The Rising Cost of U.S. Crop Insurance under Climate Change

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Abstract

This paper quantifies how climate change affects federal outlays on premium subsidies in the U.S. Federal Crop Insurance Program under the status quo subsidy schedule. Using the dynamic model of land use and insurance choice developed in Obolensky (2026), I compare a stationary-climate baseline to a climate-change counterfactual over 2030–2050 and compute equilibrium paths for premiums, insurance participation and contract choice, cultivated acreage, and prices. Climate change increases aggregate subsidy outlays by 9.9% on average over 2030–2050. Fiscal impacts are highly spatially heterogeneous, with county-level changes ranging from -30% to 60%. To clarify mechanisms, I implement a Shapley-value accounting decomposition that separates the change in subsidy outlays into four channels: (i) premium growth driven by shifts in yield loss risk, (ii) changes in insurance participation and contract choice, (iii) changes in cultivated area and crop allocation that alter subsidized exposure, and (iv) premium growth driven by equilibrium price feedbacks induced by aggregate acreage adjustment. The results show that higher loss risk is the dominant driver of subsidy growth, insurance demand modestly amplifies spending, and land-use adjustment partially offsets fiscal exposure by reducing insured acres and shifting production toward relatively safer crops. However, land-use adjustment also raises equilibrium prices, increasing insurance liability and placing upward pressure on premiums. The results provide a transparent mapping from climate risk into federal fiscal exposure under current crop-insurance policy and clarify how endogenous adaptation reshapes subsidy growth.

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1 Introduction

The U.S. Federal Crop Insurance Program (FCIP) is the central federal instrument for insuring agricultural production risk. Through subsidized, federally regulated contracts, the program provides indemnities for yield and revenue losses caused by adverse natural events and price shocks, and it has grown into a core component of farm safety-net spending. Participation is widespread: in 2024, roughly 89% of acreage in major field crops was enrolled in FCIP, and premium subsidies alone totaled $10.4 billion (United States Department of Agriculture, Economic Research Service 2025).[1] As climate change increases the frequency and severity of weather extremes that drive crop losses, a first-order policy question is how the fiscal cost of FCIP premium subsidies will evolve over time and across space under current program rules.

Climate risk maps into federal outlays through a small number of accounting channels. Premium rates are regulated and set by actuarial rating at the county–crop–plan level, so increases in expected losses or prices raise posted premiums.[2] Premium subsidies are then determined by a statutory coverage-level schedule that reduces producer-paid premiums and scales federal spending with insured liability. Under this structure, a warmer and more volatile climate tends to increase premiums, but the resulting fiscal impact is not purely mechanical: producers can respond endogenously by adjusting insurance participation and contract choice and by reallocating land across crops or into fallow, altering the insured exposure base on which subsidies are paid. Quantifying the program's fiscal exposure to climate risk therefore requires an approach that simultaneously disciplines how local climate shifts the distribution of insured losses and accounts for endogenous adaptation on both the insurance and land-use margins.

This paper provides such a quantification under the status quo subsidy schedule. I use the dy-

1. I focus on corn, soybeans, and wheat in agricultural counties west of the 100th meridian, where dryland production is broadly comparable and where the model is estimated. In the stationary-climate baseline, producers in this sample receive about $3.7 billion in premium subsidies per year (in 2020 dollars).

2. FCIP operates as a public–private partnership in which private insurers sell and service policies, while the U.S. Department of Agriculture (USDA) regulates contracts and premium rates and subsidizes both producer premiums and certain administrative and operating costs. This paper focuses on premium subsidies and abstracts from delivery costs and underwriting gains.

namic structural model of crop allocation and insurance choice developed in Obolensky (2026) to evaluate how climate change affects equilibrium premiums, insurance take-up and contract choice, and land use, and how these equilibrium responses translate into federal premium-subsidy outlays.[3] I compare two environments over 2030–2050 that differ only in the evolution of climate risk: a stationary-climate baseline, and a climate-change counterfactual constructed from downscaled projections under a moderate emissions scenario (RCP4.5). In both environments, the insurance menu and statutory subsidy schedule are held fixed, while posted premiums adjust endogenously to remain actuarially fair given the model-implied distribution of yield and revenue outcomes.

The results show that climate change increases premium-subsidy outlays under the status quo subsidy schedule, with effects that grow over time and vary sharply across space. Aggregating across the simulated equilibrium, climate change increases premium-subsidy spending by 9.9% on average over 2030–2050, roughly $365 million dollars annually. Fiscal impacts are highly heterogeneous across counties, ranging from roughly −30% to 60%. This heterogeneity reflects both spatial variation in how climate change shifts loss risk and endogenous responses in insurance participation and land use that reshape insured exposure.

I use a Shapley-value accounting decomposition that separates the change in subsidy outlays into four channels: (i) premium growth driven by shifts in yield loss risk, (ii) changes in insurance participation and contract choice, (iii) changes in cultivated area and crop allocation that alter subsidized exposure, and (iv) premium growth driven by equilibrium price feedbacks induced by aggregate acreage adjustment. Over 2030–2050, higher loss risk is the dominant driver of subsidy growth (14%), increased insurance demand modestly amplifies spending (2.3%), and land-use adjustment partially offsets fiscal exposure by reducing insured acres and shifting production toward relatively safer crops −8.7%. At the same time, land-use adjustment raises equilibrium prices, increasing insurance liability and placing upward pressure on premiums and

3. Premiums depend on planting-time beliefs about both yields and prices. Because crop prices are equilibrium objects that respond to aggregate acreage, premiums reflect both physical climate risk and general-equilibrium price feedbacks induced by adaptation.

subsidy (2.4%), so adaptation has countervailing fiscal effects.

Related literature and contributions. In addition to the methodological advances detailed in Obolensky (2026), this paper contributes to two bodies of work.

First, a long tradition in climate-economy modeling translates physical climate risks into economic damages by combining climate projections with sector-specific response functions, beginning with integrated assessment models (IAMs) and evolving toward empirically grounded damage-function architectures (Nordhaus 1991; Hope 2006; Stern 2007; Dell, Jones, and Olken 2012; Burke, Hsiang, and Miguel 2015; Hsiang et al. 2017). A parallel and growing macro-public-finance literature emphasizes that physical climate risk can propagate to the public balance sheet through higher spending needs, changes in tax bases, and sovereign risk premia and borrowing costs (Barrage 2020, 2024; Cevik and Jalles 2022; Mallucci 2022). Within U.S. agriculture, recent work has begun to quantify how warming can affect crop-insurance pricing and outlays under existing program rules (Tack, Coble, and Barnett 2018; U.S. Department of Agriculture, Economic Research Service 2024). This paper contributes a micro-founded case study of fiscal climate exposure by mapping projected changes in agricultural risk federal premium-subsidy outlays under the status quo subsidy schedule.

Second, a large empirical literature emphasizes that credible long-run damage assessments must grapple explicitly with adaptation and heterogeneity in vulnerability, including endogenous adjustments in technology, management, cropping patterns, and land use, as well as the costs and limits of these responses (Barreca et al. 2016; Burke and Emerick 2016; Hornbeck and Keskin 2014; Costinot, Donaldson, and Smith 2016; Carleton et al. 2022; Gammans and Mérel 2025; Hultgren et al. 2025). This paper contributes to that agenda by transparently separating actuarial changes in insured losses from endogenous responses in insurance participation, contract choice, and land allocation, thereby quantifying how adaptation mediates the pass-through from climate risk into FCIP subsidy spending.

2 Context

The FCIP is the primary federal instrument for subsidizing insurance against agricultural production risk in the United States. Through Multi-Peril Crop Insurance, the program protects farmers against unavoidable losses in crop yield or revenue caused by adverse natural events, including droughts, floods, pests, and disease.

The contracts offered through the program are sold and serviced by private insurers but designed and regulated by the U.S. Department of Agriculture (USDA). This paper focuses on two widely used individual products—Yield Protection (YP) and Revenue Protection (RP)—each available at multiple coverage levels. YP insures against yield shortfalls relative to a guaranteed yield and values indemnities using the planting-time price election (disciplined by futures prices). RP insures against revenue shortfalls and includes a harvest-price feature in which the guarantee is computed using the higher of a planting-time projected price and a harvest price. This feature makes the expected value of RP payouts sensitive to planting-time beliefs about the distribution of prices, including the likelihood of price increases between planting and harvest. In the model, I capture this price component through planting-time price beliefs—using the mean belief for YP and the full belief distribution for RP—rather than by simulating realized harvest prices. Coverage choices determine insured liability and therefore the level of expected payouts that underlie premiums and subsidy outlays.

Premium rates are regulated and set using actuarial rating—tied to expected payouts implied by the rating formula—rather than determined through price competition among insurers. Federal premium subsidies are determined by a statutory coverage-level schedule.[4] The schedule reduces producer-paid premiums and generates federal outlays that scale with insured exposure. Subsidy spending depends mechanically on planted acres, take-up, coverage choice, and premiums. Consistent with this institutional design, the fiscal object of interest in this paper

4. In the status quo, premium subsidy rates vary with the elected coverage level. Subsidy rates are highest at low coverage and decline with coverage: 67% at 50% coverage, 64% at 55% and 60%, 59% at 65% and 70%, 55% at 75%, 48% at 80%, and 38% and 85%.

is premium subsidy outlays. I abstract from other components of program finance—including administrative and operating reimbursements to insurers and reinsurance transfers—and focus on how climate change shifts subsidy outlays under the status quo subsidy schedule.

3 Empirical Strategy

This section outlines the empirical framework developed in Obolensky (2026) and summarizes the estimation steps and counterfactual algorithm.

3.1 Setup

Farmers are forward-looking price takers who operate a single-crop technology in each period. Each year, farmers make planting and crop insurance decisions before yields and prices are realized. During the pre-planting season (January–March), a farmer first decides whether to cultivate their land and, if so, which crop to plant. Conditional on the planting decision, the farmer then chooses a crop insurance product and coverage level in a static discrete-choice problem. The insurance menu consists of yield and revenue products. Yield Protection (YP) truncates the yield distribution, whereas Revenue Protection (RP) truncates the revenue distribution; in both cases, the degree of truncation is determined by the chosen coverage level.

Farmers base planting and insurance decisions on posted premiums and subsidies, past land use, and planting-time beliefs about the upcoming growing-season yield and price distributions. When forming price beliefs, farmers recognize that international markets clear and that equilibrium prices depend on global production and demand conditions.

Risk preferences discipline insurance demand: holding beliefs and prices fixed, more risk-averse farmers value the truncation provided by higher coverage and by revenue insurance. Dynamic incentives arise in crop choice because land use is history dependent. Switching costs and rotation benefits generate persistence in crop allocations and allow the model to match observed crop rotation patterns. Figure 1 summarizes the timing of planting, insurance purchase, and payoff realization in the model.

[FIGURE 1 ABOUT HERE]

Impact of climate change. Climate change affects decisions through planting-time beliefs about the distribution of yields and prices. Local climate conditions enter yields through crop-specific responses to growing-season heat and precipitation, and projected climate change alters not only the expected level of these conditions but also their variability and the likelihood of extreme realizations. As a result, the distribution of yield outcomes that farmers anticipate at planting becomes more dispersed and places greater probability mass on adverse states, generating county- and crop-specific changes in downside risk. Crop prices are determined in equilibrium through world production and consumption, so global climate shocks likewise widen the distribution of equilibrium prices by increasing uncertainty about aggregate supply conditions. Finally, because U.S. planting decisions contribute to aggregate production, endogenous acreage choices feed back into planting-time crop prices, linking local adaptation decisions to the distribution of revenue risk that is relevant for insurance demand and ultimately the fiscal costs of the crop insurance program.

3.2 Data, sample, and estimation

Data. Climate is summarized by three moments of the distribution: extreme degree days above 30°C, growing degree days between 10 and 30°C, and precipitation. These measures are constructed from PRISM (2011-2022) and from NASA downscaled projections under RCP4.5 (2016-2050). I construct land use using the USDA CropLand Data Layer (CDL). To reduce pixel-level misclassification and obtain stable rotation measures, I aggregate the CDL to a coarser 600m-grid and construct county-level two-lag transition frequencies across corn, soybeans, wheat, and fallow. Crop-insurance enrollment, paid premiums, and indemnities come from the RMA Summary of Business. Realized yields and prices are taken from USDA-NASS. Pre-planting futures prices from CBOT are used to discipline planting-time price beliefs in-sample, and auxiliary production, trade, and cost data are used to discipline equilibrium price responses when simulating out of sample.

Sample. The main estimation sample includes counties west of the 100$^{\text{th}}$ meridian that have persistent agricultural area and stable crop composition over 2008–2020. Specifically, a county is selected if (i) it lies west of the 100$^{\text{th}}$ meridian[5], (ii) at least 5% of its area is classified as agricultural land in the CDL in every year of the sample period, and (iii) at least 60% of its agricultural area is allocated to one of the three focal crops—corn, wheat, or soybeans—in every year of the sample period. Farmers decisions in other U.S. counties are not endogenized but participate in determining equilibrium crop prices, in the same way non U.S. countries.

Estimating crop insurance demand parameters (static block). To estimate insurance demand, I recover planting-time yield beliefs and combine them with futures-based price beliefs to compute each insurance plan's expected net revenue and revenue variance at the time of choice. I then estimate a static discrete-choice model of insurance demand by matching county-level plan shares across coverage levels and contract types. Identification comes from within-county, within-year differences in expected returns and risk across contracts generated by yield-risk beliefs and futures-implied price risk. For details on estimation see Obolensky (2026).

Estimating crop choice parameters (dynamic block). Because futures prices are not observed off the realized path, I construct price beliefs for the dynamic crop-choice problem using the calibrated crop demand-and-trade block together with beliefs over aggregate acreage. I then estimate dynamic crop-choice parameters by maximum likelihood using nested fixed point. Switching costs and rotation benefits are identified from land-use transitions conditional on expected net returns, allowing the model to rationalize persistence in crop allocations while still generating economically meaningful responses to changes in relative profitability and risk. Empirically, the estimates imply strong history dependence in land use consistent with observed

5. As a result, I focus on counties where dryland production practices are relatively comparable to reduce confounding from irrigation-intensive systems that are not explicitly modeled.

rotation patterns.

3.3 Counterfactual Design

I simulate equilibrium outcomes over 2020–2050 under two environments that differ only in the evolution of climate risk.[6] The first is a stationary-climate baseline (NoCC) in which the distribution of climate variables is held fixed at its recent historical benchmark, constructed as the average climate distribution over 2016–2020. The second is a climate-change counterfactual (CC) that follows projected climate paths under a moderate emissions scenario (RCP4.5). In both environments, the insurance menu and the statutory premium-subsidy schedule are held fixed at their status quo values. Given each climate environment, I combine the projected climate inputs with the estimated yield-weather relationships and the demand-and-trade block to update insurance premiums and planting-time beliefs on yields and crop prices, construct insurance payoffs, and solve for the resulting equilibrium paths of land use and insurance choices.

4 Fiscal Costs under Climate Change

This section quantifies how projected climate change affects federal outlays on premium subsidies in the FCIP under the status quo statutory subsidy schedule. The fiscal object of interest is premium-subsidy spending, which depends on cultivated acres, insured exposure and insurance premiums. Let m index counties, k index crops, and t index years. Government spending in year t can be written as

$$G_t = \sum_{m,k} A_{mkt} \sum_{j \in \mathcal{J}} \sigma_{jmkt} \, s_j \text{Premium}_{jmkt}, \tag{1}$$

where A_{mkt} denotes cultivated acres, σ_{jmkt} is the share of acres enrolled in product j in county m in year t, s_j is the statutory subsidy rate for product j and Premium_{jmkt} is the posted premium per acre.

6. In Section 4, results are computed for the 2030-2050 period.

Throughout, I report climate-driven changes as the difference between the climate-change counterfactual and the stationary-climate baseline (CC–NoCC). When reporting aggregate changes, I present percentage differences relative to the NoCC baseline unless otherwise noted.

4.1 Main results: government spending over time and space

Figure 2 summarizes the primary fiscal result. Panel A shows that climate change increases aggregate premium subsidy outlays over time, with the increase accelerating after 2040. The solid line reports the median across Monte-Carlo simulation draws, and the shaded band denotes the 5th and 95th percentiles, reflecting simulation uncertainty from repeated acreage paths using common random numbers across climate environments. Over the full simulation horizon, climate change increases aggregate premium-subsidy spending by 9.9% on average over 2030–2050, with increases reaching 14% in 2045–2050. 2020, annual premium-subsidy outlays in the sample average \$3.7 billion; thus a 9.9% increase corresponds to about \$365 million per year.

Panel B of Figure 2 highlights that fiscal exposure is highly spatially heterogeneous. The map displays the average change in county-level premium subsidies over 2030–2050 and reveals clusters of large increases concentrated in counties where climate change most sharply raises downside yield and revenue risk. While many counties exhibit moderate increases, others experience substantially larger spending growth; at the upper tail, county-level changes approach 70% in the most affected areas. Importantly, this heterogeneity arises even though the statutory subsidy schedule is held fixed: it is driven by spatially uneven changes in premiums and by endogenous producer responses that adjust insured exposure.

[FIGURE 2 ABOUT HERE]

Decomposition of fiscal impacts. Changes in subsidy outlays reflect interactions among premiums, insurance demand, and land use. Because these margins move jointly in equilibrium, I decompose the CC−NoCC difference in G_t using a Shapley-value accounting framework and report contributions from four channels:[7] *Premium: Yield risk* (premium changes driven by shifts in loss risk), *Insurance Take-Up* (changes in participation and contract choice), *Land Use* (changes in cultivated area and crop allocation that alter subsidized exposure), and *Premium: Price feedback* (premium changes driven by equilibrium price-belief feedbacks induced by aggregate acreage adjustment).

Figure 3 reports the decomposition averaged over 2030–2050. Over this period, the net increase in subsidy outlays is 9.9%.[8] Physical loss risk accounts for the bulk of this increase: as climate change raises downside yield risk during the pre-planting season, premiums rise mechanically. Absent farmers' endogenous responses, the increase in yield risk would lead to a 14% increase in government spending. Despite these higher premiums, farmers' endogenous insurance demand further amplifies government spending by 2.3% annually on average, reflecting increased participation and shifts toward more comprehensive coverage (I examine these margins in Section 4.3).

Land-use adaptation partially offsets fiscal exposure—either because fewer acres are cultivated and insured or because acreage shifts toward relatively safer crops within counties (I examine these margins in Section 4.4). However, adaptation also operates through an opposing channel. When aggregate adaptation reduces effective production—through lower yields but also through fallowing or reallocation away from high-risk high-yield crops—equilibrium crop prices increase. Higher prices raise insurance liability and expected payouts, placing upward pressure on premiums and partially offsetting the exposure-reducing effect of land-use adjustment.

Taken together, the decomposition highlights that adaptation affects fiscal costs through two countervailing forces: it lowers the quantity of insured exposure but can simultaneously increase the price at which that exposure is insured. The remainder of this section examines each channel in turn and relates it to the patterns in Figures 4–8.

7. Shapley values average marginal contributions over all orderings of the channels, yielding an allocation that is invariant to the sequence in which mechanisms are introduced.

8. For context, the U.S. government disbursed roughly $10 billion per year in crop-insurance premium subsidies between 2010 and 2020.

[FIGURE 3 ABOUT HERE]

4.2 Mechanism 1: yield risk

A primary driver of rising subsidy outlays is the increase in insurance premiums induced by climate-driven changes in loss risk. Figure 4 isolates this mechanism by computing premiums under climate change while holding fixed the no-climate-change aggregate market state used to form planting-time price beliefs. Premiums are averaged across insurance plans within each county–crop–year and aggregated using fixed baseline (NoCC) acreage weights, removing compositional changes from endogenous take-up and acreage reallocation and, by construction, abstracting from equilibrium price feedbacks.

Panel A of Figure 4 shows that yield-risk-driven premiums rise substantially under climate change, with increases that accelerate over time to reach 30% in 2050. Panel B shows pronounced spatial heterogeneity in premium growth which closely mirrors the geography of government spending changes in Figure 2: the Corn Belt sees the largest increase in premiums over time while the South and North of the study area see muted change. This pattern reflects spatially heterogeneous increases in weather uncertainty and hence in the yield loss distribution.

[FIGURE 4 ABOUT HERE]

4.3 Mechanism 2: insurance take-up and contract choice

Climate change also affects subsidy spending by shifting insurance participation and contract selection. Figure 5 reports climate-driven changes in (i) the share of planted acres insured under any plan, (ii) the conditional share of insured acres enrolled in Revenue Protection, and (iii) the conditional share of insured acres insured at high coverage levels (above 75%).

[FIGURE 5 ABOUT HERE]

Panel A shows that climate change increases insurance participation, from 1 p.p. in 2030 to

3 p.p. in 2050. This is consistent with higher perceived downside risk increasing the value of truncating the yield or revenue distribution at planting. Panels B and C show that, conditional on take-up, producers also reoptimize along the intensive margin by shifting toward contracts that provide greater risk protection—including RP and higher coverage levels—despite the fact that these products carry higher premiums. Because the statutory subsidy schedule subsidizes a fraction of the posted premium, contract upgrading increases subsidized liability and therefore raises government spending beyond the direct effect of higher actuarial risk. The Shapley decomposition indicates that this behavioral channel is economically meaningful but secondary relative to the premium channel: it modestly amplifies subsidy growth rather than driving it.

4.4 Mechanism 3: land-use responses and adaptation

Producers adapt to changing climate risk by adjusting cultivated area and crop allocation, which alters the insured exposure base on which premium subsidies are paid. These land-use responses partially offset the fiscal impact of premium growth.

[FIGURE 6 ABOUT HERE]

Figure 6 summarizes the extensive-margin adjustment. Under climate change, producers leave more land uncultivated, with the aggregate increase in fallow area rising steadily over time (Panel A) and varying widely across space (Panel B). By 2050, fallowing is about 17% higher than in the stationary-climate baseline, mechanically shrinking the acreage that can be enrolled in insurance and therefore reducing the exposure base on which premium subsidies are paid. This response is concentrated in counties where downside risk rises most sharply, so the expected return to cultivating falls relative to the outside option of leaving land idle. The spatial pattern is stark: some Corn Belt counties—including parts of Illinois—exhibit increases in fallow land exceeding 70%, indicating that extensive-margin adaptation is a first-order margin in the areas facing the largest deterioration in risk-adjusted profitability.

Figure 7 highlights the intensive margin of adaptation through within-county crop switching.

For each crop, the figure relates the change in the crop's cultivated acreage share within a county (CC−NoCC) to the change in its premium relative to the county-year average.[9] Across corn, soybeans, and wheat, crops whose relative premiums rise more tend to lose acreage share, consistent with within-county switching toward safer crops; fiscally, this shifts insured exposure away from the most adversely affected crop–county combinations and further dampens climate-driven subsidy growth.

[FIGURE 7 ABOUT HERE]

Figure 8 maps a county-level index of intensive adaptation through within-county crop switching. The index is positive when, within a county, acreage shifts away from crops whose premiums rise more under climate change and toward crops whose premiums rise less (using baseline acreage shares as weights). Values near zero indicate limited within-county reshuffling, or offsetting reallocations that net out across crops. The map shows substantial geographic heterogeneity: intensive switching is concentrated in a subset of counties clustered at the southern border of the considered sample, while many exhibit little within-county adjustment. This pattern is consistent with uneven scope for mitigating rising risk through crop substitution.

[FIGURE 8 ABOUT HERE]

4.5 Mechanism 4: crop price feedback

In the model, prices enter insurance valuation through planting-time price beliefs. Changes in these beliefs can affect premiums even holding fixed the physical yield-loss distribution. For YP, expected indemnities are valued using the mean price belief, so higher expected prices raise the expected dollar value of insured yield shortfalls. For RP, expected payouts depend on the full distribution of price beliefs.

Figure 9 shows that mean planting-time price beliefs rise under climate change. Averaged over

9. To isolate differences in physical loss risk across crops, the premium changes used here abstract from equilibrium price-feedback effects that operate through aggregate crop-mix adjustment.

2030–2050, the mean price-belief increase is 1.4% for corn, 2.6% for soybeans, and 2.8% for wheat. These shifts reflect the interaction of climate-driven yield changes with endogenous acreage and crop-mix adjustment documented in Section 4.4, which tightens expected supply relative to the stationary-climate path.

[FIGURE 9 ABOUT HERE]

In the decomposition, the resulting price-feedback channel contributes 2.4% to premium-subsidy spending over 2030–2050 (Figure 3). Intuitively, this term offsets part of the exposure-reducing effect of land-use adjustment: fewer acres are insured, but the expected dollar value of insured losses rises when planting-time price expectations are higher (and, for RP, when the distribution of price beliefs shifts).

5 Conclusion

This paper quantifies how climate change affects federal outlays on premium subsidies in the U.S. FCIP under the status quo subsidy schedule. Using the model developed in Obolensky (2026), I compare a stationary-climate baseline to a climate-change counterfactual over 2030–2050 and trace out the paths of premiums, insurance participation and contract choice, and cultivated acreage. The analysis shows that government spending rises substantially under climate change.

A central contribution of the paper is a transparent accounting of mechanisms. The decomposition clarifies how subsidy growth reflects the interaction of changes in loss risk with endogenous producer responses. Higher loss risk raises premiums directly and is the largest force pushing outlays upward. Insurance demand responds to the evolving risk environment, modestly amplifying spending through higher participation and shifts toward more protective contracts. Fallowing and within-county crop switching reduce subsidized exposure and partially offset fiscal pressure. At the same time, land-use adjustment increase equilibrium crop prices, which raises insurance liability and places upward pressure on premiums. Taken together, these results highlight that adaptation via crop switching has countervailing fiscal effects: it lowers insured exposure but can increase the per-acre cost of revenue protection through price feedbacks.

Several caveats are worth noting. The analysis assumes insurance participation and crop switching are the only adjustment margins available to farmers and abstracts from other potentially important forms of adaptation—e.g., irrigation and water constraints, technology adjustment, planting-date or variety choice. Accounting for these channels could further reduce insured exposure under climate change.

In addition, the fiscal accounting in this paper centers on premium subsidies. Other components of FCIP finance—delivery costs, underwriting gains, and reinsurance transfers—are held outside the analysis. As a result, the estimates should be interpreted as capturing one, albeit central, channel through which climate change affects federal outlays.

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Figures

Figure 1. Timing of Farmers' Decisions

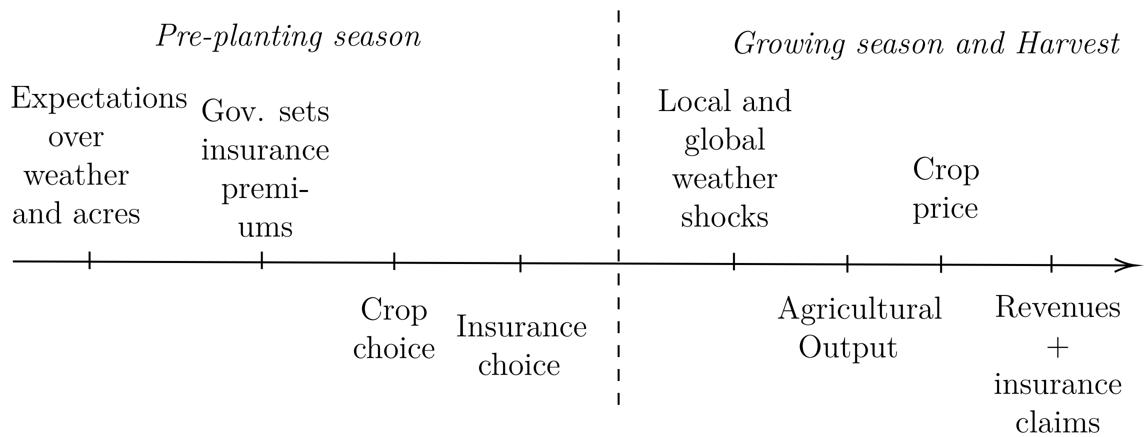
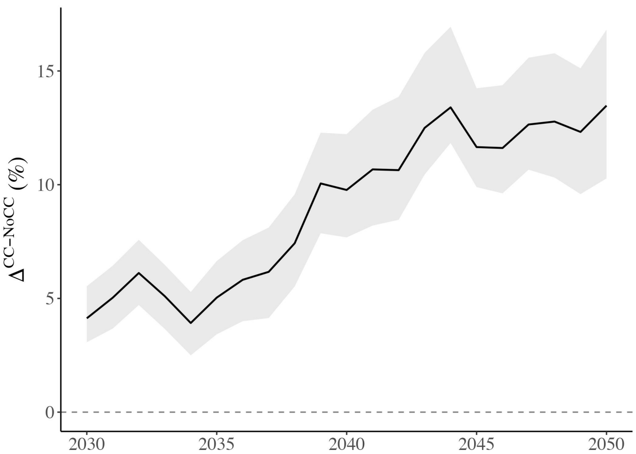
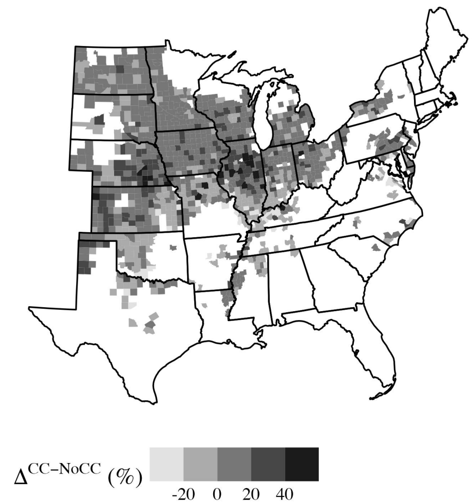


Figure 2. Government Outlays



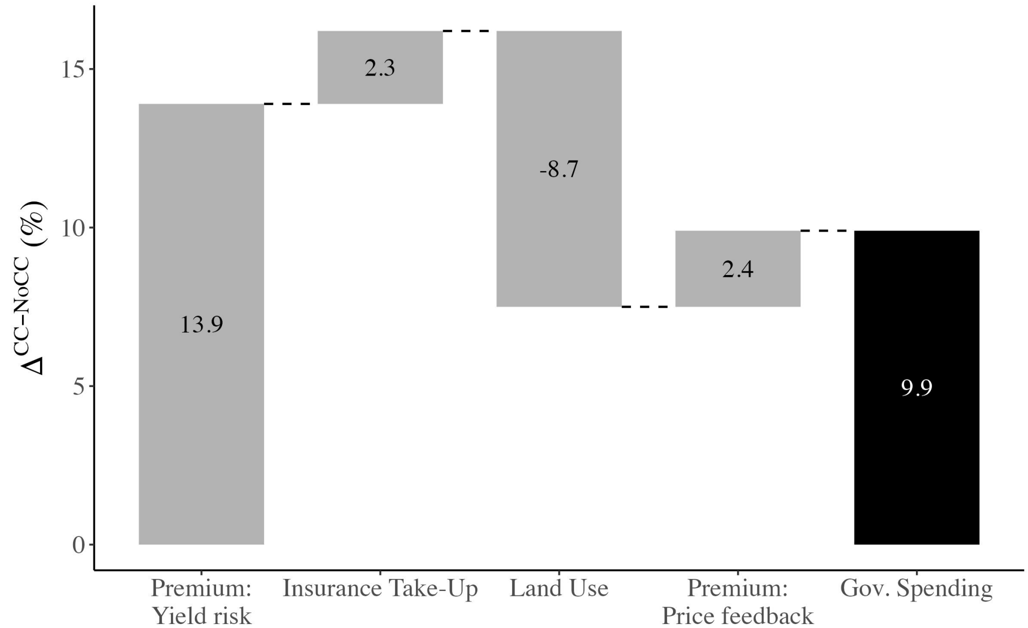
(A) Over Time



(B) Over Space

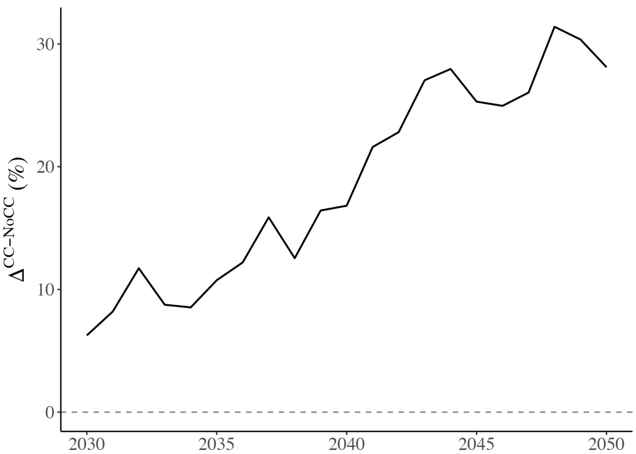
Notes: This figure plots the climate-driven change in federal crop insurance premium subsidies under the status quo subsidy schedule. Panel A shows the path of aggregate government outlays in the climate change counterfactual relative to the no climate change baseline (CC - NoCC), expressed in percentage terms. The solid line reports the median across Monte-Carlo simulation draws. The shaded region denotes the 5th and 95th percentiles. Panel B maps the spatial distribution of the average change in county-level premium subsidies over the period 2030 to 2050. Spending changes reflect endogenous responses in premiums, insurance take-up, and land-use decisions.

Figure 3. Determinants of Increase in Government Spending

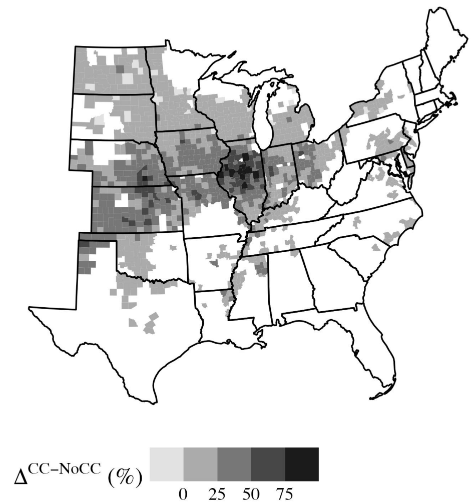


Notes: This figure presents a Shapley decomposition of the average change in government spending on crop-insurance premium subsidies between the climate-change and no-climate-change counterfactuals (CC−NoCC), averaged over 2030–2050 and expressed as a percent change relative to the NoCC baseline. The bars report the Shapley contributions of four equilibrium channels. *Premium: Yield risk* captures the change in premiums induced by climate-driven shifts in the yield and revenue loss distribution, holding fixed the NoCC aggregate market state used to form planting-time price beliefs. *Insurance Take-Up* captures changes in insurance participation and contract choice. *Land Use* captures changes in cultivated area and crop allocation that alter subsidized exposure. *Premium: Price feedback* captures the residual change in premiums attributable to equilibrium price-belief feedbacks induced by aggregate acreage and crop-mix adjustment (e.g., higher crop prices raising insurance liability and expected indemnities). The final bar *Gov. Spending* reports the net change in subsidy outlays and equals the sum of the preceding contributions. Positive values indicate channels that increase subsidy outlays under climate change, while negative values indicate channels that offset the fiscal effect of climate change.

Figure 4. Posted Insurance Premiums: Yield Risk Component



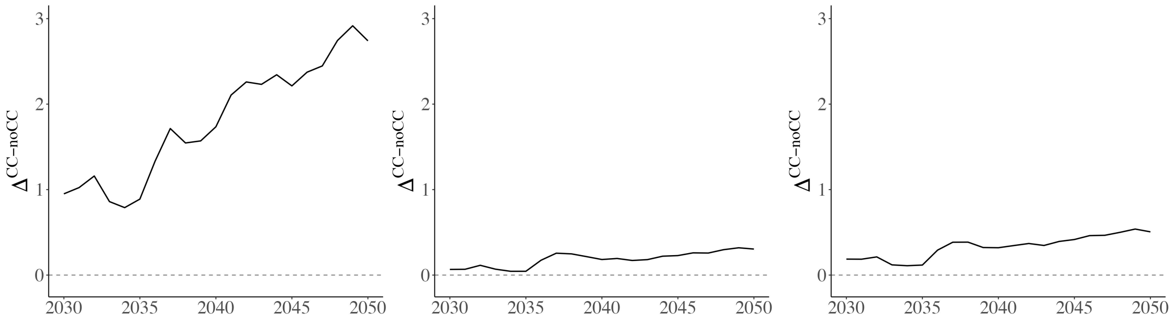
(A) Over Time



(B) Over Space

Notes: This figure shows the effect of climate change on posted premiums, isolating the direct effect of climate change on insurance risk exposure and abstracting from endogenous changes in insurance take-up and crop allocation: in both panels, premiums are computed under climate change while holding fixed the NoCC aggregate market state used to form planting-time price beliefs. Panel A plots the path of average premiums in the climate-change environment relative to the no-climate-change baseline (CC−NoCC), expressed in percent. Panel B maps the spatial distribution of the average county-level premium change over 2030–2050, constructed using the same fixed baseline weights.

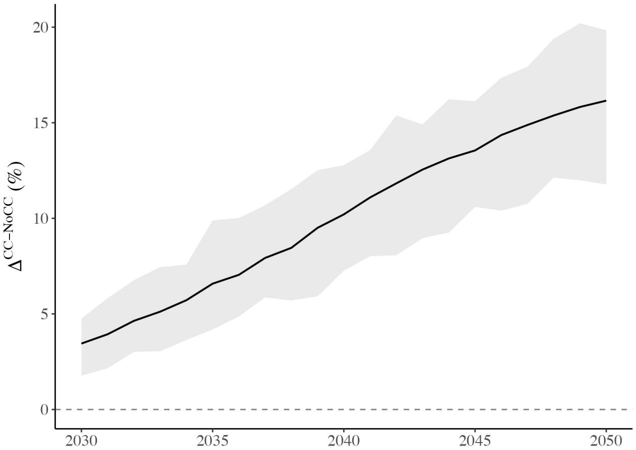
Figure 5. Insurance Product Market Shares



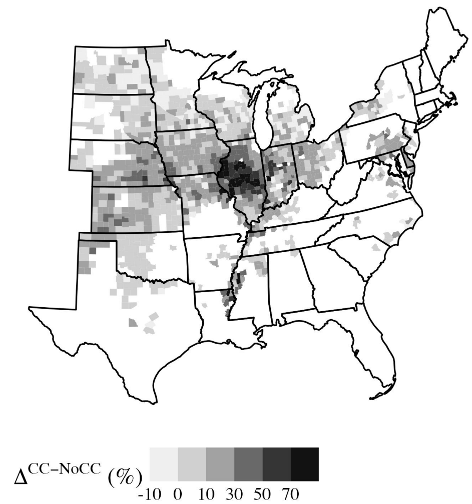
(A) Any Insurance **(B)** Revenue Protection **(C)** High Coverage (>75%)

Notes: This figure illustrates how climate change affects insurance participation and contract choice. All panels report differences between the climate change and no climate change counterfactuals (CC - NoCC), expressed in percentage points. Panel A shows the change in the fraction of planted acres insured under any crop insurance plan. Panel B shows the change in the share of insured acres covered by Revenue Protection contracts, conditional on insurance participation. Panel C shows the change in the share of insured acres covered at high coverage levels (coverage rates above 75 percent), conditional on insurance participation. Panels B and C therefore isolate contract substitution among insured farmers.

Figure 6. Fallow Land



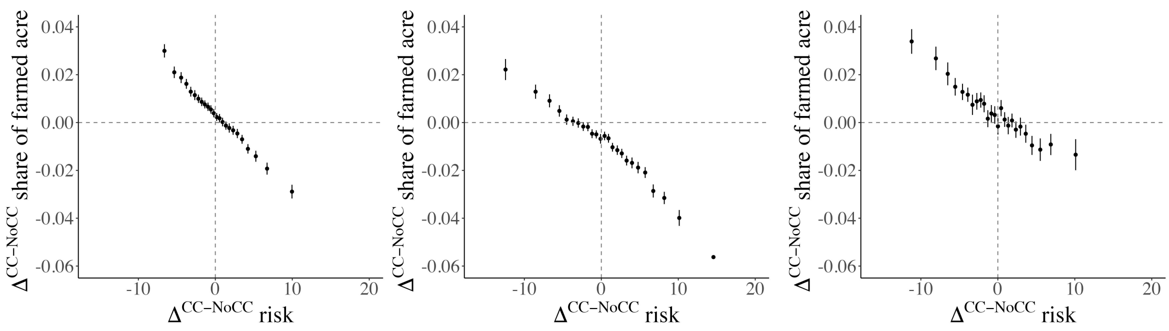
(A) Over Time



(B) Over Space

Notes: This figure plots the climate-driven change in fallow land over time. Panel A shows the path of fallow land in the climate change counterfactual relative to the no climate change baseline (CC - NoCC), expressed in percentage terms. The solid line reports the median change in fallow land between the climate change and no climate change counterfactuals (CC - NoCC) across Monte-Carlo simulation draws, and the shaded region denotes the 5th and 95th percentiles. Panel B maps the spatial distribution of average changes in fallow acreage over the period 2030 to 2050.

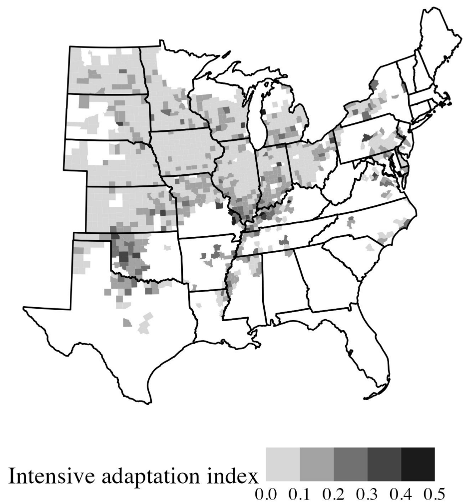
Figure 7. Crop Mix and Risk



(A) Corn **(B)** Soybeans **(C)** Wheat

Notes: This figure examines adaptive crop reallocation in response to climate-induced changes in relative risk. Each panel plots, for a given crop, the change in that crop's acreage share within a county (CC - NoCC) against the change in its premium relative to the county average (CC - NoCC). Points represent binned county-crop-year observations weighted by baseline (NoCC) acreage for the period 2030–2050. A negative relationship indicates that crops whose relative risk increase more under climate change lose acreage share. This pattern is consistent with within-county adaptation through crop switching.

Figure 8. Intensive Margin of Adaptation



Notes: This figure maps a county-level index of intensive adaptation through within-county crop switching under climate change. For each county m and year t, the index is $AI_{mt} = -\sum_k w_{mkt}\,\Delta risk_{mkt}\,\Delta sh_{mkt}$, where $\Delta risk_{mkt}$ is the change in crop k's premium relative to the county average (CC - NoCC). This difference in premiums is driven by differences in yield risk and abstracts from crop price feedback driven by adaptation via crop switching. Δsh_{mkt} is the change in crop k's cultivated acreage share within the county (CC - NoCC), and w_{mkt} are baseline (NoCC) acreage weights within county-year. Positive values indicate reallocation toward crops whose relative premiums increase less under climate change, consistent with adaptation via crop switching. The map reports the average of AI_{mt} over the period 2030 to 2050.

Figure 9. Equilibrium Crop Price Beliefs

(A) Corn **(B)** Soybeans **(C)** Wheat

Notes: This figure plots the percent change in the mean planting-time crop price beliefs under climate change relative to the stationary-climate baseline (CC−NoCC) over 2030–2050. Price beliefs are equilibrium objects in the model and therefore reflect the interaction of climate-driven yield changes with endogenous land-use adjustment that alters expected aggregate production (including fallowing and crop reallocation). Higher mean price beliefs increase the expected dollar value of insured losses and contribute to the *Premium: Price feedback* component of the fiscal decomposition in Figure 3.