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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, with urban and neighboring counties as respective control groups, confirm that households substituted insurance for religiosity. This substitution was associated with an increase in moral hazard.

Keywords: Household Risk Management, Financial Contracts, Social Networks

JEL Codes: G5, G51, G52

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), 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] Chen (2010) reports that religiosity alleviates the financial constraints

[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.

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. By encouraging 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.[3]

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 in counties where agricultural risk is higher. This inverse relation is not observed in urban counties. A difference-in-difference method is estimated to exploit cross-sectional variation across rural versus urban counties and time-series variation before versus after the FCIRA of 1994. The results from this estimation confirm that religious adherence decreased more after 1994 in

[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.

[3]Although the FCIRA of 1994 is central to our study's identification, its implications do not require government subsidies since several FinTech applications are also attempting to lower the cost of using financial contracts to manage risk. For example, Budish (2018) and Abadi and Brunnermeier (2018) examine the cost associated with maintaining a decentralized blockchain.

rural counties than in urban counties. As the FCIRA of 1994 did not directly affect religious activities, reverse causality is unlikely to confound our empirical support for the substitution hypothesis.

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. Finally, church donations capture changes in religiosity that occur before an individual declares herself to be a non-adherent on the next census. Using annual data on church donations, the difference-in-difference methodology confirms that church donations decreased more in rural counties after 1994 than in urban counties.

We also find that crop insurance displaced precautionary savings. 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 informal risk-sharing agreements to mitigate moral hazard by facilitating monitoring and information sharing. The displacement of these risk-sharing agreements by government-subsidized financial contracts appears to have increased moral hazard.

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 creates social networks that alter household participation in the stock market. Conversely, we find that the use of financial contracting to manage household risk alters church attendance. Moreover, by examining the broader implications of finance for society, our study parallels Engelberg and Parsons (2016)'s study regarding the implications of finance on investor health.

The remainder of the paper is organized as follows. Section II reviews related literature and develops our hypothesis, Section III describes our data. Section IV reports our main empirical results, while Section V reports economic consequences of increased crop insurance usage. 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. 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.

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 are able to 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 a field crop to be hedged, 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 attributable to 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, government subsidies increased nearly 250% from \$255 million to \$889 million, resulting in the total out-of-pocket cost farmers paid to purchase crop insurance in 1995 being similar to 1994.

The large increase in crop insurance usage induced by the FCIRA of 1994 lowered the consumption 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 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

[4] We compute normalized income volatility as the standard deviation of a county's annual average income from 1980 to 1994 (1995 to 2010) divided by the county's average income during this period.

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 impact 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 formalized in Appendix A, which presents an illustrative model, based on a simplified version of Azzi and Ehrenberg (1975), to formalize religious adherence as a risk management mechanism. In this model, utility is a function of three components: consumption, a psychological benefit from religious participation, and leisure which is decreasing with religious participation. Other benefits of religious adherence such as access to education would weaken empirical support for the substitution hypothesis since

[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.

these benefits are unrelated to household risk management.

Although the implications of our study are not limited to social networks based on religious adherence, social networks that require less commitment such as recreational sports clubs are less effective at facilitating risk sharing. Thus, the increased use of crop insurance is predicted to exert a weaker impact on these low-commitment social networks.

To our knowledge, this substitution hypothesis has not been previously tested. In particular, the 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] 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.

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. 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

[6]This distinction is important since several FinTech applications are intended 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. This conditioning can reduce the informational advantage of social networks that function as informal credit markets.

(*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. 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 is lower. Therefore, interventions such as crop selection, irrigation, and drainage are unable to overcome poor soil.[7] 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.

[7]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.

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 B 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 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 that U.S. households use religious adherence to manage agricultural risk. 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, 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

$$\text{Adherence}_{i,t} \;=\; \beta_1 \,\text{Agriculture}_{i,t} + \gamma \,\text{X}_{i,t} + \epsilon_{i,t}\,, \tag{1}$$

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.

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.

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. This variation in agricultural risk and religious adherence attributable 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 the percentage of time-series variation in religious adherence that is explained by the panel regression specification.

In unreported results, we also examine the composition of religious adherents based on the strictness of their denomination since strict denominations are likely to be more effective at mitigating adverse selection (Iannaccone (1994)) and consequently at facilitating risk sharing.[8] 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. Compared to agricultural counties with good soil, agricultural counties with poor soil have 60% more adherents from strict denominations. 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 asso-

[8]Strict religious denominations include the Church of Jesus Christ of Latter-Day Saints, Evangelicals, Seventh-Day Adventists, and Southern Baptists.

ciated with changes in religious adherence. Indeed, the results in Table 2 extend the prior literature on informal risk sharing within agricultural communities that typically studies kinship networks in developing countries.

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.

$$\text{Adherence}_{i,t} \quad = \quad \beta_1 \, \text{Finance}_{i,t} + \beta_2 \, \text{Agriculture}_{i,t} + \gamma \, \text{X}_{i,t} + \epsilon_{i,t} \, . \tag{2}$$

County fixed effects are included to identify the impact of time-series variation in crop insurance usage on religious adherence, while year fixed effects control for time series variation in religious adherence that is unrelated to crop insurance usage. 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 of equation (2). 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 sizable 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.

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 religion adherence equals -4.92% over the entire 1980 to 2010 period. Thus, the increased use of financial contracting to manage the exposure of households to agricultural risk 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.

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 involving church donations. Second, the demographic trend involving the migration of young non-adherents from agricultural counties to metropolitan counties increases the religious adherence of agricultural counties. This trend is addressed by our next analysis involving the membership of church congregations.

C Church Congregations

The number of members in a church congregation may 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 B of Table 3 reports results with *Number of Congregation Members* (in logs) as the dependent variable in equation (2). 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 the decrease of the average congregation size. 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 the *Number of Congregations* (in logs) as the dependent variable in equation (2). In contrast to having *Number of Congregation Members* as the dependent variable, the β_1 coefficient for *Finance* is close to zero and statistically insignificant for *Number of Congregations*.

The results in Panel B 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 Method

To account for omitted variables such as political and social conditions that differ across counties, we estimate a difference-in-difference methodology to isolate the FCIRA of 1994's impact on religious adherence in rural counties. To account for any pre-trend or post-trend in religious adherence before and after this legislation, we examine census data in 1980, 1990, 2000, and 2010. This methodology exploits cross-sectional variation across rural versus urban counties and time-series variation before versus after the FCIRA of 1994. Urban counties are defined as those where the fraction of total land area under cultivation by field crops (*Agriculture*) is below a specified threshold ranging from 1% to 5%. This range classifies 13.5% to 33% of counties as urban.

The difference-in-difference method conditions on a *Treated Counties Post-FCIRA* variable to identify county-year observations for rural counties during the post-1995 subperiod in the following specifications.

$$\text{Finance}_{i,t} = \beta\,\text{Agriculture}_{i,t} + \delta\,\text{Treated Counties Post-FCIRA}_{i,t} + \gamma\,\text{X}_{i,t} + \epsilon_{i,t}\,, \quad (3)$$

$$\text{Adherence}_{i,t} = \beta\,\text{Agriculture}_{i,t} + \delta\,\text{Treated Counties Post-FCIRA}_{i,t} + \gamma\,\text{X}_{i,t} + \epsilon_{i,t}\,. \quad (4)$$

These specifications include county and year fixed effects as well as county characteristics.

According to Table 4, the negative coefficient in equation (4) for the *Treated Counties 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 coefficient of 0.069 for the treatment variable in equation (3) when crop insurance usage is the dependent variable. Both these coefficients are significant at the 1%-level. Therefore, as predicted by the substitution hypothesis, the difference-in-difference methodology confirms that the FCIRA of 1994 exerted a significantly larger negative impact on religious adherence (and larger positive impact on crop insurance usage) in rural counties than urban counties.

E Additional Support for the Substitution Hypothesis

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

Placebo Tests. We estimate equation (2) in metropolitan counties and urban counties where agricultural risk is minimal. Metropolitan counties are defined as those with a population in the top decile of all U.S. counties.[9] 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. Households affected by the Great Flood of 1993 may become less religious as a result of this natural disaster instead of the FCIRA of 1994. However, as a federal law, the FCIRA of 1994 reduced the cost of crop insurance in all U.S. counties, including those unaffected by the Great Flood.[10] According to Panel A of Table 5, the coefficient from equation (2) 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

[9]Similar results are obtained if metropolitan counties are defined as those with a population above 200,000.
[10]Unaffected counties are those not located in the following states: North Dakota, South Dakota, Nebraska, Kansas, Minnesota, Iowa, Missouri, Wisconsin, and Illinois.

with the substitution hypothesis.

Change on Change Regression. The following change on change regression examines county-level changes in religious adherence from 1990 to 2000 since the FCIRA of 1994 occurred in the middle of this decade.

$$\Delta \text{Adherence}_i \;=\; \beta_1 \, \Delta \text{Finance}_i + \beta_2 \, \Delta \text{Agriculture}_i + \gamma \, \Delta \text{X}_i + \epsilon_i \,. \tag{5}$$

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 (5) 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 crop insurance is associated with a decline in religious adherence between 1990 and 2000.

Spatial First Difference Analysis. The Spatial First Difference (SFD) methodology in Druckenmiller and Hsiang (2018) controls for omitted variables by examining neighboring counties. Intuitively, the SFD methodology is similar to the previous change on change regression in equation (5), except that the Δ operator applies to the difference between neighboring counties instead of differences over time. Nevertheless, the SFD methodology determines whether a change in financial contracting causes a change in religious adherence. 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.[11] 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.

$$\text{Donation}_{i,t} \;=\; \beta\,\text{Agriculture}_{i,t} + \delta\,\text{Treated Counties Post-FCIRA}_{i,t} + \gamma\,\text{X}_{i,t} + \epsilon_{i,t}\,. \quad (6)$$

Consistent with earlier support for the substitution hypothesis based on religious adherence, 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 are not affected by the FCIRA of

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

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 county-level bank deposits (logged) proxy for precautionary savings.

$$\log(\text{Bank Deposits})_{i,t} \quad = \quad \beta_1 \, \text{Finance}_{i,t} + \beta_2 \, \text{Agriculture}_{i,t} + \gamma \, \text{X}_{i,t} + \epsilon_{i,t} \, . \tag{7}$$

County and year fixed effects are included in this specification along with county characteristics. Equation (7) 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 (7).

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 crop insurance 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 events.

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.[12]

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 (2) 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 (2) 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.

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

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. Specifically, 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. Overall, our results indicate that the displacement of informal risk sharing within a social network by a formal insurance contract has negative implications for traditional risk management mechanisms and productivity.

Intuitively, the use of crop insurance allowed farmers to reduce not only the effort and expenditures required to diversify crops, but also the effort and expenditures required to maintain high agricultural productivity. For example, Smith and Goodwin (1996) report that crop insurance reduced crop yields by lowering fertilizer usage. As monitoring and information sharing within church congregations can alleviate moral hazard, the displacement of religious adherence by crop insurance offers an alternative explanation for the associated reductions in crop diversification and crop yields. The results in Panel A of Table 7 support this explanation since decreases in crop diversification parallel decreases in religious adherence.

VI Conclusion

We examine household risk management decisions regarding their 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 as a result of government subsidies. 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 subsidies and finance in society.

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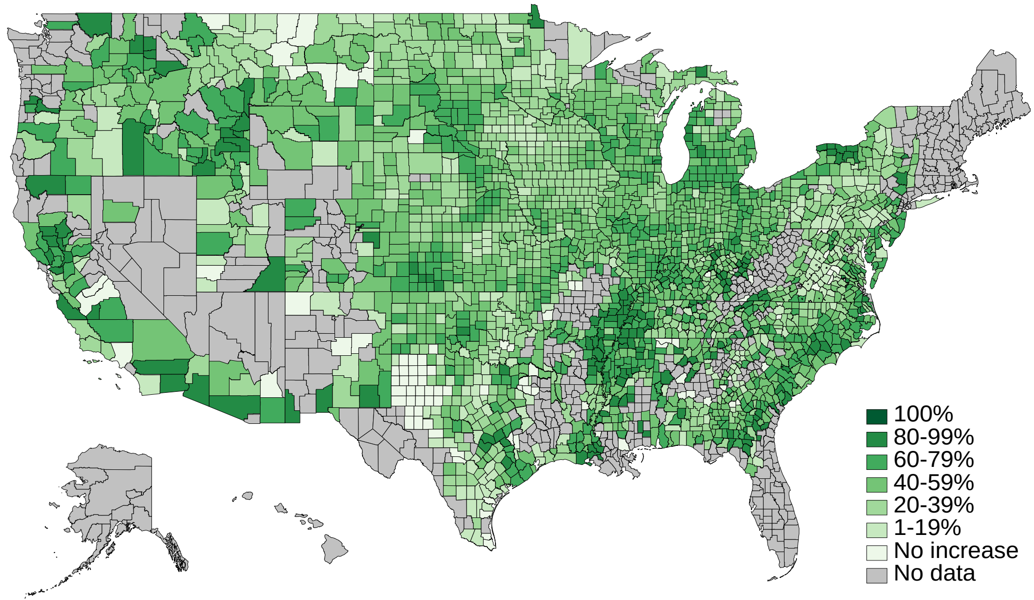
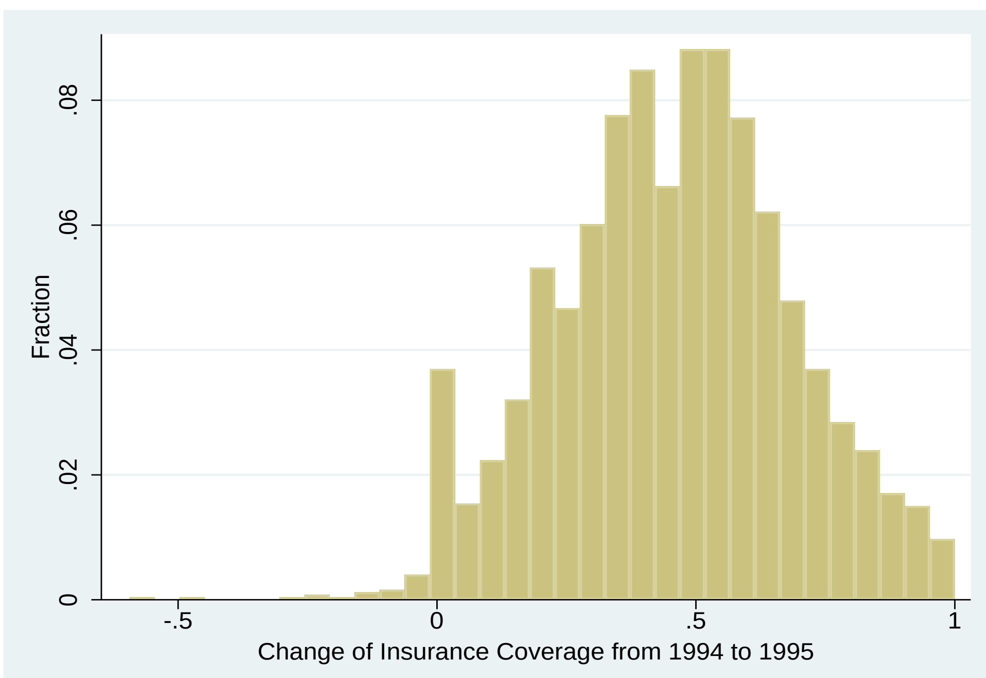
Figure 1: County-Level Variation Across Changes in Crop Insurance

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

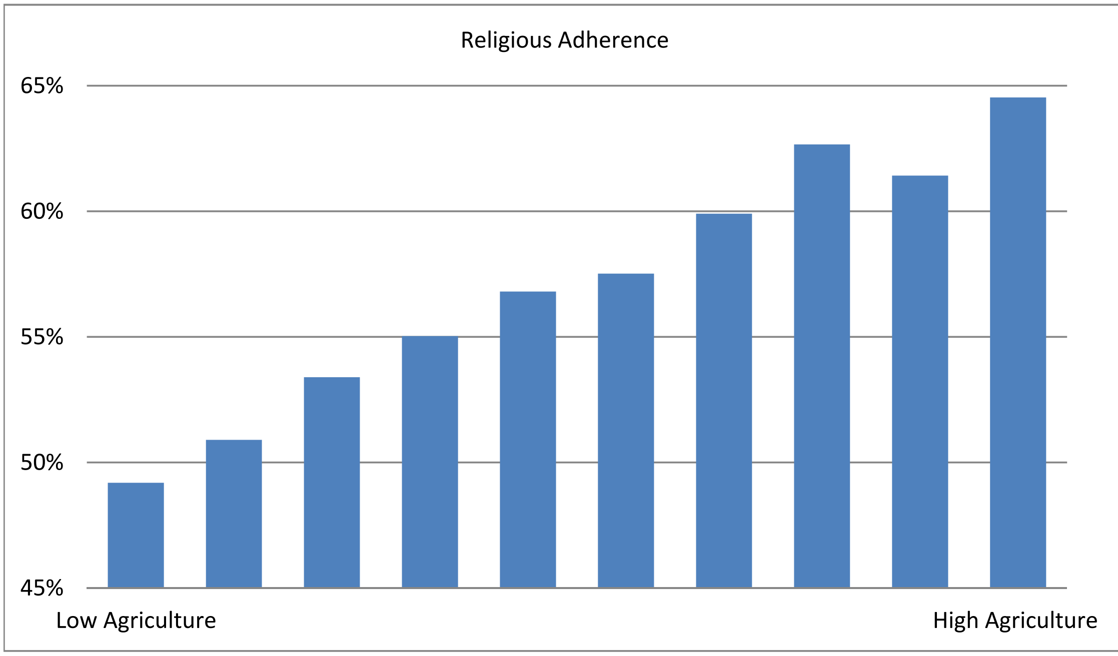


Panel B: Histogram of changes in crop insurance usage from 1994 to 1995



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 B 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 (1) 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 (2), $\text{Adherence}_{i,t} = \beta_1 \,\text{Finance}_{i,t} + \beta_2 \,\text{Agriculture}_{i,t} + \gamma \,\text{X}_{i,t} + \epsilon_{i,t}$. 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. Panel B 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 x 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: 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

The table reports the results from a difference-in-difference methodology in equations (3) and (4) 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 is required to be below a specified threshold ranging 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 *Treated Counties Post-FCIRA* variable to identify county-year observations pertaining to rural counties during the post-1995 subperiod. 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.

	Religious Adherence			Crop Insurance Usage		
	Urban Counties with Agriculture below			Urban Counties with Agriculture below		
	1%	2%	5%	1%	2%	5%
Urban Counties	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

Table 5: Additional Support for the Substitution Hypothesis

Panel A reports the results from the panel regression in equation (2) 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 (5). 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 (6) 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%
Urban Counties	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 (2) 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 (2) 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 (2) 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

Appendix A: Illustrative Model

Using a simplified version of Azzi and Ehrenberg (1975), utility $U(c_i, r_i, z_i)$ is a function of three components: consumption, a psychological benefit from religious participation, and leisure. The one-period model examines the religious participation of an individual whose consumption differs across two states; good and bad, These states vary across individuals.

In the good state, which occurs with probability $1-\lambda$, consumption equals $1-p$. This amount normalizes consumption to one unit minus a "premium" p that is paid to insure against the poor state. In the bad state, which occurs with probability λ, consumption is reduced to $m = \frac{p\,(1-\lambda)}{\lambda}$. This amount equates the expected cost of insurance $(1-\lambda)\,p$ with its expected benefit $\lambda\, m$, assuming consumption would otherwise be zero in the bad state. 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. For simplicity, the model assumes this benefit equals the amount of time spent participating in religious activities. Thus, the psychological benefit one receives from religion is identical to the fraction of time spent on religious activities. Individuals also derive a benefit from leisure time z_i, with the time spent on religious activities implying less time is available for leisure due to the following time constraint that is normalized to 1

$$z_i + r_i \;\; = \;\; 1\,. \tag{8}$$

For the utility function $U(c_i, r_i, z_i)$, utility from c_i and r_i is not additively separable. Following Azzi and Ehrenberg (1975), leisure z_i enters the utility function linearly to supplement consumption, while α is an exogenous weight that captures the utility from time spent on (non-religious) leisure activities and is assumed to be identical for all individuals. The resulting log utility equals

$$U(c_i, r_i, z_i) \quad = \quad ln\,(c_i + r_i) + \alpha \times z_i\,. \tag{9}$$

Expected utility equals

$$\begin{aligned} E\left[U(p, r_i)\right] &= (1-\lambda) \times ln\,(1-p+r_i) + \lambda \times ln\,(m+r_i) + \alpha\,(1-r_i) \\ &= (1-\lambda) \times ln\,(1-p+r_i) + \lambda \times ln\left(\frac{p\,(1-\lambda)}{\lambda} + r_i\right) + \alpha\,(1-r_i)\,. \end{aligned} \tag{10}$$

Setting the first-order condition for equation (10) with respect to p to 0 results in

$$\frac{\partial E[U]}{\partial p} = 0 \quad \Rightarrow \quad p* = \lambda\,. \tag{11}$$

Thus, the optimal "premium" $p*$ increases with risk, λ.

Proposition 1 *Religious participation increases with agricultural risk.*

Proof: Setting the first-order condition for equation (10) with respect to r_i to 0 results in

$$\frac{\partial E[U]}{\partial r_i} = 0 \quad \Rightarrow \quad r_i* = \frac{1}{\alpha} + \lambda + 1\,. \tag{12}$$

The first-order condition in equation (12) has the following implications

1. The higher the exposure to risk, λ, the higher is religion participation r_i*.

2. The higher the preference for leisure, α, the lower is religion participation r_i*.

Proposition 2 *Substitution Hypothesis The use of financial contracting to manage risk lowers religious participation.*

Proof: λ is a function of both risk and financial contracting denoted κ, $\lambda = f(\text{risk}, \kappa)$. With financial contracting lowering risk

$$\frac{\partial \lambda}{\partial \kappa} < 0\,, \tag{13}$$

equation (12) implies that the optimal level of religion participation r_i* declines with financial contracting

$$\frac{\partial r_i*}{\partial \kappa} = \frac{\partial r_i*}{\partial \lambda} \times \frac{\partial \lambda}{\partial \kappa} < 0\,. \tag{14}$$

Appendix B: 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