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Crop Insurance, Disaster Payments, and Land Use Change: The Effect of Sodsaver on Incentives for Grassland Conversion

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Subsidized crop insurance may encourage conversion of native grassland to cropland. The Sodsaver provision of the 2008 farm bill could deny crop insurance on converted land in the Prairie Pothole states for 5 years. Supplemental Revenue Assistance payments, which are linked to crop insurance purchases, could also be withheld. Using representative farms, we estimate that Sodsaver would reduce expected crop revenue by up to 8% and expected net return by up to 20%, while increasing the standard deviation of revenue by as much as 6% of market revenue. Analysis based on elasticities from the literature suggests that Sodsaver would reduce grassland conversion by 9% or less.

Key Words: bootstrap, crop insurance, grassland, joint densities, Sodsaver, Supplemental Revenue Assistance

JEL Classification: Q2

The potential environmental impacts of Federal farm programs—commodity programs, crop insurance, and disaster payments—continue to receive attention from a wide variety of groups, including federal and local government, non-governmental organizations, and the popular press. Recent concern has focused on the role of federally subsidized crop insurance in the conversion of grassland to cropland. Environmentalists, wildlife groups, and some livestock interests are particularly concerned about the loss of native grasslands in the Prairie Pothole Region (PPR) of the Northern Plains (Morgan, 2008).

Grasslands are important breeding habitats for ducks and other migratory birds. About 50% of North American ducks are produced in the grasslands of the Northern Plains, even though this habitat accounts for only 10% of duck breeding territory (U.S. Department of Commerce, National Oceanic and Atmospheric Administrationand others). Ducks are particularly drawn to small wetlands surrounded by grasslands—a key feature of the PPR. Many other migratory birds also depend on these grasslands, including a number of species that are shown by the Breeding Birds Survey to be in decline: the grasshopper sparrow, bobolink, Baird's sparrow, northern harrier, horned lark, loggerhead shrike, and lark sparrow (Johnson, 2000).

Fragmentation of grasslands (through conversion to cropland, for example), overgrazing, and the spread of invasive species are damaging the quality of habitats for ducks and other grassland-dependent species (Conner et al., 2010). When

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compared with cultivated cropland, grasslands store substantial amounts of carbon (Eve et al., 2002) and produce runoff that is relatively free of the sediment, nutrients, and pesticides that can damage wetlands and water quality in general (U.S. Government Accountability Office, 2007).

In a study of grassland to cropland conversion for 1985–2003, Stephens et al. (2006) show that grassland losses averaged 0.6% per year in the "Hyde-Hand" area of South Dakota, a region that includes all of Hyde, Hand, and Faulk Counties in East-Central South Dakota and parts of surrounding counties including Sully and Edmunds. At that rate, grassland loss approaching 10% would have been observed over the 18-year study period. These findings are generally supported by Farm Service Agency data on "new breakings" for 2005 and 2006, which also indicates a relatively high rate of grassland to cropland conversion in this portion of South Dakota.

Once lost, native grassland habitats are difficult to restore. The native grasses can be readily replanted but only at significant expense. A U.S. Government Accountability Office (USGAO) report (2007) cites Fish and Wildlife Service estimates of $200 per acre for native grass restoration in South Dakota where grassland prices range from $750–$1,050 per acre. Other components of native grassland including forbs, vertebrate animals, invertebrates, and soil microorganisms are important to the quality of the grassland habitat but cannot be readily restored (Johnson, 2000).

Crop insurance indemnities and disaster payments have been cited as contributing to grassland conversion. At current subsidy rates, farmers who purchase 70% coverage (the most popular level in the Northern Plains) pay only 41% of insurance premiums (the subsidy rate is 59% for 70% coverage). The USGAO (2007) study notes that the 16 South Dakota counties with the largest number of converted acres (according to Farm Service Agency new breakings data) had an average annual crop insurance indemnity of $13 per acre while the average annual indemnity was less than $7 in all other counties. Although disaster assistance has been ad hoc in recent years, disaster payments of some type were approved by Congress in every year between 1985 and 2007, totaling $30 billion over that period (Goodwin and Rejesus, 2008). Stephens et al. (2006) note that disaster payments in the "high-conversion" counties of Hyde, Hand, and Faulk were roughly $60 per cropland acre between 1996 and 2004, while these payments were only $10 per acre in Lake, Moody, and Minnehaha counties, where crop production has long been the dominant land use.

In response to concern about the loss of grassland habitat and the role of farm programs, the Food, Conservation, and Energy Act of 2008 (hereafter the 2008 Farm Act) included a limited version of a "Sodsaver" provision. If implemented, Sodsaver would deny crop insurance coverage for the first 5 years of crop production on land converted from native grass. Because benefits from the new standing disaster program—the Supplemental Revenue Assistance (SURE) program (also part of the 2008 Farm Act)—are contingent on crop insurance purchase (where available), these payments may also be denied. However, Sodsaver is limited to PPR states (Iowa, Minnesota, South Dakota, North Dakota, and Montana) and will be implemented only at the governor's request. As of February 2011, there have been no requests for Sodsaver implementation.

The manager's statement accompanying the House-Senate conference committee report on the 2008 Farm Act also requested additional study of the role of crop insurance in grassland conversion, indicating that additional research could affect the eventual implementation of a Sodsaver-type program. Previous studies on the land use effect of crop insurance (e.g., Goodwin, Vandeveer, and Deal, 2004; Lubowski et al., 2006) have concluded that the overall effect of crop insurance is small. Depending on the study, subsidized crop insurance may have increased land in crop production by 1–3 million acres nationally. Nonetheless, this issue is worth revisiting. Previous studies use data from the 1990s or earlier, predating the increase in crop insurance premium subsidies that began in 1999 and was codified in the Agricultural Risk Protection Act of 2000. Furthermore, the SURE program offers disaster benefits to producers who purchase crop insurance but does not require the payment of an additional premium.

If Sodsaver is implemented, its effect on grassland conversion will depend on (1) how crop insurance and SURE affect the mean and variability of crop revenue on converted grassland over the period of the Sodsaver sanction and (2) how these changes in revenue affect producer plans for grassland to cropland conversion. To gauge the effect of Sodsaver on crop revenue and returns, we devise seven representative farms based on North and South Dakota counties where grassland to cropland conversion was particularly high in 2005–2006 (Table 1). To provide context, we also develop farms representing two South Dakota counties (Turner and Union) where most land is cropped and conditions are similar to western Corn Belt conditions. Producers in these "comparison" counties, located in the southeast corner of South Dakota, generally enjoy higher yields and lower yield variability than in the high conversion counties that are located to the west and north. These producers face lower crop insurance premiums and, therefore, receive smaller premium subsidies (as a percentage of revenue) than producers in the high conversion counties.

We assume that each representative farmer maximizes utility and is risk averse. The effect of Sodsaver sanctions is estimated as the: (1) change in expected revenue; (2) increase in standard deviation of revenue; (3) risk premiums producers would be willing to pay to retain risk reduction that would be lost during the 5-year Sodsaver moratorium; and (4) likely effect of these changes on grassland conversion, given land use conversion elasticities drawn from the literature. In the next section, we develop models of crop insurance and SURE, accounting for U.S. Department of Agriculture Risk Management Agency (RMA) rules regarding insurance coverage on land that has no history of crop production. Marketing loan benefits could also affect grassland conversion decisions but these are not affected by Sodsaver. Following development of policy models we develop a theoretical framework for estimating producer risk premiums based on the loss of risk reduction due to Sodsaver. In the following section, we develop simulation methods. At the heart of each representative farm is a joint distribution of prices and yields for major crops (corn, soybeans, and wheat) and livestock grazing where revenue per animal unit (AU) is the "price" and the stocking rate (AU per acre) is the "yield." After developing the joint distributions, we show how they are combined with program models to estimate mean and variance effects and, finally, to estimate risk premiums. Next, we report and discuss simulation results including the potential effect of

Table 1. New Breakings, 2005–2006, for Selected Counties in North and South Dakota

County	New Breakings 2005[a]	New Breakings 2006	Total New Breakings	Percent of Statewide New Breakings[b]	Percent of Grassland
North Dakota					
Stutsman	NA	1,971	1,971	9.57	0.975
South Dakota					
Beadle	2,055	2,101	4,156	4.05	0.841
Edmunds	3,845	4,361	8,207	8.00	2.082
Faulk	2,831	2,170	5,001	4.88	1.138
Hand	5,040	2,748	7,788	7.59	1.063
Hyde	2,835	1,501	4,336	4.23	0.818
Sully	1,867	3,943	5,810	5.66	2.865
North Dakota total (2006)			1,971	9.57	
South Dakota total (2005 and 2006)			35,298	34.41	

Source: Farm Service Agency

[a] When land is cropped for the first time, farmers who receive farm program payments must request an environmental review to determine whether sodbuster or swampbuster sanctions apply. New breakings are the number of acres reviewed.

[b] New breakings totaled 20,592 acres in North Dakota in 2006 and 102,571 acres in South Dakota for 2005 and 2006, combined.

these changes on grassland to cropland conversion. In the final section we offer concluding remarks on the potential effectiveness of Sodsaver as a method of limiting grassland conversion.

Theoretical Framework

Crop Insurance Model

Currently, RMA new land rules govern crop insurance coverage on converted grassland in the first few years of crop production. In general, insurance purchase requires at least 1 year of actual crop history, so land cannot be insured in the first year of crop production.[1] On land with 1–3 years of crop history, RMA uses special rules to calculate actual production history (APH) yields. Typically, the APH yield is the average of the producer's previous 10 crop yields, but could be calculated from as few as 4 actual yields. On existing cropland that has fewer than 4 years of crop insurance yield history, RMA uses transitional yields (which are based on historic county yields) to fill out the yield history. On land that has not been cropped (including converted grassland) RMA new land rules require farmers to accept a 10 to 20% reduction in the transitional yields, reducing the APH yield. Because RMA premium rating methods assume that a lower APH yield indicates a higher likelihood of loss, the reduction in APH yield increases the premium rate (U.S. Department of Agriculture Risk Management Agency, 2007) and reduces the expected indemnity, reducing net return to crop insurance purchase, at least in the short run.

The specific reduction in transitional yields depends on when crop insurance is first purchased. If land is cropped for the first time in year t, and the producer purchases insurance in year $t + 1$, transitional yields used to fill out the yield history are reduced by 20%. For producers who defer insurance purchase until year $t + 2$, transitional yields are reduced by 10%. We assume first purchase of crop insurance is in year $t + 1$.

We also estimate the effect of Sodsaver if RMA new land rules were relaxed. In the "No Restriction" scenario, farmers can purchase crop insurance in the first year of production and transitional yields are used as to fill out yield histories, without reduction, to calculate the APH yield.

In the Northern Plains in 2007, Revenue Assurance (RA) accounted for 74% of insured corn acreage (most insured for 70 and 75% coverage), 82% of insured soybean acreage (mostly 70 and 75% coverage), and 44% of insured wheat acreage (almost all of it at 65, 70, or 75% coverage). For the purpose of our analysis, we assume that all three crops are insured under RA at 70% coverage. Under the base price option, the per-acre indemnity is:

$$(1) \qquad I_{it} = \max((\theta p_{it}^{b} \bar{y}_{it} - p_{it} y_{it}), 0)$$

where I_{it} is the indemnity for crop i at time t, θ is the coverage level, p_{it}^{b} is the RA base (expected) price, $\bar{y}_{it}$ is the producer's APH yield, p_{it} is the realized price, and y_{it} is the actual yield.

By law, U.S. Department of Agriculture must attempt to devise actuarially fair premiums.[2] Actuarially fair premiums are equal to the expected indemnity, but farmer-paid premiums are subsidized by the federal government:

$$(2) \qquad \rho_{it} = (1 - \gamma)\, E\,(I_{it})$$

where ρ_{it} is the farmer-paid premium and γ is the premium subsidy (59% for 70% coverage).

For converted grassland, where new land rules apply and assuming that crop insurance is purchased in the second year of crop production, the APH yield for crop i would evolve as:

[1] Crops could be insured during the first year of production through written agreement. Written agreements are developed (or denied) on a case-by-case basis and cannot be effectively modeled.

[2] Some researchers have argued that premiums are not actuarially fair (Just, Calvin, and Quiggen, 1999; Makki and Somwaru, 2001). RMA data shows that crop insurance losses are persistent in the Northern Plains (Glauber, 2003), suggesting that premiums are low and that our estimates of the crop insurance premiums may be, on average, higher than actual premiums.

$$
\begin{aligned}
&\bar{y}_{it}^{NL} = 0\\
&\bar{y}_{i,t+1}^{NL} = ((1-0.20)(\tilde{y}_{i,t-1} + \tilde{y}_{i,t-2} + \tilde{y}_{i,t-3}) + y_{it})/4\\
&\bar{y}_{i,t+2}^{NL} = ((1-0.20)(\tilde{y}_{i,t-1} + \tilde{y}_{i,t-2}) + y_{it} + y_{i,t+1})/4\\
&\bar{y}_{i,t+3}^{NL} = ((1-0.20)\tilde{y}_{i,t-1} + y_{it} + y_{i,t+1} + y_{i,t+2})/4\\
&\bar{y}_{i,t+\tau}^{NL} = \tau^{-1}\sum_{s=t}^{t+\tau-1} y_{is} \qquad \tau = 4, 5.
\end{aligned}
\tag{3}
$$

where $\bar{y}_{it}^{NL}$ is the APH yield for crop i at time t and $\tilde{y}_{i,t-1}$ is the transitional yield for time $t-1$. In the No Restriction scenario, where the new land rules are relaxed, the APH would evolve as:

$$
\begin{aligned}
&\bar{y}_{it}^{NR} = (\tilde{y}_{i,t-1} + \tilde{y}_{i,t-2} + \tilde{y}_{i,t-3} + \tilde{y}_{i,t-4})/4\\
&\bar{y}_{i,t+1}^{NR} = (\tilde{y}_{i,t-1} + \tilde{y}_{i,t-2} + \tilde{y}_{i,t-3} + y_{it})/4\\
&\bar{y}_{i,t+2}^{NR} = (\tilde{y}_{i,t-1} + \tilde{y}_{i,t-2} + y_{it} + y_{i,t+1})/4\\
&\bar{y}_{i,t+3}^{NR} = (\tilde{y}_{i,t-1} + y_{it} + y_{i,t+1} + y_{i,t+2})/4\\
&\bar{y}_{i,t+\tau}^{NR} = \tau^{-1}\sum_{s=t}^{t+\tau-1} y_{is} \qquad \tau = 4, 5.
\end{aligned}
\tag{4}
$$

SURE Payments Model

Payments can be made only to producers who are located in counties where a disaster has been declared (for our analysis, we assume that the Secretary of Agriculture determines that there has been a weather-related production loss of 35% or more in at least one crop), counties contiguous to disaster counties, or to any producer who experiences production 50% or more below normal levels.[3] Once a disaster is declared, the SURE payment is made when whole-farm revenue drops below a revenue guarantee:

$$D_t = \max(0.60(G_t - R_t), 0) \tag{5}$$

where G_t is the SURE guarantee and R_t is total farm revenue. The SURE guarantee depends on the level of crop insurance coverage selected by the producer, expected prices, and the producer's APH yield, but is limited to no more than 90% of expected revenue:

$$G_t = \min\left(1.2\sum_i (a_{it}\theta p_{it}^b \bar{y}_{it}),\ 0.90 \times \sum_i a_{it} p_{it}^b \max(\bar{y}_{it}, y_i^{ccp})\right) \tag{6}$$

where a_{it} is planted acreage of crop i at time t (or acreage where planting was prevented) and y_i^{ccp} is the producer's counter-cyclical payment program yield. Total farm revenue (for crops) includes market revenue, crop insurance indemnities, and commodity program payments:

$$R_t = \sum_i a_{it}(p_{it}y_{it} + I_{it} + L_{it}) + 0.15DP_t + CCP_t \tag{7}$$

where L_{it} is the per-acre marketing loan benefit, DP_t is the producer's total (farm-level) direct payment, and CCP_t is the total counter-cyclical payment.[4] When the market price of a covered commodity (e.g., corn, wheat, soybeans) drops below a fixed "loan rate," the marketing loan benefit is the difference between the loan rate and the market price:

$$L_{it} = \max((\bar{p}_i - p_{it})y_{it}, 0) \tag{8}$$

where $\bar{p}_i$ is the loan rate. The change in the SURE payment triggered by bringing new land into crop production is:

$$\Delta D_t = \max(0.60(\Delta G_t - \Delta R_t), 0). \tag{9}$$

If cropping patterns on new land reflect those of the overall farm, the per-acre change in the guarantee will be:

[3] Smith and Watts (2010) note that offering payments to individuals who experience low revenue may result in moral hazard for farmers who anticipate losses large enough to trigger crop insurance indemnities but not large enough to trigger SURE payments. Once losses are large enough to trigger crop insurance indemnities, additional losses are fully offset by indemnities (assuming the market price is at or below the insurance price, which varies depending on the insurance product purchased). Producers who destroy enough of their crop (through lax practices or outright fraud) to qualify for SURE payments would see an increase in overall revenue due to the addition of the SURE payment. We do not attempt to model this behavior but recognize that these incentives exist.

[4] Farm revenue, as specified in the text, assumes the farmer will stay with traditional commodity programs. Farmers who choose the Average Crop Revenue Election program (ACRE) will lose countercyclical payments while direct payments will be reduced by 20% and the loan rate by 30%.

$$\Delta G_t = 1.2 \sum_i (a_{it}/A_t)\theta p_{it}^b \bar{y}_{it} \text{ or } \Delta G_t = 0.90 \times \sum_i (a_{it}/A_t) p_{it}^b \max(\bar{y}_{it}, y_{it}^{ccp}) \tag{10}$$

where $A_t = \sum_i a_{it}$ is total crop acreage at time t. Under the new land rules, the per-acre change in farm revenue will be:

$$\Delta R_t = \sum_i (a_{it}/A_t)\left(p_{it}y_{it} + I_{it}^{NL} + L_{it}\right) \tag{11}$$

where I_{it}^{NL} is the crop insurance indemnity under the new land rules (the change in revenue for the No Restriction scenario is obtained by replacing I_{it}^{NL} with I_{it}^{NR}). We do not include direct and countercyclical payments because they do not apply to new land. For the sake of brevity, we assume that planting decisions on existing cropland will not be affected by land use conversion.

Risk Premiums: When facing the new land rules, the producer's risk premium—his willingness to pay for the risk reduction due to crop insurance and SURE—is defined as:

$$E\left(u(w_t + \pi_t^{NL} - \psi_t^{NL})\right) \equiv E\left(u(w_t + \pi_t^{NL} + \varphi_t^{NL})\right), \tag{12}$$

where u is utility, w_t is wealth at the beginning of period t, ψ_t^{NL} is the risk premium, π_t^{NL} is the producer's net return during period t, and φ_t^{NL} is a term that eliminates the risk reducing effect of crop insurance and SURE on converted grassland while holding expected profit and expected end-of-period wealth constant. The left hand side of Equation (12) is expected utility when crop insurance and SURE are available, less the risk premium. The right-hand side of Equation (12) is expected utility when variance reduction due to crop insurance and SURE is removed. Suppose, for example, that φ_t^{NL} is set up to remove the variance reduction due to crop insurance, and, for simplicity, assume that the producer grows only one crop. The producer's profit at time t would be: $\pi_t^{NL} = p_t y_t - c_t + I_t^{NL} - \rho_t$, where c_t is crop production cost. To remove the risk reducing effect of crop insurance without also reducing expected profit, we set $\varphi_t^{NL} = -I_t^{NL} + E(I_t^{NL})$ so that $\pi_t^{NL} + \varphi_t^{NL} = p_t y_t - c_t + E(I_t^{NL}) - \rho_t$. Effectively, φ_t^{NL} removes annual indemnity payments and replaces them with a payment that equals the expected value of the indemnity. Without the countercyclical effect of crop insurance indemnities, the variance of crop revenue would rise while the expected value payment $(E(I_t^{NL}))$ maintains expected net return equal to the case where crop insurance indemnities are paid. In other words, $\pi_t^{NL} + \varphi_t^{NL}$ is a mean preserving spread of π_t^{NL}. So, a risk averse producer will be indifferent between $\pi_t^{NL} + \varphi_t^{NL}$ and $\pi_t^{NL} - \psi_t^{NL}$.

Simulation Methods and Data

We develop a series of representative farms based primarily on county data. Underlying each representative farm is a joint distribution of prices and yields for the three predominant crops (corn, soybeans, and wheat) and grazing land. Our work builds on, but is distinct from previous efforts to develop joint price-yield distributions such as Vedenov and Powers (2008), Featherstone and Kastens (2000), and Gray et al. (2004). In this section, we (1) develop the price and yield distributions, (2) show how the mean and variance effects of program benefits are calculated using these distributions, and (3) specify the utility function, farm-level profit, and risk parameters needed (along with the joint distributions) to estimate risk premiums.

Price and Yield Distributions: The joint distribution of yields and prices for corn, soybeans, and wheat is modeled by generating correlated within-season price and yield deviates (Cooper, 2009, 2010). First, national average yields (obtained from the National Agricultural Statistics Service (NASS)) are re-expressed as within-season yield deviations for crop i in year s as $\Delta Y_{is} = (Y_{is} - E(Y_{is}))/E(Y_{is})$, where expected yields, $E(Y_{is})$ are estimated by regressing national average yields on a linear trend using data for 1975–2008. We use capital letters to denote past yields and prices, distinguishing them from the prospective yields and prices, and s to denote past years. County yields, obtained from NASS, are also transformed to deviation form (denoted as ΔY_{is}^k) where k indexes the county.

Realized harvest prices are also transformed into deviation form: $\Delta P_{is} = (P_{is} - E(P_{is}))/E(P_{is})$ where $E(P_{is})$ is the planting time expected price. We follow RMA definitions for expected (RA base) and realized prices. The expected price of corn is the average of daily closing prices in February for the December Chicago Board of Trade (CBOT) corn contract. The realized price is the average of daily closing prices during October for the CBOT December corn contract. Expected and realized soybean prices are based on the February and October prices, respectively, for the December CBOT soybean contract. For hard red spring wheat, expected and realized prices are based on March and August prices, respectively, for the Minneapolis Grain Exchange September contract.

The relationship between price and yield vectors is estimated by regressing ΔP_i on ΔY_i and other explanatory variables (z_i):

$$\Delta P_i = g\left(\Delta Y_i, z_i\right) + \varepsilon_i \tag{13}$$

where ε_i is the error term. We expect that $d\Delta P_i / d\Delta Yi < 0$, i.e., the greater the realization of national average yield over the expected level, the more likely harvest time price will be lower than the expected price. See Cooper (2009, 2010) for details.

We jointly estimate the distributions of price and yield deviations by repeated estimation of Equation (13) using a pairs bootstrap approach in a joint resampling methodology that involves drawing independent and identically distributed observations with replacement from the original data set (e.g., Yatchew, 1998). For each draw of a yield deviation, we estimate a price-yield coefficient vector using Equation (13). The procedure creates M (=1,000) coefficient vectors representing uncertainty in the yield-price relationship.

Next, deviation vectors for national and county yields, $\Delta\hat{Y}_i$ and $\Delta\hat{Y}_i^k$, respectively, i = 1,..,3, (i.e., corn, soybeans, and wheat) are generated using a block-bootstrap approach (e.g., Lahiri, 1999) in which the pairwise relationship between yield values is maintained across each crop and yield aggregation. We draw N (= 1,000) times with replacement from ΔY_i and ΔY_i^k, i = 1,..,3, k = 1,...,9, always drawing from the same row (same s) from all vectors. The simulated yield data maintains the underlying historical Pearson and rank correlation, as well as any other relationship between the variables, between county and national yield data, both within crops and across crops. For each element of the simulated national yield deviation vector (e.g., $\Delta\hat{Y}_{ni}$ where n indexes the elements of $\Delta\hat{Y}_i$) we generate M simulated price deviations for each crop based on the M price-yield coefficient vectors, resulting in an $M \times N$ (1000×1000) price deviation matrix, $\Delta\hat{P}_i$, with typical element $\Delta\hat{P}_{mni}$.

We do not extrapolate yields into the future using estimated trends. If yields are trending upward, APH yields will lag behind actual yields, decreasing the probability of a crop insurance indemnity. Modeling the trend, however, would require modeling the effect of higher yields on crop prices without other variables used in estimating price deviations. Forecasting those variables would add considerably to the uncertainty of our results.

We make two adjustments to the crop yield distributions. First, grassland is less productive, on average, than cropland. In the seven "high conversion" counties we consider, average rangeland productivity is 18% lower than average cropland productivity.[5] Because relatively high productivity rangeland is most likely to be converted to crop production, we assume that crop yields on converted grassland will be about 10% lower than on average cropland.

Second, farm-level crop yields are typically more variable than county average yields. To represent farm-level yields, county-level yield standard deviations are inflated using a method similar to that of Coble, Dismukes, and Thomas (2007). We select the inflation factor, α_{ki}, such that the APH indemnity calculated from our yield distribution is equal to the APH premium:

$$\begin{aligned} &\underset{\alpha_{ki}}{MIN}\Big[\omega_i^k - N^{-1} \\ &\quad \times \sum_n \max\Big\{p_i^{APH}\Big(\theta E(Y_{i,2008}^k) - y_{ni}^k\Big), 0\Big\}\Big]^2 \end{aligned} \tag{14}$$

where $y_{ni}^k = \hat{Y}_{ni}^k + h_{ni}((\alpha_{ki}\cdot\sigma(\hat{Y}_i^k))^2 - (\sigma(\hat{Y}_i^k))^2)^{0.5}$, $\hat{Y}_i^k$, h_{in} is a $N(0,1)$ random variable, $\sigma(\hat{Y}_i^k)$ is the

[5] Average productivity is based on land use information from the 2007 National Resources Inventory (U.S. Department of Agriculture Natural Resources Conservation Service, 2009) and the National Commodity Crop Productivity Indicator or NCCPI (Dobos, Sinclair, and Hipple, 2008).

standard deviation for $\hat{Y}_i^k$, ω_i^k is the RMA premium rate (excluding the fixed rate load), p_i^{APH} is the APH price, and the coverage rate, θ, is 0.65. The expected value and standard deviation of resulting yields are reported in Table 2. Full covariance matrices are available from the authors upon request. In the balance of the paper, we drop the county superscript (k) to reduce clutter.

Yield and price deviation vectors are also created for grazing land. We assume that grasslands are used for cow-calf operations. Cow-calf revenue per animal unit is based on Economic Research Service (ERS) farm cost and returns estimates for the Northern Plains for 1975–2008. Expected revenue is the trend revenue obtained by regressing revenue on lagged revenue, futures prices (average of July closing for fed cattle for the following year August contract, i.e., July 2002 closing prices for August 2003 contract), and a time trend. Revenue variability is based on the error term. Forage yield variability is based on Natural Resource Conservation Service Soil Survey estimates for normal years, favorable years, and unfavorable years. Following USGAO, we assume that favorable conditions are realized with 20% higher than average rainfall and unfavorable conditions occur when rainfall is 20% lower than average. Forage yields are converted to stocking rates (animal units per acre) using rules derived from Natural Resource Conservation Service technical documents (see Metz, 2007). Deviation vectors for cow-calf revenue (the "price" in dollars per AU) and stocking rate (the "yield" in AU per acre) are generated as part of the block-bootstrap procedure already described. We draw N (=1,000) times with replacement from the cow-calf revenue and forage yield vectors always drawing from the same row (same year) as crop yield vectors to maintain historical correlations between the grazing "price" and "yield" as well as with crop prices and yields.

Expected Value and Variance of Crop Revenue: As no better estimate of prices and yields (excluding the yield trend) exists for periods $t = 1,\ldots, T$ than the estimates for period 0, we assume that the density of price and yield is the same for each period, the allocation of acreage across crops is fixed, and

Table 2. Expected Yields, Standard Deviations, and County Transitional Yields

	Corn			Soybeans			Wheat		
County	Expected Yield	Yield Standard Deviation	County Transitional Yield	Expected Yield	Yield Standard Deviation	County Transitional Yield	Expected Yield	Yield Standard Deviation	County Transitional Yield
Stutsman	94.2	45.2	81	28.8	10.3	22	33.8	14.3	34
Beadle	95.8	46.9	94	30.0	14.7	30	39.8	15.9	38
Edmunds	99.8	44.3	99	27.2	12.7	28	40.7	16.3	39
Faulk	103.5	48.1	100	28.3	12.3	29	41.8	17.7	41
Hand	84.1	44.7	80	26.2	14.9	25	35.0	18.3	34
Hyde	76.6	46.2	68	25.6	15.3	25	32.8	21.3	32
Sully	67.5	38.0	71	31.6	15.9	29	32.4	20.4	31
Turner[a]	119.7	42.6	121	34.3	11.3	34	NA	NA	NA
Union[a]	131.7	49.1	132	38.7	12.7	36	NA	NA	NA

Source: ERS analysis of NASS and RMA data.

[a] Comparison counties.

total crop acres are fixed except for the conversion of grassland from within the farm. We drop time subscripts for acreages, expected (RA base) prices, realized prices, and actual yields but retain the time subscript for the APH yields because they evolve through time during the first few years of crop production.

Using the joint distribution, the expected value of crop insurance indemnities that would be denied by Sodsaver, assuming the new land rules are in force, would be:

$$E(I^{NL}) = (MN)^{-1} \sum_m \sum_n \sum_i T^{-1} \times \sum_t \delta_t (a_i/A) I_{it}^{NL}(p_{mni}, y_{ni} \mid \theta, \bar{y}_{it}^{NL}). \tag{15}$$

where T is the time horizon (=5) and δ_t is a discount factor based on a 7% discount rate. Similar expressions are used to calculate the expected value of market revenue, SURE payments, marketing loan benefits, and total revenue under RMA new land rules and the No Restriction scenario. The variance of crop revenue on converted acreage, given the new land rules, would be:

$$V(\Delta R^{NL}) = (MN)^{-1} \sum_m \sum_n T^{-1} \times \sum_t \delta_t \big(\Delta R_t(p_{mni}, y_{ni} \mid \theta, \bar{y}_{it}^{NL}) - E(\Delta R_t(p_{mni}, y_{ni} \mid \theta, \bar{y}_{it}^{NL}))\big)^2. \tag{16}$$

Other variance expressions are obtained by changing the APH calculation or excluding crop insurance and SURE from the revenue calculation. Cropland and grazing acreages are county averages from the 2007 Census of Agriculture (Table 3). The proportion of cropland in corn, soybeans, and wheat is based on 3-year averages (2005–2007) of NASS county estimates (Table 3).

Risk Premiums: To simulate risk premiums we specify utility as a power function: $u(w_t + \pi_t) = (w_t + \pi_t)^{1-\eta} / (1-\eta)$, where η is the coefficient of relative risk aversion and $w_t + \pi_t$ is end of period wealth. This function has been used previously in similar work (see Gray et al., 2004; Vedenov and Powers, 2008). End of period wealth is based on initial wealth and farm profits. Under the new land rules, farm profit is represented by:

$$\pi_t^{NL} = A\left(\sum_i (a_i/A)(p_i y_i + L_i + I_{it} - C_i - \rho_{it})\right) + D_t + CCP + DP + A_{conv}\left(\sum_i (a_i/A)(p_i y_i + L_i + I_{it}^{NL} - C_i - \rho_{it})\right) + \Delta D_t^{NL} + (A_g - A_{conv})(R_g - C_g) \tag{17}$$

where A is crop acreage before conversion; P_i is market price for crop i; y_i is the yield; L_i is the marketing loan benefit; I_{it} is the crop insurance indemnity, C_i is per-acre cost; and ρ_{it} is the per-acre insurance premium; D_t is the SURE payment; CCP is the countercyclical payment; DP is the direct payment; A_{conv} is acreage converted from grass to crops; I_{it}^{NL} is the indemnity on converted land; ΔD_t^{NL} is the change in SURE payment due to conversion; A_g is grazing acreage before conversion; R_g is annual per-acre grazing land revenue, and C_g is annual per-acre grazing land (beef cow-calf) cost. Finally, to complete the specification of the RHS of Equation (12), φ_t^{NL} eliminates the counter cyclical effect of crop insurance and SURE payments on acres converted from grassland to cropland:

$$\varphi_t^{NL} = A_{conv}\left(\sum_i (a_i/A)(E(I_{it}^{NL}) - I_{it}^{NL})\right) + E(\Delta D_t^{NL}) - \Delta D_t^{NL}. \tag{18}$$

Other data needed to specify farm profits are given in Table 3. While the price-yield distributions are used to specify revenue, crop-specific non-land production costs are based on ERS estimates for the Northern Great Plains for 2007 (we assume that net return is the residual return to land). Production costs are aggregated using crop proportions as weights. Non-land cost per animal unit in the Northern Great Plains is obtained from the ERS and converted to cost per acre using the estimated stocking rate.

Initial wealth is based on the county average value of land and buildings, adjusted for the

Table 3. Acreages, Initial Wealth, and Production Costs in Representative Farms

County	Initial Cropland[c]	Initial Grassland[c]	Converted Grassland[b]	Proportion of Land Rented[c]	Initial Wealth[f]	Corn[d]	Soybeans[d]	Wheat[d]	Crop Cost[e]	Grazing Cost[e]
	Acres				Dollars	Proportion of Cropland			Dollars per Acre	
Stutsman	932	155	23	0.48	403,326	0.16	0.55	0.28	207.63	128.08
Beadle	756	231	35	0.47	579,196	0.39	0.41	0.20	234.07	155.41
Edmunds	972	560	84	0.39	798,872	0.33	0.39	0.28	225.71	118.38
Faulk	1,334	684	103	0.42	982,699	0.23	0.43	0.34	214.13	124.69
Hand	1,026	777	116	0.40	856,701	0.29	0.22	0.49	217.35	143.67
Hyde	1,016	1,594	239	0.46	764,702	0.20	0.05	0.76	200.56	123.20
Sully	2,556	471	71	0.44	1,308,987	0.18	0.05	0.77	198.24	127.69
Turner[a]	451	43	6	0.54	317,515	0.53	0.47	0.00	254.14	198.19
Union[a]	471	41	6	0.57	256,874	0.52	0.48	0.00	253.25	126.55

[a] Comparison counties.
[b] 15% of initial grassland.
[c] Source: Census of Agriculture 2007.
[d] Source: NASS county crop data 2005–2007.
[e] Source: ERS Farm Costs and Returns estimates (operating costs and allocated overhead, except land).
[f] Source: Census of Agriculture and ERS data, see text.

average proportion of land rented (ranges from 43 to 61%, based on the 2007 Agriculture Census) and debt-to-asset ratio (0.17, based on the 2007 ERS farm balance sheet for the Northern Plains). Over the 5-year period of the Sodsaver sanction, a producer's actual wealth could accumulate (decline) as farms experience profits (losses) possibly reducing (increasing) the risk premium in years 2–5. Given the uncertainty surrounding initial wealth in years 2–5, we elect to calculate a risk premium for each year using initial wealth based on the 2007 Agriculture Census data (i.e., assuming $w_t = w_0$, $t = 1,\ldots4$) and report the 5-year net present value (NPV) of annual risk premiums.

Finally, we assume that the coefficient of relative risk aversion is constant and equal to 2 (see Harwood et al., 1999) but test the sensitivity of the model using values of 1.5 and 2.5. A range of values have been estimated for U.S. agriculture. Many studies report values in the range of 1–3, as reported in Table 2 of Saha, Shumway, and Talpaz (1994), although some studies report higher values, at least on the upper end of a range (e.g., Chavas and Holt (1990) report a range 1.42–6.76 for constant relative risk aversion). More recently, Lence (2000) reports an estimated constant relative risk aversion of 1.136. Just and Peterson (2003) also suggest that many risk aversion coefficient values reported in the literature are implausibly high. So, we consider only a relatively narrow range of values. We also consider changes in acreage and debt-to-asset ratio.

Simulation Results

Sodsaver would deny crop insurance and, by extension, SURE payments during the first 5 years of crop production on converted grassland. Under RMA new land rules, the 5-year net present value of crop insurance and SURE payments (what would be withheld under Sodsaver) range from \$26 per acre (Stutsman County) to \$58 per acre (Hyde and Sully) in high conversion counties and are \$29–\$36 in the comparison counties (Table 4, Column 3). As a percentage of total expected crop revenue on converted grassland, expected payments range from just over 2% to just over 5% in high conversion counties and are less than 2% in

Table 4. Expected 5-year NPV of Net Crop Insurance Indemnities and SURE Payments

Column	New Land Rules					No Restriction Scenario				
	1	2	3	4	5	6	7	8	9	10
County	Net Indemnity	SURE Payment	Total	Percent of Total Revenue	Percent of Net Return	Net Indemnity	SURE Payment	Total	Percent of Total Revenue	Percent of Net Return
	—Dollars per Acre—			—Percent—		—Dollars per Acre—			—Percent—	
Stutsman	21.14	4.96	26.10	2.11	4.92	31.31	7.66	38.96	3.12	7.17
Beadle	40.08	9.43	49.51	3.52	8.06	62.63	17.27	79.91	5.56	12.40
Edmunds	35.04	11.49	46.54	3.40	7.70	55.88	19.79	75.67	5.41	11.94
Faulk	31.73	10.59	42.32	3.05	6.39	50.74	18.40	69.14	4.89	10.04
Hand	40.52	11.29	51.81	4.23	10.64	61.14	18.55	79.70	6.37	15.48
Hyde	42.67	15.49	58.16	5.09	12.54	63.12	24.45	87.57	7.47	17.76
Sully	41.02	17.41	58.44	5.36	13.99	61.65	27.89	89.54	7.99	19.95
Turner[a]	22.37	6.83	29.20	1.69	3.37	39.45	13.28	52.74	3.01	5.92
Union[a]	27.89	8.22	36.11	1.88	3.38	46.89	14.20	61.09	3.13	5.59

[a] Comparison counties.

both of the comparison counties (Table 4, Column 4).

If RMA new land rules were eliminated or by-passed, crop insurance indemnities and SURE payments could be considerably larger. For the No Restriction scenario in high conversion counties, the 5-year NPV of crop insurance and SURE payments ranges from $39 per acre in Stutsman County (Table 4, Column 8), a 50% increase from new land rules (compare Columns 3 and 8), to nearly $90 per acre in Sully county, a 47% increase from new land rules. In the comparison counties, the 5-year NPVs also increase by roughly 50%. As a percentage of total revenue, the difference in expected net indemnities and SURE payments between the new land rules and the No Restriction scenario ranges from about 1% of total revenue (Stutsman; subtract column 4 (2.11%) from column 9 (3.12%) in table 4) to more than 2.5% of revenue (Sully) in the high conversion counties and are about 1.5% in the comparison counties.

Stutsman County is somewhat of an outlier among high conversion counties—expected payments in all other high conversion counties are considerably higher both in absolute dollars and relative to total revenue. A key difference between Stutsman and other high conversion counties is that crop insurance transitional yields are low relative to expected yields (Table 2). For most counties and crops, our expected yields (which are 10% less than county average expected yields) are very close to the transitional yields. For corn and soybeans in Stutsman County, however, transitional yields are 13 and 21% less than expected yields, respectively. Lower transitional yields lead to lower APH yields which, in turn, mean higher premium rates and lower guarantees for both crop insurance and SURE, leading to less frequent and smaller net crop insurance indemnities and SURE payments.

Simulation results reported in Table 4 consider only the 5 years of the Sodsaver moratorium. Over a longer time horizon the effect of Sodsaver, *expressed as a percentage of total crop revenue*, would decline as farmers become fully eligible for crop insurance and SURE on converted grassland at the end of the 5-year Sodsaver moratorium. In Hyde County, for example, Sodsaver reduces the NPV of expected revenue on converted grassland by 5.1% over 5 years (under new land rules), 2.8% over 10 years, and 2.2% over 15 years.

Results are also based on 2008 when crop prices were at historically high levels. Lower expected prices at planting time, however, would have little effect on expected crop insurance indemnities and SURE payments because these programs protect farmers against loss of revenue due to unexpectedly low yields or large intra-season price declines. In Hyde County, for example, expected net revenue from crop insurance and SURE payments would remain at or near their base levels (roughly $60 per acre under new land rules), even as the expected prices of corn, soybeans, and wheat all drop to 50% of base levels (assuming price volatility does not change). Expected marketing loan benefits, however, are designed to protect farmers against low prices in an absolute sense. When producers expect prices that are 70% of 2008 levels, expected marketing loan benefits begin to rise and continue rising as expected prices decline, supporting expected revenue against further decline. Marketing loan benefits are not subject to Sodsaver sanctions.

Lower expected yields would have a larger impact on net indemnities and SURE payments because they also imply higher yield variability. Based on research by Skees and Reed (1986), RMA rating assumes an inverse relationship between expected yields and yield variability. When yields are 10% lower than reported in Table 2, estimated net indemnities and SURE payments in Hyde County for the new land rules would be about $65 per acre, compared with $58 in our base results, a decline of $7 per acre. The 5-year NPV of market revenue also drops from $1085 to $978, a decline of $107 per acre. So, the increase in expected net indemnities and SURE payments would offset less than 7% of the expected revenue reduction due to lower yields. If some production costs are also lower, reduction in net return may be less than $107 per acre.

Standard deviations of crop revenue and risk premiums are reported in Table 5. With Sodsaver in force, the range of average annual standard deviations in high conversion counties is 27 to 48% of expected market revenue and 25 to 26% in comparison counties (Table 5, Column 2).

Table 5. Revenue Variability and Risk Premiums

	Market		New Land Rules				No Restriction Scenario			
Column	1	2	3	4	5	6	7	8	9	10
County	Average Annual Standard Deviation		Average Annual Standard Deviation	Standard Deviation of 5-year NPV	Risk Premium		Average Annual Standard Deviation	Standard Deviation of 5-year NPV	Risk Premium	
	Dollars per Acre	Percent Expected Revenue	Percent Expected Revenue		Dollars per Acre	Percent Expected Revenue	Percent Expected Revenue		Dollars per Acre	Percent Expected Revenue
Stutsman	64.02	26.50	23.96	16.00	10.09	0.84	22.80	15.15	13.85	1.15
Beadle	81.89	30.15	26.23	17.58	10.96	0.81	24.05	15.94	15.23	1.12
Edmunds	78.00	29.48	25.26	16.97	10.22	0.77	22.94	15.19	14.62	1.10
Faulk	79.43	29.52	25.70	17.20	10.75	0.80	23.56	15.59	15.40	1.14
Hand	80.45	34.33	29.54	19.82	12.22	1.04	27.18	18.04	17.16	1.46
Hyde	101.28	46.66	40.96	27.40	21.32	1.96	38.27	25.37	29.66	2.73
Sully	98.24	47.63	41.31	27.68	20.43	1.98	38.28	25.36	27.95	2.71
Turner[a]	85.76	25.24	22.92	15.30	15.81	0.93	21.30	14.10	20.47	1.21
Union[a]	97.74	25.87	23.27	15.54	20.34	1.08	21.73	14.39	28.30	1.50

[a] Comparison counties.

Under the new land rules (in the absence of Sodsaver), the average annual standard deviation in high conversion counties varies from 24% (Stutsman) to 41% (Sully) of expected market revenue, reductions ranging from 3 to 7% of market revenue (Table 5, Column 3). In comparison counties, average annual standard deviations for market revenue are roughly 25% of expected market revenue with Sodsaver and would be about 23% under the new land rules. (Similar results for the No Restriction scenario are in Table 5, Column 7).

Farmers may be able to smooth out year-to-year fluctuations in revenue through borrowing or the timing of major purchases such as machinery or consumer durable goods (Just, 2003). Variability over a period of years, however, is more difficult to avoid and may be a better indicator of the additional risk faced by producers subject to Sodsaver. If we consider the 5-year moratorium as a whole, the revenue standard deviations fall by roughly one third for both the new land rule (Table 5, Column 4) and the No Restriction scenario (Table 5, Column 8). In Sully County, for example, average annual standard deviation under the new land rules is 41% of expected market revenue while the standard deviation of the 5-year NPV is 28% of expected market revenue.

The 5-year net present value of annual risk premiums, based on revenue under the new land rules, vary from about 0.77% of expected market revenue (Edmunds) to just under 2% (Hyde and Sully) in high conversion counties (Table 5, Column 6). In the comparison counties, risk premium estimates are 0.93% (Turner) and 1.08% (Union). In the No Restriction scenario, estimated risk premiums range from 1.1% (Edmunds) to 2.7% (Sully) of market revenue (Table 5, Column 10). Estimated risk premiums are higher for the No Restriction scenario because the loss of risk reduction is greater than under the new land rules—that is, in the absence of the new land rules, producers facing Sodsaver would have more to lose. Using some alternate values of the risk aversion coefficient, the amount of land converted, and debt-to-asset ratio, risk premiums can be as high as 2.5% for the new land rules and 3.5% in the No Restriction scenario (Table 6). We note that these estimates

Table 6. Estimated Risk Premium for Risk Reduction due to Crop Insurance and SURE, as a Percentage of Market Revenue

Constant Relative Risk Aversion	Grassland Converted (%)	Debt-to-Asset Ratio		Stutsman	Beadle	Edmunds	Faulk	Hand	Hyde	Sully	Turner[a]	Union[a]
Base case												
2	15	0.17	New land	0.84	0.81	0.77	0.80	1.04	1.96	1.98	0.93	1.08
			No Restriction	1.15	1.12	1.10	1.14	1.46	2.73	2.71	1.21	1.50
Sensitivity analysis												
1.5	15	0.17	New land	0.66	0.65	0.58	0.60	0.78	1.46	1.51	0.76	0.87
			No Restriction	0.90	0.93	0.83	0.86	1.10	2.03	2.06	1.21	1.12
2.5	15	0.17	New land	1.01	1.01	0.96	1.00	1.31	2.48	2.47	0.93	1.22
			No Restriction	1.36	1.40	1.34	1.43	1.84	3.44	3.35	1.38	1.79
2	5	0.17	New land	1.16	1.02	0.82	0.82	1.07	1.76	2.09	1.86	1.73
			No Restriction	1.57	1.40	1.18	1.14	1.48	2.44	2.89	2.41	2.25
2	15	0.34	New land	1.01	0.97	0.96	0.98	1.34	2.55	2.46	0.93	1.16
			No Restriction	1.36	1.40	1.34	1.40	1.86	3.52	3.33	1.21	1.50

[a] Comparison counties

are based on annual variance because previously estimated risk parameters are based on annual variance.

Finally, using the sum of estimated change in expected revenue and the risk premium along with land use change elasticities from the literature, we estimate the potential effect of Sodsaver on land conversion. Lubowski, Plantinga, and Stavins (2008) report a comprehensive set of land conversion elasticities. For rangeland conversion with respect to cropland returns they report values of 0.35 or less, although none are significantly different from zero. For pasture conversion, estimated elasticities are as high as 0.38 and are all significantly different from zero. Barr et al. (2010) recently estimated that cropland acreage would increase by 0.029% for a 1% increase in net return to crop production. Although not directly comparable to the values reported by Lubowski, Plantinga, and Stavins (2008), they do support the finding that major land use is not highly responsive to short run economic conditions. Ahmed, Hertel, and Lubowski (2008) show that, even in the long run, it is reasonable to assume that land use is relatively inelastic with respect to crop returns. Because previously reported values are likely to depend on geographic scope and overall economic conditions for the periods studied, actual response in high conversion counties may differ. We consider conversion elasticities between 0.1 and 0.5.

The effect of Sodsaver on net return to crop production (the change in expected revenue plus the risk premium) would be largest in Hand, Hyde, and Sully counties. Under the new land rules, net crop insurance indemnities and SURE payments would account for 11.6, 12.5, and 14.0% of net return, respectively (Table 4, Column 5). Adding in associated risk premiums and assuming that our best estimate of grassland-to-cropland conversion with respect to cropland net return is 0.3, these changes in net revenue reduce conversion by 3.8%, 4.9%, and 5.4% in Hand, Hyde, and Sully Counties, respectively (Figure 1). The change in expected return (without the risk premium) accounts for 81%, 73%, and 74% of the effect in Hand, Hyde, and Sully counties, respectively, indicating the slowdown in conversion would be 19 to 27% less if producers are, in fact, risk neutral. In the comparison counties (Turner and Union), Sodsaver would reduce net return to crops on converted grassland by about 4.4% which translates to reduction in grassland conversion of less than 2% if the elasticity of land conversion is 0.3. The change in expected return (without the risk premium) accounts for about 77% of the land use effect in these counties, implying that risk neutral producers would slow conversion by 23% less than risk averse producers with constant relative risk aversion of 2. If conversion elasticities are actually very low, the change in conversion could be as little as 0 to 3%. If elasticities are on the high side of our range, the slow-down of conversion could be as much as 2.5 to 9%.

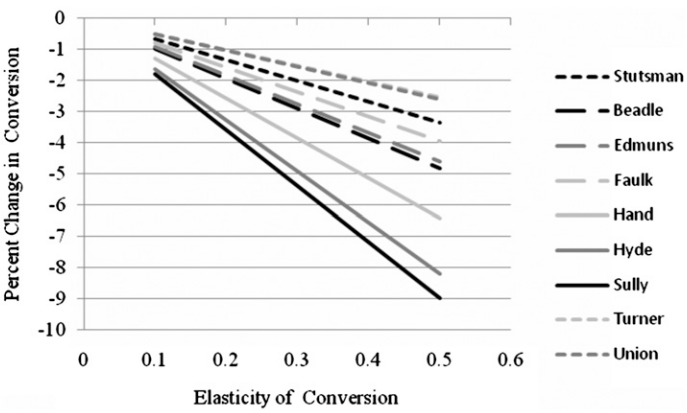

Figure 1. Potential Reduction in Grassland to Cropland Conversion Due to Sodsaver when New Land Rules are in Force

Conclusion

We found significant variation in the potential effect of Sodsaver between high conversion and comparison counties and also among the high conversion counties themselves. In a small group of counties (Hand, Hyde, and Sully), the effect of Sodsaver would be relatively large, reducing total expected revenue by 4.2 to 5.4% and expected net return by 10 to 14%. Other high conversion counties (Beadle, Edmunds, Faulk, and Stutsman) would experience more modest effects, with Sodsaver-induced reductions in expected revenue of between 2.1% and 3.4% and reductions in net return of 4.9 to 7.7%. Comparison counties experienced the smallest effects of 1.7 to 1.9% reductions in expected revenue and a reduction of roughly 3.4% in expected net return. Risk effects would be even more varied. Hyde and Sully counties stand out with estimated risk premiums approaching 2% of expected revenue. In other high conversion counties, however, risk premiums vary between 0.8 and 1.0% while comparison counties have risk premiums of 0.9 to 1.1%.

SURE payments would be a significant share (20–25%) of benefits subject to Sodsaver. The ultimate effect of SURE on land use and other production decisions may depend on whether farmers view SURE as a more stable, reliable source of disaster assistance compared with ad hoc programs which have been the norm in recent years. Greater certainty about disaster assistance could make farmers more willing to include it when "penciling out" grassland conversion decisions. On the other hand, farmers may already consider disaster assistance when making these decisions, given the frequency of ad hoc disaster programs.

Crop insurance and SURE provide producers with protection against intra-season losses due to an unexpected drop in crop yield or price. Producers can receive benefits when expected crop prices are at historically high levels (as in our analysis), providing some protection against loss when market-based conversion incentives are highest. Marketing loan benefits, on the other hand, protect producers against low absolute prices. For our base (2008) prices, the possibility of marketing loan benefits is remote. If prices fall dramatically or if Congress elects to raise loan rates, producers could, once again, receive marketing loan benefits. Of course, lower crop prices would also mean sharply reduced conversion incentives. Again, we note that marketing loan benefits are not subject to Sodsaver.

Finally, would the Sodsaver sanction be large enough to make a difference in land use conversion? Previous studies imply that major land use change is not very responsive to changes in revenue or net return. If that is true, the reduction in conversion due to Sodsaver is likely to be modest even in counties where the effect of Sodsaver would be relatively large. Even when considering relatively large conversion elasticities, estimated reduction in grassland to cropland conversion is 9% or less.

Temporarily denying crop insurance and SURE payments on converted grassland may not be enough to stop native grassland conversion. Many other factors may also be at work: Long term changes in policy, technology, and markets may be encouraging farmers to convert grassland to cropland. Farm program changes from the mid-1990s allow producers to expand crop production beyond base acreage and shift to non-traditional crops without risking loss of commodity payments. The availability of genetically modified corn and soybeans has triggered a switch from wheat to corn and soybeans all along the western edge of the traditional Corn Belt. The switch may also be drawing strength from explosive growth in corn demand for ethanol production and other purposes.

Given the limited effect of Sodsaver on farm program benefits, it should not be surprising that its land use effect is also modest. The Wetland Conservation or "Swampbuster" provision is a policy model with more significant sanctions. Under Swampbuster, farmers who drain wetlands could lose nearly all farm program payments throughout the farm—not just on drained acres. Although crop insurance is not currently subject to Swampbuster sanction, producers could lose direct payments, countercyclical payments, marketing loan benefits, Conservation Reserve Program payments, and other program benefits. A similar provision, designed to conserve native grassland, could provide a stronger disincentive to grassland conversion than we estimate for the current Sodsaver provision.

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