Hidden Safety Net of Underutilized Supplemental Insurance in US Agriculture

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**5.1 Establishing the baseline**

Table S4 presents a look at the effectiveness of integrating basic crop insurance policies (APH, YP, RP, and RP-HPE) with supplemental protection (SCO and ECO) over the period from 2015 to 2023. TThe data reveals an increase in revenue transfer potential under baseline conditions, with the observed stacking rate generating approximately 7.54% more revenue than scenarios lacking any crop insurance. This increase primarily originates from the subsidized portions of insurance premiums and indemnity payments that cover losses. Moreover, the baseline highlights a substantial reduction in revenue variability. Specifically, the overall risk associated with revenue fluctuations decreased by nearly 28.93% when compared to instances without insurance coverage. The baseline scenario shows a decrease in both relative and absolute downside risks by 68.88% and 64.96%, respectively. The cost for this level of security? An actuarially fair premium rate of 12.13 cents per dollar of liability, 63.68% of which is subsidized by the federal government, leaving farmers to pay 4.28 cents out of pocket.

Figure S2 further enriches our understanding by pinpointing oats as the crop with the highest downside revenue risk reduction rate at 79.33%, closely followed by canola (74.69%), sorghum (72.74%), wheat (72.52%), sunflowers (71.25%), dry peas (70.35%), dry beans (68.93%), corn (68.76%), cotton (67.6%), soybeans (67.43%), barley (66.68%), popcorn (64.78%), peanuts (60.34%), and rice (54.48%). The geographical distribution of these crops along downside risk reduction potential also in Figure S2, showcases states (major crop in that state) like North Dakota (wheat), Oregon (wheat), Arizona (cotton), Oklahoma (wheat), and South Dakota (corn) as leaders in downside revenue risk reduction, with rates exceeding 73%. Conversely, states such as Connecticut (corn), California (almonds), Massachusetts (cranberries), Arkansas (soybeans), and Georgia (cotton) are identified as having the lowest risk reduction rates, ranging less than 61%. Comparing Figure S2 to S3 and S4 indicates that the programs which offer high downside revenue risk reduction also tend to involve higher revenue transfers and greater out-of-pocket costs for producers.

**3. 5.2 Effects of Increasing Participation in Supplemental Protection**

Compared to the existing 2015 to 2023 benchmark, the basic policy alone has a negligible effect on risk mitigation and revenue transfer. Specifically, the policy’s capability to reduce relative [absolute] downside risk is marginally diminished by approximately 0.66 [0.71] percent from the baseline, while the potential for revenue transfer is reduced by 1.63 percent. These findings suggest that purchasing a basic policy without fully stacking with a supplemental plan fails to exploit the full benefits of risk reduction and income transfer available to producers during this period. Fully integrating the SCO with the basic policy increases revenue metrics, with relative [absolute] downside risk reduction and revenue transfer improving by 14.7 [16.06] and 58 percent, respectively, compared to baseline levels. Moreover, the addition of ECO at a 95% coverage level significantly amplifies improvements across all evaluated metrics. The combination of Basic + ECO95 enhances both relative and absolute measures of downside risk reduction by 10.43 and 11.39 percent, respectively, and increases revenue transfer by 28.99 percent above the baseline. The most comprehensive benefits are observed when SCO and ECO95 are synergistically stacked with basic policies, delivering the highest increments in downside risk reduction (16.48 and 18.11 percent), overall risk alleviation (36.95 percent), and revenue transfer (68.74 percent). These results underscore that multi-layered insurance options offer the most effective safeguard against a wide array of agricultural risks, providing substantial protective measures that exceed those of standalone policies.

While enhanced participation in SCO and ECO is correlated with improvements in risk reduction and revenue transfer, it also leads to higher aggregate actuarially fair premium rates and reduced aggregate subsidy rates, resulting in increased aggregate premium paid rates. Notably, the combination Basic + ECO95 exhibits the highest increase in the premium rate faced by producers, at 95.66%, stemming from a 50.76% increase in the actuarially fair premium rate and a 10.66% reduction in the subsidy rate. In terms of the premium rate paid, Basic + ECO95 is followed by Basic + SCO + ECO95 (66.34%), Basic + SCO + ECO90 (49.55%), Basic + SCO (38.16%), Basic + ECO90 (35.79%), and Basic only (-2.38%).

**Crop Heterogeneous**

Heterogeneity across crops arises when it comes to balancing risk reduction and cost. As shown in Figure 4 (Panel Crop), three distinct categories emerge. First, among rice, barley, peanuts, and dry peas full participation in Basic + SCO + ECO95 delivers substantial downside risk reduction—ranging from 16.17 to 54.65percent improvement over the baseline—at marginal costs of 25.51 to 73.02 percent above baseline. Further, the ratio of downside revenue risk reduction to increased out-of-pocket cost (i.e., elasticity) for these crops’ is 1.34, 0.85, 0.58, and 0.47, respectively. This implies a basic insurance policy with a supplemental plan particularly appealing for producers of rice, barley, peanuts, and dry peas.

The next group consisting of cotton, dry beans, sorghum, and canola also show considerable improvements in downside risk reduction (above 13.09 percent) but require additional premiums ranging from 33.22 to 63.02 percent above the baseline. Although these crops still benefit significantly from fully stacking basic insurance with a supplemental plan, the higher premium costs make this option relatively expensive compared to the first group. The final group consisting of wheat, popcorn, sunflowers, soybeans, oats, and corn provide only modest risk reduction (below 19.38 percent of the baseline), with marginal costs spanning 39.9 to 79.71 percent above baseline. This lower level of protection, combined with relatively high additional costs, makes stacking policies less appealing for producers seeking strong coverage without substantially increasing their expenses.