Does The Samaritan's Dilemma Matter? Evidence From U.S. Agriculture

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Abstract

The Samaritan's dilemma posits a downside to charity: recipients may begin to rely on free aid instead of their own efforts. Anecdotally, the expectation of free assistance is thought to be an important explanation for the relatively low rates of insurance take-up and risky behavior in several important settings, but reliable empirical evidence is scarce. We estimate whether the Samaritan's dilemma exists in U.S. agriculture, where both private crop insurance and frequent federal disaster assistance are present. We find that bailout expectations are qualitatively and quantitatively important for the intensive margin of the insurance decision. Furthermore, they appear to reduce both the amount of farm inputs and subsequent crop revenue.

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1 Introduction

The state often acts as the "insurer of last resort" during systemic shocks, such as natural disasters (e.g., Hurricanes Katrina and Sandy) and economic crises (e.g., the financial crisis of 2007-2008). In doing so it faces the Samaritan's dilemma, first described by Buchanan (1975): agents who anticipate a bailout may take on more risk than they otherwise would.[1] For example, they might purchase less flood insurance or invest in riskier securities. This type of moral hazard increases the economic cost of the shock and decreases overall welfare due to the variability in the marginal utility of income across states of nature (Kaplow, 1991; Coate, 1995; Kim and Schlesinger, 2005). In other words, bailout expectations lead to unequal marginal utilities of income across states of nature, which in turn creates a welfare loss even if real outcomes such as output are unaffected. If the latter are affected as well, the welfare loss is larger.

We provide some of the first evidence on the empirical importance of the Samaritan's dilemma. The analytical models of Bruce and Waldman (1991) and Coate (1995), which formalize the inefficiency associated with the Samaritan's dilemma, also demonstrate one of the biggest challenges to empirically investigating it – the endogeneity of bailouts. The size of a bailout depends on economic agents' risk exposure, and agents' risk exposure depends on their expectation of a bailout. Few empirical studies have adequately addressed this issue.[2] Moreover, large systemic shocks are rare, and the government has a mixed record of responding to such shocks, making it difficult for investigators to infer agents' expectations. For example, the government's actions following the financial crisis of 2007-2008 were unprecedented in recent history, as was the crisis itself. In such situations, the expectations of recipients may or may not have corresponded to what actually transpired. More importantly, rare systemic shocks do not easily lend themselves to systematic examination.

To credibly gauge the relevance of the Samaritan's dilemma for the provision of social insurance, we would need a setting with fairly frequent aggregate shocks, extensive insurance availability, and relatively frequent government bailouts that, to some extent, vary exogenously. U.S. agriculture provides such a setting. Agricultural producers can purchase heavily subsidized crop insurance, but the government appears unable to withhold *ex post* aid: Congress provided *ad hoc* disaster payments every year between 1990 and 2010, the period of our analysis, at an average

[1] Terms that describe phenomena similar to the Samaritan's dilemma include "*ex ante* moral hazard" and, more generally, "crowd out". *Ex ante* moral hazard typically refers to market insurance crowding out self-protection activities (Ehrlich and Becker, 1972). Papers that deal with crowd out more generally typically consider the relationship between a permanent public insurance program and private insurance (e.g., Cutler and Gruber, 1996; Brown and Finkelstein, 2008; Gruber and Simon, 2008). By contrast, the *ad hoc* nature of bailouts makes them more similar to charity than to public insurance.

[2] Exceptions are Raschky and Schwindt (2009) and Kousky et al. (2013). See Raschky and Weckhannemann (2007) for an overview of the literature.

of $1.8 billion per year.[3] Politics has long been thought to play a role in disaster aid allocation (Garrett et al., 2006), creating plausibly exogenous variation in aid that is not directly related to farmers' insurance decisions.

We rely on political variation to identify the causal relationship between aid expectations and insurance decisions. Specifically, our choice of instrument is guided by the "swing voter" theory: we use changes in the percent of a county's voters who voted for a third-party candidate in the most recent presidential election as an instrument for disaster aid. As we discuss later, third-party voters are easier to sway than someone voting for a Republican or Democrat, making them excellent targets for politicians of both parties. Likewise, disaster aid is a good means of targeting voters, as the majority of Americans favor financially supporting farmers, especially in bad years (e.g., Kull et al., 2004). Our identifying assumption is that recent voting behavior in a county is related to the crop insurance decisions of a county's farmers only through the disaster aid channel. Because farmers make up a small fraction of the electorate in the modern U.S., our instrument is likely to meet the exogeneity requirement.

The same instrument addresses measurement error that may arise from observing actual disaster payments instead of the expected payments that influence the insurance decision. Because politicians' incentives are known in advance, they likely play a role in farmers' expectations of a bailout. We use county fixed effects to account for unobserved heterogeneity, such as the inherent riskiness of an area for crop production. We account for macro-level shocks, such as price variation or policy changes, with year fixed effects. Finally, we control for a number of time-variant county characteristics, including farm and non-farm incomes, total employment, population, the share of population employed in agriculture, and the number of farm proprietors. Thus, our identification comes from within-county *changes* in voting patterns, disaster aid, and insurance coverage.

We find that the elasticity of farmers' out-of-pocket expenditure on insurance with respect to expected disaster payments is about -0.2. That is, a one-percent increase in expected disaster payments reduces the premiums farmers pay by 0.2 percent. We confirm this result by using alternative measures of coverage, such as total liability, the total number of policies, and premiums subsidies. Consistent with some farmers reducing insurance coverage rather than foregoing it altogether, we find evidence that farmers are also choosing less generous insurance plans. Finally, we find evidence that bailout expectations result in reduced spending on farm labor and fertilizer, marginally lower yields, and significantly lower revenue from crop sales.

Our results suggest that the Samaritan's dilemma is a more pervasive phenomenon than expected. The theoretical literature predicts that subsidizing risk-reduction activities reduces agents' reliance on bailouts (Coate, 1995); the theory can be extended to show that increasing the uncertainty of a bailout also reduces the Samaritan's dilemma. Crop insurance is heavily subsidized—the

[3] All dollars are inflation-adjusted to 2011.

government currently pays about two-thirds of the premiums—and bailouts are *ad hoc* and thus inherently uncertain. And yet we find that the Samaritan's dilemma exists and is substantial.

Our findings generalize to a number of settings. Two that are particularly similar to the one we examine here are domestic disaster aid more generally and foreign aid. The United States spent about $31 billion in foreign economic assistance in the 2012 fiscal year (United States Agency for International Development, 2014). Not including agriculture, the United States spent about $100 billion on domestic disaster relief and recovery in the 2011-2013 fiscal years (Weiss and Weidman, 2013). In both cases, the aid is discretionary and thus uncertain. At the same time, it is awarded fairly regularly, making it more likely that potential recipients will expect it. The similarities between these settings and ours make the existence of such inefficiencies in the former very likely.[4]

Our findings also empirically validate the idea that the Samaritan's dilemma and, more generally, *ex ante* moral hazard—where recipients expose themselves to a higher risk of income loss because of the presence of some safety net—are present in social insurance settings such as unemployment insurance, TANF, or SNAP (Buchanan, 1975). However, in contrast to private insurance markets where premiums, deductibles, and copayments can be adjusted to internalize *ex ante* moral hazard (Dave and Kaestner, 2009; Chiappori, 2000), the Samaritan's dilemma implies long-run, persistent welfare losses in social insurance programs that cannot easily be tailored to individual behavior.

Finally, our findings are also relevant for gauging the social value of agricultural subsidies, which are prevalent in developed nations. In their theoretical work on the Samaritan's dilemma, Bruce and Waldman (1991) and Coate (1995) suggest that an in-kind transfer in the form of full insurance coverage increases efficiency over a cash transfer. Although some agricultural subsidies are independent of production or prices, many are effectively insurance programs where payments depend on market conditions. Indeed, in the United States, unconditional payments to producers have been shrinking over time, while subsidies for crop insurance have grown substantially and now account for a large share of agricultural support. Our findings suggest that one can think of agricultural subsidies as an answer to the Samaritan's dilemma and that removing them may reduce, rather than increase, efficiency. At the same time, even large subsidies appear to not eliminate the Samaritan's dilemma entirely.

The rest of the paper is organized as follows. In Section 2, we outline a simple model that demonstrates the inefficiency of *ex post* relief. In Section 3, we provide background on crop insurance and disaster payments in the U.S. In Section 4, we describe our data and empirical strategy. Section 5 presents the results, and Section 6 concludes.

[4] Also see Raschky and Schwindt (2009) and Kousky et al. (2013) for evidence on the Samaritan's dilemma in these two areas.

2 Conceptual Framework

In this section, we examine a model of the relationship between bailout expectations and the insurance decision of a potential aid recipient. Our aim is not to develop new theoretical insights, but to provide intuition for why *ex post* bailouts create an inefficiency even when the recipient's only margin of adjustment is how much insurance to purchase. Thus, we construct the simplest possible model here and refer interested readers to Bruce and Waldman (1991) and Coate (1995) for a more general framework.

It is worth noting that bailout expectations may also affect real outcomes, such as investment and output. We also assume that the government acts to maximize the joint welfare of its citizens; in reality, political economy considerations may play a non-trivial role in the bailout decision. In these other cases, the reasons for inefficiency are clearer, so we do not focus on them here.

Basic setup The economy is composed of two representative agents, indexed by 1 and 2. Their concave utility functions are denoted by $u(w_1)$ and $u(w_2)$, respectively, where w_i is the wealth of agent i.

Agent 1 faces the possibility of a loss L, which occurs with probability γ. Prior to the realization of the loss, she can buy actuarially fair insurance from a perfectly competitive risk-neutral insurance sector. Her initial wealth is given by w_1^0, and the amount of insurance she purchases is denoted by x. After she makes her insurance decision, the state of the world is realized (the loss does or does not occur), and the government decides how much money to transfer between the agents. The government's objective is to maximize the simple sum of the agents' utilities, $u(w_1) + u(w_2)$.

Importantly, the government has no constraints on its ability to make *ex post* transfers and thus cannot commit to a particular transfer level before the state of the world is known. Finally, we assume that $w_2 \geq w_1^0$. Because agent 2 never sustains a loss and the government maximizes the simple sum of the agents' utilities, this implies that the government will never transfer wealth from agent 1 to agent 2.

First best Because the agents' utility functions are identical and the government weights their welfare equally, the first best solution equalizes the *ex post* marginal utilities of both agents across both states of the world. This perfect consumption smoothing occurs when agent 1 purchases full insurance against the loss ($x = L$) and the government makes a fixed *ex post* transfer T in either state of the world such that $u'(w_1^0 - \gamma L + T) = u'(w_2 - T)$. One way in which the first best can be achieved is if the government can commit to the transfer level prior to the realization of the loss. In this case, the transfer will simply raise agent 1's wealth in all states of the world, and it is trivial to show that agent 1 will choose to be fully insured.[5] We proceed to show that in the case where commitment is not possible, the marginal utilities of agents will generally differ across states of the world, deviating from the first-best outcome.

The no-commitment case Now suppose the government cannot commit to a particular transfer level. We proceed by backward induction, first considering the government's *ex post* transfer decision after agent 1 has purchased x dollars of insurance. We then consider agent 1's insurance decision.

When the government makes its transfer decision, agent 1 has $w_1^0 - \gamma x$ in wealth if the loss did not occur (denoted by w_{NL}) and $w_1^0 + (1-\gamma)x - L$ if the loss occurred (denoted by w_L). Once state $S \in \{L, NL\}$ is realized, the government will solve:

$$max_{T_S} u(w_S + T_S) + u(w_2 - T_S)$$

The optimal transfer T_S will be such that $u'(w_S + T_S) = u'(w_2 - T_S)$. In general, the transfer amount T will depend on w_S, which in turn depends on agent 1's insurance decision, x. Thus, we can write the transfer in state S as $T_S(x)$.

A few features of this solution are worth pointing out. First, $T_{NL}(x) = T_L(x)$ if and only if $w_L = w_{NL}$. The latter condition will in turn be true if and only if agent 1 purchases full insurance. More importantly, if $w_L \neq w_{NL}$, then $w_L + T_L(x) \neq w_{NL} + T_{NL}(x)$. That is, if agent 1's insurance decision does not result in equal levels of pre-transfer wealth in all states of the world (i.e., she does not purchase full insurance), then her marginal utilities in the two states of the world will not be equal to each other even after the government makes transfers, deviating from the first-best outcome. The same will be true of agent 2.[6] Thus, the key determinant of efficiency in the no-commitment setting is whether agent 1 will purchase full insurance.

To shed light on this question, we next examine the insurance decision of agent 1 when the government cannot commit to a particular transfer amount. She expects to receive $T_L(x)$ if the loss occurs and $T_{NL}(x)$ if it does not. Taking this into account, she will maximize her expected utility:

$$max_x \gamma u(w_1^0 + (1-\gamma)x - L + T_L(x)) + (1-\gamma)u(w_1^0 - \gamma x + T_{NL}(x))$$

Solving and simplifying, we get the first order condition that:

$$\frac{u'(w_1^0 + (1-\gamma)x - L + T_L(x))}{u'(w_1^0 - \gamma x + T_{NL}(x))} = \frac{T'_{NL}(x)}{T'_L(x)} \tag{1}$$

[5] Alternatively, the government can make an *ex ante* transfer and commit to making no further transfers after the state of the world is realized. Such an arrangement will also induce agent 1 to take out full insurance.

[6] However, *within* a particular state of the world, the marginal utilities of agents 1 and 2 will always be equal.

If agent 1 buys full insurance, then the marginal utilities in the two states of the world will be equal to each other; that is, the ratio of marginal utilities in equation 1 will be equal to 1. Conversely, if $\frac{T'_{NL}(x)}{T'_L(x)} \neq 1$, then the agent does not purchase full insurance. In the Online Appendix, we derive the expressions for $T'_{NL}(x)$ and $T'_L(x)$ and argue that, in general, their ratio will not be equal to 1. Thus, *ex post* transfers reduce insurance purchases and, more importantly, result in an efficiency loss from a decrease in the amount of consumption smoothing in the economy.[7] Similar to Coate (1995), a simple way to achieve the first-best even with limited commitment is for the government to make an in-kind transfer of full insurance to agent 1, which can be financed by taxing agent 2 or both agents. However, anything less than full subsidization will result in some degree of inefficiency.

As mentioned earlier, other efficiency losses can also arise in settings where *ex post* transfers are present. If, in addition to reducing insurance coverage, potential aid recipients also reduce effort or investment, the inefficiency of *ex post* bailouts is exacerbated. Further inefficiencies result if the government awards aid for political reasons.

3 Disaster Payments and Crop Insurance

Federal crop insurance and agricultural disaster payments have provided overlapping risk protection to farmers for over 40 years. The Agricultural Adjustment Act of 1938 established the Federal Crop Insurance Corporation (FCIC) to administer what was essentially, until 1980, an experimental crop insurance program.[8] In 1973, while crop insurance was in this experimental phase, Congress established a standing Crop Disaster Payment (CDP) program that was akin to free insurance coverage for a select group of crops. When yields fell below two-thirds of normal, low-yield payments were made to farmers who participated in income- and price-support programs. The Government Accountability Office (GAO) (1980) recognized the conflict between these programs—the Samaritan's dilemma—when it reported that, where crop insurance was offered, "[disaster] payments actually compete with crop insurance because they require no premiums."

In 1980, Congress responded by ending the standing CDP program and greatly expanding the Federal Crop Insurance (FCI) program.[9] In spite of this expansion, Congress quickly established a pattern of having two parallel mechanisms for dealing with crop-loss risk by providing \$1.4 billion in drought relief in 1981 and, in 1980–1988, \$6.9 billion in disaster payments on top of \$4.3 billion in crop insurance indemnities (U.S. General Accounting Office, 1989). At the same

[7]Another way to understand the inefficiency is to recognize that in the second-best scenario, risk-averse agent 2 rather than the risk-neutral insurance sector is bearing some of agent 1's risk.

[8]For a more detailed history of the early crop insurance program see Glauber and Collins (2002).

[9]In 1981, the Federal Crop Insurance Corporation (FCIC) added 1,340 county programs (a county program is a particular crop-county combination), and in 1982, 8,278 county programs were added.

time, FCI participation stagnated at 50 million acres, less than 25% of insurable acres (Glauber and Collins, 2002). In 1989 the GAO reported that, "federal disaster assistance programs provide farmers with direct cash payments at no cost to the farmers, resulting in the perception [among farmers] that crop insurance is unnecessary."

Despite GAO warnings, Congress continued to frequently authorize *ad hoc* CDP programs throughout the 1990's and 2000's. In an attempt to reduce disaster payment uncertainty, the 2008 farm bill established a standing disaster program called the Supplemental Revenue Assistance Program (SURE) (Food, Conservation, and Energy Act of 2008, 2008). The program, however, failed to reduce uncertainty; according to USDA officials it was "the most complex program USDA's Farm Service Agency has undertaken" (Shields, 2010). Moreover, despite the standing disaster program, Congress passed *ad hoc* disaster payment legislation in 2009, and in a rare move the president sidestepped Congress and implemented a CDP in 2010. SURE expired in 2011 and was not renewed in the 2014 farm bill. Overall, Congress allocated $40.2 billion (2011 dollars) to CDP programs in 1990–2011.[10]

Figure 1 shows the pattern of indemnity payments, made by insurance companies, and crop disaster payments, made by the government, over the same time period. To control for the growth of insurance coverage, we show these quantities as a percent of total liability. On average, disaster and indemnity payments are similar in magnitude. In several years, disaster payments exceed indemnity payments, although in recent years disaster payments have been relatively low, potentially due to increasing coverage. Disaster payments were made in every year, although in some years the amount is very small. Consistent with their *ad hoc* nature, disaster payments are much more volatile than indemnity payments.

Unlike crop insurance, disaster payments are not perfectly predictable, and the disaster designation process adds to their uncertainty. First, a state's governor requests a disaster designation for the affected counties in the state. The Secretary of Agriculture then determines whether a natural disaster has caused a 30-percent or more production loss of at least one crop in the county. Once the Secretary of Agriculture issues a disaster designation, farmers in the primary *and contiguous* counties become eligible for emergency loans. Farmers in these counties may also receive disaster payments if Congress passes legislation funding an *ad hoc* disaster program. Disaster payments are usually calculated in a way that is very similar to a not-very-generous crop insurance plan.[11]

CDP programs are administered in such a way that disaster payments are a *de facto* supplement to indemnity payments. In an effort to be equitable and not discourage crop insurance purchase, Congress typically mandates that "there should not be discrimination, in making payments, against

[10]See the appendix for a list of public laws passed between 1989 and 2009 that authorize crop disaster payments.

[11]We provide more details on how crop insurance and disaster aid payments are typically calculated in the Online Appendix.

persons who had acquired federal crop insurance." (2000 Crop Disaster Program, 2001) In other words, both insured and uninsured farmers can qualify for disaster payments. Only the U.S. Troop Readiness, Veterans' Care, Katrina Recovery, and Iraq Accountability Appropriations Act of 2007 (2007) and the Food, Conservation, and Energy Act of 2008 (2008) have limited disaster payments to farmers who purchased insurance or who did not have the option to purchase insurance.[12] For insured farmers, disaster payments "top up" indemnity payments. However, insurance payments are not ignored completely; once the sum of indemnity and disaster payments reaches 95% of the farmer's expected revenue, the farmer is not eligible for more disaster payments.[13] Because disaster payments are paid *in addition* to crop insurance, farmers may respond either along the intensive margin, by purchasing less insurance than they otherwise would, or the extensive margin, by forgoing crop insurance.

Starting from the mid-1990's, farmers have had a lot of choice when it comes to crop insurance. Importantly, farmers can choose the generosity of the insurance plan they purchase. The options typically range from a 50% coverage plan, which only pays indemnities after the farmer's yield or revenue has fallen to 50% or less of its expected value, to a 90% coverage plan, which begins paying after only a 10% drop. In addition, farmers can choose how much money they are paid per unit of shortfall from a pre-specified range.[14]

Unlike many other insurance markets, providers of crop insurance cannot set their own prices or offer customized insurance plans. However, the federal government reinsures the providers and reimburses them for administrative expenses. The prices and plans are determined by the Risk Management Agency (RMA) of the USDA and are typically made public near the end of the preceding calendar year. The rating methodology used to set prices has been fairly consistent and largely formulaic throughout our sample period (Coble et al., 2010, 2011).

Although Congress has regularly responded to agricultural disasters with CDP programs, it has not been without reluctance. Over the period of our analysis Congress attempted to move away from CDP programs by strengthening the Federal Crop Insurance (FCI) program and weakening its own ability to pass disaster-assistance legislation by tightening budgetary constraints. In 1990–1994 disaster payments came from emergency supplemental appropriations that were exempted from discretionary spending caps. The Federal Crop Insurance Reform (FCIR) Act of 1994 made future agricultural crop disaster payments subject to discretionary spending caps by restricting them from being classified as "emergency" payments. The 1994 Act also greatly expanded the

[12]The latter group has access to a separate disaster assistance program called Noninsured Crop Disaster Assistance Program (NAP), which we do not consider here.

[13]Typically, a CDP program stipulates "the sum of the value of the crop not lost, if any; the disaster payment received under this part; and any crop insurance payment . . . for losses to the same crop, cannot exceed 95 percent of what the crop's value would have been if there had been no loss" (2005–2007 Crop Disaster Program, 2008).

[14]For more details, see the Online Appendix.

crop insurance program by *mandating* catastrophic-level (50%) coverage for farms receiving other government support. Together, these requirements sent a signal that future disaster payments were unlikely (see Jose and Valluru, 1997).[15] Congress, however, rescinded the catastrophic-coverage mandate after just one year. In 1998, it also reverted disaster spending to "emergency" status and implemented a multi-year CDP program—something it said it would not do four years earlier.[16]

Since Congress ended the standing CDP in 1980, it has subsidized crop insurance premiums to encourage farmers to purchase more coverage and thereby reduce the need for *ad hoc* disaster payments. Despite premium subsidies of 30% for 50–65% coverage and 17% for 75% coverage during the 1980s and early 1990s, voluntary participation in the Federal Crop Insurance (FCI) program remained low. In addition to mandating 50% coverage, the 1994 FCIR Act attempted to increase participation by increasing the subsidy rate on crop insurance premiums.[17]

Figure 2 illustrates the evolution of the crop-insurance premium subsidy rates from 1990–2011. The figure shows the dramatic rise in the subsidy for 50% coverage due to the 1994 legislation and a modest increase for the other groups of about 10 percentage points each. Farmers' responses to the increased premium subsidies in 1994 were slight. Figure 3 illustrates the share of total acres insured by FCI by coverage group from 1990–2011. Nearly all of the increase in participation in 1995 came from the mandated CAT (50%) coverage. Once the mandate was removed, participation levels fell until 2001 when premium subsidies increased even more. The Agricultural Risk Protection Act of 2000 (ARPA) increased premium subsidies by half for the 65% coverage level, more than doubled the 75% coverage level subsidy, and nearly tripled the 85% coverage level subsidy. Even with these dramatically increased subsidy rates, participation didn't return to the 1994-mandated level until 2004.

Another important source of aid that farmers may have come to rely on is non-disaster related agricultural subsidies. Subsidies are typically tied to market price and thus tend to be lower in a disaster year, when supply is low and prices are high. The low subsidies may put additional pressure on politicians to give disaster aid. Evaluating the effect of non-disaster subsidies, however, is outside the scope of this paper.

Despite circumstances that favor the Samaritan's dilemma, it is not a foregone conclusion in this setting. Four potentially offsetting factors make it difficult to determine, *ex ante*, the extent to which government bailouts affect insurance decisions. First, free disaster payments may seem preferable to costly insurance, but due to heavy premium subsidies, crop insurance is cheap, which

[15] Speaking just before passage of FCIR, Rep. Larry Combest declared, "This means an end to emergency spending for agricultural disasters." (Rep. Combest (Texas), 1994)

[16] Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 1999 (1998)

[17] The subsidy rate varies by coverage level, but does not vary geographically. Thus, politicians cannot target particular areas by altering crop insurance subsidies.

should reduce the amount of crowd out. Second, although disaster payments have been made fairly regularly, they are still more uncertain than insurance payments. Third, since indemnity payments are largely ignored when calculating disaster payments, we expect lower crowd out than if insured producers could not receive disaster payments. Finally, if the conditions that trigger crop insurance and disaster payments are very similar, then the latter might be a good substitute for the former. However, as we show in later sections, disaster payments are heavily influenced by politics. Moreover, they do not appear to function as an insurance product in the average county. Thus, the importance of the Samaritan's dilemma is ultimately an empirical question.

4 Empirical Strategy

4.1 Data

We identify the effect of expected disaster payments on crop insurance coverage with county-level administrative data. Crop insurance data are publicly available from the RMA. For each year between 1990 and 2011, the dataset reports the number of insurance policies purchased, the amount of premiums and premium subsidies paid, total liability, the number of acres insured, and the total indemnity payments.[18] We measure county-level crop-related disaster payments with USDA Farm Services Agency (FSA) data, obtained through a Freedom of Information Act request. After 1994, uninsurable crops received disaster payments through the "Non-insurable Crop Disaster Assistance Program" (NAP). We eliminate NAP payments from our data and focus on the disaster payments that may directly affect farmers' insurance decisions. The county-level characteristics we control for in our estimation come from the Regional Economic Information Systems (REIS) and the County Business Patterns (CBP) databases.

Despite the absence of individual-level data connecting disaster payments to crop insurance decisions, program features allow us to estimate the magnitude of the Samaritan's dilemma at the county level. Notably, all farms in a county face similar incentives because both the disaster designation process and the crop-insurance base premium calculation occur at the county level.

Table 1 shows key summary statistics for our main regression sample. As we discuss below, it is important to our identification strategy that only a small fraction of a county's population is composed of farmers and their employees. Specifically, less than 4% of the average county's population are farm proprietors. About 1% of total employment is in the forestry/agriculture sectors, and farm income represents only about 3.5% of total personal income on average.

[18] We exclude rangeland, which became insurable in the middle of our sample period, from the crop insurance sample. Because of its low value, it is not likely to be receiving a substantial amount of disaster payments. However, it makes up a significant fraction of insured acres (but not of premiums or liabilities), and its inclusion may obscure farmer responses to disaster payments on that margin.

The next few variables in Table 1 summarize the insurance coverage in our sample. On average, there are about 420 crop insurance policies issued per county in each year, covering over 65,000 acres. Farmers in the average county spend about \$670,000 on insurance, with the government contributing an additional \$880,000 in premium subsidies. Because of the heavy premium subsidies, we distinguish between premiums that are paid by the farmers themselves and total spending on insurance coverage. Specifically, we refer to the former as "out-of-pocket" insurance expenditure and premiums that include subsidies *and* out-of-pocket payments as "gross premiums."

The mean total liability in a county is about \$18 million. Over our sample period, insurers paid \$1.2 million in indemnity payments each year, on average, while the government disbursed an additional \$460,000 in disaster payments to producers who could have purchased insurance. Thus, disaster payments are over a third of the size of indemnity payments, while subsidies are two-thirds as large as the indemnity payments themselves. Taken together, subsidies and disaster payments exceed indemnity payments, reinforcing the idea that farmers enjoy substantial government support in this market.

Finally, as we discuss in detail below, we use the percent of voters casting ballots for a third-party candidate in the most recent previous presidential election as our instrument. The 2004 and 2008 county-level data come from Dave Leip's Atlas of U.S. Presidential Elections (Leip, 2014), while earlier data were generously shared by James Snyder.[19] We fill in the missing years using votes from the most recent past presidential election. In the average county, about 33,000 votes were cast, with about 7% of those votes going to a third-party candidate. The standard deviation of 8.2 suggests that there is substantial variation in third-party voting in our sample.

4.2 General Empirical Framework

Several metrics of the multifaceted insurance decision are available to us. The total number of policies—$Policies_{c,t}$, where c represents the county and t the year—provides a clear measure of the extensive margin of the insurance decision at first glance. However, because farmers may consolidate multiple plots under one policy or insure them separately, a drop in the number of policies does not map neatly into a drop in the number of farmers with no insurance. A cleaner measure of the extensive margin available to us is the total number of acres insured.

Much of the response to disaster aid expectations may be on the intensive margin, with farmers reducing their insurance coverage rather than foregoing it altogether. A metric that captures both margins, farmers' out-of-pocket expenditure on insurance—$Premiums_{c,t}$—is arguably the most relevant measure of the Samaritan's dilemma in such a setting. Total liability and subsidy payments made by the government provide alternative measures of both the intensive and extensive margins.

[19] Available from `http://uselectionatlas.org/`.

The central empirical question examined in this paper is "Is the Samaritan's dilemma relevant in US agriculture?" We answer this question by testing whether farmers purchase less crop insurance—$Insurance_{c,t}$, as measured by one of the metrics above—when they expect more *ad hoc* disaster payments conditional on *a*) county fixed effects (a_c) that account for the underlying soil type, climate, and other characteristics that determine the inherent riskiness of producing in each area and *b*) year fixed effects (a_t) that account for macroeconomic shocks such as annual price variation and broad changes in the crop insurance program over time. If the Samaritan's dilemma holds, we would expect estimates of γ in the following equation to be negative.

$$Insurance_{c,t} = a_c + a_t + \gamma E[Disaster_{c,t}] + \mathbf{X'_{c,t-1}}\phi + \varepsilon_{c,t}. \tag{2}$$

The key variable is $E[Disaster_{c,t}]$, farmers' expectation of disaster payments in county c and year t. The county-level control variables in equation (2), $\mathbf{X_{c,t-1}}$, include population, the number of farm proprietors, total farm income, and per capita income from REIS, as well as the fraction of total employment in forestry and agriculture sectors from CBP. The characteristics are lagged throughout because the insurance decision must be made by March of each year in most cases.

Already, a key challenge in estimating equation 2 is apparent. If farmers are at all forward-looking, their insurance decision will be based on expected disaster payments, $E[Disaster_{c,t}]$. However, those expectations are unobservable to us. Instead, we observe *actual* disaster payments, $Disaster_{c,t}$. At the very least, the latter measure is a noisy estimate of farmer expectations. More likely, realized disaster payments are themselves affected by farmers' insurance decisions.

Table 2 shows the results of estimating equation (2) with ordinary least squares where our measure of $Insurance_{c,t}$ is $\ln(Premiums_{c,t})$, the log of farmers' out-of-pocket expenditure on insurance (i.e., not counting subsidies) in county c in year t.[20] We substitute the log of realized disaster payments, $\ln(Disaster_{c,t} + 1)$, for $E[Disaster_{c,t}]$. All specifications include county and year fixed effects, while Columns 4–6 also control for lagged county-level characteristics. Standard errors are clustered by county.

We find a *positive* and highly significant relationship between contemporaneous disaster payments and insurance expenditure, possibly because both variables are responding to an unobservable shock. For example, low precipitation prior to the growing season may be indicative of adverse growing conditions, prompting farmers to take out more insurance to protect themselves and leading to higher disaster payments. Additionally, the adoption of a high-value crop might prompt more coverage and increase the size of disaster payments. Moreover, reverse causality is a potential

[20]We add 1 to disaster payments prior to taking the natural log due to the presence of many zeros. Our results are robust to adding other positive numbers to all disaster payments and to replacing the zeros with small positive numbers. Adding 1 to other variables prior to taking the log increases the magnitude of most of our estimates, making our conclusions even stronger.

concern: areas that buy less insurance coverage may receive more aid.

We also find a positive relationship between lagged disaster payments and insurance expenditure; when we include both lagged and contemporaneous disaster payments, each is significant. Specifically, a 1% increase in disaster payments is associated with a 0.007 to 0.009% increase in insurance expenditure in the current year and a 0.011 to 0.012% increase in the following year. The lagged positive relationship can also arise for a number of reasons. First, farmers who receive disaster payments are typically required to purchase crop insurance in the next one or two years. Second, an adverse event can trigger disaster payments *and* change farmers' beliefs about risk to their crops, resulting in more insurance in future years. More generally, simultaneity confounds the OLS estimate of γ in equation (2). Thus, without a valid instrument that holds risk constant, we cannot say much about the Samaritan's dilemma.

In addition to the simultaneity of crop insurance coverage and disaster payments, we address several other sources of bias with an instrumental variables strategy. Changes in the risk environment constitute one of the main econometric problems in interpreting an estimate of γ as evidence of the importance of the Samaritan's dilemma. Over the period of our analysis several innovations, e.g., climate change and genetically modified seed, have changed the pattern and practice of crop production in ways that may have affected both the crop insurance decision and disaster payments but remain unobserved and unaccounted for in the analysis. We also do not observe farmers' expectations, as discussed above. This "expectation error" will attenuate our estimate in the same way measurement error would.

To address these potential sources of bias, we need to isolate variation in disaster payments that is correlated with farmers' expectations and uncorrelated with the risk environment. Our instrument is derived from county-level voting patterns, which we can plausibly assume affect the benefit of crop insurance only through their effect on disaster payments.

4.3 The Political Determinants of Disaster Aid

To identify the effect of aid expectations on the insurance decision, we exploit the political determinants of agricultural disaster aid over a twenty-year period, using the "swing voter" model as our guide. The "swing voter" model posits that elected officials cater to easily persuadable voters (e.g., Lindbeck and Weibull, 1987; Dahlberg and Johansson, 2002). This model is typically formulated as two parties promising transfers in exchange for votes. The parties have limited resources and must thus direct transfers to places or voters where they get the most "bang for their buck'.' Rationally, the parties promise the marginal dollar in a way that maximizes the number of votes they subsequently receive. The easiest-to-persuade voters that are targeted by the marginal dollar of funds are then referred to as "swing voters".

Although the theory behind the swing voter model is clear, the empirical literature has surprisingly little to say about the characteristics of actual swing voters in the United States or even how to measure whether someone is easily persuadable.[21] In one of only two systematic studies, Mayer (2007) defines a swing voter as one who equally likes or dislikes the two major parties.[22] Using National Election Studies data from 1972–2004, he finds that approximately 9% of voters view the two major parties equally favorably or equally unfavorably and that these voters are almost equally likely to vote for Democrats and Republicans. Expanding this definition to include voters who very slightly favor one party over another, he finds that about 23% of the electorate can be classified as a swing voter in each presidential election during this time period, on average. Surprisingly, there are few systematic demographic differences (e.g., age, race, or gender) between swing and non-swing voters. However, swing voters are less partisan, are more likely to be moderates, and care less about who wins the election.

There are no county-level surveys that we can use to gauge how many voters are indifferent between the major parties. Our measure of how many easily persuadable voters there are in a county is the percentage of votes cast for a third-party candidate in the most recent previous presidential election. It is generally agreed that third-party voters are dissatisfied with the major parties and/or the government, feeling alienated from or perceiving little difference between the two major parties (e.g., Rosenstone, 1996; Donovan et al., 2000; Allen and Brox, 2005). Gold (1995) attributes the fact that 19% of voters cast their ballot for Perot in the 1992 election to a "large base of weak partisans". Contrary to popular belief, Herron and Lewis (2007) predict that at least 40% of Nader voters in Florida would have voted for Bush, not Gore, if Nader were not running.[23] Both these findings support the idea that third-party voters could be appropriate targets for both major parties. Overall, the characteristics of third-party voters correspond nicely to those we would expect swing voters to have.

Of course, if third-party voters' expression of dissatisfaction were permanent, they would not be easy to persuade. However, the national share of votes going to a third party in a presidential election has varied widely: between 1988 and 2012, it ranged from under 2% in 2008 to almost 19% in 1992.[24] At the county level, the variation is even larger. Because we use county fixed effects, our identification will be off of the *changes* in the share of votes going to a third party, which directly corresponds to voters who switch between voting for a major party or not voting at all and voting for a third-party candidate.

[21]For example, considering only "undecided" voters as swing voters might miss a substantial fraction of the electorate with a very weak and easily changeable preference (Mayer, 2007).

[22]Also see Kelley (1983).

[23]To do this, they analyze actual ballots, using individual voting patterns in non-presidential races to estimate the counterfactual in the presidential race.

[24]The share of votes going to third parties in presidential elections has been falling during our time period. We use year fixed effects to flexibly capture this trend.

Politicians appear to be aware of the perils and opportunities that third parties represent. The Nader candidacy appears to have affected how and where Al Gore campaigned in 2000 (Ceaser and Busch, 2001). More generally, Hirano and Snyder (2007) find that much of the 20^{th} century decline in third-party voting in the United States was due to the Democratic Party adopting left-wing third parties' agendas. More recently, the emergence of the Tea Party movement seems to have caused the Republican party to shift to the right in order to attract the disaffected voters (Jacobson, 2011; Abramowitz, 2011; Williamson et al., 2011).

We do not claim that swing voter channel is the only one through which politicians direct agricultural funds to their advantage. Politicians may also allocate aid in response to their core constituents' preferences—the "core voter" theory (e.g., Cox and McCubbins, 1986; Levitt and Snyder, 1995)—or increase voter support by a combination of increasing turnout of loyal voters and decreasing turnout of non-loyal voters (Chen, 2013). Because the main goal of this paper is to estimate the effect of disaster aid on the decision to insure, fully explaining the political process behind the allocation of funds is outside its scope.

A key difference between our identification strategy and the standard framework of the swing voter model is that agricultural disaster aid is given to a very small fraction of the electorate. However, voters are likely to be in favor of agricultural disaster aid. Previous research has shown that the majority of Americans favor agricultural subsidies for small farms (e.g., Kull et al., 2004; Ellison et al., 2010b,a; Lusk, 2012).[25] Moreover, the second most common reason for favoring subsidies is the unpredictability of farmers' incomes, due to weather and other factors (Ellison et al., 2010a).[26] Relatedly, the majority of subsidy proponents prefer to give farmers subsidies only in "bad years" (Kull et al., 2004). Finally, although an earlier study finds higher levels of support for farm subsidies among Democrats (Variyam et al., 1990), more recent studies find no relationship between a Republican versus Democratic party affiliation and the level of support for farm subsidies (Ellison et al., 2010a; Lusk, 2012). Thus, it is rational for Congressmen to allocate agricultural disaster spending strategically, including to areas where farmers are not a large fraction of the voting population.

Given that agricultural disaster payments are potentially used to buy votes, we have to be careful to avoid reverse causality. For this reason, we use election results from the most recent year that *precedes* the year for which disaster payments are given. Campaigns that promise disaster aid and subsequently deliver may be problematic too; in that case, we would be picking up the effect of disaster aid on voting rather than the other way around. For this reason, we use presidential rather than Congressional elections: specific promises about agricultural disaster aid are unlikely

[25]Most Americans believe that small farmers get an equal or greater share of agricultural subsidies than large farmers, while in reality the former receive only 20% (Kull et al., 2004).

[26]The most common reason was to maintain a secure food supply for U.S. citizens, which might also lead voters to support disaster aid.

to be made during presidential campaigns. Moreover, if this mechanism were at play, we would expect to find a *negative* relationship between disaster aid and third party voting, whereas we find a positive one.

In some cases, disaster payments are given to producers several years after the damaging events, yet we assign disaster payments to the year in which the disaster occurred, regardless of when the payments were made. Not only is this a good proxy for the farmers' aid expectations, but it also works with our exclusion restriction. Suppose agricultural disaster aid is not given immediately following a disaster. This may affect how the electorate of that county votes in the subsequent election. The reaction of the electorate may be larger in counties where farmers had less insurance coverage. The outcome of the vote may then prompt Congress to give disaster payments in subsequent years, as we posit. However, the voting outcome itself may be affected by the disaster and, more worryingly, by the farmers' insurance decisions. Assigning disaster payments to the year in which the disaster occurred year avoids this pitfall.

To summarize, it seems plausible that Congressmen would target counties where a third-party candidate had recently won a surprisingly large number of votes by allocating more agricultural disaster payments to farmers in that county. The identifying assumption is that county-level voting outcomes are only related to the insurance decision through the disaster aid channel. The summary statistics in Table 1 demonstrate that farmers represent a small fraction of the electorate in most counties, and are thus unlikely to be driving the political trends. Thus, the exclusion restriction is likely to hold because we do not expect county-wide voting changes to directly affect or be affected by an individual farmer's incentives to insure. However, in subsequent analysis, we nevertheless control for time-varying county characteristics that could potentially affect both the crop insurance decision and political attitudes.

5 The Effect of Disaster Aid on Crop Insurance

5.1 Swing Voters and the Allocation of Disaster Aid

Figure 4 shows the spatial distribution of our instrument for the counties in our preferred regression sample. To illustrate the variation used in subsequent analysis, we subtract the county-level mean and account for year fixed effects. We then take the absolute value and average over time by county. The resulting map demonstrates the locations of the largest sources of political variation. Darker areas correspond to larger fluctuations in politics over our time period. Although we see some geographic concentration, there is plenty of idiosyncratic variation outside these areas, suggesting that our results will not be driven by a particular part of the country.

Table 3 reports ordinary-least-squares regression estimates of equation (3), where $\ln\left(Disaster_{c,t}\right)$

is the log of total disaster payments made to county c in year t. The variable $PctInd_{c,t-1}$ measures the percentage of the electorate that voted for a third party candidate, based on the most recent previous presidential election. Similar to equation (2), $\mathbf{X_{c,t-1}}$ represents the time-varying control variables that could potentially affect both the crop insurance decision and political attitudes.

$$\ln\left(Disaster_{c,t}\right) = a_c + a_t + \beta PctInd_{c,t-1} + \mathbf{X'_{c,t-1}}\theta + \nu_{c,t}. \quad (3)$$

The results show a strong relationship between disaster payments and political changes in the county. Specifically, a one standard deviation increase in the percent of people who voted for a third party candidate in the last presidential election increases disaster payments in that county by $33 - 35\%$, suggesting that disaster payments are being used to sway independent voters. This result is consistent with the idea that independents are easier to influence. All else equal, counties with higher populations, lower per-capita income and lower total employment receive more disaster payments. Surprisingly, the number of farm proprietors and the share of agricultural employment are *not* significant predictors of disaster payments. The F-statistic in the specification that includes controls for county characteristics, as well as year and county fixed effects (Column 4), is significantly above the conventional threshold of 10.

5.2 IV Regression Results

We estimate the importance of the Samaritan's dilemma for out-of-pocket spending on insurance, $\ln(Premiums_{c,t})$, with equation (4) by instrumenting for log disaster payments, $\ln(Disaster_{c,t})$, with the percentage of the electorate that voted for a third party candidate, $PctInd_{c,t-1}$.

$$\ln\left(Premiums_{c,t}\right) = a_c + a_t + \gamma \ln\left(\widehat{Disaster}_{c,t}\right) + \mathbf{X'_{c,t-1}}\phi + \varepsilon_{c,t}. \quad (4)$$

The variable $\ln\left(\widehat{Disaster}_{c,t}\right)$ is the predicted value of the disaster payments from the first stage. As above, $\mathbf{X_{c,t-1}}$ represents the time-varying control variables that could affect the crop insurance decision. In this specification, $\gamma < 0$ indicates the presence of the Samaritan's dilemma.

Table 4 shows the effect of disaster payments on crop insurance expenditure in a county, as estimated by equation (4). Column 2 shows our preferred specification, which includes controls for county characteristics. A one-percent increase in expected disaster payments causes spending on insurance to drop by 0.20 percent. This estimate is highly significant. Without controlling for county characteristics, we get a slightly lower but still highly significant estimate of -0.14. Furthermore, the results are even stronger if we include observations where no out-of-pocket premiums are paid by adding 1 to net premiums prior to taking the log (Columns 3-4). In dollar terms, our key estimate corresponds to a decrease in out-of-pocket insurance spending of about $\$25,000$

per county.[27]

Other measures of the insurance coverage are available to us. In Table 5, we estimate how disaster payment expectations change total liability (Column 1). We again find evidence of the Samaritan's dilemma: a one percent increase in expected disaster payments lowers total liability by 0.19% or about $\$570,000$ per county.

The two estimates above capture both the extensive margin of the insurance decision (choosing whether or not to have crop insurance) and the intensive margin (choosing how much crop insurance to purchase). Because there could be differential selection out of insurance, we cannot estimate the intensive margin separately. We can, however, look at the extensive margin. Column 2 in Table 5 shows the causal relationship between disaster payments and the total number of policies (in logs). Indeed, the number of policies falls as expectations of disaster payments increase. The elasticity of insurance take up with respect to disaster payments is also estimated to be about -0.2. However, we cannot tell whether farmers are dropping insurance coverage for some of their plots or consolidating multiple plots into a single policy. To probe this further, we look at the number of insured acres as the outcome (Column 3). We find no evidence that the number of acres insured declines, suggesting that farmers respond to disaster payment expectations by reducing the number of policies they hold rather than foregoing insurance altogether. This response is sensible for several reasons. First, completely dropping coverage is risky because disaster payments may end up not being given. Second, the 50% coverage level plans are almost fully subsidized. Finally, disaster payments top up insurance indemnity payments, which means that farmers with the least generous insurance plans will not lose out on most disaster payments.

Finally, we consider the extent to which the government crowds out its own subsidy payments (Column 4). Insurance subsidy payments decrease by 0.34% for every percent increase in expected disaster payments. In dollar terms, this corresponds to about $\$43,000$ per county. Thus, for every dollar the government crowds out in farmer out-of-pocket spending, it crowds out about $\$1.72$ in subsidy spending.

Next, we investigate whether the expectation of disaster payments causes some farmers to switch to a less generous insurance plan. Recall that a farmer's combined payments from crop insurance and disaster programs cannot exceed 95% of his baseline income. The probability that this happens is increasing in the plan's coverage level. Thus, instead of dropping insurance coverage altogether, which could be devastating if disaster aid is not given, a farmer may choose a plan with a lower coverage level.

To see if farmers are selecting out of more generous insurance plans, we look at changes in the number of policies in different coverage levels. As in the case of liability and premiums paid,

[27] Calculated by the equation $e^{\mu+\widehat{\gamma}} - e^{\mu}$, where μ is the mean of the dependent variable and $\widehat{\gamma}$ is the estimated impact of additional disaster payments.

these estimates will include both selection, i.e., who chooses to forego insurance, and changes in insurance decisions among those who continue to insure. For simplicity, we combine coverage levels into four groups: 50%, 55-65%, 70-75%, and 80-90% coverage levels. To avoid missing values, we add 1 to each variable prior to taking the log.[28] The results are shown in Table 6. We find that for a 1% increase in expected disaster payments, the number of farmers choosing the most generous set of plans falls by about 1.2%, while the number of plans with a 70 or 75% coverage level falls by 0.4%. Correspondingly, there is a *rise* in the number of the less generous plans, by about 0.2% in both the 50% and 55-65% coverage levels. The latter results confirm that some farmers are responding to higher expected disaster payments by switching to less generous insurance plans.[29]

Finally, it is important to recognize that farmers may also respond to disaster payments by switching to a higher-risk crop, adopting a riskier farming strategy without switching crops (e.g., lowering pest control expenditure), or exerting less effort in maintaining a high crop yield. How these strategies will affect yields on net is unclear. It is possible that average yields are unchanged if the riskier strategy simply raises the yield variance. However, the riskier strategy may also result in a higher expected yield *and* higher yield variance. Finally, because disaster payments are higher when yields are lower, the farmer has an incentive to reduce effort and aim for a lower yield. It is thus theoretically unclear whether yields should increase, decrease, or remain unchanged with higher expectations of disaster payments.

In Table 7, we look at how disaster payments affect expenditure on farm labor and fertilizer, yields, and crop revenue. We use data on yields for seven major crops (barley, corn, oats, rice, sorghum, soybeans, and wheat), measuring the yield in a county by averaging realized yields across crops, weighting by the number of acres harvested.[30]

The results point to further welfare losses from farmers altering their farming strategies in response to disaster payment expectations. We find that farm labor costs fall by a small but significant amount (0.06% for a one-percent increase in disaster payments). Similarly, fertilizer expenditure falls by about 0.12%, and average yields are marginally lower. Finally, we find no evidence that farmers are switching to higher-value crops, as receipts from crop sales fall by 0.35%.

[28] Our results are similar if we do not add 1 to the number of policies prior to taking the log, although the number of observations becomes unbalanced and the first stage F-statistics fall.

[29] If we look at the number of acres insured at each coverage level, our results are similar with the exception that the number of acres covered at 70-75% coverage levels increases. This further points to farmers consolidating multiple plots under the same insurance plan in response to disaster payment expectations.

[30] Yield data are from the National Agricultural Statistical Service. Expenditure on farm labor and fertilizer, as well as crop revenue is reported by REIS.

5.3 Robustness

Our results are generally robust to a number of assumptions. Adding 1 to the outcome variables prior to taking the log generally *increases* the magnitude of the elasticity estimates, which, if anything, strengthens our conclusions (Appendix Table A3). In addition, we find a marginally significant drop in the number of acres insured in this case. Excluding counties that report more than 5% agricultural employment at any point in the sample does not have a meaningful impact on the results, except that the drop in labor costs is no longer significant (Appendix Table A4). In another robustness check, we exclude counties that are not in our data for the full sample period (Appendix Table A5). In this case, the fall in mean yields is no longer significant, but our other results are almost unchanged.

We have also probed the robustness of our instrument and second-stage results to including other controls that could affect both the insurance decisions of farmers and the population's decision of whether to vote for a third-party candidate. The occurrence of extreme events could plausibly lead farmers to increase their insurance coverage and cause voters to prefer or stay away from a third-party candidate. Using data from the Spatial Hazard Events and Losses Database for the United States (SHELDUS), we added flexible controls for up to four years of past extreme events to our preferred specification. Our point estimates become slightly (but not significantly) *larger* in absolute terms, but our overall conclusions are left unchanged.[31]

So far, we have not considered the possibility that insurance *prices* might be changing in anticipation of greater disaster aid from the government. Although this is a possible channel through which the Samaritan's dilemma would manifest itself, it is not likely in this setting for two reasons. First, insurance providers are not free to set their own prices. Second, the USDA Risk Management Agency, which sets the prices, uses a formulaic approach that is unlikely to be affected by county-level politics (Coble et al., 2010, 2011).

6 Conclusion

The Samaritan's dilemma was described by James Buchanan forty years ago. This type of moral hazard may exist in many areas of the economy, from banks taking on excessive risk to homeowners foregoing flood insurance because they expect to be bailed out. Its existence and magnitude both have important policy implications: if the Samaritan's dilemma is a practical concern, then an in-kind transfer of insurance enhances both *ex ante* and *ex post* efficiency (Bruce and Waldman, 1991; Coate, 1995). However, few empirical papers confirm or disprove its existence.

We test for the existence of the Samaritan's dilemma in U.S. agriculture, an area in which it

[31] These results are available upon request.

has long been posited to be a problem. Since the establishment of modern crop insurance in 1980, Congress has passed *ad hoc* bills granting disaster aid to farmers who suffered crop losses, even if they had insurance. We instrument for disaster payments using political variation at the county level. We then estimate how expected disaster payments affect farmers' crop insurance decisions.

We find that the Samaritan's dilemma exists and is of a considerable magnitude. Out-of-pocket insurance expenditure is very sensitive to disaster payments, decreasing by 0.2% for every percent increase in expected disaster payments. This is driven by a combination of farmers foregoing insurance, switching to less generous insurance plans, and possibly consolidating multiple plots under the same policy. The government crowds out its own premium subsidies at a rate of about 34%. Furthermore, bailout expectations also affect real outcomes, as farmers reduce expenditure on farm labor and fertilizer and subsequently realize lower revenues from crop sales.

Overall, our estimates imply that eliminating disaster payments would significantly raise insurance coverage and reduce inefficiencies in farm investment decisions. Of course, eliminating disaster payments would require the government to be able to commit to not grant them *ex post*, something that it has not been able to do thus far. In this situation, the heavy subsidization of crop insurance may be welfare improving over farmers relying only on *ex post* aid. Relatedly, the commitment problem the government faces may also justify the large subsidies that farmers in many developed nations receive.

If the government is unable to commit to not bail out farmers, why does it not give farmers completely free insurance, as Coate (1995) suggests? One possibility is that it is politically advantageous to target *ex post* disaster payments to particular constituencies. Congress members may get more "credit" from their constituencies for voting for disaster payments each year than for passing a free crop insurance bill. Alternatively, disaster payments might be useful as a bargaining chip by Congressmen from non-disaster counties to garner support for their own policies. Finally, it is possible that an insurance system where farmers make no out-of-pocket payments is politically infeasible. Although the definitive answer is outside the scope of this paper, it is a fruitful area for future research.

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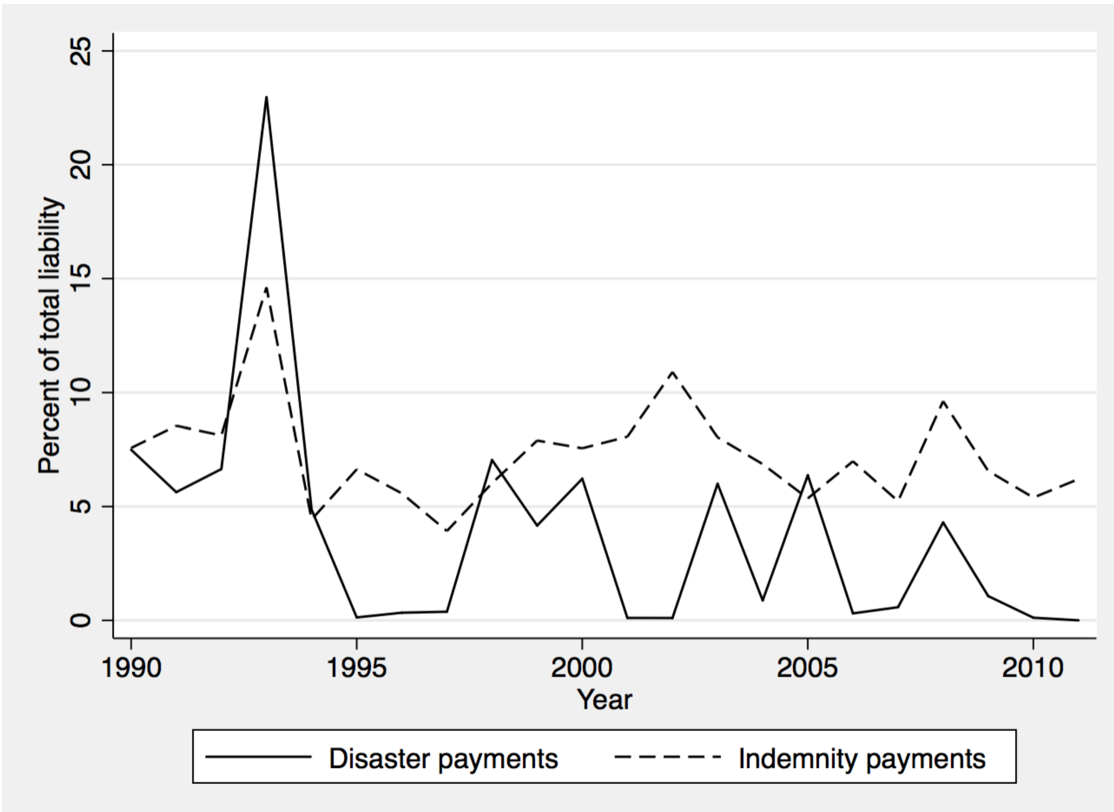
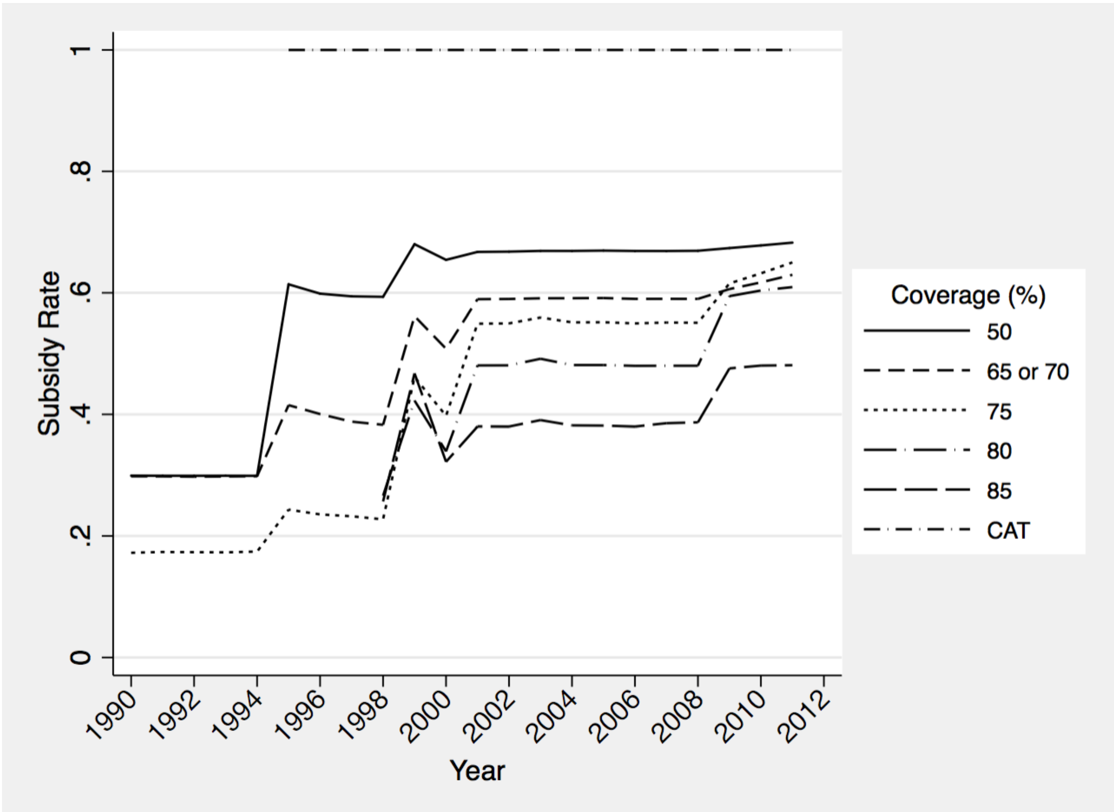
Figures

Figure 1: Indemnity and disaster payments over time



Notes: Disaster payment series represents payments to producers of crops for which insurance is available.

Figure 2: Crop Insurance Premium Subsidy Rates from 1990-2010



Notes: Each line illustrates the average subsidy rate across all insurance plan types at each coverage level. GRP and GRIP plans are excluded because they have a slightly different subsidy schedule. *Data Source*: USDA Risk Management Agency Summary of Business files.

Figure 3: Share of Insurable Acres Covered by Crop Insurance from 1990-2010

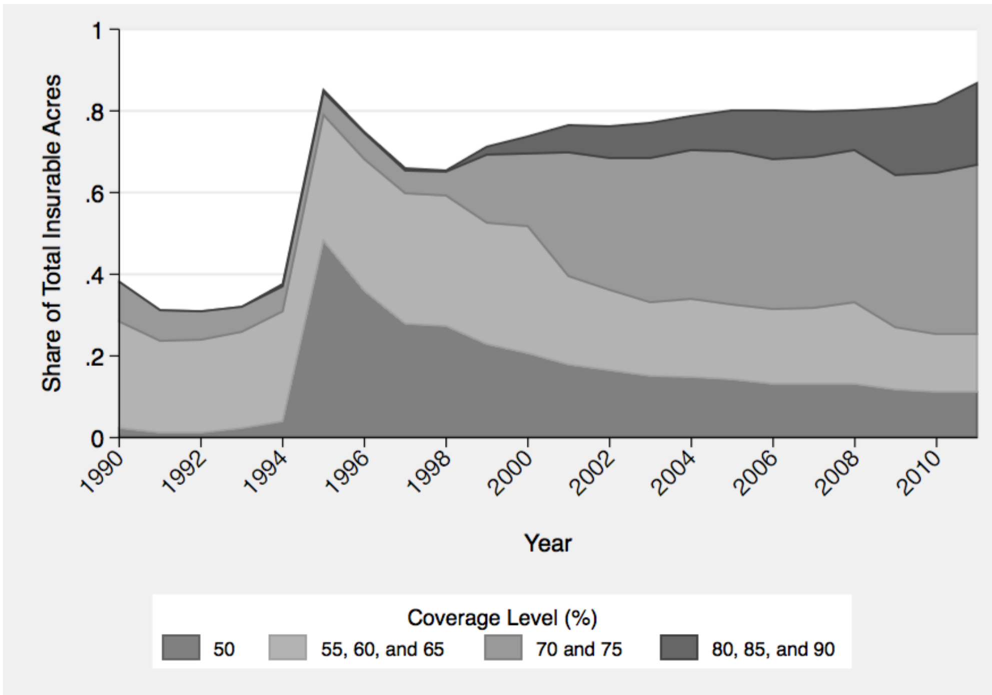
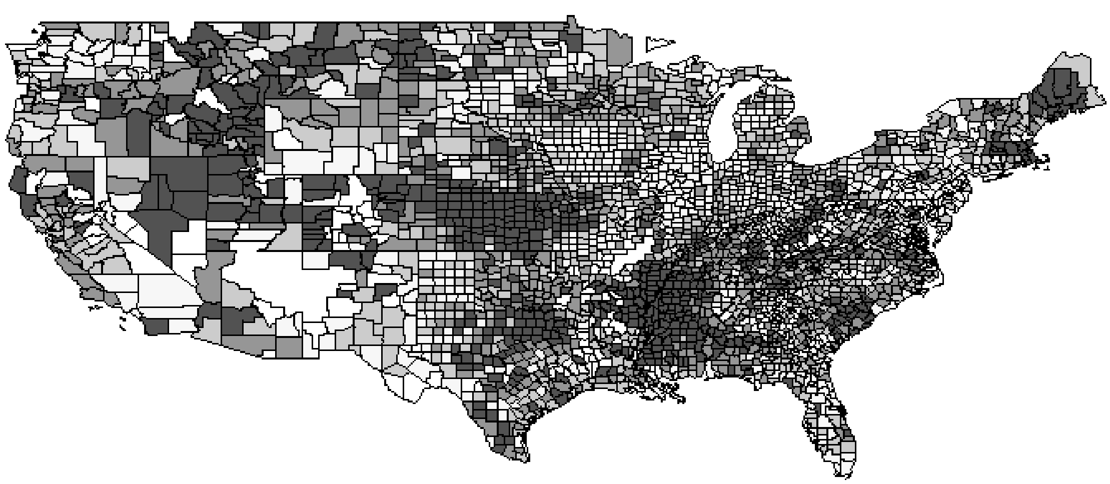


Figure 4: Absolute mean changes in percent voting for third party candidate



Notes: Illustrates mean absolute changes between 1988 and 2008, accounting for national trends and county fixed effects. Darker areas indicate larger changes. Shown only for counties included in the regression sample.

Tables

Table 1: Summary statistics

	(1) Mean	(2) Std. Dev.	(3) Min	(4) Max	(5) Obs
Percent of population who are farm proprietors	3.71	3.96	0	37	60,592
Percent employed in forestry or agriculture	1.03	2.35	0	100	60,590
Farm income as percent of total income	3.50	8.22	-314	125	60,592
Number of policies	420	602	0	7,304	60,592
Acres insured (thousands)	66	98	0	1,036	60,592
Premiums net of subsidies (thousands)	673	1,233	0	22,455	60,592
Subsidies (thousands)	883	1,775	0	32,163	60,592
Liability (millions)	18	34	0	890	60,592
Indemnity (thousands)	1,236	3,385	0	152,862	60,592
Disaster payments (thousands)	460	1,539	-95	109,931	60,592

Sources: Regional Economic Information Systems, County Business Patterns, and David Leip's Atlas of U.S. Presidential Elections. Unit of observation is a county-year. All monetary amounts are in 2011 dollars. Excludes counties with fewer than 18 observations over the sample period and observations that are missing control variables. Total number of counties in the sample is 2916.

Table 2: The relationship between insurance expenditure and disaster payments, OLS

	(1)	(2)	(3)	(4)	(5)	(6)
Disaster aid this year (log)	0.009***		0.007***	0.009***		0.007***
	(0.001)		(0.001)	(0.001)		(0.001)
Disaster aid last year (log)		0.012***	0.012***		0.012***	0.011***
		(0.001)	(0.001)		(0.001)	(0.001)
Farm proprietors (log)				-0.283***	-0.217**	-0.216**
				(0.093)	(0.096)	(0.096)
Pct. employed in ag.				-0.004	-0.004	-0.004
				(0.004)	(0.004)	(0.004)
Population (log)				-0.177	-0.260**	-0.266**
				(0.124)	(0.129)	(0.129)
Per capita pers. inc. (log)				-0.676***	-0.649***	-0.646***
				(0.115)	(0.112)	(0.112)
Total employment (log)				-0.035	-0.014	-0.011
				(0.056)	(0.057)	(0.057)
Dep. var. mean	11.837	11.861	11.861	11.837	11.862	11.861
Observations	57,879	55,105	55,105	57,879	55,210	55,105
R-squared	0.916	0.920	0.920	0.917	0.920	0.920

Significance levels: * 10 percent, ** 5 percent, *** 1 percent. Standard errors (in parentheses) clustered by county. Outcome variable is log of farmers' out-of-pocket expenditure on crop insurance in the county. All regressions include county and year fixed effects. Specifications with controls also include farm income decile indicators, which are omitted for readability. All characteristics controls are lags.

Table 3: The effect of politics on disaster payments

	(1)	(2)	(3)	(4)
Pct. voting for third party (std. dev.)	0.072***	0.025	0.352***	0.325***
	(0.019)	(0.018)	(0.050)	(0.050)
Number of farm proprietors (log)				0.032
				(0.173)
Pct. employed in forestry/agriculture				-0.008
				(0.008)
Population (log)				0.656***
				(0.252)
Per capita personal income (log)				-0.660**
				(0.269)
Total employment (log)				-0.374***
				(0.138)
Fixed effects	None	County	County, Year	County, Year
F-statistic	14.209	1.893	49.606	42.604
Dep. var. mean	7.827	7.827	7.827	7.827
Observations	57,876	57,876	57,876	57,876
R-squared	0.000	0.093	0.673	0.673

Significance levels: * 10 percent, ** 5 percent, *** 1 percent. Standard errors (in parentheses) clustered by county. The outcome variable is log of (total disaster payments in the county + 1). Specifications with controls also include farm income decile indicators, which are omitted for readability. All characteristics controls are lags.

Table 4: The effect of disaster payments on out-of-pocket insurance expenditure

	(1)	(2)	(3)	(4)
	Net premium (log)		Net premium + 1 (log)	
Disaster payments (log)	-0.137**	-0.197***	-0.285**	-0.371***
	(0.058)	(0.066)	(0.119)	(0.136)
Number of farm proprietors (log)		-0.293***		-0.372**
		(0.101)		(0.171)
Pct. employed in forestry/agriculture		-0.005		-0.010
		(0.005)		(0.007)
Population (log)		-0.023		-0.146
		(0.145)		(0.251)
Per capita personal income (log)		-0.817***		-1.054***
		(0.137)		(0.224)
Total employment (log)		-0.124*		-0.161
		(0.069)		(0.115)
F-statistic	52.195	44.827	43.967	37.050
Dep. var. mean	11.837	11.837	11.328	11.328
Observations	57,845	57,845	60,455	60,455
Adjusted R-squared	0.053	-0.262	-0.349	-0.685

Significance levels: * 10 percent, ** 5 percent, *** 1 percent. Standard errors (in parentheses) clustered by county. The net premium is the farmers' out-of-pocket expenditure on crop insurance in the county. All regressions include county and year fixed effects. Specifications with county characteristics controls also include farm income decile indicators, which are omitted for readability. All characteristics controls are lags.

Table 5: The effect of disaster payments on other measures of insurance coverage

	(1) Liability (log)	(2) Policies (log)	(3) Acres insured (log)	(4) Subsidy (log)
Disaster payments (log)	-0.185***	-0.186***	0.019	-0.336***
	(0.067)	(0.052)	(0.041)	(0.077)
Number of farm proprietors (log)	0.114	0.088	-0.284***	-0.206**
	(0.100)	(0.079)	(0.071)	(0.099)
Pct. employed in forestry/agriculture	-0.006	-0.004	0.000	-0.007
	(0.005)	(0.003)	(0.003)	(0.005)
Population (log)	0.704***	0.341***	0.572***	0.287*
	(0.151)	(0.119)	(0.104)	(0.150)
Per capita personal income (log)	-0.406***	-0.530***	-0.292***	-0.538***
	(0.133)	(0.104)	(0.087)	(0.148)
Total employment (log)	-0.194***	-0.142***	-0.214***	-0.214***
	(0.071)	(0.051)	(0.047)	(0.078)
F-statistic	37.816	37.816	38.327	37.816
Dep. var. mean	15.026	4.698	9.470	11.925
Observations	60,004	60,004	59,396	60,004
Adjusted R-squared	-0.060	-0.708	0.434	-0.165

Significance levels: * 10 percent, ** 5 percent, *** 1 percent. Standard errors (in parentheses) clustered by county. All regressions include year and county fixed effects as well as farm income decile indicators, which are omitted for readability. All characteristics controls are lags.

Table 6: The effect of disaster payments on coverage level choice

	(1) 50% (log)	(2) 55-65% (log)	(3) 70-75% (log)	(4) 80-90% (log)
Disaster payments (log)	0.203***	0.178***	-0.374***	-1.150***
	(0.064)	(0.057)	(0.100)	(0.199)
Number of farm proprietors (log)	0.115	0.630***	-0.437***	-2.501***
	(0.083)	(0.080)	(0.126)	(0.230)
Pct. employed in forestry/agriculture	0.004	0.007**	-0.037***	-0.037***
	(0.003)	(0.003)	(0.008)	(0.012)
Population (log)	0.552***	0.602***	-1.094***	-1.768***
	(0.134)	(0.122)	(0.203)	(0.350)
Per capita personal income (log)	0.286**	-0.099	-0.388**	-2.445***
	(0.122)	(0.109)	(0.198)	(0.366)
Total employment (log)	0.023	-0.047	-0.034	0.043
	(0.064)	(0.054)	(0.097)	(0.185)
F-statistic	37.050	37.050	37.050	37.050
Dep. var. mean	3.237	3.579	2.912	0.997
Observations	60,455	60,455	60,455	60,455
Adjusted R-squared	0.327	-0.901	-0.921	-9.277

Significance levels: * 10 percent, ** 5 percent, *** 1 percent. Standard errors (in parentheses) clustered by county. Percentages given in each column indicate coverage levels. 1 has been added to all variables prior to taking the log. All regressions include year and county fixed effects, as well as controls for county characteristics. Farm income decile indicators are included in the regression but are omitted from the table for readability. All characteristics controls are lags.

Table 7: The effect of disaster payments on input spending and real outcomes

	(1) Labor cost (log)	(2) Fertilizer spending (log)	(3) Mean yield (log)	(4) Cash receipts (log)
Disaster payments (log)	-0.060**	-0.121***	-0.029*	-0.347***
	(0.024)	(0.029)	(0.016)	(0.063)
Number of farm proprietors (log)	0.140***	-0.041	-0.048**	0.248***
	(0.033)	(0.035)	(0.021)	(0.069)
Pct. employed in forestry/agriculture	-0.001	-0.006**	-0.001	-0.004
	(0.002)	(0.002)	(0.002)	(0.004)
Population (log)	0.211***	-0.398***	-0.169***	-0.135
	(0.052)	(0.061)	(0.031)	(0.109)
Per capita personal income (log)	0.191***	-0.063	0.059*	-0.108
	(0.050)	(0.057)	(0.034)	(0.113)
Total employment (log)	0.018	0.011	0.005	-0.079
	(0.025)	(0.028)	(0.016)	(0.057)
F-statistic	34.966	36.758	28.656	35.172
Dep. var. mean	8.434	8.375	8.096	9.876
Observations	60,881	60,704	51,544	60,942
Adjusted R-squared	-0.636	-2.811	0.089	-12.836

Significance levels: * 10 percent, ** 5 percent, *** 1 percent. Standard errors (in parentheses) clustered by county. All regressions include year and county fixed effects, as well as controls for county characteristics. Farm income decile indicators are included in the regression but are omitted from the table for readability. All characteristics controls are lags.

6.1 Appendix: Model (For Online Publication)

To derive $T_L(x)$ and $T_{NL}(x)$, recall the first order condition $u'(w_S + T_S(x)) - u'(w_2 - T_S(x)) = 0$, where $S \in \{L, NL\}$. Differentiating with respect to x, we get:

$$u''(w_0^1 - \gamma x + T_{NL}(x))(T'_{NL}(x) - \gamma) - u''(w_2 - T_{NL}(x))T'_{NL}(x) = 0$$

Solving for $T'_{NL}(x)$, we get:

$$T'_{NL}(x) = \frac{\gamma u''(w_0^1 - \gamma x + T_{NL}(x))}{u''(w_0^1 - \gamma x + T_{NL}(x)) - u''(w_2 - T_{NL}(x))}$$

Similarly, the expression for $T'_L(x)$ is:

$$T'_L(x) = \frac{(1-\gamma)u''(w_0^1 + (1-\gamma)x - L + T_L(x))}{u''(w_0^1 + (1-\gamma)x - L + T_L(x))) - u''(w_2 - T_L(x))}$$

As long as agent 1 has fewer resources than agent 2 ($w_2 > w_0^1$), both $T'_{NL}(x)$ and $T'_L(x)$ will be negative. More importantly, even if agent 1 buys full insurance ($x = L$), the ratio $\frac{T'_{NL}(x)}{T'_L(x)}$ will not be equal to 1 unless $\gamma = 0.5$. Thus, except for this knife-edge case, purchasing full insurance is not an equilibrium in this model.

6.2 Appendix: Crop Insurance and Disaster Aid Payment Calculations (For Online Publication)

Individual farmers' disaster payments are calculated in much the same way as a crop insurance indemnity payment.[32] This similarity may have made it easier for farmers to view *ad hoc* CDP programs as a supplement to, or even a substitute for, crop insurance. Equation (5) illustrates the basic structure of an insurance indemnity or a disaster payment.

$$Payment = \underbrace{\bar{P} \times \bar{Y}}_{\text{Protection}} \times \underbrace{\frac{\max[0, \bar{Y} - Y]}{\bar{Y}}}_{\text{Trigger}}, \tag{5}$$

where $\bar{P}$ is the price guarantee, $\bar{Y}$ is the yield guarantee, and Y is the actual yield. The yield guarantee is typically the farmer's average actual yield over the past 4–10 years. In cases where insurance is based on the county's rather than the individual's yield, the yield guarantee is the expected county yield, as calculated from historic data.

As the left half of equation (5) shows, the protection level for both crop insurance and disaster assistance equals the price guarantee multiplied by the yield guarantee. The right half of Equation (5) illustrates the triggering mechanism: farmers begin to receive payments once the actual yield falls below the yield guarantee.

Farmers choose the price and yield guarantees ($\bar{P} \times \bar{Y}$) that determine their crop insurance indemnity payment. They typically choose 100% of the USDA-calculated expected market price as the price guarantee. The indemnity payment trigger can be determined by *a*) individual yield, *b*) individual revenue, *c*) mean county yield, or *d*) mean county revenue. Farmers cannot take out multiple insurance plans for the same plot. However, farmers who have multiple land parcels within the same county can choose to combine them under a single policy, as long as the same crop is grown on each one. This lowers the farmers' premium as well as the probability that the farmer receives an indemnity payment.

Within these plan types, farmers choose the covered yield—$\bar{Y}$ in equation (5)—as a percentage of their historical yield ranging from 50% to 90% in 5% increments.[33] For example, if a farmer chooses a 65% coverage level in an individual yield plan, he does not receive payments until his actual yield (Y) falls to more than 35% below his historical baseline.

The trigger for free-to-the-farmer disaster payments is legislated by Congress. However, as with crop insurance, its basis is determined by the yield shortfall. Historically, Congress has set

[32] Only the Supplemental Revenue Assistance Program (SURE) differs substantively from the following description. Despite program differences, SURE provides similar incentives for farmers to under insure. See Shields (2010) for details on SURE.

[33] Not all coverage levels are available for all plan types and in all years. For a more comprehensive overview of the U.S. crop insurance market, see Babcock (2012).

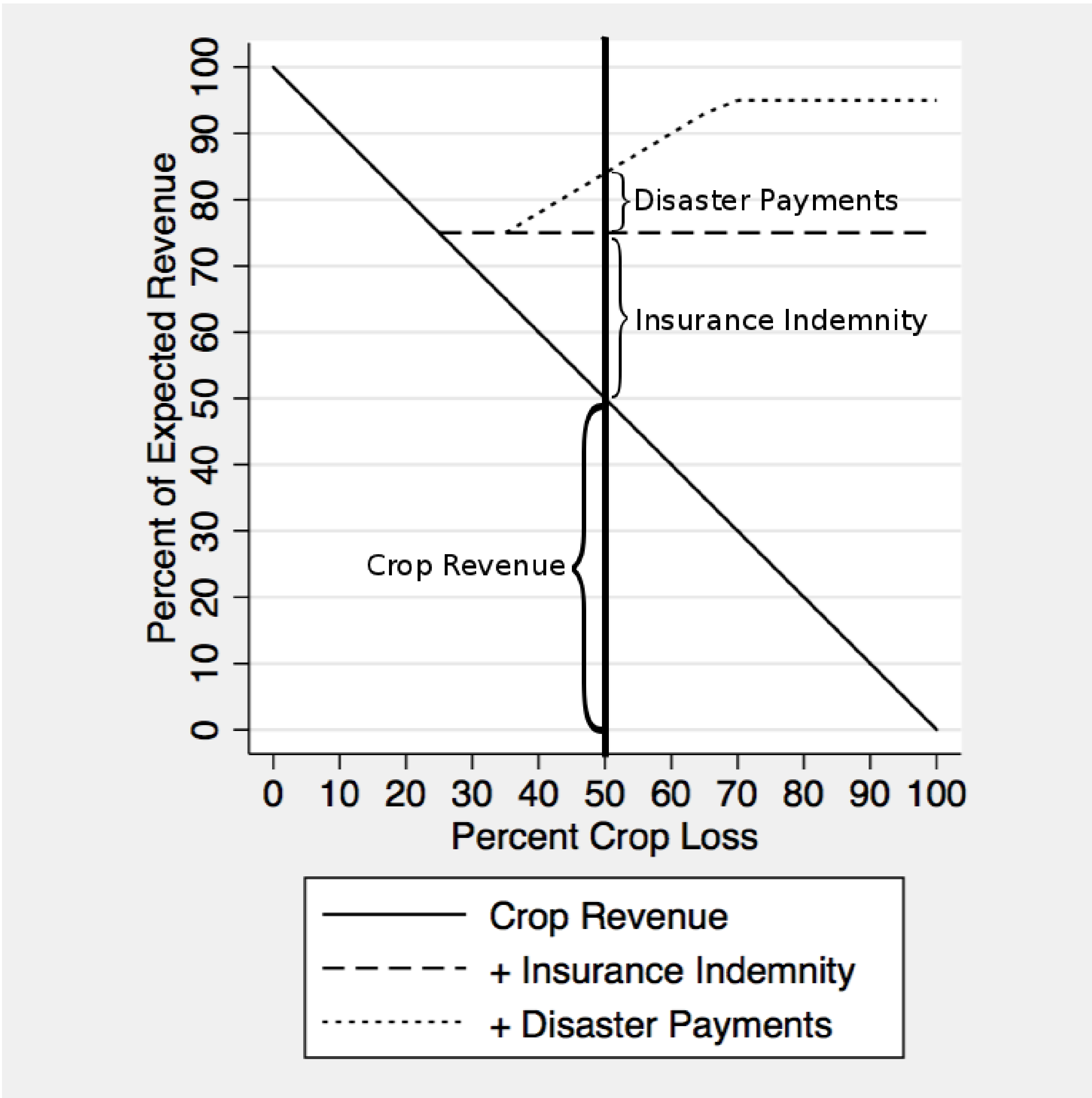
the yield guarantee ($\bar{Y}$) to 65% of a farm's historical-average yield. The price guarantee ($\bar{P}$) is often set at 60% of the market price, but it has been set as low as 45% in some years. To encourage future uptake of crop insurance, the legislation provides a higher price guarantee for disaster aid to farms with crop insurance vis-à-vis farms who could have purchased crop insurance but did not.

To illustrate the change in total crop revenue—expected crop sales, indemnities, and disaster payments—as crop losses grow, consider the example of a farm that is eligible for disaster payments and has 75% crop insurance coverage, as shown in Figure A1. The downward-sloping line represents the assumed linear relationship between crop loss and sales revenue—a 1% increase in crop loss decreases crop sales by 1%.[34] The horizontal, dotted line shows the level of crop revenue and indemnity payments at the 75% yield guarantee; indemnities as a percent of expected revenue equal the vertical distance between the sales revenue (solid) line and the "+ indemnity" (dotted) line. The dash-dot line represents crop revenue, insurance indemnities, and disaster payments. Since disaster payments increase as crop losses grow, as a percentage of expected revenue they equal the vertical distance between the "+ indemnity" line and the "+ disaster payments" line. The solid vertical line in Figure A1 helps to illustrate the components of total revenue if the farm had experienced a 50% crop loss. Crop-sales revenue would equal 50% of expected revenue, the indemnity payment would equal 25%, and the disaster payment would equal 9% (60% of the price times the 15% shortfall). Overall, this example farm receives 84% of expected revenue when suffering a 50% crop loss.

The example illustrated in Figure A1 shows that, with disaster payments, a farm with 75% crop insurance coverage receives more revenue from a 50% crop loss than it would with just a 24% crop loss. At the extreme, the example farm receives higher revenue from total crop loss than from a 10% crop loss.

[34]Because yields are likely to be correlated across farmers, crop sales revenue should fall by less than 1% due to higher prices in the case of loss. However, this does not affect the general point illustrated by the graph.

Figure A1: An Illustration of Farm Revenue as Crop Losses Increase for the Example of 75% Crop Insurance Coverage



6.3 Appendix Tables (For Online Publication)

Table A1: Laws providing disaster assistance for farmers, 1989-2009

Disaster Assistance Act of 1988 (P.L. 100-387, August 11, 1988)	Disaster Assistance Act of 1989 (P.L. 101-82, August 14, 1989)
Dire Emergency Supplemental Appropriations for Natural Disasters and Operation Desert Shield/Desert Storm (P.L. 102-229, December 12, 1991)	Dire Emergency Supplemental Appropriations Act, 1992; Hurricane Andrew, Typhoon Omar, Hurricane Iniki, etc. (P.L. 102-368, September 23, 1992)
1997 Emergency Supplemental Appropriations Act for Recovery from Natural Disasters, and for Overseas Peacekeeping Efforts, Including Those in Bosnia (P.L. 105-18, June 12, 1997)	Emergency Supplemental Appropriations for Relief from the Major, Widespread Flooding in the Midwest Act of 1993 (P.L. 103-75, August 12, 1993)
Emergency Supplemental Appropriations Act of 1994 (P.L. 103-211, February 12, 1994)	Agricultural, Rural Development, FDA, and Related Agencies Appropriations Act, 1995 (P.L. 103-330, September 30, 1994)
Omnibus Consolidated Rescissions and Appropriations Act of 1996 (P.L. 104-134, April 26, 1996)	Agricultural, Rural Development, FDA, and Related Agencies Appropriations Act, 1997 (P.L. 104-180, August 6, 1996)
Omnibus Consolidated Appropriations Act, 1997 (P.L. 104-208, September 30, 1996)	Supplemental Appropriations Act of 1993 (P.L. 103-50, July 2, 1993)
1998 Supplemental Appropriations and Rescissions Act (P.L. 105-174, May 1, 1998)	Omnibus Appropriations Act of 1999 (P.L. 105-277, October 21, 1998)
Agricultural, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, FY2001 (P.L. 106-387, October 28, 2000)	Agricultural, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, FY2000 (P.L. 106-78, October 22, 1999)
Consolidated Appropriations Act for FY2000 (P.L. 106-113, November 29, 1999)	Agriculture Risk Protection Act of 2000 (P.L. 106-224, June 20, 2000)
Emergency Supplemental Act for FY2000 (Title II of the Military Construction Appropriations Act, 2001) (P.L. 106-246, July 13, 2000)	1999 Emergency Supplemental Appropriations Act (P.L. 106-31, May 21, 1999)
Supplemental Appropriations Act, 2001 (P.L. 107-20, July 24, 2001)	FY2001 Supplemental Authorization for Agriculture (P.L. 107-25, August 13, 2001)
Consolidated Appropriations Resolution, FY2003 (P.L. 108-7, February 20, 2003)	Military Construction Appropriations and Emergency Hurricane Supplemental Appropriations Act, 2005 (P.L. 108-324, October 13, 2004)
Department of Defense, Emergency Supplemental Appropriations to Address Hurricanes in the Gulf of Mexico, and Pandemic Influenza Act, 2006 (P.L. 109-148, December 30, 2005)	U.S. Troop Readiness, Veterans' Care, Katrina Recovery, and Iraq Accountability Appropriations Act, 2007 (P.L. 110-28, May 25, 2007)
Consolidated Appropriations Act, 2008 (P.L. 110-161, December 26, 2007)	American Recovery and Reinvestment Act (ARRA), 2009 (P.L. 111-5, Feb. 17, 2009)

Table A2: Examples of crop disaster assistance programs

Crop Disaster Assistance	1999 Citrus Losses In California
Apple & Potato Quality Loss	Crop Hurricane Damage Program
Disaster - Cane Sugar	Disaster - Hurricane Hugo
Disaster Assistance - Big Horn River	Disaster Reserve Flood Compensation Program
Disaster Supplemental Appropriation	Disaster – Non-Program Crops
Disaster – Program Crops	Emergency Assistance Program
Emergency Conservation Program	Florida Hurricane Citrus Disaster
Florida Sugarcane Disaster Assistance Program	Hawaii Sugar Disaster
Hurricane Indemnity Program	Karnal Bunt Fungus Payment
Louisiana Sugarcane Disaster - Hurricane	Multi-Year Crop Loss Disaster Assistance
North Carolina Crop Hurricane Damage Program	Pasture Flood Compensation
Quality Losses Program	Single-Year Crop Loss Disaster Assistance
Specialty Crop Hurricane Disaster	Supplemental Revenue Assistance Program
Sugar Beet Disaster Program	Tree Assistance Programs
Tobacco Disaster Assistance	

Table A3: The effect of disaster payments with 1 added prior to taking logs

	(1) Net premiums (log)	(2) Policies (log)	(3) Acres insured (log)	(4) Subsidy (log)
Disaster payments (log)	-0.371***	-0.212***	-0.112*	-0.487***
	(0.136)	(0.054)	(0.063)	(0.111)
Number of farm proprietors (log)	-0.372**	0.042	-0.533***	-0.417***
	(0.171)	(0.078)	(0.101)	(0.141)
Pct. employed in forestry/agriculture	-0.010	-0.005	-0.005	-0.011*
	(0.007)	(0.003)	(0.004)	(0.006)
Population (log)	-0.146	0.287**	0.399***	0.240
	(0.251)	(0.118)	(0.155)	(0.209)
Per capita personal income (log)	-1.054***	-0.565***	-0.496***	-0.802***
	(0.224)	(0.107)	(0.124)	(0.211)
Total employment (log)	-0.161	-0.147***	-0.293***	-0.307***
	(0.115)	(0.052)	(0.063)	(0.108)
F-statistic	37.050	37.050	37.050	37.050
Dep. var. mean	11.328	4.724	9.308	11.837
Observations	60,455	60,455	60,455	60,455
Adjusted R-squared	-0.685	-1.205	0.093	-1.017

Significance levels: * 10 percent, ** 5 percent, *** 1 percent. Standard errors (in parentheses) clustered by county. 1 has been added to all dependent variables prior to taking the log. All regressions include county and year fixed effects and controls for county characteristics. Coefficients on farm income decile indicators are omitted for readability. All characteristics controls are lags.

Table A4: The effect of disaster payments on insurance decisions, no farm counties

	(1)	(2)	(3)	(4)
	Panel A: measures of insurance takeup			
	Net premium (log)	Policies (log)	Acres insured (log)	Subsidy (log)
Disaster payments (log)	-0.145**	-0.176***	0.031	-0.290***
	(0.062)	(0.051)	(0.042)	(0.071)
F-statistic	44.215	38.083	38.328	38.083
Dep. var. mean	11.837	4.736	9.476	11.928
Observations	50,417	52,303	51,794	52,303
Adjusted R-squared	0.051	-0.568	0.430	0.087
	Panel B: real outcomes			
	Labor cost (log)	Fertilizer spending (log)	Mean yield (log)	Cash receipts (log)
Disaster payments (log)	-0.021	-0.094***	-0.034**	-0.332***
	(0.021)	(0.025)	(0.015)	(0.060)
F-statistic	36.244	38.057	31.581	35.847
Dep. var. mean	8.473	8.416	8.122	9.932
Observations	53,033	52,877	45,173	53,064
Adjusted R-squared	-0.019	-1.631	0.059	-11.953

Significance levels: * 10 percent, ** 5 percent, *** 1 percent. Standard errors (in parentheses) clustered by county. Sample excludes counties where more than 5% of the population was employed in farming at any point in time during our sample period. All regressions include county and year fixed effects and controls for county characteristics, which are not shown for readability. All characteristics controls are lags.

Table A5: The effect of disaster payments on insurance decisions, counties with 22 observations

	(1)	(2)	(3)	(4)
	Panel A: measures of insurance takeup			
	Net premium (log)	Policies (log)	Acres insured (log)	Subsidy (log)
Disaster payments (log)	-0.236***	-0.176***	0.030	-0.403***
	(0.077)	(0.054)	(0.040)	(0.089)
F-statistic	34.157	32.475	32.424	32.475
Dep. var. mean	12.177	5.090	9.882	12.325
Observations	52,670	53,004	52,932	53,004
Adjusted R-squared	-0.546	-0.554	0.488	-0.472
	Panel B: real outcomes			
	Labor cost (log)	Fertilizer spending (log)	Mean yield (log)	Cash receipts (log)
Disaster payments (log)	-0.064**	-0.147***	-0.020	-0.341***
	(0.026)	(0.034)	(0.017)	(0.064)
F-statistic	32.324	32.237	25.323	32.154
Dep. var. mean	8.513	8.584	8.100	10.086
Observations	53,048	53,028	48,489	53,052
Adjusted R-squared	-0.738	-4.006	0.142	-11.799

Significance levels: * 10 percent, ** 5 percent, *** 1 percent. Standard errors (in parentheses) clustered by county. Sample restricted to counties that were present in each of the 22 years of the sample. All regressions include county and year fixed effects and controls for county characteristics, which are not shown for readability. All characteristics controls are lags.