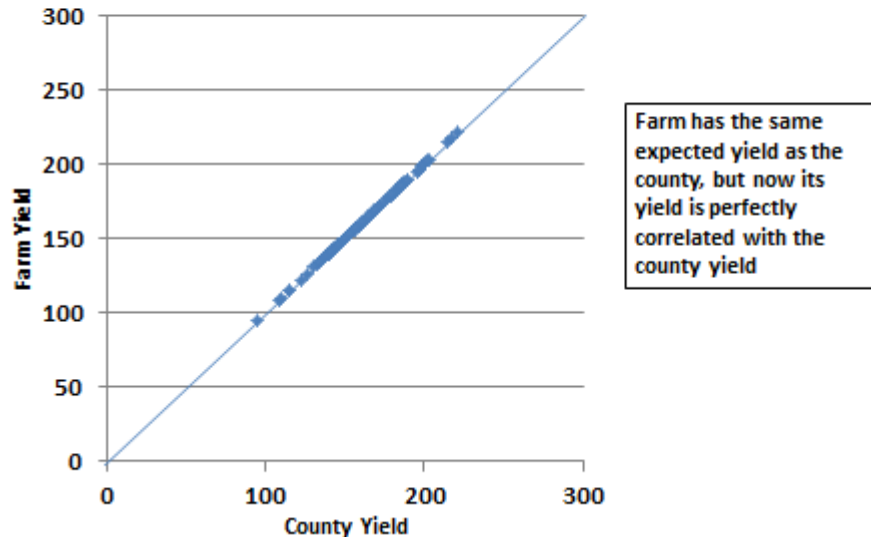
**Fig. 1. Example County and Farm Yields with No Systematic Production Risk**



**Fig. 2. Example County and Farm Yields with Some Systematic Production Risk**



**Fig. 3. Example County and Farm Yields with No Idiosyncratic Production Risk**



### **Systematic Risk from the Insurers' Perspective:**

With very few exceptions, the existence of an insurance market is based on the concept of the law of large numbers. If exposures are independent, the law of large numbers implies that the insurer's risk over its entire book of business is relatively small, with gains on many policies offsetting the losses on a few. On the other hand, if exposures are correlated, then the insurer's risk can be considerable. Simulations conducted by Miranda and Glauber for the 1993 year estimated that the crop insurance portfolios of the ten largest AIPs were 20 to 50 times riskier relative to a hypothetical portfolio consisting of independent crop insurance losses.<sup>2</sup> Facing such a high systematic risk, crop insurance companies would seek reinsurance. The consensus in the literature is that private insurance and reinsurance markets do not provide adequate coverage at a reasonable premium rate for the systematic risk in crop insurance markets.

Various proposals have emerged in the literature to address systematic risk in crop insurance markets including: (1) government provided subsidized reinsurance (Duncan and Myers), (2) government provided reinsurance through area insurance (Miranda and Glauber) and (3) options markets, futures markets and forward marketing (Grant, 1985; Chambers and Quiggin). These proposals will be reviewed in the following section.

---

<sup>2</sup> The analysis was done for the 1993 crop year. The authors made simplifying assumptions such as every farmer chose 65 percent coverage with the yield protection policy. They modeled only the joint distribution of farm-level yields and left out modeling of the joint distribution of price and yield. They combined eight years of farm level data with the county level data which went back 30 years from 1992. The farm level data covered corn, soybeans and wheat farmers who were enrolled in the program in 1993. The sample consisted of 15 percent of the all farmers enrolled in the program in 1993.

### *Government Provided Reinsurance through the Standard Reinsurance Agreement (SRA)*

Based on a theoretical model, Duncan and Myers study the question of whether, in the presence of systematic risk, a private crop insurance market can be established so that crop insurance companies obtain an adequate return and farmers obtain adequate coverage levels at affordable premium rates. The authors recognize that the accumulation of risk across a crop insurance portfolio due to systematic risk creates a challenge for the private insurance market since investors generally require a return commensurate with the risk they take. While it might be possible to set the rates at a level that compensates insurers for their high degree of systematic risk, those rates might discourage farmers from participating in the program. If the risk premium is sufficiently high, it may even lead to the complete break-down of the market. They find that reinsurance (private or government provided) will help only if there is a somewhat functioning private crop insurance market to begin with. In case of complete market failure, only subsidized reinsurance can help facilitate the market. In that case, a higher subsidy amount further improves the market outcome in the form of lower premiums, higher coverage and participation levels. Duncan and Myers note that whether the cost of subsidized reinsurance outweighs the resulting benefits is an open question.

Consistent with the Duncan and Myers analysis, and to ensure participation of private insurers in crop insurance by limiting their exposure to systematic risk, the U.S. government acted as reinsurer under terms specified in various SRAs since 1981 (U.S. General Accounting Office, 1992; Mason, Hayes and Lence, 2001). The SRA is a risk-sharing agreement in which insurers give up a portion of underwriting gains in low loss years in order to be able to transfer a portion of underwriting losses to the government in high loss years. The SRA allows private companies to cede the bulk of the risk to the government on a certain share of policies they sell, while the policies they retain are allocated into different risk-sharing funds with varying exposure to risk. This facilitates the government's objective of making crop insurance available to all eligible producers, including producers who would otherwise find it difficult to obtain coverage in the private market due to their underwriting characteristics, while simultaneously transferring most of the risk of these producers to the government.

In the early 1990s, Miranda and Glauber criticized the government-provided reinsurance through the SRA by arguing: (1) it does not provide good incentives to companies to monitor adverse selection and moral hazard problems at the farm level; (2) it provides a rather excessive rate of return on retained premium (above 18 percent). These criticisms were made following a time period, the 1980s and early 1990s, during which the actuarial performance of the crop insurance program had been dismal (Glauber, 2004). The Federal Crop Insurance Act of 1994 and the Agricultural Risk Protection Act of 2002 (ARPA) increased the participation of low risk producers in the program through increased premium subsidies under the expectation that increased participation would lead to less adverse selection and lower, more accurate, premium rates. Consistent with that expectation, the crop insurance program's actuarial performance has improved over time.

In regard to the first point raised in Miranda and Glauber, one has to recall that the crop insurance industry is highly regulated compared to other lines of insurance. Private insurers must accept the premium rates and underwriting provisions as set by government. Instead, they compete only in the quality of their service. In addition, once a company decides to operate in a given state, it has to offer all plans of insurance that are approved for sale (except pilot programs) to every farmer in that state (universal service requirement). To mitigate the loss potential due to

the universal service requirement, companies can cede a portion of their policies they deem highly risky to the Assigned Risk Fund (ARF), where they retain a relatively lower proportion of the premium and its associated risks compared to other reinsurance funds. Nevertheless, ceding to ARF is done as a proportion of the entire reinsurance fund rather than on an individual contract basis. That is, each company retains at least some liability on every policy it underwrites. This is in contrast to flood insurance where the government takes all the risk and the companies bear none. Since the 1980s, successive SRAs have steadily increased the risk retained by the companies. For example in the 1986-90 SRA, the government assumed 100 percent of the losses for which the loss ratio exceeded 1.565. In the 2011 SRA, the government assumes 100 percent of the losses for which the loss ratio exceeds 5.0. Because crop insurance companies maintain substantial “skin in the game,” they have ample incentives to rigorously adjust losses. This incentive has increased over time.

In regard to the second point raised in Miranda and Glauber, an historical perspective can be useful. In terms of potential returns, the basic structure of SRA did not change in the late 1990s. The main change between the 1998 SRA and the 2005 SRA was the introduction of net book quota share (NBQS). NBQS requires that companies cede five percent of their cumulative underwriting gains or losses to the Federal Crop Insurance Corporation (FCIC). Because companies obtain underwriting gains more often than losses, the reinsurance provided by NBQS tends to benefit FCIC more so than the companies. Vedenov et al. (2006) find that the expected returns to companies would be decreased due to NBQS by 1.1 percent after adjusting for the companies’ behavioral response. Another change in the 2005 SRA was an increase in cession limits, but Vedenov et al. calculate that companies would increase gross premiums ceded to the ARF only in a limited number of states. In the 2011 SRA, NBQS is increased to 6.5 percent, and if there is an underwriting gain, the additional 1.5 percent is to be distributed back to companies operating in under-served states. Finally, the 2011 SRA introduced alternative risk sharing provisions based on groupings of states to reflect differing underwriting gain potential among states, further decreasing the companies’ expected returns.

The crop insurance industry believes that a fairly negotiated SRA is the foundation of the program. Since the passage of the Federal Crop Insurance Act of 1980, which mandated private and public partnership and private delivery of the program, the crop insurance program has grown to become the centerpiece of the agricultural safety net for crops and currently protects about \$110 billion worth of liability. Beyond fulfilling their delivery and service obligations, insurers have contributed to the program by providing input and feedback on the implementation of ever-changing rules and policies and investing in physical and human capital in the form of information technology and specialized skills.

The reduction in reinsurance support provided by the government, together with reduced payments for delivery costs, have cut AIP funding. The 2008 farm bill cut total program funding by \$6.4 billion over the following 10 years. On top of that, the 2011 SRA took an additional \$6 billion out over 10 years, all from the AIPs. In the aftermath of the 2011 SRA, several crop insurance companies were sold to large international reinsurers. Indeed, one year after the 2011 SRA, the President proposed an additional \$6.3 billion in cuts to the AIPs over 10 years as part of the Budget Control Act of 2011 deficit reduction process. In addition, a separate proposal to change the way premium rates are determined would further erode the expected returns to AIPs. These actions and proposals are in sharp contrast to the conclusions of the Grant Thornton study of industry profitability, which found that crop insurers are much more efficient at delivering crop insurance than are Property and Casualty (P&C) insurers in general, that they face

substantially greater risk than P&C insurers, yet achieve a lower rate of return despite the greater risk (Grant Thornton, LLP, 2010).

### *Government Provided Reinsurance through Area Insurance Plans*

Instead of reinsurance through the SRA, Miranda and Glauber proposed reinsurance through area yield insurance plans as a solution to the systematic risk problem in crop insurance. The idea is that the government would absorb the systematic risk while companies would retain the residual risk. Area yield insurance would protect against regional yield shortfalls and be rated and sold by the federal government. A separate insurance product could be offered by private companies to protect against a farmer's residual (basis) risk. Private companies could determine the premium rates for such a marginal product and would be entitled to ensuing underwriting gains or losses. The authors argue that such a design would give AIPs a strong incentive to monitor moral hazard and adverse selection and the actuarial performance of their book of business would improve. Once reinsurance was provided through area plans, they even envisioned the possibility that the federal government could get out of the crop insurance market.

The crop insurance industry has considered in the past whether it would be advantageous for the SRA to provide area yield or revenue protection to insurers in place of the existing reinsurance arrangements. But the effectiveness of this concept would depend on the size of the area used to define systematic risk. For example, Miranda and Glauber's analysis compares national versus state level yield options. An insurer might need to be protected against systematic risk at the state level, but the government might be willing to provide protection against systematic risk only at the county level.

If we consider the relationship between county and state risk, each county contributes to the statewide risk but has its own idiosyncratic risk. Since insurers like to retain the idiosyncratic risk, it may work to their advantage to get area reinsurance protection at the state level instead. Having statewide area protection would enable insurers to offset losses in one county with gains in another. While one might think that the same argument would imply that insurers ought to prefer area reinsurance protection on a countrywide basis rather than a state basis, the mix of business issue may be the reason why this wouldn't be preferred.

In line with Miranda and Glauber's suggestion, area yield or revenue insurance products have been offered to farmers at the county level (albeit through insurers) over the last decade and a half while the government and insurers have shared risk with area plans and the government has continued to provide reinsurance through the SRA. Nevertheless, the experience with the existing area insurance plans identified significant informational and operational issues, which will be reviewed in more detail in the next section.

### **Systematic Risk from the Farmers' Perspective**

The conventional thinking has been that systematic risk lies at the core of farmers' risk exposure and it is quite uniform and common across farmers in a given area and even across counties in a given state or region. Such a view has been instrumental for the introduction and development area yield or revenue insurance plans and area revenue farm programs.

### *Area Yield or Revenue Insurance Plans*

Group Risk Protection (GRP) Insurance and Group Risk Income Protection (GRIP) are area based plans protecting against yield and revenue shortfalls at the county level, respectively. GRP started out as a pilot program for soybeans in 1993 and expanded to other major crops the

following year. GRIP was proposed as a pilot by the private sector in 1997. Starting in 2004, GRIP also began to offer the harvest price option (GRIP-HPO), which sets the insurance guarantee at the higher of planting or harvest prices. Farmers have had little demand for GRP and GRIP in most areas, as these plans accounted for less than four percent of the total MPCCI program premium in 2010.

In crop year 2011, the Risk Management Agency (RMA), on behalf of the FCIC, introduced the Common Crop Insurance Policy (Combo Policy) replacing the previous individual insurance plans with the goal of unifying and simplifying the Federal crop insurance program. To bring the area plans in line with the Combo Policy changes, FCIC proposed a rule to replace GRP Insurance, GRIP Insurance, and GRP-HPO Insurance with new plans called Area Yield Protection Insurance (AYP), Area Revenue Protection Insurance with Harvest Price Exclusion (ARP-HPE), and Area Revenue Protection Insurance (ARP), respectively. These new area plans collectively are referred to as ARPI.

While the new area plans improve upon GRIP-HPO, GRIP, and GRP by establishing uniform commodity prices across plans, the proposed rule raises issues in other respects, such as the introduction of the “total loss factor” in the indemnity calculation and the additional burden and cost of reporting production. Despite proposing new plans of insurance for area coverage, some underlying concerns with area plan protection remain.

Farmers currently do not report their acreage and production with GRP and GRIP plans. This has kept transaction costs low and provided an advantage over individual insurance plans for which production reporting has been mandatory. Nevertheless, the experience with GRP and GRIP programs has pointed out significant problems with the availability of reliable county yield estimates from the National Agricultural Statistics Service (NASS). RMA discontinued GRP/GRIP programs in 1,062 counties in 2010, which included counties producing corn, soybeans, grain sorghum, and peanuts due to the introduction of revised standards by NASS which resulted in fewer but more reliable county yield estimates.

With the new area plan, ARPI, FCIC proposes to require farmers to submit both an acreage report and an annual production report. With the new production reporting requirement, FCIC proposes to build its own database in order to support and maintain area plans. Since FCIC collects more detailed information from a much larger sample of farmers than NASS, its goal may be to rely more heavily on its own data in establishing expected and final county yields. Using the best combination of available data, FCIC intends to release expected county yields on a crop, type, and practice basis. Otherwise, the coverage will not be available.

The new ARPI plan proposal maintains the “multiplier” concept from GRP and GRIP so that farmers with above average yields can get higher protection, and it renames the “multiplier” as “protection factor”. This is intended to address the difference in each farmer’s own yield as compared to the county average. The maximum protection factor a farmer can select is reduced from 1.5 to 1.2 in the proposal. Also, the proposal introduces a new concept called “total loss factor” (TLF) which is motivated as accounting for lower county variation compared to an individual farmer’s variation.

Under the existing area plans, the total policy protection is paid out only if the county experiences a 100 percent loss. In other words, the deductible disappears in its entirety only when a total loss occurs. Under the new plans, due to introduction of TLF, the total policy protection is paid out even in cases where a total loss has not occurred. Moreover, the inclusion of a protection factor that permits the insured potentially to over-insure the crop is problematic. In the aggregate, this could result in total indemnity payments for a county in excess of the total

value of the crop. Given the new requirement for the insured to provide production information, this problem could be mitigated by requiring the insured to support the selected protection factor based on the farmer's own yield in relation to the county yield, just as a farmer needs to support his APH yield to obtain coverage under individual plans of insurance.

In summary, the experience with GRP and GRIP plans indicated that area plans can also be prone to moral hazard and adverse selection. Transaction costs with these plans will be increasing due to the acreage and production reporting requirement of the new area insurance, however, the reported data may provide more and better county yield data for RMA to operate the plans. Finally, even if the problems with area plans can be overcome, it has been theoretically shown that individual insurance does a better job in minimizing farmers' risk as compared to area insurance (Bulut, Collins, and Zacharias, 2010).

### *Hedging Against Systematic Risk Using Price Options and Futures Contracts*

An alternative tool for hedging systematic risk is the use of price options, futures contracts, and forward marketing (Grant; Chambers and Quiggin; Barnaby, 2011). However, this idea is dismissed in Miranda and Glauber who reason that the correlation between U.S. output and price has weakened due to increasing international trade. One limitation in Miranda and Glauber's paper is that they assume producers have no control over the idiosyncratic risk they face, which is at odds with the very definition of idiosyncratic risk as being diversifiable risk. In fact, Chambers and Quiggin criticize this assumption and model the producer's choice on the amount of idiosyncratic risk they retain (thereby the amount of idiosyncratic risk they transfer) and the amount of production.

Chambers and Quiggin point out that because of the availability of other financial instruments closely related to agriculture (such as options, futures and forward marketing), the role of area insurance in covering systematic risk can be redundant. They even speculate that, under certain conditions, the provision of area insurance may increase the systematic risk. Chambers and Quiggin show that area insurance will be useful to the degree it would reduce the idiosyncratic risk producers are facing rather than protecting against systematic risk. Even then, Chambers and Quiggin question whether the resulting reduction in idiosyncratic risk could justify the cost of introducing area insurance.

Grant analyzes the economic decisions of a risk-averse farmer when confronting two types of risk: 1) price risk only, and 2) joint price and quantity risk. If forward contracting is available, and there is only price risk, Grant shows that a farmer can fully hedge risk through forward marketing and the production decision is then independent of the farmer's risk aversion and distribution of price risk. If forward contracting is available, and there is joint output and price risk, then the use of forward marketing does not eliminate all the risk and the choices of production and the forward position are related. Both choices depend on the degree of risk-aversion and the joint distribution of price and quantity. The difference in farmers' decisions across two risk environments arises from the role of the covariance between quantity and price.

Barnaby (2011) points out that a revenue insurance plan, which protects against price risk in either direction, complements forward marketing plans. A producer may be able to hedge a larger share of expected production because insurance provides resources to offset the obligation to deliver in the event of a crop loss. Finally, revenue insurance is more economical than having a separate yield insurance policy and buying put option in futures market.

### *Area Revenue Farm Programs*

The 2008 Farm Bill emphasized the revenue protection goal for farm programs and introduced new programs such as Supplemental Revenue Assistance Payments (SURE) and Average Crop Revenue Election (ACRE). This was despite the fact that the premium of revenue insurance products which provide protection against revenue shortfalls as a share of total U.S. crop insurance premium is about 80 percent. Farmers have been receiving such protection (individual or county based) since the 1990s. SURE is a whole farm program and makes payments based on individual producer losses over an entire farm. ACRE protects against revenue shortfalls for a crop at the state level.

Using a farm level data obtained from Illinois and Kansas Farm Management Associations (for corn, soybeans, and wheat in Illinois and for corn, sorghum, soybeans, and wheat in Kansas) over the time period from 1978 to 2008, Zulauf (2011) finds that the systematic component of the losses appears to be mostly shallow losses, while deeper losses pertain to the idiosyncratic component and that the pattern for shallow versus deep losses differs across states. Zulauf argues that a reason for the introduction of different programs such as ACRE and SURE in addition to crop insurance could be to accommodate different loss patterns in different states.

The duplication of coverage and overlap between ACRE and crop insurance appears to be modest (Zulauf, Schnitkey, and Langemeier, 2010). They are separate programs whereas in order to receive a SURE payment, the farmer has to purchase crop insurance. Net crop insurance indemnities are counted against the SURE guarantee which eliminates duplication of payments between the two. Both ACRE and SURE are subject to payment limits while crop insurance is not. The program complexity and slow payment of claims have been major issues for both ACRE and SURE.

Overall the participation has been low and selective by region and crop with ACRE. Even though ACRE is optional for all eligible farmers and farmers do not directly pay for it, selection of ACRE has an implicit premium as farmers must give up 20 percent of their direct payment and their entire price-based countercyclical payment along with a 30 percent reduction to their marketing loan rate. This implicit premium does not change with the systematic risk associated with the area and is not based on actuarial or underwriting considerations (Barnaby, 2010). If the implicit premium is mispriced, it may discourage or encourage participation depending on the farmer's risk.

Using a theoretical model, Bulut, Collins, and Zacharias (2011) study a risk-averse farmer's relative coverage demand for area versus individual insurance. Assuming that the farmer's losses are imperfectly and positively correlated with area losses, they show that under actuarially fair premium rates, farmers would purchase individual insurance only. In addition, if area-insurance is underpriced while individual insurance is fairly priced, separate area and individual plans are substitutes and demand for area insurance increases whereas demand for individual insurance decreases as the correlation between farmer and area losses increases. Furthermore, whenever individual insurance becomes overpriced while area insurance is fairly priced, some additional demand for area insurance will be created. The model can be useful to explain the pattern of actual coverage in counties where ACRE participation is low or high.

From the perspective of a policyholder with crop insurance, whether a loss is due to systematic risk, that is, whether the farmer's loss is correlated to those of other policyholders, or not is irrelevant, so long as these losses can be protected at an affordable premium and the insurer can process and pay for the legitimate claim. Nevertheless, there are two exceptions to this argument.

A small portion of systematic risk stemming from market equilibrium risk could be of concern to producers (Zulauf; Schnitkey, 2011). Crop insurance is effective at protecting against within-year price changes but not against price declines which persist over multiple years and might affect the entire farm sector. ACRE is viewed as fulfilling that role through its guarantee based on a 2-year moving average of prices and complements crop insurance in that regard (Schnitkey; Zulauf).

Another issue is the imperfect indemnification of shallow losses on individual plans due to the deductible. For example, maximum coverage that can be obtained with revenue or yield protection insurance is 85 percent. Through the deductible, the policyholder has a stake in the outcome, which reduces the moral hazard concern. One way to address the imperfect indemnity or shallow loss issue (albeit indirectly) is via area plans whose indemnities are perceived as being outside of an individual farmer's control. SURE is a more direct approach to addressing shallow losses but may require some modifications in order to be more effective (Schnitkey; Zulauf).

Finally, Zulauf suggests that a farmer's premium subsidies be equal to the systematic risk portion of the farmer's expected loss and argues that current levels of subsidy are higher than the frequencies of actual losses would suggest. Recall that Zulauf's analysis is based on data from Illinois and Kansas for a few major crops. We are unaware of comprehensive U.S. estimates of farm and county yield, loss, or revenue correlations based on individual farm data. Barnett et al. (2005) report estimated average correlations between farm and county yields for corn in 10 states using individual farm data on nearly 67,000 farms during 1985-1994. Their correlations varied widely; they were generally high in the heart of the corn belt, ranging from 0.71 in Ohio to 0.82 in Illinois, but fell to 0.49 in Texas and 0.36 in Michigan. These wide correlation differences across regions suggest that county area plans are likely to be of widely differing risk reduction value to producers in various regions. Note that Barnett et al. reported the average estimated correlations between farm and county yields. There is a distribution of the correlation between a farmer's and area losses in a given area, that is, farmers differ in how their yields track the county average yield. That further complicates Zulauf's idea of relating farmer's subsidy to the systematic risk a farmer faces.

An alternative explanation for the producer subsidy could be the discrepancy between a farmer's assessment versus government assessment of the risk. Some evidence on farmers' overconfidence and bias in underestimating the risk has been reported (Umarov and Sherrick, 2005; Gao et al., 2011).

### **Concluding Comments**

This article discusses the systematic risk issue in crop insurance markets by reviewing the related agricultural economics literature. After examining the issue from both insurers' and farmers' perspectives, the review raises the following points.

From the insurer's perspective, systematic risk is best addressed through a fairly negotiated SRA agreement. The alternative idea of providing reinsurance through area plans has not been appealing to companies. A fair negotiation must recognize and emphasize the contribution of the private-public partnership in creating the success of the crop insurance program as seen today. The focus of such negotiations should be on whether the program operates effectively and achieves the objectives set for it by Congress by ensuring effective and efficient delivery, creating new insurance opportunities for farmers, keeping premiums affordable, and expanding crop insurance coverage.

From the farmers' perspective, the risk management needs of the producer are best met with individual crop insurance under actuarially fair rates along with the use of forward marketing. Coverage restrictions imposed in individual insurance against moral hazard concerns can result in a limited indemnity or shallow loss issues. In that context, a partial role for area farm programs or insurance plans to cover deductibles and therefore to improve risk protection is possible. Even then, the individual plan must be the base product while the area plan is stacked on top of individual insurance. Multi-year price risk is a component of systematic risk and can be addressed through actuarially based multiyear insurance policies or farm programs.

We argue that the definition of systematic risk should be expanded to include risks associated with climate change and regulations. Climate change has been recognized for increasing risks not only for agricultural insurers but also for other lines of insurance, both catastrophic and non-catastrophic (NAIC, 2008). Even though some resist reacting to the potential risks of "climate change," farmers have been adapting to it in various parts of the world such as by changing crop varieties (New York Times, 2011). RMA argues that setting premiums based on actual losses would reflect any additional risk due to climate change.

Even though justification can be found for government's role in crop insurance markets as a reinsurer, the funding cuts in the 2008 Farm Bill, the 2011 SRA and the proposals for further cuts to address the Federal budget deficit and premium rate changes have amplified insurers' regulatory risk concerns. Regulatory risk adds to the systematic risk companies are facing and further increases the necessary risk-premium for their involvement in crop insurance markets.

**References:**

- Barnaby, G.A. 2011. "Improved Farm Financial Safety Net Based on Revenue Insurance." Presented at the 2011 Annual Meeting of the Agricultural and Applied Economics Association, July 24-26, 2011, Pittsburgh, Pennsylvania.
- Barnett, B.J., J.R. Black, Y. Hu, and J.R. Skees. 2005. "Is Area Yield Insurance Competitive with Farm Yield Insurance?" *Journal of Agricultural and Resource Economics*. 30(2): 285: 301.
- Bulut, H., K. Collins, and T. Zacharias. 2011. "Optimal Coverage Demand with Individual and Area Plans of Insurance." Selected paper for presentation at the 2011 Annual Meeting of the Agricultural and Applied Economics Association, July 24-26, 2011, Pittsburgh, Pennsylvania.
- Coble, K.H. and B.J. Barnett. 2008. "Implications of Integrated Commodity Programs and Crop Insurance." *Journal of Agricultural and Applied Economics*. 40(2): 431-442.
- Chambers, R.G. and J. Quiggin. 2002. "Optimal Producer Behavior in the Presence of Area-Yield Crop Insurance." *American Journal of Agricultural Economics*. 84(2): 320-334.
- Duncan, J. and R. M. Myers. 2000. "Crop Insurance Under Catastrophic Risk." *American Journal of Agricultural Economics*. 82 (4). 842-855.
- Fabozzi, J.F and F. Modigliani. 2003. *Capital Markets: Institutions and Instruments*. 3<sup>rd</sup> Edition. Prentice Hall, New Jersey.
- Glauber, J. W. 2004. "Crop Insurance Reconsidered." *American Journal of Agricultural Economics*. 86 (5): 1179-1195.
- Gao, X. and C.G. Turvey, R. Nie, L. Wang and R. Kong. 2011. "Crop Insurance Rate Making in the Absence of Crop Yield Data: Subjective Assessments and PERT Distributions in Shaanxi China." Paper presented at SCC-76 Group Annual Meeting, Atlanta, GA, March.
- Grant, D. 1985. "Theory of the Firm with Joint Price and Output Risk and a Forward Market." *American Journal of Agricultural Economics*. 67(3): 630-635.
- Grant Thornton, LLP. 2011. *Federal Crop Insurance Program: Profitability and Effectiveness Analysis 2010 Update*. January 13. Available online at [http://www.ag-risk.org/NCISPUBS/SpecRPTS/GrantThornton/Grant\\_Thornton\\_Report-2010\\_FINAL.pdf](http://www.ag-risk.org/NCISPUBS/SpecRPTS/GrantThornton/Grant_Thornton_Report-2010_FINAL.pdf)
- Mahul, O. 2001. "Managing Catastrophic Risk Through Insurance and Securitization." *American Journal of Agricultural Economics*. 63(3): 656-661.
- Mason C., D.J. Hayes and S.H. Lence. 2001. "Systemic Risk in U.S. Crop and Revenue Insurance Programs." CARD Iowa State University Working Paper 01-WP 266.

- Miranda, M.J. and J.W. Glauber. 1997. "Systemic Risk, Reinsurance, and the Failure of Crop Insurance Markets." *American Journal of Agricultural Economics*. 79 (1): 206-215.
- NAIC. 2008. "The Potential Impact of Climate Change on Insurance Regulation". White Paper. Available at [http://www.naic.org/store\\_pub\\_whitepapers.htm#climate\\_change](http://www.naic.org/store_pub_whitepapers.htm#climate_change) .
- New York Times Article, 2011. "Farm Groups Step up Interest in Insurance Due to Extreme Weather, but Don't Talk Climate Change." September 14. By Jean Chemnick.
- Schnitkey, G. 2011. "Farm Commodity Programs Given the Existence of Crop Insurance." *Farmdocdaily*. Available online at <http://www.farmdocdaily.illinois.edu/004352print.html> .
- Skees, J.R. and B.J. Black. 1999. "Conceptual and Practical Considerations for Sharing Catastrophic/Systemic Risks." *Applied Economic Perspectives and Policy*. 21(2): 424-441.
- Umarov, A.A. and B. Sherrick. 2005. "Farmers' Subjective Yield Distributions: Calibration and Implications for Crop Insurance Valuation." Presented at the American Agricultural Economics Association Annual Meeting in Providence, RI, July.
- U.S. General Accounting Office. 1992. *Crop Insurance Program Has Not Fostered Significant Risk Sharing by Insurance Companies*. Report to the Chairman, Committee on Agriculture, Nutrition, and Forestry, U.S. Senate, Washington DC, GAO/RCED-92-25, January.
- Zulauf, C. 2011. "A Coordinated Framework for a 21<sup>st</sup> Century Farm Safety Net." Presented at the Agricultural and Applied Economics Association Meeting in Pittsburgh, PA, July.
- Zulauf, C., G. Schnitkey, and M. Langemeier. 2010. "Average Crop Revenue Election, Crop Insurance, and Supplemental Revenue Assistance: Interactions and Overlap for Illinois and Kansas Farm Program Crops." *Journal of Agricultural and Applied Economics*, 42(3): 501-515.