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Does Finance Make Us Less Social?

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Abstract

Informal risk sharing within social networks and formal financial contracts both enable households to manage risk. We find that financial contracting reduces participation in social networks. Specifically, increased crop insurance usage decreased local religious adherence and congregation membership in agricultural communities. Our identification utilizes the Federal Crop Insurance Reform Act of 1994 that doubled crop insurance usage nationally within a year, although changes in usage varied across counties. Difference-in-Difference and Spatial First Difference tests confirm that households substituted insurance for religiosity. This substitution was associated with reductions in crop diversification and crop yields, indicating an increase in moral hazard.

Keywords: Household Risk Management, Financial Contracts, Social Networks

JEL Codes: G5, G51, G52

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I Introduction

How do households manage income risk? This question is not only central to modern finance but also to society at large. Traditionally, households relied on social networks, typically within their local communities or extended family, to navigate difficult times. However, does the relatively recent use of financial contracts to manage risk affect household participation in social networks? We examine this question by testing whether the increased use of crop insurance reduced religious activities in agricultural communities.

Our research question is motivated by Rajan (2019)'s description of how financial markets, in conjunction with governments, have encroached on activities that once reinforced community bonds. This encroachment may explain why the role of finance in society is so contentious (Zingales (2015)). Therefore, besides contributing to the literature on household risk management, our results also contribute to policy debates regarding the role of government and finance in society.

An existing literature documents that risk pooling within social networks enables households to manage the consumption risk associated with income shocks (Ambrus et al. (2014), Mobarak and Rosenzweig (2013), Fafchamps and Gubert (2007), Townsend (1994)). Within agricultural communities, the *farmers' cooperative* functions as an informal credit market by financing the consumption of farmers experiencing a poor harvest and delaying their payments (Kimball (1988)). The church also provides a social network capable of facilitating risk sharing since Iannaccone (1992) argues that churches mitigate adverse selection through prohibitions, rituals, and other commitments. The monitoring and information sharing needed to ensure compliance with these commitments enables churches to also mitigate moral hazard and enforce risk-sharing agreements.[1] Therefore,

[1] Enforcement can involve suspending access to the risk-sharing agreement for members that exert insufficient effort, commit inadequate resources, or fail to reciprocate. The podcast Creating God on National Public Radio's Hidden Brain summarizes the ability of religious institutions to enforce contracts.

the ability of religiosity to facilitate risk sharing does not require direct cash transfers from religious institutions to households.

Moreover, empirical evidence has specifically found that social networks defined by religiosity enhance risk sharing. Chen (2010) reports that religiosity alleviates the financial constraints of households and smooths their consumption, while Ager et al. (2016) report that church membership provided informal insurance in the aftermath of a natural disaster. While Ager and Ciccone (2018) find a positive relation between religiosity and agricultural risk, our contribution is determining whether the use of a financial contract to manage household risk displaces social networks that have traditionally facilitated informal risk sharing.

To study the risk management decisions of households, we examine the use of crop insurance for six major field crops (corn, soybeans, wheat, oats, barley, and sorghum). Of the 2 million farms in the United States, 98% are family farms.[2] In response to the Great Flood of 1993, the Federal Crop Insurance Reform Act (FCIRA) of 1994 dramatically increased subsidies for crop insurance to encourage farmers to purchase crop insurance instead of relying on federal disaster assistance. This legislation doubled the aggregate use of crop insurance from 35% of field crop production in 1994 to 77% in 1995. However, as illustrated in Figure 1, changes in the use of this financial contract varied substantially across counties.

Our substitution hypothesis posits that financial contracts to manage household risk are a substitute for religious adherence. Specifically, we predict that the increased use of crop insurance decreased religious adherence in agricultural communities. The data supports our substitution hypothesis. We find an inverse county-level relation between increases in crop insurance usage and decreases in religious adherence that is more salient

[2] United States Department of Agriculture's National Agricultural Statistics Service. Small family farms (less than $350,000 in annual gross income) account for 90% of all U.S. farms.

in counties where agricultural risk is higher. Difference-in-difference methodologies that exploit cross-sectional variation across counties and time-series variation before versus after the FCIRA of 1994 confirm our substitution hypothesis. The control groups underlying these methodologies are defined by urban counties and rural counties with unsuitable terrain for cultivating field crops as well as religious counties that experienced small increases in crop insurance usage following the FCIRA.

As the FCIRA of 1994 did not directly target religious activities, reverse causality is unlikely to confound our empirical support for the substitution hypothesis. Furthermore, prevailing trends in religiosity before the FCIRA cannot explain our empirical support for the substitution hypothesis since religious adherence was trending upward, instead of downward, before this legislation. In addition, there were no confounding government programs that would have otherwise financed the consumption of farmers or increased their income.

Furthermore, we use the spatial first difference (SFD) method of Druckenmiller and Hsiang (2018) that compares neighboring counties to account for omitted variables. Neighboring counties may be culturally similar but have different exposures to agricultural risk and therefore different responses to the FCIRA of 1994. The results from the SFD estimation confirm that the increased use of crop insurance decreased religious adherence.

Church donations are able to capture changes in religiosity that occur before individuals declare themselves to be non-adherents on the next census. Using annual data on church donations, a difference-in-difference methodology confirms that church donations decreased more in rural counties after 1994 than in urban counties. The finding is consistent with Auriol et al. (2020)'s conclusion that donations to religious institutions have an insurance motive.

We also find that crop insurance displaced precautionary savings in the form of bank deposits. This finding confirms the importance of crop insurance to household risk management and indicates that our support for the substitution hypothesis is unlikely to be spurious. While precautionary savings is a response to agricultural risk, crop diversification is a determinant of agricultural risk. We find that the increased use of crop insurance usage reduced crop diversification, especially in counties where religious adherence experienced a large decline, and also reduced crop yields. Thus, consistent with an increase in moral hazard, the reduction in crop diversification increased agricultural risk without increasing productivity. Intuitively, religious adherence enables risk-sharing agreements to mitigate moral hazard by facilitating monitoring and information sharing. Consequently, the displacement of risk-sharing agreements by government-subsidized financial contracts that reduce income risk can increase moral hazard. This conclusion is consistent with Wei and Zhang (2021)'s finding that the introduction of a government-funded pension in rural China reduced agricultural effort.

In summary, our results indicate that household participation in social networks is dependent on a cost-benefit analysis. Specifically, consistent with our substitution hypothesis, reductions in the cost of using a financial contract to manage household risk reduce participation in social networks that facilitate risk sharing. While prior empirical evidence finds that social networks impact financial outcomes (Hirshleifer (2015), Heimer (2016)), we study the impact of finance on social networks. For example, Hong et al. (2004) find that church attendance influences participation in the stock market. Conversely, we find that the use of financial contracting alters church attendance. By examining the broader implications of finance for society, our contribution parallels Engelberg and Parsons (2016)'s study regarding the impact of financial markets on investor health.

For emphasis, the implications of our study are not limited to social networks based on religious adherence. However, social networks that require less commitment such as recreational sports clubs are less effective at facilitating risk sharing. Therefore, the impact of insurance usage on low-commitment social networks is likely to be less salient. The implications of our study are also not limited to instances where government subsidies lower the cost of financial contracting since several FinTech applications are attempting to lower the cost of using financial contracts to manage household risk.

The remainder of the paper is organized as follows. Section II reviews the related literature and develops our substitution hypothesis. Section III describes our data. Section IV provides our empirical support for the substitution hypothesis, while Section V reports on its economic consequences. Section VI then concludes.

II Literature Review and Empirical Hypothesis

As family farms are primarily responsible for the production of field crops, the use of crop insurance by farmers producing these crops provides an ideal setting for studying household risk management. To manage their exposure to agricultural risk, households can either (i) participate in an informal risk-sharing agreement facilitated by their religious adherence, or (ii) purchase a financial contract in the form of crop insurance.

A Informal Risk-Sharing Agreements

Social networks provide households with access to informal risk-sharing agreements (Ambrus et al. (2014), Fafchamps and Gubert (2007), and Ligon et al. (2002)). Although the empirical literature on informal risk sharing within agricultural communities often studies kinship networks in developing countries (Townsend (1994), Kinnan and Townsend (2012)), Kranton (1996) demonstrates that reciprocity is self-sustaining in developed economies with cash-based markets. Moreover, besides kinship, social networks based on religious adherence also facilitate risk sharing. Putnam and Campbell (2010) report that a common religious background increases trust, which is crucial for risk sharing according to Karlan et al. (2009). Gurun et al. (2018) also document that trust among religious adherents facilitates financial intermediation.[3] Furthermore, Putnam (2000) reports that religious adherence facilitates risk sharing by enhancing reciprocity, while Berman (2000) reports that religious adherence facilitates risk sharing by signaling commitment.

While Mobarak and Rosenzweig (2013) report that informal risk sharing mitigates the demand for insurance in India, their study is not motivated by a cost-benefit analysis that determines household participation in risk-sharing agreements. In contrast, our study identifies reductions in participation arising from a reduction in the cost of insurance. Binzel et al. (2013) find that access to banking displaced informal risk sharing in India. While the banking system may facilitate the accumulation of precautionary savings, access to banking is not a substitute for risk sharing.

Finally, although agricultural risk has a systematic component, the consumption of farmers experiencing a poor harvest can be supported by other congregation member whose incomes are not derived from agricultural production. Thus, informal risk-sharing agreements in agricultural communities can diversify agricultural risk across different occupations. Nevertheless, the agricultural risk borne by an informal risk-sharing agreement increases with agricultural production. Therefore, we use the proportion of a county's land area cultivated with field crops as a proxy for agricultural risk.

B Crop Insurance

Private insurance companies sell crop insurance to farmers. Each crop insurance policy and corresponding premium are subject to approval by the Federal Crop Insurance Corporation before being underwritten by the United States Department of Agriculture's Risk Management Agency (Glauber (2004)).

While a futures contract enables the price risk of specific field crops to be hedged,

[3] FinTech applications also require costly mechanisms to build and maintain trust. For example, Budish (2018) and Abadi and Brunnermeier (2018) examine the cost associated with decentralized blockchains.

crop insurance enables farmers to hedge their idiosyncratic output risk. In contrast to disaster assistance, which resulted from an uncertain political process and was a response to systematic output reductions caused by natural disasters, crop insurance offers more complete coverage against idiosyncratic as well as systematic output reductions.

Crop insurance began in 1938 with the Federal Crop Insurance Act. However, the use of this financial contract was negligible until subsidies were introduced by the Federal Crop Insurance Act of 1980. Nevertheless, the low use of crop insurance during the 1980s necessitated government disaster assistance when large floods occurred. However, the Great Flood of 1993 was a critical event for crop insurance. Rainfall in the summer of 1992 lead to above-normal reservoir levels in the Missouri and Upper Mississippi River basins. As rain persisted into 1993, soils in the region were completely saturated by June and subsequent rain resulted in severe flooding throughout the Midwest that caused approximately $15 billion in damage.

In response to the Great Flood of 1993, Congress passed the Federal Crop Insurance Reform Act (FCIRA) of 1994 that increased subsidies for crop insurance. This legislation also authorized a catastrophic loss policy that was completely subsidized by the government, except for a small administrative fee. The FCIRA doubled the use of crop insurance from 100 million acres in 1994 to more than 220 million acres in 1995. Before government subsidies, the total amount of crop insurance premiums paid by farmers increased by 63% from $949 million in 1994 to over $1.55 billion in 1995. However, as government subsidies increased nearly 250% from $255 million to $889 million, the total out-of-pocket cost farmers paid to purchase crop insurance in 1995 was similar to 1994.

The increase in crop insurance usage induced by the FCIRA of 1994 lowered the income risk of farmers. Across all agricultural counties, normalized income volatility declined from 0.245 to 0.191.[4] This difference has a corresponding t-statistic of 28.73. A

[4]We compute normalized income volatility as the standard deviation of a county's annual average income

larger difference of 0.072 (t-statistic of 26.88) is found in agricultural counties with poor soil where normalized income volatility declined from 0.250 to 0.178. The role of soil quality in determining agricultural risk is described in the next section.

Figure 1 illustrates the variation across county-level changes in crop insurance usage between 1994 and 1995. Consistent with adverse selection, crop insurance usage increased more in counties with higher agricultural risk. However, as crop insurance usage was already higher in these counties before the FCIRA of 1994, only 10% of the variation across county-level changes in crop insurance is explained by agricultural risk.

Overall, the exogenous reduction in the cost of crop insurance attributable to the FCIRA of 1994 is the cornerstone of our identification strategy since this legislation originated with a natural disaster and was not intended to alter religiosity. In particular, government subsidies for crop insurance did not alter the pecuniary or non-pecuniary cost of religious adherence.[5]

C Substitution Hypothesis

Our testable hypothesis involves the impact of crop insurance on religious adherence since this financial contract is designed specifically to mitigate agricultural risk.

SUBSTITUTION HYPOTHESIS: *The use of crop insurance reduces the religiosity of households exposed to agricultural risk.*

The substitution hypothesis is motivated by the following illustrative model that parallels Azzi and Ehrenberg (1975). To formalize the role of religious adherence as a risk management mechanism, the illustrative model assumes utility $U(c_i, r_i, z_i)$ is a function of three components: consumption, a psychological benefit from religious participation, and

from 1980 to 1994 (1995 to 2010) divided by the county's average income during this period.

[5]Gruber and Hungerman (2008) document the non-pecuniary cost of religious adherence as the repeal of Sunday shopping prohibitions lowered church attendance. The repeal of these state laws occurred more than a decade before the FCIRA of 1994.

leisure that decreases with religious participation. The one-period model examines the religious participation of an household whose consumption differs across two states; good and bad.

In the good state, which occurs with probability $1 - \lambda$, consumption equals $1 - p$. This amount normalizes consumption to one unit minus an "insurance premium" p that insures against the poor state. In the bad state, which occurs with probability λ, consumption is reduced to $m = \frac{p\,(1-\lambda)}{\lambda}$. The amount m equates the expected cost of insurance $p\,(1 - \lambda)$ in the good state with its expected benefit $\lambda\, m$ in the bad state, assuming consumption would be zero in the bad state without insurance. The state-dependence of consumption is summarized as

State	Probability	Consumption
Bad	λ	m
Good	$1 - \lambda$	$1 - p$

The amount p represents lost consumption in the good state that is transferred to those experiencing the bad state. The psychological benefit of religion is a function of religiosity r_i expressed in units of time. This benefit is constant across the two states and equals the amount of time household i spent participating in religious activities. Conversely, household i benefits from leisure time z_i, which decreases with the time spent participating in religious activities due to the following time constraint that is normalized to 1

$$z_i + r_i \;=\; 1\,. \tag{1}$$

Following Azzi and Ehrenberg (1975), the utility from consumption, c_i, and religious participation, r_i, are not additively separable, while leisure, z_i, enters the utility function linearly to supplement consumption. Specifically, α is an exogenous parameter that captures the utility from leisure and is identical for all households. The resulting utility function equals

$$U(c_i, r_i, z_i) \;=\; ln\,(c_i + r_i) + \alpha\, z_i\,, \tag{2}$$

implying that expected utility equals

$$\begin{aligned} E\,[U(p, r_i)] &= (1-\lambda)\;ln\,(1-p+r_i) + \lambda\, ln\,(m+r_i) + \alpha\,(1-r_i) \\ &= (1-\lambda)\;ln\,(1-p+r_i) + \lambda\, ln\left(\frac{p\;(1-\lambda)}{\lambda} + r_i\right) + \alpha\,(1-r_i)\;. \end{aligned} \tag{3}$$

This expected utility has a first order condition with respect to p equaling

$$\frac{\partial E[U]}{\partial p} = 0 \;\;\Rightarrow\;\; p* = \lambda\,, \tag{4}$$

which implies the optimal insurance premium $p*$ increases with risk, λ. Moreover, religious participation also increases with risk, as the first-order condition for equation (3) with respect to r_i

$$\frac{\partial E[U]}{\partial r_i} = 0 \;\;\Rightarrow\;\; r_i* = \frac{1}{\alpha} + \lambda + 1\,, \tag{5}$$

has two implications:

1. Religious participation r_i* increases with risk, λ.
2. Religious participation r_i* decreases with a greater preference for leisure, α.

To formalize the substitution hypothesis, allow λ to be a function of financial contracting denoted κ, $\lambda = f(\kappa, Risk)$, as well as aggregate $Risk$ that includes soil conditions, agricultural intensity, and other county-level factors. With financial contracting lowering risk

$$\frac{\partial \lambda}{\partial \kappa} \; < \; 0\,,$$

equation (5) implies that optimal religious participation r_i* declines with financial contracting

$$\frac{\partial r_i*}{\partial \kappa} \; = \; \frac{\partial r_i*}{\partial \lambda} \; \frac{\partial \lambda}{\partial \kappa} < 0\,.$$

Thus, the increased adoption of crop insurance is predicted to lower religious adherence.

Besides access to an informal risk-sharing agreement, other benefits of religious adherence such as access to education weaken empirical support for our substitution hypothesis since crop insurance is not a substitute for these benefits. Furthermore, our substitution hypothesis is distinct from the substitution between government expenditures and church expenditures on social assistance that directly finance the consumption of low income households (Hungerman (2005), Gruber and Hungerman (2007)). In our identification, the government decreases the cost of using a financial contract to manage household risk without increasing household income.[6] Nevertheless, we control for income in our empirical tests and obtain similar results in counties whose average incomes were stable before and after the FCIRA of 1994.

[6]This distinction is important since several FinTech applications are attempting to lower the cost of using financial contracts to manage household risk. FinTech is also conditioning on soft information from social media that previously was privy to members of social networks, thereby reducing the informational advantage of social networks that function as informal credit markets.

III Data

The United States Department of Agriculture (USDA) provides annual data on the total acreage of each county that is cultivated with field crops. The Risk Management Agency at the USDA provides annual data on the total acreage of each county that is cultivated with field crops and covered by crop insurance.

For each county, we compute agricultural intensity (*Agriculture*) as the proportion of a county's total acreage that is cultivated with field crops.[7] Throughout the remainder of the paper, agricultural counties refer to counties whose agricultural intensity (*Agriculture*) is above the national median. The use of financial contracting to manage agricultural risk (*Finance*) is computed as the proportion of a county's acreage cultivated with field crops that is covered by crop insurance. Both *Agriculture* and *Finance* are constructed annually.

Besides *Agriculture*, we measure agricultural risk using a county-level proxy for soil quality, Available Water Storage (AWS), from the National Cooperative Soil Survey at the USDA's Natural Resources Conservation Service. AWS refers to the quantity of water that is capable of being stored to a depth of 25 centimeters by accounting for a variety of different soil characteristics such as its density, mineral composition, etc. The capacity for water storage is measured in centimeters of water per centimeter of soil. Soil with high water retention can withstand greater variation in precipitation. Thus, good soil with a high AWS is associated with lower agricultural risk since this soil is able to self-insure the production of field crops against a deficit or surplus of water. Unreported results confirm that crop yields are higher in counties with better soil, while the volatility of crop yields and therefore agricultural incomes are lower. Consequently, interventions such as crop selection,

[7] As a proxy for agricultural intensity, the percentage of a county's area cultivated with field crops from the U.S. Department of Agriculture is more relevant than the fraction of agricultural employment from the U.S. Bureau of Labor Statistics since agricultural employment is broadly defined to include employment in alternative types of agriculture, such as ranching. Nevertheless, rural counties with these alternative types of agriculture are included in the control group of a later difference-in-difference test.

irrigation, and drainage are unable to overcome poor soil.[8] Furthermore, crop insurance payout rates and premiums are not used to measure agricultural risk since both these variables are confounded by moral hazard as well as the subsidies and reinsurance provided by the federal government (Horowitz and Lichtenberg (1993), Roberts et al. (2006)).

County-level religion and population data are obtained from the United States Census. The number of religious adherents and the number of church congregations for each Christian religion are available every decade for 1980, 1990, 2000, and 2010. The census measures *participation* and not simply a *belief* in a religion as all adherents of a Christian religion are required to be members of a Christian church congregation. However, our results are robust to the inclusion of non-Christian religions that have relatively few adherents in agricultural counties.

Religious adherence is computed by dividing the total number of Christian adherents in a county by the county's total population. Thus, any outward migration of non-religious residents from agricultural counties increases rather than decreases religious adherence. An alternative metric for religiosity is the average size of church congregations. This alternative metric accounts for differences across Christian denominations, and is robust to the inward migration of non-religious residents. Appendix A describes the main variables used in our empirical tests.

Each county is identified by its five-digit FIPS code. During the 1980 to 2010 sample period, Table 1 contains summary statistics for the variables involved in testing the substitution hypothesis. The summary statistics highlight the significant variation across counties in field crop production, the use of crop insurance, agricultural risk, and the proportion of the population that adheres to a Christian religion as well as the average

[8] To clarify, Genetically Modified Organisms (GMOs) involve either herbicide-tolerant or pest-tolerant field crops but GMO crops are not tolerant of poor soil. More important, by reducing risk, the adoption of GMOs is expected to decrease the use of crop insurance, which Figure 1 indicates is not observed in the vast majority of counties following the FCIRA of 1994.

membership of Christian congregations. Table 1 reports that the average county has 24% of its land under cultivation by field crops, 56% of its population being a Christian adherent, and 81 church congregations with the average congregation having 306 members.

IV Empirical Results

This section reports empirical support for the substitution hypothesis. Before examining this hypothesis, we first provide evidence of a positive association between religious adherence and agricultural risk within U.S. agricultural communities. This preliminary evidence extends the existing literature that documents the prevalence of informal risk-sharing agreements in developing countries.

A Religious Adherence and Agricultural Risk

According to Figure 2, for counties in the lowest decile of agricultural intensity (*Agriculture*), 49% of the population are religious adherents compared to 65% for counties in the highest decile of agricultural intensity. The positive relation between the level of religious adherence and agricultural intensity in a county is nearly monotonic.

More formally, we estimate the following panel regression with county-year observations

$$\text{Adherence}_{i,t} = \beta_1 \,\text{Agriculture}_{i,t} + \gamma \,\text{X}_{i,t} + \epsilon_{i,t} \,, \tag{6}$$

using 1990 and 2000 census data to conform with our later results for the substitution hypothesis. Year fixed effects are included to absorb any trend in religiosity across the United States. County fixed effects are also included to account for variation in *Adherence* across counties and determine whether changes in agricultural activity induce changes in religious adherence. Standard errors are clustered by county. The control variables in X represent the following county characteristics: population and per capita income as well as the percentage of the population that is college educated, foreign born, married, and African American since these demographic variables may be correlated with religious adherence and agricultural production. A later analysis focuses on the average age of residents in each county, and the impact of the FCIRA on demographic characteristics such as age across counties.

The results in Panel A of Table 2 indicate that religious adherence is higher in counties with greater agricultural production. In the first column, results are presented without including any county-level control variables. In the second column, county-level control variables are included. We find a consistently positive relation between changes in religious adherence and agricultural activity as the β_1 coefficient for *Agriculture* is statistically significant at the 1%-level across both specifications. In particular, the statistical significance of the β_1 coefficient does not attenuate as control variables are added. Instead, the point estimate for *Agriculture* only declines slightly from 0.541 to 0.477. For the more conservative estimate, a one standard deviation increase in agriculture (25%) leads to a 11.9% (= 25% $\times$ 0.477) increase in religious adherence. With religious adherence averaging 56%, this increase in religious adherence is economically significant. Consequently, informal risk sharing within agricultural communities is not limited to kinship networks in developing countries but also pertains to social networks based on religious adherence in the United States.

In addition, the positive relation between changes in agricultural activity and religious adherence is limited to counties with poor soil where agricultural risk is higher. Specifically, the β_1 coefficient equals 0.624 in counties with poor soil and is statistically significant at the 1%-level, compared to the statistically insignificant 0.099 coefficient in counties with good soil. Variation in the relation between agricultural risk and religious adherence due to soil quality is invoked in our subsequent test of the substitution hypothesis.

As religious adherence varies substantially across counties, the inclusion of county fixed effects results in the standard R-squared measure being near 1. To examine time-series variation in religious adherence, we also report a time series R-squared measure that is obtained by regressing religious adherence on county fixed effects in the first stage, then using the residuals from this regression as dependent variables in a second stage. The R-squared from the second stage represents the time series R-squared, which captures time-series variation in religious adherence that is explained by the panel regression specification.

We also examine the composition of religious adherents based on the strictness of their denomination. Strict denominations are likely to be more effective at mitigating adverse selection (Iannaccone (1994)) and consequently at facilitating risk sharing. Strict religious denominations include the Church of Jesus Christ of Latter-Day Saints, Evangelicals, Seventh-Day Adventists, and Southern Baptists. We construct a county-level strictness ratio defined as the number of adherents in strict Christian denominations divided by the total number of Christian adherents. Consistent with the need for great risk sharing, agricultural counties with poor soil have nearly 55% more adherents from strict denominations compared to those with good soil. Specifically, the percentage of strict adherents in counties with poor soil is 34% versus 22% in counties with good soil. This 12% difference is significant at the 1%-level (t-statistic of 56.48). Thus, agricultural risk influences the strictness of the social contract that binds religious adherents.

Overall, consistent with Ager and Ciccone (2018)'s finding that households use religious adherence to mitigate agricultural risk, changes in agricultural activity are positively associated with changes in religious adherence.

B Substitution Hypothesis

The substitution hypothesis posits that lowering the cost of crop insurance displaces religiosity as a mechanism to manage household risk. In the panel regression below, the dependent variable *Adherence* is computed by dividing the total number of Christian adherents in a county by the county's total population. *Finance* is the independent variable of primary interest and is computed as the proportion of acreage cultivated by field crops in a county that is covered by crop insurance.

$$\text{Adherence}_{i,t} = \beta_1 \,\text{Finance}_{i,t} + \beta_2 \,\text{Agriculture}_{i,t} + \gamma \,\text{X}_{i,t} + \epsilon_{i,t} \,. \tag{7}$$

We include county fixed effects to account for unobserved political, social, and economic conditions that differ across counties, and year fixed effects to control for time-series variation in religious adherence at the national level. With both county and year fixed effects, we identify the impact of time-series variation in crop insurance on religious adherence at the county level. This panel regression is estimated using 1990 and 2000 census data, since the FCIRA of 1994 was implemented between these census dates.

Panel A of Table 3 reports the results from equation (7). In the first column, we include county fixed effects and year fixed effects, while *Agriculture* is included in the second column. In the third column, an extensive set of time-varying county characteristics are included as control variables.

In support of the substitution hypothesis, the evidence in Table 3 reveals an economically and statistically significant inverse relation between crop insurance usage and religious adherence. First, the point estimate for *Finance* is statistically significant at the 1%-level across all specifications. The significance level does not attenuate with the addition of control variables. Second, the point estimate for *Finance* is consistently negative, ranging from -0.044 to -0.128 across the different specifications.

Financial contracting is not limited to exerting a contemporaneous impact on social contracting. Appendix B details the results from a distributed lags model that extends equation (7) by including lagged values of *Finance*. The results in the appendix are consistent with financial contracting exerting a contemporaneous and delayed impact on social contracting for up to four years. This finding suggests a gradual substitution away from informal risk-sharing.

To understand the economic impact of financial contracting on religious adherence, the point estimate of -0.044 implies that if crop insurance usage increases from 40% to 80% of the acreage under cultivation by field crops, religious adherence decreases by -1.76%. For comparison, the average county-level change in religious adherence equals -4.92% over the entire 1980 to 2010 period. Thus, the increased use of financial contracting during the 1990s accounts for an economically significant portion of the total decline in religiosity during our four-decade long sample period.

For counties with poor soil, where agricultural risk and religious adherence are both higher according to Figure 2, the substitution effect is predicted to be stronger. Consistent with this prediction, the results in Panel A of Table 3 indicate that the displacement of religiosity by crop insurance is concentrated in agricultural counties with higher agricultural risk. Specifically, in counties with poor soil, the β_1 coefficient for *Finance* is -0.047 and statistically significant at the 1%-level. Conversely, for counties with good soil, the β_1 coefficient is near zero and statistically insignificant.

These results in Panel B of Table 3 arise from redefining agricultural intensity, hence agricultural risk, as the percentage of employment in a county that is involved in farming. However, using this alternative measure of agricultural intensity, *Farm Employment*, does not change our empirical support for the substitution hypothesis since the β_1 coefficients for *Finance* remain negative. Therefore, for the remainder of the paper, we continue to condition on *Agriculture* instead of *Farm Employment* as our proxy for agricultural intensity since employment in farming includes ranching and other types of agriculture.

Our results likely underestimate the impact of financial contracting on social networks for two reasons. First, participation in a church congregation is continuous rather than binary. For example, an individual's religious commitment can decline over an extended period of time before the individual declares herself to be a non-adherent. This decline is not captured by our current measure of religious adherence but is addressed in a later analysis of church donations. Second, any migration of non-adherents from agricultural counties to metropolitan counties increases the religious adherence of agricultural counties. The outward migration of non-adherents is addressed by our next analysis involving the membership of church congregations. Unlike religious adherence, the size of church congregations is not impacted by the outward migration of non-adherents from rural counties.

The average age of rural counties increased by 2.3 years during our sample period compared to an increase of 2.5 years in urban counties. Specifically, in rural counties, the average age was 36.0 years in the pre-FCIRA period from 1980 to 1994 and 38.3 years in the post-FCIRA period from 1995 to 2010. In urban counties, the average age was 35.3 years in the pre-FCIRA period and 37.8 years in the post-FCIRA period. Thus, although rural counties were generally older, the trend toward an aging population is more pronounced in urban counties. A later analysis confirms that rural counties age slower post-FCIRA and experience a decline in population. While the greater aging of urban counties relative to rural counties may have several causes (such as longer life expectancy), this result does not provide direct evidence that the migration of young people from rural to urban counties is responsible for the decline in religiosity documented in Table 3. Indeed, a later analysis confirms that adding age to the county-level characteristics controlled for in equation (7) does not alter our support for the substitution hypothesis.

C Church Congregations

The number of members in a church congregation can proxy for the size of the risk pool underlying an informal risk-sharing agreement. In particular, risk sharing can occur across all religious adherents in a county or more narrowly within individual church congregations where monitoring and information sharing are likely to be greater.

Panel C of Table 3 reports results with *Number of Congregation Members* (in logs) as the dependent variable in equation (7). This dependent variable is defined as the number of Christian adherents in a county divided by the number of Christian congregations in the county. The β_1 coefficient for *Finance* remains negative and statistically significant at the 1%-level, indicating that the increased use of crop insurance is associated with a decrease in the average size of church congregations (fewer members per congregation). In addition, the positive β_2 coefficient for *Agriculture* indicates that congregations are larger in counties with higher agricultural risk. This positive relation is consistent with the need for larger risk pools in counties with higher agricultural risk.

We also examine the number of church congregations to address the possibility that the reduction in average congregation size was caused by an increase in the number of congregations. This analysis has *Number of Congregations* (in logs) as the dependent variable in equation (7). In contrast to *Number of Congregation Members*, the β_1 coefficient for *Finance* is close to zero and statistically insignificant for *Number of Congregations*.

Overall, the results in Panel C of Table 3 indicate that the increased use of crop insurance decreased the average size of church congregations but not the number of congregations. More formally, crop insurance usage induced change at the intensive margin (number of members per congregation) but not at the extensive margin (number of congregations). This combined evidence indicates that crop insurance reduced the size of risk pools underlying informal risk-sharing agreements within church congregations.

D Difference-in-Difference Methodologies

The previous panel regressions contain county fixed effects to account for variation in county-level characteristics and year fixed effects to account for time-series variation at the national level. The impact of crop insurance on religiosity we document is primarily from changes in crop insurance usage attributable to the FCIRA of 1994 that vary across counties.

To further address the issue of omitted variables, we use a difference-in-difference methodology that compares the disparate implications of the FCIRA across counties. This methodology conditions on time-series variation before versus after the FCIRA of 1994, and initially conditions on cross-sectional variation across urban versus rural counties. Our initial assumption is that since urban counties have little agricultural production, urban counties are less affected by the FCIRA than rural counties. Thus, urban and rural counties serve as the control and treatment group, respectively. We then create an interaction term defined as the product of the post-FCIRA indicator and the treatment (non-urban) indicator, *Treated Counties* × *Post-FCIRA*. This variable identifies county-year observations involving rural counties during the post-1995 subperiod. We then estimate difference-in-difference tests based on the following specifications

$$(8) \quad \text{Adherence}_{i,t} = \beta\, \text{Agriculture}_{i,t} + \delta\, \text{Treated Counties}_i \times \text{Post-FCIRA}_{i,t} + \gamma\, \text{X}_{i,t} + \epsilon_{i,t}\,,$$

$$(9) \quad \text{Finance}_{i,t} = \beta\, \text{Agriculture}_{i,t} + \delta\, \text{Treated Counties}_i \times \text{Post-FCIRA}_{i,t} + \gamma\, \text{X}_{i,t} + \epsilon_{i,t}\,.$$

These specifications include county and year fixed effects as well as county characteristics. To account for any pre-trend or post-trend in religious adherence before and after the FCIRA of 1994, respectively, we examine census data in 1980, 1990, 2000, and 2010. Urban counties are first defined as those where the fraction of total land area under cultivation by field crops (*Agriculture*) is below a threshold, which is specified as either 1%, 2%, or 5%.

According to Panel A of Table 4, the negative δ coefficient in equation (8) for the *Treated Counties* $\times$ *Post-FCIRA* variable equals -0.020 when religious adherence is the dependent variable and urban counties are defined using the 1%-threshold for *Agriculture*. This decrease in religious adherence is accompanied by a positive δ coefficient of 0.069 for the treatment variable in equation (9) when crop insurance usage (*Finance*) is the dependent variable. Both these coefficients are significant at the 1%-level. Therefore, after the FCIRA of 1994, rural counties experienced a significantly larger decrease in religious adherence, and a significantly larger increase in crop insurance usage, compared to urban counties. These combined results support our substitution hypothesis.

To further identify counties that are less affected by crop insurance, we use U.S. Census data on the percentage of a county's land area that is urban. Rural counties are those that have 1% or less of their land area classified as urban. This pre-selection classifies 51.5% of counties as rural before their exposure to field crop production is identified using the 1%, 2%, and 5% thresholds for *Agriculture*. Rural counties in the control group, which have negligible field crop production, may instead be involved in natural resource extraction, ranching, or other economic activities such as tourism. We then repeat the above difference-in-difference methodology in equations (8) and (9), with the results reported in Panel B of Table 4. These results continue to support our substitution hypothesis and parallel those in Panel A without the pre-selection of rural counties using U.S. Census data.

We then replace the *Agriculture* thresholds with county-level terrain data to identify the agricultural risk associated with field crop production in rural counties. For this difference-in-difference implementation, rural counties with mountainous terrain form the control group. We collect terrain data from the Distributed Active Archive Center at The

Oak Ridge National Laboratory.[9] After imposing the 1% or less urban area requirement to identify rural counties, rural counties with mountainous terrain are placed in the control group. This control group consists of counties predominately in Montana, Wyoming, Colorado, Utah, Idaho, Oregon, and Washington but also counties in Arizona, New Mexico, Nebraska, and South Dakota. The results from this alternative difference-in-difference specification are reported in Panel C of Table 4, and provide further empirical support for the substitution hypothesis.

Another difference-in-difference test conditions on small versus large increases in crop insurance from 1994 to 1995 among religious counties. We define religious counties as those with religious adherence rates above the cross-sectional median in 1990 (last census before the FCIRA of 1994). Among these religious counties, large (small) increases in crop insurance between 1994 and 1995 are defined as those above the 75th (below the 25th) percentile. These increases are attributed to the FCIRA of 1994 and denoted ΔCI. Intuitively, the control group contains religious counties such as those in Texas where field crop production is negligible and increases in crop insurance were correspondingly small, while the treatment group contains religious counties such as those in Kansas where field crop production is high and increases in crop insurance were correspondingly large. While a multitude of factors may influence a county's religiosity, the FCIRA of 1994 targeted crop insurance, not religious activities. Thus, reverse causality is unlikely to confound our interpretation of this difference-in-difference methodology.

Panel D of Table 4 provides additional support for the substitution hypothesis since the δ coefficient in equation (8) with the modified *Treated Counties* $\times$ *Post-FCIRA* variable equals -0.035 and is significant at the 5%-level. Thus, among religious counties, larger increases in crop insurance usage are associated with greater declines in religious adherence. As expected, the δ coefficient in equation (9) with the modified treatment

[9] Terrain data can be downloaded from https://doi.org/10.3334/ORNLDAAC/656.

variable is positive since the treatment and control groups are partially defined by differences in crop insurance.

In addition, Appendix C uses the *Treated Counties* × *Post-FCIRA* interaction variable in the first column of Panel A of Table 4 based on the 1% threshold for *Agriculture* to examine the FCIRA's impact on demographic characteristics. This analysis finds that while the population of rural counties declined post-FCIRA compared to urban counties, the percentage of their population at or below the age of 40 became higher. Interestingly, the FCIRA did not induce differences in the other demographic characteristics used as control variables such as the percentage of the population that are married or college-educated.

While the FCIRA exerted an insignificant impact on race, marriage, and education, rural counties became relatively youthful and experienced a relative decline in population compared to urban counties following this legislation. In particular, both urban and rural counties aged but urban counties aged more rapidly during our sample period. These findings are difficult to reconcile with the outward migration of young non-adherents from rural counties being responsible for the decline in rural religiosity that supports our substitution hypothesis. More important, such migration would increase rather than decrease our definition of religious adherence, and therefore bias our results against supporting the substitution hypothesis. Indeed, additional results in Appendix C confirm that adding age as a county-level control variable does not alter our empirical support for the substitution hypothesis.

E Trends in Religious Adherence

We also address the possibility that a pre-existing trend in religious adherence before the FCIRA complicates our support for the substitution hypothesis. Specifically, decreasing religiosity during the 1980s would complicate empirical support for the substitution hypothesis based on the subsequent FCIRA of 1994.

Recall that year fixed effects control for national trends. To further examine the influence of trends, we identify trends in religious adherence before the FCIRA across different counties. According to the results below, religious adherence in the 1980s increased, not decreased, in religious counties for both the treatment (Large ΔCI) and control (Small ΔCI) groups underlying the previous difference-in-difference estimation.

	$\Delta Adherence$	
Religious Counties	1980s (Pre-FCIRA)	1990s (FCIRA)
Small ΔCI	0.064	-0.077
Large ΔCI	0.088	-0.124
Difference	0.024***	-0.047***
	(0.006)	(0.000)

Following the increasing trend in religiosity during the 1980s, religious adherence experienced a greater reversal during the 1990s in the treatment group that experienced larger increases in crop insurance.[10] Indeed, the increasing trend in religious adherence prior to the FCIRA of 1994 was stronger in the treatment group (Large ΔCI) than the control group (Small ΔCI). Overall, trends in religious adherence prior to the FCIRA do not explain our empirical support for the substitution hypothesis.

F Additional Support for the Substitution Hypothesis

Several additional tests provide further empirical support for the substitution hypothesis.

Placebo Tests. For counties where agricultural risk is minimal, crop insurance is not

[10] The change in religious adherence from 2000 to 2010 was a negligible -0.002 for counties in the treatment group.

predicted to affect local religious adherence. Therefore, we estimate equation (7) in metropolitan counties and urban counties. Metropolitan counties are defined as those with a population in the top decile of all U.S. counties.[11] Urban counties are defined as those where *Agriculture* is in the bottom 5% of all U.S. counties. Within these two subsets, Panel A in Table 5 reports no inverse relation between the use of crop insurance and religious adherence. Specifically, the coefficients in both metropolitan and urban counties for *Finance* are statistically insignificant. Therefore, the placebo tests find no substitution effect in counties where no substitution effect is predicted.

Counties Unaffected by the Great Flood. Natural disasters such as floods can affect religiosity (Sinding Bentzen (2019), Pargament (2001)). In our context, the religiosity of households that experienced the Great Flood of 1993 may have changed as a result of this natural disaster instead of the FCIRA of 1994. To isolate the FCIRA's impact on religiosity, we examine counties that were unaffected by the Great Flood. As federal legislation, the FCIRA applies to all U.S. counties, both those affected and unaffected by the Great Flood.[12] Therefore, we re-estimate equation (7) with only counties unaffected by the Great Flood. According to Panel A of Table 5, the coefficient from equation (7) for *Finance* in these unaffected counties is -0.051, which is statistically significant at the 1%-level and larger than its counterpart from the full sample. Social stress or a loss of faith due to the Great Flood is unlikely to explain this result. Instead, the reduction in religious adherence in the unaffected counties is consistent with the substitution hypothesis.

Change on Change Regression. Our study does not attempt to explain cross-sectional county-level differences in religiosity that can arise from observed as well as unobserved historical, social, political, and economic factors. Instead, our goal is to

[11] Similar results are obtained if metropolitan counties are defined as those with a population above 200,000.
[12] The counties unaffected by the Great Flood of 1994 are those not located in the following states: North Dakota, South Dakota, Nebraska, Kansas, Minnesota, Iowa, Missouri, Wisconsin, and Illinois.

understand whether the increased use of financial contracts to manage household risk, specifically crop insurance, explains variation in religious adherence. In other words, we do not intend to explain differences in religiosity between counties, but explain changes in religiosity within these counties during the 1990s as a result of the FCIRA of 1994. Thus, the focus of our empirical strategy is to study changes in religious adherence and crop insurance around this legislation. The following change on change regression from 1990 to 2000 facilitates a direct test of these changes.

$$\Delta\text{Adherence}_i \quad = \quad \beta_1\, \Delta\text{Finance}_i + \beta_2\, \Delta\text{Agriculture}_i + \gamma\, \Delta\text{X}_i + \epsilon_i\,. \tag{10}$$

In the above specification, the change in religious adherence ($\Delta Adherence$) is the dependent variable and the change in the percentage of insured acres ($\Delta Finance$) is the independent variable of primary interest. Although households in certain counties may be reluctant to increase their use of crop insurance (due to their innate conservatism for example), this reluctance would not induce spurious support for the substitution hypothesis since equation (10) conditions on changes in crop insurance usage.

According to Panel B of Table 5, the coefficient for $\Delta Finance$ in the full specification is -0.043 and statistically significant at the 1%-level. This change on change regression result confirms that increased crop insurance usage is associated with a decline in religious adherence between 1990 and 2000.

Spatial First Difference Analysis. The Spatial First Difference (SFD) is a novel cross-sectional research design that detects causal effects in the presence of omitted variables using neighboring units of observation (Druckenmiller and Hsiang (2018)). This approach, which is ideally suited for county-level studies, assumes that neighboring counties are comparable. Intuitively, two neighboring counties have common characteristics and are more similar than two otherwise random counties. By restricting comparisons to neighboring counties, the influence of omitted variables regarding local climate, political, and economic conditions are controlled for by the SFD methodology, thereby allowing us to determine whether a change in financial contracting causes a change in religious adherence. The SFD methodology is similar to the previous change on change regression in equation (10), except that the Δ operator applies to the difference between neighboring counties instead of differences over time.

To implement the SFD methodology, we use a shapefile for all US counties obtained from ESRI, an international supplier of geographic information system software, and adopt the replication codes from the Global Policy Lab provided by Druckenmiller and Hsiang (2018). The results from the SFD estimation in Panel B of Table 5 confirm the substitution hypothesis as crop insurance exerts a negative impact on religious adherence. In particular, the coefficient for $\Delta Finance$ in the full specification is -0.020 and statistically significant at the 5%-level.

Church Donations. In addition to religious adherence, we examine an alternative measure of religiosity based on church donations. Time-series variation in church donations allows us to measure declines in religiosity that occur before church members declare themselves unaffiliated with any congregation in the next census. Annual donation data is obtained from the Presbyterian church over the 1994 to 1998 subperiod.[13] In this sample, the average annual donation per congregation member is \$557.

The availability of annual donation data between 1994 and 1998 enables us to study the immediate impact exerted by the FCIRA of 1994 using the following difference-in-difference methodology.

$$(11)\quad \text{Donation}_{i,t} \;=\; \beta\,\text{Agriculture}_{i,t} + \delta\,\text{Treated Counties}_i \times \text{Post-FCIRA}_{i,t} + \gamma\,\text{X}_{i,t} + \epsilon_{i,t}\,.$$

[13] Hungerman (2005) contains a detailed description of the donation data.

Consistent with our earlier support for the substitution hypothesis and the empirical evidence in Auriol et al. (2020) that finds an insurance motive for donations to religous institutions, the coefficient for the *Treated Counties* × *Post-FCIRA* variable in Panel C of Table 5 is negative for every specification and significant at the 1%-level. The most conservative point estimate (-36.518) indicates that doubling crop insurance usage is associated with a $37 decrease in the average donation by those who continue to be congregation members.

Finally, in an unreported robustness test, we use Canadian census data to examine religious adherence during the 1990s in three Canadian provinces (Manitoba, Saskatchewan, and Alberta) that have significant field crop production. Canadian farmers have been covered by a comprehensive crop insurance program since 1959 and were not affected by the FCIRA of 1994. In contrast to our evidence in the United States, we find a slight increase in religious adherence during the 1990s in the three Canadian provinces. Therefore, this placebo test finds no substitution effect where no substitution effect is predicted.

V Economic Consequences

This section studies the implications of financial contracting for traditional risk management mechanisms other than informal risk-sharing agreements facilitated by religious adherence. These alternative mechanisms are precautionary savings and crop diversification. We also examine whether crop insurance usage affects agricultural productivity defined by crop yields.

A Precautionary Savings

According to Rampini and Viswanathan (2017), the high cost of using financial contracts to insure consumption against income shocks leads households to rely on precautionary savings. We examine whether precautionary savings is reduced by crop insurance in the following panel regression where annual county-level bank deposits (logged) between 1994 and 2000 proxy for precautionary savings.

$$\log(\text{Bank Deposits})_{i,t} = \beta_1 \, \text{Finance}_{i,t} + \beta_2 \, \text{Agriculture}_{i,t} + \gamma \, \text{X}_{i,t} + \epsilon_{i,t} \, . \tag{12}$$

County and year fixed effects are included in this specification along with county characteristics. Equation (12) is also estimated with the number of bank branches in a county as the dependent variable. Bank deposit and branch data is obtained from the Federal Deposit Insurance Corporation. In addition, we compute two normalized dependent variables, per capita bank deposits and bank branches per 1,000 inhabitants, for use as dependent variables in equation (12).

Table 6 provides evidence that crop insurance displaced precautionary savings. Specifically, the negative β_1 coefficients for *Finance* across the four proxies indicate that precautionary savings in agricultural counties was displaced by crop insurance. This displacement confirms the importance of crop insurance to household risk management and provides further support for the substitution hypothesis.

B Crop Diversification and Moral Hazard

While precautionary savings is a response to agricultural risk and investment opportunities, crop diversification is a determinant of agricultural risk. Thus, the impact of the substitution hypothesis on moral hazard can be directly examined using crop diversification. In comparison to crop insurance, disaster assistance is less susceptible to moral hazard due to its dependence on exogenous natural disasters.

Crop diversification has a central role in the management of agricultural risk that parallels its importance in finance. For example, medieval farmers diversified their production by "strip farming", that is cultivating multiple land plots in different locations (Desai (2017)). In the modern era, crop diversification has been found to increase agricultural productivity and lower agricultural risk.[14]

We examine the impact of crop insurance on two county-level proxies for crop diversification; a *Crop Herfindahl Index* and the average *Number of Crops* grown. Our analysis of crop diversification estimates equation (7) with both these proxies as the dependent variable. Furthermore, although crop diversification preserves soil quality and lowers agricultural risk, a reduction in crop diversification may be justified if agricultural productivity improves as a result of specialization. Therefore, we also estimate equation (7) with average crop yields per acre across the six field crops as the dependent variable to determine whether the increased use of crop insurance affected productivity.

The results in Panel A of Table 7 indicate that the increased use of crop insurance usage reduced crop diversification, especially in counties that experienced large decreases in religious adherence. Moreover, Panel B of Table 7 indicates that the increased use of crop insurance generally decreased crop yields. Consequently, the increased use of crop insurance was not associated with an increase in agricultural productivity due to specialization.

In conjunction, the reductions in crop diversification and crop yields are consistent with moral hazard since the reduction in crop diversification increased risk without increasing productivity. Furthermore, consistent with a decline in effort being responsible for the decline in crop productivity, Appendix C provides evidence that the FCIRA of 1994 reduced employment in the farm sector. Overall, our results indicate that the displacement of informal risk sharing within a social network by a formal insurance contract has negative

[14] The Food and Agriculture Organization of the United Nations.

implications for traditional risk management mechanisms and productivity.

Intuitively, the use of crop insurance allowed farmers to reduce the effort and expenditures required to diversify crops as well as the effort and expenditures required to maintain high agricultural productivity.[15] As monitoring and information sharing within church congregations can alleviate moral hazard, the displacement of religious adherence by crop insurance offers an explanation for the associated reductions in crop diversification and crop yields. The results in Table 7 support this explanation since decreases in crop diversification parallel decreases in religious adherence.

C Consumption Implications

A reduction in income risk without a corresponding reduction in income may increase consumption as precautionary savings becomes less important. Our substitution hypothesis also suggests that consumption related to social activities may decrease relative to non-social activities as informal social contracts become less important for household risk management.

Detailed state-level consumption data from the Bureau of Economic Analysis begins in 1997, after the FCIRA of 1994. Nevertheless, this data indicates that average household consumption increased every year from $19,966 in 1997 to $20,927 in 1998, $22,123 in 1999, and $23,498 in 2000. These consumption increases average $1,177, which is large compared to the previously reported declines in bank deposits and church donations whose approximate magnitudes are -$1,510 and -$36.50, respectively. However, uncompensated time commitments required by religious activities are more relevant to our study of household risk management than the explicit financial cost of religious adherence. In particular, dollar-denominated church donations may be less consequential than the

[15]For example, Smith and Goodwin (1996) report that crop insurance reduced crop yields by lowering fertilizer usage.

implicit costs of demonstrating commitment to a social contract that facilitates risk sharing and rendering assistance to members of the social contract in need.[16]

To distinguish between social and non-social consumption, we define spending on recreational services and food services as social consumption since these consumption categories often involve members of different households. In contrast, we define spending on financial services, healthcare, transportation (including travel), motor vehicles, and home furnishings as non-social consumption since these consumption categories are more likely intended to pertain to members of an individual household.

Consistent with the argument that increased consumption results from a reduction in income risk, the increased use of crop insurance is associated with higher total consumption. In particular, Table 8 indicates that increased crop insurance usage is positively associated with spending on non-social consumption. In addition, households appear to have re-allocated precautionary savings to other financial services.

Although declining participation in religious activities could increase participation in other social activities, our empirical results suggest a positive relation between participation in religious and social activities in general. This positive relation suggests that declines in religious adherence are likely to be mirrored by declines in less stringent "recreational" social networks that are less adept at facilitating risk sharing.

Overall, despite being limited to state-level post-FCIRA consumption data, we find suggestive evidence that declines in church donations, precautionary savings, and income risk lead to higher consumption. Specifically, our evidence suggests that increased crop insurance usage (decreased income risk) is associated with higher non-social consumption involving healthcare, financial services, travel, motor vehicles, and home furnishings but lower social consumption involving recreational services and food services. Consequently,

[16]For example, participating in religious activities for 3 hours per week at $20 per hour leads to an annual $3,120 cost. Incurring this high cost may be necessary to mitigate much larger negative income shocks imposed by agricultural risk.

our support for the substitution hypothesis based on religiosity likely applies more broadly to participation in other social networks.

Nevertheless, Chetty and Looney (2006) caution that consumption alone is insufficient to understand the risk management decisions of farmers since farmers often smooth their consumption by altering their labor supply (Kochar (1999), Cameron and Worswick (2003)) in response to agricultural shocks. Besides altering non-farm employment, Rosenzweig and Stark (1989) link marriage and migration patterns to consumption smoothing in agricultural communities as marriage to geographically distant partners improves income diversification within extended families. Hess (2004) examines the general use of marriage to smooth consumption. Overall, increased consumption is not the only response to reduced income risk. Instead, the displacement of informal social contracts that manage income risk by formal insurance contracts can increase leisure, decrease the supply of labor, and lead to marriage being deferred.

VI Conclusion

We examine household risk management decisions regarding the use of formal financial contracts and traditional yet informal risk-sharing agreements. We find evidence that households in agricultural communities use religious adherence to manage their exposure to agricultural risk. More important, after an exogenous reduction in the cost of crop insurance due to government subsidies, we find that increased crop insurance usage lead to a decrease in religious adherence. Therefore, our results indicate that households replaced informal risk sharing facilitated by religious adherence with a formal financial contract (insurance) when the financial contract became less costly. This substitution is consistent with a cost-benefit analysis determining household participation in social networks that facilitate risk sharing.

The increased use of crop insurance also displaced traditional risk management mechanisms such as precautionary savings and crop diversification. Moreover, consistent with an increase in moral hazard, the increased use of crop insurance decreased agricultural productivity. Thus, our results contribute to our understanding of household risk management and public policy debates regarding the role of government and finance in society.

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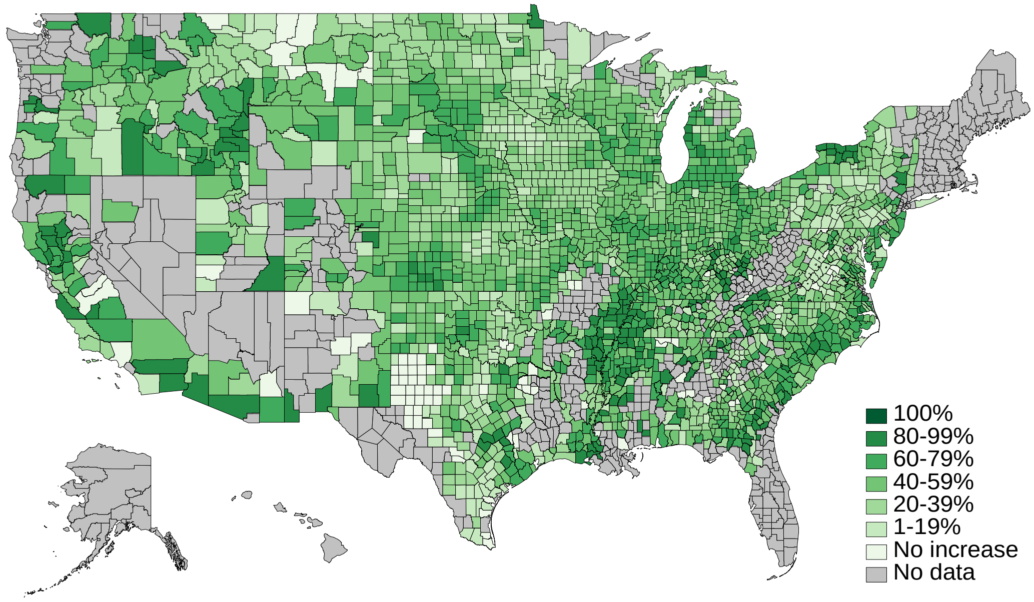
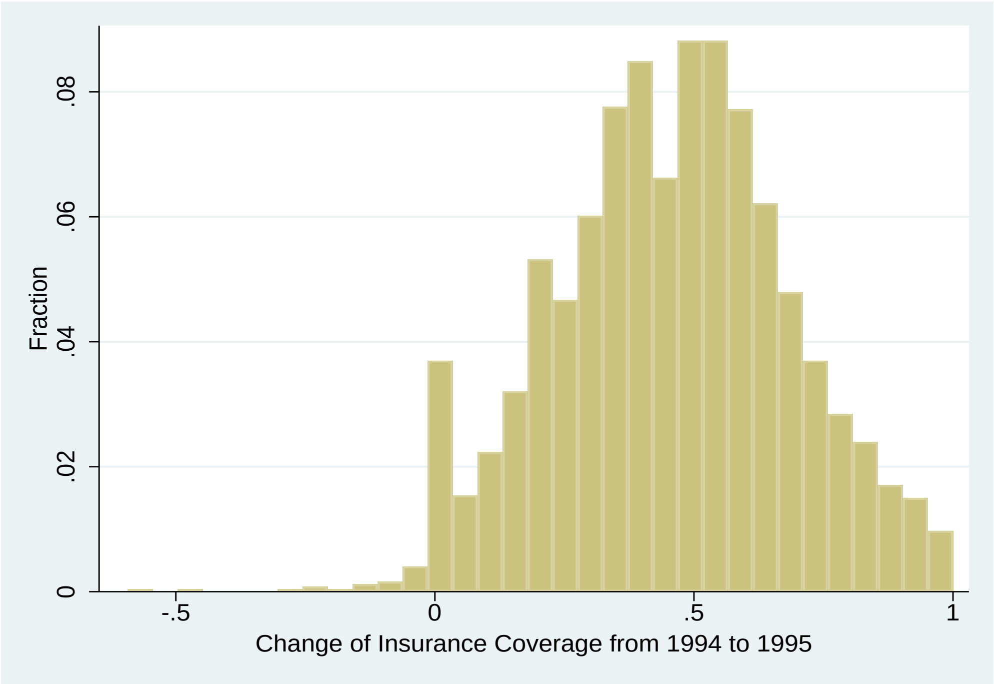
Figure 1: County-Level Variation Across Changes in Crop Insurance

Panel A: Percentage change in crop insurance usage from 1994 to 1995 by county

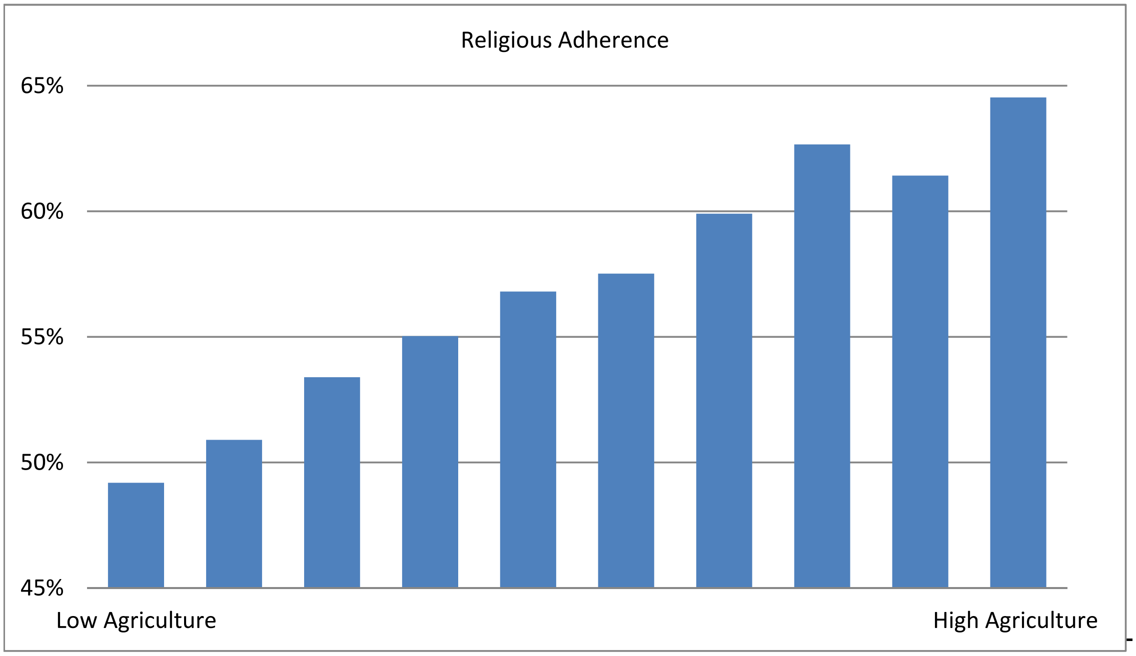


Panel B: Histogram of changes in crop insurance usage from 1994 to 1995



This figure illustrates county-level variation in the use of crop insurance between 1994 and 1995 due to the Federal Crop Insurance Reform Act of 1994.

Figure 2: Agriculture and Religious Adherence



This figure illustrates the county-level relation between agricultural intensity and religious adherence (defined as the number of religious adherents in a county divided by the county's population) based on census data from 1980, 1990, 2000, and 2010.

Table 1: Summary Statistics

The table below provides summary statistics between 1980 and 2010 for the county-level variables used to empirically test our substitution hypothesis. Appendix A contains a description of these variables. Panel A and Panel B are based on annual county-level observations, while Panel C is based on county-level observations from the 1980, 1990, 2000, and 2010 census.

Panel A: Agriculture

	N	Mean	Std. Dev.	5%	Median	95%
Agriculture	74,072	24%	25%	0%	13%	74%
Soil Quality	72,759	13.15	7.10	3.00	12.00	26.00

Panel B: Financial Contracting

	N	Mean	Std. Dev.	5%	Median	95%
Insured Acreage	69,491	61,922	105,000	178	18,949	255,000
Finance	69,491	47%	36%	1%	42%	100%

Panel C: Religiosity

	N	Mean	Std. Dev.	5%	Median	95%
Number of Religious Adherents	10,069	36,594	128,000	1,897	12,445	135,000
Religious Adherence	10,069	56%	18%	29%	55%	88%
Number of Congregation Members	10,068	306	199	115	250	679
Number of Congregations	10,069	81	129	12	50	235

Table 2: Agricultural Risk and Religious Adherence

This table reports the results from the panel regression in equation (6) using 1990 and 2000 census data. The dependent variable is religious adherence at the county level. Year fixed effects are included to absorb any trend in religious adherence across the United States. County fixed effects are included to account for variation in religious adherence across counties and determine whether changes in agricultural activity induce changes in religious adherence. Standard errors are clustered by county. The county characteristics include population and per capita income as well as the percentage of the population that is college educated, foreign born, married, and African American since these demographic variables may be correlated with religious adherence and agricultural production. To obtain the time series R-squared, we first regress religious adherence on county fixed effects and then use the residuals from this regression as the dependent variable. Standard errors are White (1980) heteroskedasticity-robust. ***, **,* represents statistical significance (different from zero) at the 1%, 5%, and 10% levels, respectively.

	All Counties		Poor Soil	Good Soil
Agriculture	0.541***	0.477***	0.624***	0.099
	(0.082)	(0.083)	(0.128)	(0.087)
County Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
County Characteristics	No	Yes	Yes	Yes
Observations	5,142	5,142	2,675	2,467
R-squared	0.913	0.915	0.894	0.943
Time Series R-squared	0.269	0.293	0.390	0.180

Table 3: Substitution Hypothesis

Panel A of this table reports on the relation between the use of crop insurance (*Finance*) and religious adherence (*Adherence*) based on the panel regression in equation (7), $\text{Adherence}_{i,t} = \beta_1 \text{Finance}_{i,t} + \beta_2 \text{Agriculture}_{i,t} + \gamma \text{X}_{i,t} + \epsilon_{i,t}$. The sample period is based on the census in 1990 and 2000. Good Soil (Poor Soil) refers to counties with above-median (below-median) soil quality measured by available water storage. County and year fixed effects are included in each specification, with standard errors clustered by county. The county characteristics in X include population and per capita income as well as the percentage of the county's population that is college educated, foreign born, married, and African American. To obtain the time series R-squared, we first regress religious adherence on county fixed effects and then use the residuals from this regression as the dependent variable. In Panel B, the *Agriculture* control variable (percentage of land area in a county cultivated with field crops) is replaced with county-level *Farm Employment*, the percentage of employment involved in farming activities, as a proxy for agricultural intensity, hence agricultural risk. Panel C reports the effect of crop insurance on the average number of members in a church congregation and the number of congregations, both in logs. Standard errors are White (1980) heteroskedasticity-robust. ***, **,* represents statistical significance (different from zero) at the 1%, 5%, and 10% levels, respectively.

Panel A: Effect of Crop Insurance on Religious Adherence

	All Counties				Poor Soil	Good Soil
Finance	-0.068***	-0.049***	-0.044***	-0.128***	-0.047**	-0.005
	(0.015)	(0.015)	(0.015)	(0.020)	(0.020)	(0.022)
Agriculture		0.468***	0.412***	0.348***	0.524***	0.097
		(0.084)	(0.084)	(0.083)	(0.134)	(0.087)
Finance × Soil Quality				0.094***		
				(0.016)		
County Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
County Characteristics	No	No	Yes	Yes	Yes	Yes
Observations	5,002	5,002	5,002	4,915	2,570	2,432
R-squared	0.910	0.912	0.915	0.918	0.892	0.943
Time Series R-squared	0.264	0.285	0.307	0.343	0.405	0.189

Panel B: Agriculture Defined by Employment in Farming

	All Counties				Poor Soil	Good Soil
Finance	-0.068***	-0.069***	-0.060***	-0.086***	-0.067***	-0.009
	(0.015)	(0.015)	(0.015)	(0.016)	(0.019)	(0.022)
Farm Employment		0.422***	0.393***	0.409***	0.611**	0.429***
		(0.149)	(0.145)	(0.144)	(0.251)	(0.152)
Finance × Soil Quality				0.103***		
				(0.016)		
County Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
County Characteristics	No	No	Yes	Yes	Yes	Yes
Observations	5,002	4,965	4,965	4,878	2,535	2,430
R-squared	0.910	0.911	0.915	0.918	0.892	0.944
Time Series R-squared	0.264	0.272	0.302	0.331	0.400	0.201

Panel C: Effect of Crop Insurance on Church Congregations

	Number of Congregation Members				Number of Congregations			
	All Counties		Poor Soil	Good Soil	All Counties		Poor Soil	Good Soil
Finance	-0.055*	-0.071***	-0.072**	-0.007	0.003	-0.023	-0.031	-0.006
	(0.028)	(0.027)	(0.035)	(0.042)	(0.017)	(0.015)	(0.020)	(0.023)
Agriculture	0.676***	0.800***	1.004***	0.249	-0.187**	-0.013	-0.001	-0.049
	(0.169)	(0.165)	(0.268)	(0.162)	(0.084)	(0.080)	(0.128)	(0.101)
County Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County Characteristics	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Observations	5,002	5,002	2,570	2,432	5,002	5,002	2,570	2,432
R-squared	0.965	0.968	0.963	0.976	0.995	0.996	0.996	0.997
Time Series R-squared	0.088	0.162	0.258	0.097	0.042	0.215	0.229	0.199

Table 4: Difference-in-Difference Methodology

Panel A of the table reports the results from the difference-in-difference methodology in equations (8) and (9) that exploits cross-sectional variation across rural versus urban counties and time-series variation before versus after the FCIRA of 1994. The sample period involves census data from 1980, 1990, 2000, and 2010. In urban counties, the fraction of total land area under cultivation by field crops, *Agriculture*, is required to be below a specified threshold that ranges from 1% to 5%. The difference-in-difference methodology accounts for trends affecting religious adherence in urban counties and rural counties before the FCIRA of 1994 by creating a county-year $\textit{Treated Counties}_i \times \textit{Post-FCIRA}_{i,t}$ variable defined as the product of a post-1995 indicator and a rural (non-urban) indicator. Panel B reports results after pre-selecting rural counties as those with 1% or less of their land area being urban according to the U.S. Census. The *Agriculture* thresholds then determine which rural counties are exposed to the agricultural risk of field crop production. Rural counties with minimal field crop production are assigned to the control group. Among pre-selected rural counties, Panel C uses a county's terrain to determine its exposure to agricultural risk, with mountainous rural counties assigned to the control group. Panel D reports the results from a modified methodology involving census data from 1990 and 2000 that conditions on cross-sectional variation across large versus small increases in crop insurance from 1994 to 1995 within religious counties. Religious counties have *Adherence* rates above the county-level median in 1990, while the 75th and 25th percentiles of changes in crop insurance between 1994 and 1995 define large and small increases, respectively. The indicator for large (small) increases in crop insurance then defines the treatment (control) group. The county characteristics include population and per capita income as well as the percentage of the county's population that is college educated, foreign born, married, and African American. To obtain the time series R-squared, we first regress religious adherence on county fixed effects and then use the residuals from this regression as the dependent variable. ***, **,* represents statistical significance (different from zero) at the 1%, 5%, and 10% levels, respectively.

Panel A: Variation Across Urban and Rural Counties

	Religious Adherence			Crop Insurance Usage		
	Urban Counties with Agriculture below			Urban Counties with Agriculture below		
	1%	2%	5%	1%	2%	5%
% of Counties in Control Group	13.5%	20.0%	33.0%	13.5%	20.0%	33.0%
Treated Counties × Post-FCIRA	-0.020***	-0.014**	-0.014**	0.069***	0.050***	0.048***
	(0.007)	(0.006)	(0.006)	(0.015)	(0.012)	(0.009)
Agriculture	-0.000	-0.000	-0.000	-0.375***	-0.373***	-0.373***
	(0.023)	(0.023)	(0.023)	(0.027)	(0.027)	(0.027)
County Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
County Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Observations	10,054	10,054	10,054	69,476	69,476	69,476
R-squared	0.874	0.874	0.874	0.846	0.845	0.846
Time Series R-squared	0.221	0.220	0.220	0.794	0.794	0.794

Panel B: Variation Across Rural Counties

	Religious Adherence			Crop Insurance Usage		
	Rural Counties with Agriculture below			Rural Counties with Agriculture below		
	1%	2%	5%	1%	2%	5%
% of Counties in Control Group	14.7%	21.5%	33.5%	14.7%	21.5%	33.5%
Treated Counties × Post-FCIRA	-0.029***	-0.028***	-0.021***	0.088***	0.079***	0.063***
	(0.011)	(0.009)	(0.008)	(0.019)	(0.015)	(0.012)
Agriculture	0.021	0.019	0.020	-0.241***	-0.239***	-0.242***
	(0.030)	(0.030)	(0.029)	(0.032)	(0.032)	(0.032)
County Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
County Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,201	5,201	5,201	35,824	35,824	35,824
R-squared	0.871	0.872	0.871	0.846	0.846	0.846
Time Series R-squared	0.220	0.221	0.220	0.793	0.794	0.794

Panel C: Terrain Variation Across Rural Counties

	Religious Adherence	Crop Insurance Usage
% of Counties in Control Group	3.58%	3.58%
Treated Counties × Post-FCIRA	-0.068***	0.120***
	(0.014)	(0.032)
Agriculture	0.024	-0.243***
	(0.030)	(0.032)
County Fixed Effects	Yes	Yes
Year Fixed Effects	Yes	Yes
County Characteristics	Yes	Yes
Observations	5,228	35,824
R-squared	0.873	0.845
Time Series R-squared	0.223	0.793

Panel D: Variation in Crop Insurance Usage Across Religious Counties

	Religious Adherence	Crop Insurance Usage
Treated Counties × Post-FCIRA	-0.035**	0.299***
	(0.014)	(0.028)
Agriculture	0.341**	-1.233***
	(0.146)	(0.244)
County Fixed Effects	Yes	Yes
Year Fixed Effects	Yes	Yes
County Characteristics	Yes	Yes
Observations	1,209	1,204
R-squared	0.822	0.887
Time Series R-squared	0.518	0.803

Table 5: Additional Support for the Substitution Hypothesis

Panel A reports the results from the panel regression in equation (7) for metropolitan counties, urban counties, and counties unaffected by the Great Flood of 1993. Metropolitan counties are defined as those with a population in the top decile of all counties and urban counties are defined as those with an *Agriculture* measure in the bottom 5% of all counties. County and year fixed effects are included in both specifications, with standard errors clustered by county. County Characteristics include population and per capita income as well as the percentage of the county's population that is college educated, foreign born, married, and African American. To obtain the time series R-squared, we first regress religious adherence on county fixed effects and then use the residuals from this regression as the dependent variable. Panel B reports the results from the change on change regression in equation (10). The dependent variable in this specification involves the change in religious adherence between 1990 and 2000, $\Delta\text{Adherence}_i = \beta_1\,\Delta\text{Finance}_i + \beta_2\,\Delta\text{Agriculture}_i + \gamma\,\Delta\text{X}_i + \epsilon_i$. The independent variables are also defined according to their respective change from 1990 to 2000. During the same decade, Panel B also reports the results from a Spatial First Difference procedure based on neighboring counties. Panel C reports the results from the difference-in-difference methodology in equation (11) for church donations. Standard errors are White (1980) heteroskedasticity-robust. ***, **,* represents statistical significance (different from zero) at the 1%, 5%, and 10% levels, respectively.

Panel A: County Subsets

	Metropolitan Counties with High Population	Urban Counties with Low Agriculture	Counties Unaffected by the Great Flood
Finance	0.038	0.166	-0.051***
	(0.037)	(0.291)	(0.017)
Agriculture	-0.205	32.809	0.453***
	(0.232)	(177.151)	(0.116)
County Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
County Characteristics	Yes	Yes	Yes
Observations	479	177	3,474
R-squared	0.928	0.979	0.897
Time Series R-squared	0.483	0.749	0.343

Panel B: Alternative Econometric Procedures

	Change on Change Regression			Spatial First Difference		
Change in Finance	-0.068***	-0.048***	-0.043***	-0.033***	-0.021**	-0.020**
	(0.010)	(0.010)	(0.010)	(0.009)	(0.008)	(0.008)
Change in Agriculture		0.469***	0.413***		0.232***	0.207***
		(0.057)	(0.058)		(0.052)	(0.052)
Change in County Characteristics	No	No	Yes	No	No	Yes
Observations	2,360	2,360	2,360	2,356	2,356	2,356
R-squared / Psuedo R-squared	0.022	0.050	0.078	0.009	0.05	0.089

Panel C: Difference-in-Difference for Donations

	Donation per Congregation Member		
	Urban Counties with Agriculture below		
	1%	2%	5%
% of Urban Counties in the Sample	9.2%	14.8%	25.7%
Treated Counties × Post-FCIRA	-37.834**	-37.240**	-36.518***
	(18.260)	(14.575)	(12.681)
Agriculture	-71.360***	-63.677***	-50.841**
	(20.736)	(21.198)	(20.570)
County Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
County Characteristics	Yes	Yes	Yes
Observations	13,302	13,302	13,302
R-squared	0.145	0.145	0.145

Table 6: Precautionary Savings

This table reports the results from an empirical test that replaces the dependent variable in equation (7) with four annual county-level proxies for precautionary savings available from the Federal Deposit Insurance Corporation. County and year fixed effects are included in all specifications, with standard errors clustered by county. County Characteristics include population and per capita income as well as the percentage of the county's population that is college educated, foreign born, married, and African American. To obtain the time series R-squared, we first regress religious adherence on county fixed effects and then use the residuals from this regression as the dependent variable. Standard errors are White (1980) heteroskedasticity-robust. ***, **,* represents statistical significance (different from zero) at the 1%, 5%, and 10% levels, respectively.

	Log(Deposits)	Log(Branches)	Deposits per capita	Branches per 1,000 inhabitants
Finance	-0.070***	-0.054***	-1.510***	-0.021**
	(0.020)	(0.020)	(0.255)	(0.010)
Agriculture	-0.116***	-0.086**	-2.532***	-0.031
	(0.036)	(0.041)	(0.709)	(0.025)
County Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
County Characteristics	Yes	Yes	Yes	Yes
Observations	18,428	18,428	18,428	18,428
R-squared	0.989	0.985	0.929	0.954
Time Series R-squared	0.606	0.153	0.625	0.099

Table 7: Crop Diversification and Crop Yields

Panel A of this table reports results from an empirical test that replaces the dependent variable in equation (7) with two county-level annual proxies for crop diversification; a Crop Herfindahl Index and the average Number of Crops grown. Panel B reports the impact of crop insurance on agricultural productivity by estimating equation (7) with average crop yields per acre as the dependent variable. County and year fixed effects are included in both specifications, with standard errors clustered by county. County Characteristics include population and per capita income as well as the percentage of the county's population that is college educated, foreign born, married, and African American. To obtain the time series R-squared, we first regress religious adherence on county fixed effects and then use the residuals from this regression as the dependent variable. Standard errors are White (1980) heteroskedasticity-robust. ***, **,* represents statistical significance (different from zero) at the 1%, 5%, and 10% levels, respectively.

Panel A: Crop Diversification

	Crop Herfindahl Index			Number of Crops		
	All	Decline in Religious Adherence		All	Decline in Religious Adherence	
	Counties	High	Low	Counties	High	Low
Finance	0.027***	0.050***	0.007	-0.447***	-0.689***	-0.259**
	(0.007)	(0.010)	(0.010)	(0.084)	(0.126)	(0.107)
Agriculture	-0.045*	-0.115***	-0.003	1.688***	2.901***	0.636**
	(0.025)	(0.037)	(0.034)	(0.213)	(0.284)	(0.278)
County Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
County Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Observations	36,836	36,836	17,075	36,836	19,761	17,075
R-squared	0.804	0.796	0.787	0.796	0.812	0.778
Time Series R-squared	0.168	0.182	0.184	0.449	0.448	0.467

Panel B: Crop Yields

	All Crops	Corn	Soybeans	Wheat	Oats	Sorghum	Barley
Finance	-0.021***	-0.016	0.006	-0.034***	0.045***	-0.045**	-0.103***
	(0.008)	(0.014)	(0.012)	(0.010)	(0.017)	(0.019)	(0.019)
Agriculture	0.034	-0.195***	-0.106***	0.173***	0.290***	-0.044	0.088
	(0.024)	(0.038)	(0.031)	(0.034)	(0.055)	(0.055)	(0.072)
County Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County Characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Crop Fixed Effects	Yes	No	No	No	No	No	No
Observations	142,867	33,765	31,358	31,117	20,975	15,540	10,112
R-squared	0.790	0.715	0.686	0.681	0.528	0.676	0.621

Table 8: Consumption

This table reports results from regressing social consumption and non-social consumption categories on crop insurance usage. State-level consumption data is collected from the Bureau of Economic Analysis between 1997 and 2010. Social consumption consists of recreational services and food services, while non-social consumption consists of health services, financial services, transportation services (travel), motor vehicles, and furnishings. Each of these consumption categories replace the dependent variable in equation (7). State and year fixed effects are included in both specifications, with standard errors clustered by state. State characteristics include population and per capita income as well as the percentage of the state's population that is college educated, foreign born, married, and African American. Standard errors are White (1980) heteroskedasticity-robust. ***, **,* represents statistical significance (different from zero) at the 1%, 5%, and 10% levels, respectively.

	Total	Social Consumption		Non-Social Consumption				
	Consumption	Recreation	Food	Health	Financial	Transport	Motor	Furnishings
Finance	1,132.22***	-126.093***	-82.986***	138.98*	279.17***	56.24**	128.35***	48.97**
	(401.57)	(33.378)	(22.195)	(75.55)	(82.57)	(23.06)	(35.72)	(24.43)
Agriculture	-9,543.25***	-32.963	-813.704	-2,905.64***	-1,257.53**	-151.26	-741.26***	-638.53***
	(3,015.27)	(1,030.753)	(685.390)	(567.29)	(619.98)	(173.16)	(268.22)	(183.47)
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State Characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	578	578	578	578	578	578	578	578

Appendix A: Variable Description

Total Acres	Number of acres in the county
Agriculture	Number of acres cultivated by field crops divided by total acres
Soil Quality	Available water storage capacity of the soil
Insured Acres	Number of cultivated acres with crop insurance
Finance	Insured acres divided by acres cultivated by field crops
Number of Religious Adherents	Number of religious adherents across all Christian denominations
Religious Adherence	Number of religious adherents divided by population
Number of Congregation Members	Number of religious adherents divided by number of congregations
Crop Herfindahl	Herfindahl index based on acres cultivated with six different field crops
Number of Crops	Number of different field crops cultivated
Income	Per capita personal income
College Degree	Percentage of population with a college degree
Foreign Born	Percentage of population born in a foreign country
Married	Percentage of adult population that is married
African American	Percentage of the population that is African American

Appendix B: Distributed Lags Model

Extending equation (7) to include five additional lags for *Finance* leads to the following panel regression

$$\begin{aligned}\text{Adherence}_{i,t} &= \beta_0\,\text{Finance}_{i,t} + \beta_1\,\text{Finance}_{i,t-1} + \beta_2\,\text{Finance}_{i,t-2} + \beta_3\,\text{Finance}_{i,t-3} + \beta_4\,\text{Finance}_{i,t-4} \\ &\quad + \beta_5\,\text{Finance}_{i,t-5} + \alpha\,\text{Agriculture}_{i,t} + \gamma\,\text{X}_{i,t} + \epsilon_{i,t}\,. \qquad (13)\end{aligned}$$

This panel regression is estimated using annual data between 1990 and 2000, with interpolation providing the dependent variable. As in the original estimation of equation (7), X represents county-level characteristics. County and year fixed effects are also included. This extension recognizes that the use of financial contracting to manage household risk may induce a gradual substitution away from social networks that facilitate risk sharing. The results from estimating equation (13) are reported below

β_0	-0.025***	-0.014***
	(0.004)	(0.003)
β_1		-0.020***
		(0.002)
β_2		-0.012***
		(0.002)
β_3		-0.006***
		(0.002)
β_4		-0.006***
		(0.002)
β_5		-0.004
		(0.003)
α	0.127***	0.129***
	(0.024)	(0.024)
Observations	26,605	25,347
R-squared	0.961	0.961

The negative β_0, β_1, β_2, β_3, and β_4 coefficients along with the insignificant β_5 coefficient indicate that the use of financial contracting to manager risk leads households to gradually substitute away from informal risk sharing over a four-year horizon. Indeed, the displacement of social networks is attributable largely to the use of crop insurance in the prior year.

Appendix C: Demographic Implications of the FCIRA

The results from a difference-in-difference methodology that examines the relative impact of the FCIRA on rural versus urban counties using the *Treated Counties* × *Post-FCIRA* interaction variable in the first column (1% *Agriculture* threshold) of Panel A of Table 4 are reported below

	College Educated	Foreign Born	Married	Black	Total Population	Average Age	Youthfulness
Treated Counties × Post-FCIRA	0.002	0.001	-0.002	0.000	-0.091***	-0.774***	0.015***
	(0.001)	(0.002)	(0.002)	(0.001)	(0.015)	(0.097)	(0.002)
Agriculture	0.014***	-0.037***	0.020***	0.000	0.048	0.915***	-0.026***
	(0.004)	(0.007)	(0.006)	(0.005)	(0.042)	(0.289)	(0.006)
County Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County Characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	10,054	10,054	10,054	10,054	10,054	10,032	10,032
R-squared	0.944	0.873	0.918	0.991	0.994	0.954	0.954

These results indicate that relative to urban counties, rural counties experienced a decline in population following the FCIRA. This decline in population was accompanied by a decrease in their average age and corresponding increase in youthfulness defined as the percentage of a county's population at or below the age of 40 years. However, the FCIRA did not induce differences between urban and rural counties in any of the other demographic characteristics.

An additional analysis supplements the results in Panel A of Table 3 by including county-level average age as a control variable. The results below indicate that the addition of age does not weaken our empirical support for the substitution hypothesis.

	All Counties	Poor Soil	Good Soil
Finance	-0.042***	-0.045**	0.001
	(0.015)	(0.020)	(0.022)
Age	0.010***	0.007	0.016***
	(0.004)	(0.006)	(0.004)
Agriculture	0.428***	0.535***	0.124
	(0.085)	(0.137)	(0.088)
County Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
County Characteristics	Yes	Yes	Yes
Observations	4,991	2,561	2,430
R-squared	0.915	0.892	0.944

In addition, the results below report a decline in employment in the farming sector following the FCIRA of 1994. Provided the decline in farm employment results in a migration of farm labor out of the affected counties, this decline is consistent with the general decline in population experienced by rural counties post-FCIRA. The decline in farm employment is also consistent with a reduction in effort explaining the reduction in field crop productivity reported in Panel B of Table 7.

	Percentage of Employment in Farming
Treated Counties × Post-FCIRA	-242.401***
	(35.857)
Agriculture	-34.333
	(72.332)
County Fixed Effects	Yes
Year Fixed Effects	Yes
County Characteristics	Yes
Observations	9,992
R-squared	0.962