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Abstract

This paper investigates the critical role of religion in the economic recovery after high-impact natural disasters. Exploiting the 2005 hurricane season in the southeast United States, we document that establishments in counties with higher religious adherence rates saw a significantly stronger recovery in terms of productivity for 2005-2010. Our results further suggest that a particular religious denomination does not drive the effect. We observe that different aspects of religion, such as adherence, shared experiences from ancestors, and institutionalised features, all drive the effect on recovery. Our results matter since they underline the importance of cultural characteristics like religion during and after economic crises.

Keywords: establishment-level productivity, natural disasters, recovery, religion

JEL classification: E23, E32, Z12

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1 Introduction

Natural disasters are a severe threat to economic development (Strobl, 2011). These events cost around $ 1 trillion and took two million lives during the 20 years preceding 2005 (Strömberg, 2007). In times when natural disasters such as hurricanes are more frequent because of climate change (Walsh et al., 2016; Hsiang and Kopp, 2018), a thorough understanding of the economic recovery process on a very granular level is essential. Previous literature shows that recovery processes in regions affected by natural disasters are heterogeneous depending on migration, politics, and institutions (Cavallo et al., 2013; Felbermayr and Gröschl, 2014).

This paper contributes to the literature by investigating the role of religion as a moderating cultural factor in high-impact natural disasters. Religion is supposed to mitigate effects from difficult situations (Schuster et al., 2001; Smith et al., 2000) and thereby play a central role in regional economies during the recovery process. Specifically, an extensive number of papers documents the importance of religion and culture for economic development (Guiso et al., 2006; McCleary and Barro, 2006; Bryan et al., 2021). Recent research further documents that people turn to religion in times of severe crises, such as earthquakes (Bentzen, 2019; Belloc et al., 2016) or the Covid-19 pandemic (Bentzen, 2020). Understanding how religion affects economic performance after natural disasters is vital. It can help to allocate government aid more efficiently and develop insurances to stimulate economies in post-disaster recovery.

The laboratory that we adopt to advance our research concerns the southeastern United States, which experienced an unexpected number of high-impact natural disasters in 2005. In line with Deryugina et al. (2018) and Schüwer et al. (2019), the 2005 hurricane season in the United States offers a unique opportunity for our study. First, the magnitude with which hurricanes hit the Gulf Coast unexpectedly in 2005 allows us to study how natural disasters affect economic activity. Secondly, the United States has a high religious adherence rate, and faith-based organizations have a considerable influence. For example, almost 90% of religious organizations actively provide social services (such as employment services, hospital visitation, and educational services) to over 70 million Americans (Gruber and Hungerman, 2007). They also spend in the range of $ 16 to $ 36 billion on philanthropic activities yearly (Biddle, 1992; Cnaan and Boddie, 2001; Stritt, 2008).

Our analysis proceeds in three steps. First, we evaluate how the 2005 hurricane season affects corporate productivity. Although most previous research identifies company location using headquarters, we use fine-grained establishment-level data to evaluate the hurricanes' effect on establishment productivity. Because evaluating the impact of the hurricanes requires a rigorous identification strategy, we collect information on each hurricanes' track and wind speed and use the maximum wind speed recorded in each county in 2005 to obtain an exogenous, continuous measure of hurricane severity. Our robust results show that the hurricanes have a considerable and long-lasting adverse impact on establishment-level productivity. More specifically, we find that hurricanes significantly decrease productivity by 0.4 percentage points comparing establishments in very low- and high- impacted counties after 2005. Considering that the average productivity declines by one percentage point in the run-up to 2005, our results imply a 40% decrease in productivity from the pre-2005 average in the southeastern United States.

Second, we investigate whether religious adherence mitigates hurricanes' adverse effects. By controlling for critical county characteristics such as human and social capital, politics, wealth, and population, we robustly find that establishments in counties with high religious intensity are less affected by hurricanes' adverse impacts. Although the adverse effect of the hurricanes on establishment productivity in the most impacted counties is equal to 0.8 percentage points when religious adherence is at its average value, a one-standard-deviation increase in religion (19 percentage points) reduces the detrimental effect on productivity by more than half.

To understand better the main factors through which religion drives the recovery process, we consider several exercises. A potential explanation of our findings is that religion is associated with "good" economic attitudes, such as confidence towards institutions and the market, as well as cooperation and thriftiness (Iannaccone, 1998). Guiso et al. (2004) and Renneboog and Spaenjers (2012) show that these characteristics are common across all the religions. However, other papers also find opposite results showing that some attitudes are heterogeneous across religions and affect economic growth differently. Basten and Betz (2013), for example, investigate the effect of Reformed Protestantism relative to Catholicism. That study finds that Reformed Protestantism affects preferences for leisure and redistribution; it also increases per capita income and inequality. Becker and Woessmann (2009) show that Protestantism positively affects economic growth through its positive effect on literacy. Arruñada (2010) also finds that Protestantism culture is conducive to economic development. However, the results suggest that the direct psychological route of the Weberian work ethic does not drive the positive effect on growth; rather, promoting an alternative social ethic that facilitates impersonal trade drives growth. On the other side, Cantoni (2015) finds no effect of Protestantism on economic growth.

We exploit heterogeneity across religions by separately analyzing the impact of different religious branches on post-disaster recovery. We find that Protestantism (mainline and evangelical) and Catholicism positively affect establishments' productivity after the 2005 hurricane season, which lets us conclude that religion-specific good attitudes do not drive our results (e.g., Protestant work ethic).

Next, we suggest two alternative measures that potentially share explanatory power with religious adherence. One is shared experiences of similar events through ancestry. Following King (2010), who describes a connection between religion and inter-generational ties, we use data about the natural disaster experiences of residents' ancestors in the counties. We find that a higher share of natural disaster experience positively affects post-disaster recovery. At the same time, the positive effect of religious adherence remains intact. However, the positive effect of ancestors' experience only emerges in more religious counties, suggesting that religion-based ties are more potent in the community and in the family facilitating the inter-generational transmission of experience, knowledge, and attitude (Dohmen et al., 2012; Florio and Manfredonia, 2021), which eventually boost the economic recovery.

Additionally, our religious-adherence measure may capture effects from the institutionalized features of religious communities. To address this concern, we collect detailed information on the number of membership organizations, including religious organizations in the United States. We find that the number of religious organizations and religious adherence both affect post-2005 recovery positively and significantly. On the other side, we do not find any evidence that other membership organizations affect post-disaster recovery.

This suggests that beyond the classical "club good" benefits that could foster recovery through both emotional and social insurance (Chen, 2010; Dehejia et al., 2007; Auriol et al., 2020; Berman, 2000), the benefits of religious organizations spill over to the community. Our results are thereby in line with studies showing that churches in the United States provide community services similar to those the government provides and can even substitute for government activities (Hungerman, 2005; Gruber and Hungerman, 2007), thereby fostering recoveries. Finally, we show that the beneficial impacts on recovery from religious adherence, ancestor experiences, and the number of religious organizations remain significant when we estimate all three factors in one regression. This is a critical result because it suggests that different aspects of religion foster economic recovery jointly.

Third, the final section of this paper investigates the aggregate effects of religious adherence. We find that after 2005, affected and more religious counties saw a significant relative increase in new establishments, but the number of closed establishments did not differ from less religious counties. In line with Schumpeter's "creative destruction process" theory (Schumpeter, 1942), both effects lead to a significant relative increase in the total number of establishments in more affected religious counties, suggesting that the positive effects on productivity go hand in hand with renewal and an increase in the size of the economy. Our final regression shows that this increase in economic capacity is accompanied by a relatively significant increase in population in the most affected religious counties.

Our paper speaks to the extensive literature arguing that religion is associated with characteristics that can positively affect economic growth (Guiso et al., 2003; Iannaccone, 1998). In a seminal paper, McCleary and Barro (2006) show that religious beliefs empirically positively affect economic growth. On the other side, they also show that church attendance negatively affects it. Campante and Yanagizawa-Drott (2015), for example, find that Ramadan fasting harms output growth in Muslim countries, but it positively affects subjective well-being. Similarly to McCleary and Barro (2006), they provide evidence that these findings are consistent with costly religious practices. Because we do not have the chance to measure religious belief intensity empirically, we cannot provide further evidence on this "believing versus belonging" hypothesis. More similar to our paper, Bryan et al. (2021), using a randomized experiment of evangelical Protestant Christian values and theology education in a developing country, find that treated households are more religious and have higher incomes. Further analysis suggests that increasing grit associated with perseverance explains the positive effect on income. Gruber (2005) uses as exogenous variation in religious participation local ancestral composition and shows that it positively affects education, income, and marriage rates.

Regarding the link between religion and natural disasters, Belloc et al. (2016) document that earthquakes in the Middle Ages in Italy affected people's religious beliefs and enhanced the ability of political-religious leaders to restore social order after a crisis. For this reason, earthquakes delayed the institutional transition from autocratic regimes to self-government in cities where the political and the religious leaders were the same people, but not in cities where political and religious powers were distinct. Similarly, Chaney (2013) shows that the Nile floods decreased the probability that Egypt's highest-ranking religious authority was replaced and increased the relative allocations to religious structures. These findings support the hypothesis that the political power of religious leaders increases during periods of economic downturn. In addition, Bentzen (2019) shows that individuals turn to religion to deal with unbearable and unpredictable life events such as natural disasters. However, to the best of our knowledge, there is no paper studying how religion affects economic growth during these critical times.

More broadly, our paper contributes to the literature on culture and economic outcomes. Only recently have economists started to document the critical role culture plays in the economy by shaping people's beliefs and behavior. In particular, religion, social capital, and human capital play a crucial role in economic growth. Guiso et al. (2004) for example, show that social capital is associated with more remarkable financial development. Also, Zak and Knack (2001) shows that social capital is associated with growth. Tabellini (2008) argues that generalized trust and individualism explain institutional and economic development. Guiso et al. (2003) show that religious beliefs are associated with several "good" economic attitudes. Barro (2001) shows that education, especially scientific education, positively affects growth. Tabellini (2010) shows that the exogenous component of culture arising from historical political institutions is strongly correlated with current economic development. Spolaore and Wacziarg (2013) provides a review of the literature. We contribute to this literature by showing that religion, irrespective of its routes, is a critical feature in post-disaster recovery that can outweigh the effects of human and social capital.

Furthermore, our analysis adds to the recent literature that studies how culture affects the performance of corporations. Bloom et al. (2012) shows that companies located in counties with more social capital are more productive because they are more likely to decentralize. Similarly, Cingano and Pinotti (2016) shows that firms in high trust regions perform better in sectors with deregulation needs. Hilary and Hui (2009) show that firms located in counties with higher religiosity experience lower risk exposure, lower investment rate, and less growth but generate more favorable market reactions when they announce new investments.

Finally, our paper contributes to the literature on how natural disasters affect economic activity. Previous research focuses on how they effect economic growth, the labor market, or the role institutions play in mitigating the negative negative effects of hurricanes. Cavallo et al. (2013), for example, find that only large natural disasters harm growth, driven by political changes. Strobl (2011) document a fall in county-level growth rates of 0.45 percentage points due to hurricanes and wealthier individuals moving away from affected counties. Felbermayr and Gröschl (2014) shows that natural disasters hurt growth but international openness and democratic institutions reduce their adverse effects.

Regarding how natural disasters affect the labor market, Deryugina et al. (2018) show that Katrina victims' incomes fully recover and even surpass that of controls from similar cities unaffected by the storm. Also, using the impact of the 2005 hurricane season, Schüwer et al. (2019) find that counties with better capitalized and more independent banks experienced a relatively better local economic development after 2005. There is less focus on how natural disasters affect corporate performance and what cultural factors allow corporations to recover after disasters. In this sense, the closer contribution to our paper comes from Hsu et al. (2018). They show that natural disasters harm corporate operating performance, and technology diversity allows corporations to recover faster.

2 Data

We collect information from different sources for our research, and we use the information at different levels of aggregation. In this section, we are going to discuss the data-collection process. Section OA1 of the online appendix describes how we clean the raw data and provides exact information about how many establishments and observations drop during the several cleaning steps. We furthermore describe each variable and its source in detail.

Establishment-level data. To approximate local business activity, we collect information from the National Establishment Time-Series (NETS) database (e.g., Currie et al., 2010; Akey and Appel, 2021; Barrot and Nanda, 2020; Addoum et al., 2020).

The NETS database gathers information on almost the universe of establishments in the United States, covering both employer and non-employer businesses. Importantly, it provides information on the establishments' exact locations, the sectors in which the establishments operate, the number of employees, and sales.

A vital characteristic of the NETS database is that no establishments are ever deleted from the database, thus avoiding selection bias issues in our analysis. Furthermore, in this way, the database allows researchers to obtain a time series of the number of new establishments and the number of establishments that go out of business in each county.

Our baseline sample comprises every establishment in the southeastern United States between 2000 and 2010. We choose this period to have a similar spell in the period before and after 2005. We exclude from the sample establishments that operate in the financial and regulated sectors (*NAICS 2-digit code equal to 52, 53, and 94*).

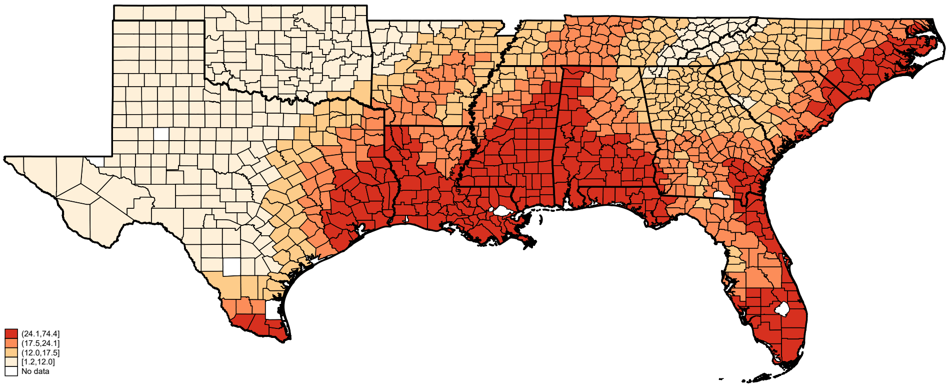
From this database, we calculate our primary outcome variable, Ln(Productivity), which is the natural logarithm of establishment sales scaled by the number of employees (Bloom et al., 2019).

The 2005 hurricane season. To accurately evaluate the severity of the hurricanes across counties, we collect information on the tracks and wind speed for each hurricane that hit the United States in 2005.

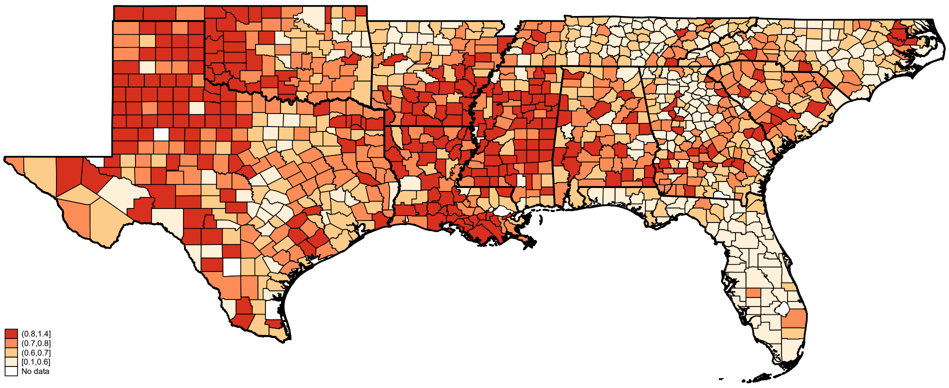
We obtain storm events from the NOAA Storm Events database. Ten tropical storms hit the southern coast of the United States in 2005 (the hurricanes Arlene, Cindy, Dennis, Emily, Katrina, Ophelia, Rita, Tammy, Twenty-Two, and Wilma). For each of these hurricanes, we interpolate hurricane tracks and model wind speeds using the approach in Willoughby and Rahn (2004). Our final treatment measure is the maximum recorded wind speed (Wind Speed) in each county in 2005 in the southeastern United States. A detailed description of every step of this process is available in section OA1 of the online appendix.

We show the graphical distribution of 2005's maximum wind speed across counties in figure 1(a). Darker colors indicate higher wind speeds. It demonstrates that coastal counties saw higher wind speed in 2005. However, it also shows sustained wind speed for several hinterland counties in every state. Additionally, every state has some counties with very modest wind

Figure 1: Wind speed and religious adherence across counties



(a) Maximum wind speed in 2005



(b) Religious adherence

Notes: Figure 1(a) shows the maximum wind speed in 2005 for every county in our sample. Darker colors indicate higher wind speed. Figure 1(b) indicates religious adherence per county. Darker colors indicate higher religious adherence. See section OA1 of the online appendix for a detailed description of every variable.

speeds in 2005, which allows for a within-state comparison of treated counties on a continuous basis.

Religion. Our source of information for religiosity is the Association of Religion Data Archives (ARDA). This database provides a complete enumeration of religious congregations and people affiliated with a congregation. In particular, it contains a county-level geographical variation on the number of churches and the number of members of each church, approximating the Census of American Religion (Finke and Scheitle, 2005). Data were collected by the Association of Statisticians of American Religious Bodies (ASARB) and compiled by Glenmary Research Center (e.g. Kumar et al., 2011; Hilary and Hui, 2009). We measure religiosity as the rate of adherence in the county where the establishment resides. Adherents comprise "all members, including full members, their children, and the estimated number of other regular participants." We measure religious adherence rates as of the year 2000, which is the last year for which census information on religiosity is available before the hurricane season. We use Religion to label this variable. We show the graphical distribution of this variable across the counties in figure 1(b). The figure shows that religious adherence is well-spread across the counties in southeastern United States. In every state, we find counties with relatively and high and low religious adherence rates. Figures 1(a) and 1(b) show no relation between wind speed and religious adherence in our sample.

County characteristics. We employ several other county characteristics to control for joint correlations with religious adherence. We use social capital (Social Capital) at the county level as of 2005. This variable's information source is the Northeast Regional Center for Rural Development at Pennsylvania State University. In line with the literature, we consider that social capital assumes different aspects that could affect economic performance. Because there are no legal or economic incentives to vote on or survey in the census, we use the information on voter turnout in presidential elections and the response rate to the Census Bureau's decennial census to capture the ramifications of social norms that emphasize cooperative behaviors (Alesina and La Ferrara, 2000). On the other side, the social networks we measure as the number of associations and non profit organizations per 100,000 people are more likely to account for the strength of local cooperative norms (Coleman, 1988). Following Hasan et al. (2017) and Perez-Truglia and Troiano (2018), we use a principal component analysis of these four variables to construct our final measure of social capital. In a critical situation, social capital could increase cooperation and foster in this way post-disaster recovery.

Also, we use a measure of human capital. Following Moretti (2004), we measure human capital (Human Capital) as the share of people over 25 with a university degree or higher. Information comes from the 2000 census. Recent literature argues that human capital works as a potential mechanism through which religion can affect economic growth (Becker and Woessmann, 2009; Valencia Caicedo, 2019). Furthermore, human capital could play a role per se in post-disaster recovery. On this point, Besley and Burgess (2002) argue that after natural disasters, governments tend to be more responsive to needs in areas where more people read newspapers, and there is a higher level of human capital.

Next, we collect information on the total county income per inhabitant from the Bureau of Economic Analysis (Income) as of 2005. This variable should cover the difference in wealth and economic prosperity between the counties. Furthermore, we use the share of African Americans (Minority) in a county. This variable comes from the 2005 Census Population Estimates. Additionally, we calculate the population density as the county population per square mile (Urban) from the 2000 Census. Last, we approximate the difference in politics among counties by the share of people who voted for the Democratic party during the 2004 presidential election (Democrats); that data is from the MIT Election Lab database.

Ancestors' experience with natural disasters. Using the 2005 American Community Survey (ACS), we compute a measure of ancestors' experience with natural disasters (Ancestors' Experience). In order to measure the historical natural disaster risk variable of residents' country of origin, we rely on the EM-DAT database. The EM-DAT database has universal coverage on all the natural disasters worldwide, starting from the year 1900. A disaster is included in the data set if it fulfills one of the following criteria: (a) at least 10 people are killed, (b) 100 people are reported affected, (c) a state of emergency is declared, or (d) international assistance is required. Using this data set, we measured the natural disaster damages by country. We normalized it with the country's population. We merged this historical natural disaster risk measure with every county in our sample using ancestors' country of origin information from the ACS. In the vein of Fulford et al. (2020), we take the county-ancestor population share to get a weighted-average measure of the local experience with natural disasters stemming from foreign ancestors.

Religious and other networks. We obtain information on the number of membership associations in 2005 from the Northeast Regional Center for Rural Development (NRCRD) database (Rupasingha et al., 2006). They use secondary data covering the entire United States to compile an extensive and comprehensive set of variables on membership organizations at the county level. More specifically, they consider the following: (1) civic organizations, (2) bowling centers, (3) golf clubs, (4) fitness centers, (5) sports organizations, (6) religious organizations, (7) political organizations, (8) labor organizations, (9) business organizations, and (10) professional organizations.

We follow Knack and Keefer (1997) and we group organizations into rent-seeking organizations ("Olson-type" organizations) and non-rent-seeking organizations ("Putnam-type" organizations). Rent-seeking organizations provide a financial incentive to form and join because they contribute to redistributing income and wealth from other parts of society to members (political organizations, labor organizations, business organizations, and professional organizations). Non-rent-seeking organizations involve social interaction that promotes trust and cooperation among members (civic organizations, bowling centers, golf clubs, and fitness centers). Thereby, we use three measures – Rent-Seeking, Non-Rent-Seeking, Religious Organizations – in our analysis. To account for the different shares per county, we scale them by the county population (per 1'000 inhabitants).

Summary statistics. Table 1 shows the summary statistics of our primary sample which comprises information about 42,847,343 observations for 4,943,312 establishments in 1,081 counties.

In the top panel, we split the sample between establishments located in counties above and below the median of Wind Speed. We report the mean and the standard deviation for both groups of establishments before 2005. We calculate the normalized difference in the last column, which indicates similarity between both groups if the normalized differences are within the range of ±0.25 (Imbens and Wooldridge, 2009).

The second panel of table 1 provides statistics for our variables when we consider the median level of Religion for the sample split. Table OA1 in the online appendix provides additional statistics for the entire sample and observation period.

When we split by Wind Speed, we find that both groups of establishments are very similar in our outcome variable and county characteristics. Most importantly, we find that the pre-2005 growth rates in productivity (ΔLn(Productivity)) are almost identical. However, we find that the African-American population is higher in counties with high Wind Speed. Those counties voted more in favor of Democrats, too. High Wind Speed counties differ also slightly in terms of Social Capital. By splitting counties into high and low religious groups, we find again that our outcomes variables at the establishment level are very similar across both groups. Urban, Minority, and Social Capital are a bit out of the ±0.25 range of normalized differences in county characteristics.

Table 1: Pre-2005 summaries and Normalized differences

	Mean	SD	Mean	SD	ND
	Wind Speed≥median		**Wind Speed<median**		
Establishment-level					
Ln(Productivity)	11.18	0.78	11.18	0.79	-0.00
Productivity	105126.66	220483.98	106231.03	221348.86	-0.00
ΔLn(Productivity)	-0.01	0.22	-0.01	0.22	0.00
County-level					
Religion	0.69	0.19	0.70	0.20	-0.03
Social Capital	-1.03	0.69	-0.65	1.16	-0.29
Human Capital	14.01	6.73	14.94	6.32	-0.10
Democrats	0.41	0.12	0.34	0.12	0.41
Income	10.16	0.19	10.18	0.19	-0.07
Urban	4.11	1.02	3.76	1.43	0.20
Minority	0.27	0.18	0.10	0.15	0.71
	Religion≥median		**Religion<median**		
Establishment-level					
Ln(Productivity)	11.17	0.80	11.19	0.78	-0.02
Productivity	104132.50	211093.90	106399.12	225936.18	-0.01
ΔLn(Productivity)	-0.01	0.22	-0.01	0.22	0.01
County-level					
Wind Speed	18.25	12.49	19.54	10.80	-0.08
Social Capital	-0.60	0.90	-1.09	0.98	0.37
Human Capital	13.74	4.98	15.20	7.74	-0.16
Democrats	0.37	0.13	0.38	0.12	-0.04
Income	10.16	0.17	10.18	0.21	-0.07
Urban	3.61	1.25	4.26	1.16	-0.38
Minority	0.22	0.20	0.15	0.16	0.26

This table shows descriptive statistics for all variables we use in our establishment-level analyses. We separate the sample into establishments in counties above (treated) and below (untreated) median Wind Speed. We also separate the sample between establishments residing in counties above and below the median religious adherence. We show the statistics for the pre-2005 period. The sample comprises 42,847,343 observations for 4,943,312 establishments residing in 1,081 counties. The last column provides normalized differences (Imbens and Wooldridge, 2009). See section OA1 of the online appendix for a detailed description of every variable.

Two aspects become apparent from table 1. First, we find no indication of different trends in establishments' productivity, which is a critical assumption for our later regression analysis. Second, we find only level differences in some county characteristics by splitting the sample by Wind Speed and Religion. We include establishment-level, state-by-year, and industry-by-year fixed effects in our regressions, controlling for general level differences. We furthermore use the mentioned county characteristics and their interactions with the treatment effect as additional controls, which curbs remaining concerns about omitted factors.

3 The Hurricane Season of 2005 and establishment-level productivity

The magnitude of the hurricanes that hit the southeast coast of the United States in 2005 was widespread and catastrophic. Four storms in this season (Emily, Katrina, Rita, and Wilma) became Category 5 hurricanes on the Saffir-Simpson Scale, the highest-ranking on the scale.[1]

The property damages from Hurricane Katrina alone was estimated between approximately $100 billion from the National Hurricane Center to $150 billion from the Congressional Research Service Schüwer et al. (2019). Furthermore, it killed more than 1,800 people, making Hurricane Katrina the deadliest natural disaster in the U.S. history since the Florida hurricane in 1928. Many cities were evacuated, and even after nine years, the population recovered to only 75 % of the pre-2005 level (Nigg et al., 2006). Corporations partially mitigated their losses through insurance. However, considering the magnitude of the unexpected losses, insurance coverage was far from complete. According to the Insurance Information Institute, only half of the total losses were insured. In the following, we will document the effects on productivity from the 2005 hurricane season.

Dynamic effects. We start to test the impact of the 2005 hurricane season on establishment performance by estimating the following regression:

$$\text{Ln(Productivity)}_{i,b,j,s,t} = \sum_{t=2000,t\neq 2004}^{2010} \beta_t(\text{Wind Speed}_j \times \alpha_t) + \alpha_i + \alpha_t \times \alpha_s + \alpha_t \times \alpha_b + \epsilon_{i,b,j,s,t} \tag{1}$$

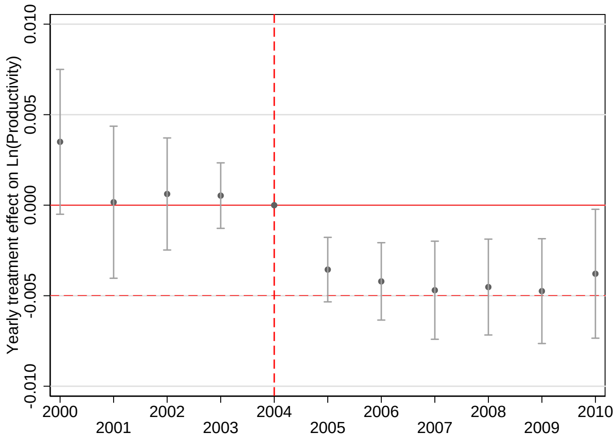
The dependent variable is the natural logarithm of the ratio between the sales and the number of employees (Productivity) at establishment i, in industry-sector b, residing in county

[1] The second section of Schüwer et al. (2019) provides comprehensive documentation of the economics of the 2005 hurricane season.

j of state s in year t. Wind Speed is the treatment variable and measures the maximum wind speed recorded in the county j in 2005. The α_t's are dummy variables that capture each year in our database between 2000 and 2010. $\alpha_t \times \alpha_s$ are state times year fixed effects. We additionally control for yearly within-industry effects using $\alpha_t \times \alpha_b$. To adjust the standard errors on the level of the treatment, we cluster them on the county level.

In this regression, we interact Wind Speed with the complete set of year dummies using 2004 as the reference year. Thereby, the coefficients β_t report the differential effect in establishment-level productivity for a particular year compared to 2004.

Figure 2: Yearly treatment coefficients



Notes: Figure 2 shows the yearly treatment effects from equation (1) with establishment, year times state and year times industry fixed effects. Treatment effects consider a change in Wind Speed from the 5th percentile (2.83) to the 95th percentile (41.64) of the distribution of Wind Speed. The dependent variable is Ln(Productivity). See section OA1 of the online appendix for a detailed description of every variable.

We present the β coefficients from equation (1) and the 95% confidence intervals in figure 2. The treatment effects are rescaled to show the effect of a change in Wind Speed from the 5th (2.83) to the 95th percentile (41.64) of the Wind Speed distribution (roughly 39 units).

Figure 2 provides several critical results. First, the yearly point estimates show significant differential effects for every year between 2005 and 2010 relative to 2004. In terms of economic magnitude, we estimate a decrease in productivity of about 0.5 percentage points relative to 2004 if we, ceteris paribus, shift an establishment from the 5th to 95th percentile of the Wind Speed distribution. Considering that the average productivity decline in the southeastern United States is 1% before 2004, the effect is economically meaningful and persistent until 2010.

Second, we find that the yearly treatment effects on productivity are not significant before 2005, except for the year 2000, when it is statistically significant at 10%. We take the almost absence of significant coefficients in the run-up period to the 2005 hurricane season to indicate that the establishments in our sample follow almost parallel trends in terms of productivity across the Wind Speed distribution, which we further corroborate in figure OA1 in the online appendix, where we show conventional time series developments in productivity. The non-significant single term for Wind Speed in column (1) of table OA6 further corroborates the absence of significant differences of productivity between more or less treated establishments for the entire pre-2005 period. This finding mirrors the tiny normalized differences between below and above median Wind Speed counties from table 1 concerning Ln(Productivity) and ΔLn(Productivity).

At this point, we conclude that the hurricane season of 2005 had a significant adverse and lasting effect on the productivity of establishments residing in more affected counties.

Difference-in-difference results. Building on the evidence from figure 2, we turn to a more conventional difference-in-difference setup and estimate the following regression.

$$\begin{aligned} \text{Ln(Productivity)}_{i,b,j,s,t} = {} & \beta(\text{Post}_t \times \text{Wind Speed}_j) \\ & + \alpha_t \times \alpha_s + \alpha_t \times \alpha_b + \epsilon_{i,b,j,s,t} \end{aligned} \tag{2}$$

This regression is equal to equation (1) except that we include the dummy *Post* to differentiate preceding periods 2000-2004 and post-hurricane periods 2005-2010 instead of yearly dummies. The β coefficient measures the difference-in-difference effect in establishments' productivity for a change in Wind Speed during 2005-2010 relative to the run-up period 2000-2004.

The first column of table 2 shows regression results for Equation (2) for a specification with establishment and year fixed effects. We find a treatment effect of -0.0002, which is significant at the 1% level. This adverse effect shows that with every Wind Speed unit, productivity at the establishment level decreases by 0.02 percentage points after 2005 relative to before. Thereby, if we compare establishment in counties at the 5th versus the 95th percentile of the distribution in Wind Speed, the economic effect becomes $-0.0002 * 39 = -0.008$, which equals

Table 2: Establishment-level effects of the 2005 hurricane season

	(1)	(2)	(3)
Dependent variable	Ln(Productivity)		
Post × Wind Speed	-0.0002***	-0.0002***	-0.0001**
	(0.0001)	(0.0001)	(0.0000)
Establishment FE	✓	✓	✓
Year FE	✓	✓	✓
Industry×Year FE		✓	✓
State×Year FE			✓
Observations	42,847,343	42,847,343	42,847,343
Counties	1,081	1,081	1,081
Adjusted R-squared	0.909	0.911	0.911

This table shows regression results for equation (2). Ln(Productivity) is the dependent variable. Standard errors are clustered at the county level. ***, **, and * denote significance at 1, 5, and 10 percent level respectively. See section OA1 of the online appendix for a detailed description of every variable.

0.8 percentage points. Given an average productivity growth pre-2005 of around 1%, this effect is sizeable.

In column (2), we add industry× year fixed effect, which helps us compare establishments from the same industry and further consider industry-wide changes over time. We find our treatment effect unchanged, with a coefficient of -0.0002, which is significant at the 1% level. In column (3), we further augment our regression with state×year fixed effect. Thereby, our results in the last column of table 2 hold fixed industry and state characteristics over time. Put differently, we further zoom in on our sample. The estimate from column (3) now rests on a within-state-industry comparison. With this, we still find an adverse treatment effect significant at the 5% level. However, the treatment effect shrinks by 50% (to 0.4 percentage points) relative to the effects in the first two columns.

Our baseline results, in general, corroborate existing literature. Analyzing firm-level data for the United States during 1978–2013, Barrot and Sauvagnat (2016) find that suppliers' sales growth decreases by 3.9 percentage points in the quarter after a major natural disaster. Similarly, Hsu et al. (2018) show that a major natural disaster leads to a decrease of 1.2 percentage points in the return on assets for public corporations in the United States. However, the effect is much smaller and equal to 0.3 percentage points for technologically diversified firms. Also, Strobl (2011) estimates that in a year in which an average hurricane strikes a county, the county's per capita economic growth rate falls on average by 0.45 percentage points.

4 The role of religion in post-disaster recovery

Our baseline results from the previous section corroborate the notion that adverse economic events decrease productivity. In this section, we extend the literature by investigating whether religion shapes economic recovery. To do this, we augment our previous regression setup from equation (2) and formulate:

$$
\begin{aligned}
\text{Ln(Productivity)}_{i,b,j,s,t} = {} & \beta(\text{Post}_t \times \text{Wind Speed}_j) \\
& + \gamma_0(\text{Post}_t \times \text{Wind Speed}_j \times \text{Religion}_j) + \eta_0(\text{Post}_t \times \text{Religion}_j) \\
& + \sum_{m=1}^{6} \left[\gamma_m(\text{Post}_t \times \text{Wind Speed}_j \times \text{X}_{m,j}) + \eta_m(\text{Post}_t \times \text{X}_{m,j})\right] \\
& + \alpha_s \times \alpha_t + \alpha_b \times \alpha_t + \alpha_i + \epsilon_{i,b,j,s,t}
\end{aligned} \tag{3}
$$

This regression comes with two distinct changes. First, we include Religion (the religious adherence in a county) and fully interact it with Wind Speed and Post. Thereby, the coefficient γ_0 indicates the differential effect from religious adherence on the treatment effect.

Second, we include six additional county measures (m): Human Capital, Social Capital, Urban, Minority, Democrats, and Income. To control whether those measures comprehensively affect post-disaster recovery, we introduce each factor by interacting it fully with Wind Speed and the Post. Thereby, the coefficients γ_m indicate the differential treatment effects of each additional county variable and in turn allows for a direct comparison with our primary variable, Religion. In order to ease the interpretation of the baseline treatment effect β, we demean every county measure. Thereby, β measures the treatment effect for establishments residing in average counties concerning the seven county characteristics we use.

We start our analysis by investigating the differential effect of religion on post-disaster recovery using establishment and time fixed effects. Column (1) of Table 3 reports the estimates. First, the baseline treatment effect Post×Wind Speed is significant at the 5% level and equal in

Table 3: The effect of religion

	(1)	(2)	(3)
Dependent variable		Ln(Productivity)	
Post × Wind Speed	-0.0002***	-0.0001**	-0.0002***
	(0.0001)	(0.0000)	(0.0000)
Post × Religion	-0.0008	-0.0020	0.0047
	(0.0073)	(0.0070)	(0.0056)
Post × Religion × Wind Speed	0.0008***	0.0008***	0.0006**
	(0.0003)	(0.0002)	(0.0003)
Post × Social Capital		0.0031*	-0.0003
		(0.0017)	(0.0012)
Post × Social Capital × Wind Speed		-0.0001**	-0.0001*
		(0.0001)	(0.0001)
Post × Human Capital		-0.0006**	-0.0001
		(0.0003)	(0.0002)
Post × Human Capital × Wind Speed		0.0000*	0.0000
		(0.0000)	(0.0000)
Post × Democrats		-0.0024	0.0044
		(0.0123)	(0.0095)
Post × Democrats × Wind Speed		-0.0011***	-0.0011***
		(0.0004)	(0.0003)
Post × Income		0.0081	0.0086
		(0.0102)	(0.0061)
Post × Income × Wind Speed		-0.0004	-0.0001
		(0.0003)	(0.0002)
Post × Urban		0.0046***	0.0003
		(0.0015)	(0.0009)
Post × Urban × Wind Speed		-0.0001	0.0000
		(0.0001)	(0.0000)
Post × Minority		0.0183*	0.0171**
		(0.0096)	(0.0079)
Post × Minority × Wind Speed		-0.0001	0.0000
		(0.0004)	(0.0004)
Establishment FE	✓	✓	✓
Year FE	✓	✓	✓
Industry×Year FE			✓
State×Year FE			✓
Observations	42,847,343	42,847,343	42,847,343
Counties	1,081	1,081	1,081
Adjusted R-squared	0.909	0.909	0.911

This table shows regression results for equation (3). Ln(Productivity) is the dependent variable. Standard errors are clustered at the county level. ***, **, and * denote significance at 1, 5, and 10 percent level respectively. See section OA1 of the online appendix for a detailed description of every variable.

terms of economic magnitude to the estimate from the previous section. Note that we demean all county characteristics. Thereby, the treatment effect is the impact of a unit change in Wind Speed for post-2005 productivity for an establishment residing in an average county concerning religion in column (1) and the seven county measures in columns (2) and (3). The almost identical estimate for the treatment effect probably resembles carving out many correlations associated with the county characteristics by our fixed effects in the previous section.

Second, the triple interaction between Post, Wind Speed, and Religion is positive and significant at the 1% level. This estimate thereby indicates that the adverse effect of higher Wind Speed on productivity is significantly mitigated if counties have higher religious adherence rates. Put differently, more religious counties help establishments to recover faster. In terms of magnitude, it implies that a one-standard-deviation increase in the rate of religious adherence (19 percentage points) mitigates the negative per-unit treatment effect by $0.0008 * 0.19 = 0.00015$ percentage points. This mitigation effect equals roughly three- quarters of the baseline treatment of -0.0002. Thus, shifting an establishment from a mean-religious county by one standard deviation mitigates most of the adverse differential hurricane effect. To finalize the discussion of this first set of results, we show that the double interaction between Post and Religion is insignificant, suggesting the absence of an effect of Religion on productivity other than through the treatment.

The setup of column (1) leaves room for considerable correlation of Religion with the error term that might affect its influence on productivity. To mitigate concerns about confounding effects, we include a set of relevant county characteristics and their interaction with the treatment effect in column (2). We find that the significant beneficial effect of Religion on post-2005 recovery remains intact even when we explicitly control for the other county covariates in our regression.

To challenges our results even further, we saturate the regression by additional state×year and industry×year fixed effects. Again, this leaves the significant detrimental treatment effect and the beneficial effect from higher religious adherence intact. Furthermore, as suggested by table OA2 in the online appendix, religious adherence negatively correlates with population density and economic wealth (e.g., Chen, 2010). As Kahn (2005) suggests, those measures correlate positively with recovery after a natural disaster. If any other similar source of omitted-variable bias affects our findings, we expect that we estimate a lower bound effect of religion intensity on post-disaster recovery, as suggested in column (2) of table 3.[2]

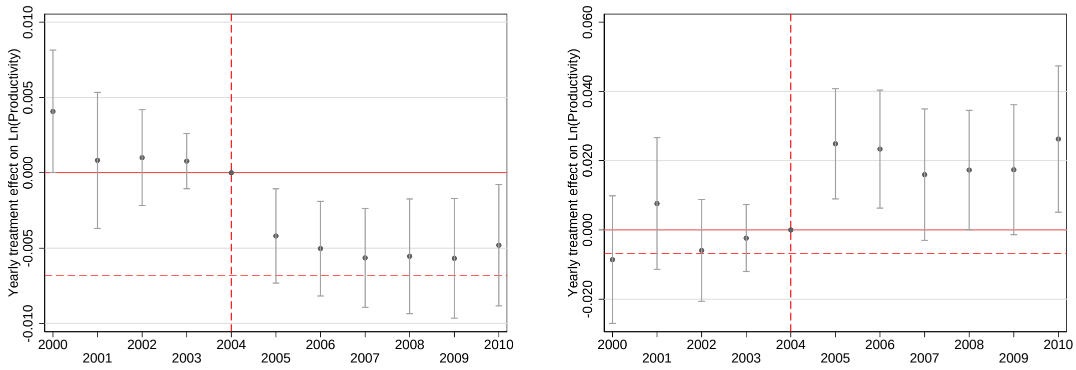
When we turn to the other county characteristics, we find that two of them significantly affect the treatment effect. Our results in column (3) show that a higher voting share for Democrats leads to an even bigger adverse treatment effect. In line with Garrett and Sobel (2003), a possible explanation for this finding is that states politically connected to the Republican president had a higher rate of disaster expenditures. Furthermore, counties with higher levels of social capital see the same effect, though only borderline significant.

One thing that might threaten the internal validity of our results is that more religious counties behave very differently in the run-up to the 2005 hurricane season. To mitigate those concerns, we re-run equation (3) with the complete set of county characteristics and fixed effects but split Post into yearly dummies similar to equation (1). Figure 3(a) shows the yearly treatment effects for establishments in average counties concerning county characteristics. In line with our previous results, almost all pre-2005 treatment effects are insignificant, suggesting the absence of parallel trends for establishments in average counties. However, starting with 2005, figure 3(a) indicates an adverse treatment effect from the 2005 hurricane season, which lasts until the end of our sample period.

Even more critical for the validity of our analysis is figure 3(b), which shows the development of the differential treatment effect of religious adherence (i.e., the triple interaction coefficient of Religion, Wind Speed, and the yearly dummies). Importantly, figure 3(b) indicates the absence of a significant pre-2005 trend of more religious counties concerning treatment. Moreover, this effect becomes positive and significant at the 1% level in 2005, and it remains so for 2006. The other coefficients are still statistically significant at the 5 % and 10 % levels until 2010, indicating that religious adherence spurs recovery of treated establishments for at least five years after the hurricane season.

[2]Because we use several variables as well as many observations, figure OA2 and table OA3 in the online appendix curb concerns that outliers or high correlations among independent variables drive our results.

Figure 3: Religion and post-disaster recovery



(a) Yearly treatment effect of the 2005 hurricane season on establishment productivity

(b) Yearly treatment effect of religion on post-disaster productivity recovery

Notes: Figure 3(a) shows the yearly treatment effect of the 2005 hurricane season on establishment productivity for average religious adherence. Figure 3(b) shows the differential effect of religion on post-disaster productivity recovery. Treatment effects consider a change in Wind Speed from the 5th percentile (2.83) to the 95th percentile (41.64) of the distribution of Wind Speed. See section OA1 of the online appendix for a detailed description of every variable.

5 The various facets of religion's impact

This section investigates potential mechanisms through which establishments in more religious counties exhibit better post-disaster performance.

Cultural attitudes. A potential explanation of our findings is that religiosity is associated with "good" economic attitudes. As we explained in the introduction, religion is associated with confidence towards institutions and the market, as well as cooperation and thriftiness. Guiso et al. (2004) and Renneboog and Spaenjers (2012) show that these characteristics are common among religions. However, some attitudes are heterogeneous across religions and affect economic growth differently (Becker and Woessmann, 2009; Basten and Betz, 2013; Arruñada, 2010). We exploit heterogeneity across religions to understand better the attitudes through which religion affects post-disaster recovery. We do this by running regressions on equation (3), inserting shares of different religious branches. In detail, we use rates for Catholic (Catholics) and Protestant (Protestants) adherence and the subgroups of Protestantism: mainline and evangelical.

First, we exploit heterogeneity in attitudes between Protestants and Catholics. We start our analysis by estimating the effect of the Catholic and Protestant shares on post-disaster

Table 4: Treatment effect from different religious groups

	(1)	(2)
Dependent variable	Ln(Productivity)	
Post × Wind Speed	-0.0001***	-0.0001**
	(0.0000)	(0.0000)
Post × Protestants	0.0002	
	(0.0067)	
Post × Protestants × Wind Speed	0.0011***	
	(0.0004)	
Post × Catholics	0.0212***	0.0224***
	(0.0070)	(0.0071)
Post × Catholics × Wind Speed	0.0005*	0.0005*
	(0.0003)	(0.0003)
Post × Mainline		-0.0164
		(0.0189)
Post × Mainline × Wind Speed		0.0023**
		(0.0010)
Post × Evangelical		0.0046
		(0.0065)
Post × Evangelical × Wind Speed		0.0009***
		(0.0003)
Est. FE	✓	✓
Year FE	✓	✓
Industry×Year FE	✓	✓
State×Year FE	✓	✓
Fully interacted county controls	✓	✓
Observations	42,847,343	42,847,343
Counties	1,081	1,081
Adjusted R-squared	0.911	0.911

This table shows regression results for equation (3) using different religious adherence rates. Ln(Productivity) is the dependent variable. Standard errors are clustered at the county level. ***, **, and * denote significance at 1, 5, and 10 percent levels respectively. See OA1 for a detailed description of every variable.

performance. We report results in column (1) of table 4. Our results show that the significant adverse treatment effect for establishments in average counties remains intact. Additionally, we find a positive and statistically significant effect of the triple interaction effect for both religious groups (though only at the 10% level for Catholics). A one-standard-deviation increase in Catholic (13 percentage points) is associated with a post-disaster recovery change of 0.01 percentage points for a one-unit change in Wind Speed. Protestants are as well positively correlated with post-disaster performance. More specifically, one standard deviation increase in the share of Protestants (0.17 percentage points) fosters post-disaster recovery by 0.02 percentage points for every one-unit change in Wind Speed.

According to the literature (Rupasingha and Chilton, 2009), different denominations within the Protestant church have different effects on economic growth. Therefore, we split Protestants into mainline and evangelical religious denominations, and we analyze the effect of these variables separately in column (2) of table 4. Although the effect of the Catholics' share of post-disaster recovery is unchanged, we show that a one-standard-deviation increase in the mainlines' share (five percentage points) increases post-disaster recovery by 0.01 for each unit of Wind Speed. Very similar, a one-standard-deviation increase in the evangelicals' share (16 percentage points) increases post-disaster recovery by 0.01 percentage points for each unit change in Wind Speed.

In conclusion, no religious denomination or religion-specific attitude (e.g., Protestant work ethic) drives our results. Table OA4 in section OA2 of the online appendix further indicates that if we include the (very small) shares of Islamic and Jewish people, the results from table 4 do not change.

Ancestors' experience with natural disasters We find that religion is a critical factor in mitigating the detrimental effects of establishment productivity for the 2005 hurricane season. Our results show that different religious denominations contribute somewhat equally to this effect. In the following, we investigate potential sources of religious adherence that drive the effects we document so far.

A first potential candidate is shared experience within communities or families. King (2010) suggests a link between religion, family, and inter-generational ties. We follow this idea and investigate whether shared experiences of natural disasters from one generation to another may correlate with our finding of a beneficial effect of religious adherence for post-disaster recovery. Put very simply, in line with other papers (Florio and Manfredonia, 2021; Dohmen et al., 2012), we suggest that if experiences with past disasters are transmitted through generations, they can influence responses to current disasters and shape recovery. Thereby, if experiences with past disasters and religion share common ground – the family – part of the religion's positive effect on recovery might stem from shared experiences. We thus investigate this potential nexus empirically.

To measure ancestors' experience with natural disasters, we collect ancestors' information from the 2005 ACS. Thereby we know the ancestral origins of people living in each of our sample counties. We then use historical disaster damages from the EM database between 1900 and 2004 for every country worldwide and finally calculate as a weighted average our new variable of interest using the ancestral origin share of people in a county in 2005. In this way, we use heterogeneity among counties concerning inter-generational disaster memories, potentially shaping the ability to deal with natural disasters.

To estimate how ancestors' experience affects establishment-level productivity post-2005, we use equation (3) and add Ancestors' Experience alongside Religion and the other county characteristics in column (1) of Table 5. In column (1), we document that the baseline adverse treatment effect remains significant. Further, the inclusion of Ancestors' Experience in the regression does not crowd out the effect of Religion which remains positive and significant. Crucially, however, we find a positive and statistically significant triple-interaction effect for the treatment effect and ancestors' experience.[3] This effect reveals that productivity is relatively higher for establishments in counties with higher Ancestors' Experience after a natural disaster. The effect is also economically meaningful. A one-standard-deviation increase in ancestors' experience (0.1) is associated with increased productivity equal to 0.01 percentage points per unit change in Wind Speed. In comparison, an increase in religious adherence by one standard deviation (0.19) relatively increases productivity by 0.01 percentage points per unit change in Wind Speed as well. From this tiny difference, we conclude that the effects from both factors are quite similar in magnitude.

[3]A potential caveat might be that ancestors' experience is endogenous in our regressions. However, we regard the ancestry variable as an additional control variable to carve out shared variation in and to investigate its moderating role of the effect of religious adherence.

Table 5: Ancestors' Experience with Natural Disasters and Religion

	(1)	(2)	(3)
		Religion	
		≥median	<median
Dependent variable		Ln(Productivity)	
Post × Wind Speed	-0.0001***	-0.0000	-0.0002***
	(0.0000)	(0.0001)	(0.0001)
Post × Religion	0.0005		
	(0.0056)		
Post × Wind Speed× Religion	0.0007***		
	(0.0003)		
Post × Ancestors' Experience	-0.0327***	-0.0317***	-0.0303
	(0.0084)	(0.0084)	(0.0199)
Post × Wind Speed× Ancestors' Experience	0.0008*	0.0012***	-0.0001
	(0.0004)	(0.0004)	(0.0010)
Establishment FE	✓	✓	✓
State×Year FE	✓	✓	✓
Industry×Year FE	✓	✓	✓
State×Year FE	✓	✓	✓
Fully interacted county controls	✓	✓	✓
Observations	42,847,343	21,073,786	21,773,557
Counties	1,081	650	431
Adjusted R-squared	0.911	0.913	0.908

This table shows regression results for equation (3) in which we interact our baseline effects with pre-2005 proxies for culture at the county level. We further augment the regression with ancestors' experience as an additional interaction variable. In columns (2) and (3), we split the sample into counties with high (Column (2)) and low (Column (3)) religious adherence, respectively, based on the median value of the distribution of this variable. Standard errors are clustered at the county level. ***, **,and * denote significance at 1, 5, and 10 percent levels, respectively. See section OA1 of the online appendix for a detailed description of every variable.

In order to investigate deeper the relation between Religion and Ancestors' Experience, we split the sample at the median of religious adherence and investigate the effect of Ancestors' Experience in columns (2) and (3). Notably, we find that the triple interaction coefficient for Ancestors' Experience is positive and statistically significant only in above-median religious counties. In our view, this finding suggests that only in counties where the family and the inter-generational transmission nexus is stronger through religion, the benefits from shared experiences, but also knowledge and attitudes (King, 2010; Dohmen et al., 2012; Florio and Manfredonia, 2021), can stimulate the economic recovery.

Religious and other membership organizations. In this section, we investigate another challenger to our results: religious and other membership organizations.

We collect detailed information on the number of membership organizations in the United States. Following Knack and Keefer (1997) and Rupasingha et al. (2006), we separate organizations into rent-seeking organizations ("Olson-type" organizations) and non-rent-seeking organizations ("Putnam-type" organizations). Rent-seeking organizations provide a financial incentive to form and join associations because they are a mechanism for the redistribution of income or wealth from other parts of society to their members. More similar to religious organizations, non-rent-seeking organizations involve social interactions that can build trust and foster cooperative habits.

We estimate a variant of equation (3) by using Religious Organizations as our new independent variable of interest. We report estimation results in table 6. In column (1), we find that a one-standard-deviation increase in Religious Organizations (an increase of 0.38 of this variable) is associated with a post-disaster increase in productivity of 0.01 percentage points.

Columns (2) and (3) introduce rent-seeking organizations and non-rent-seeking organizations separately in our regressions. In column (4), these two variables are included in the regression together. We find that neither rent-seeking organizations nor non-rent-seeking organizations predict post-disaster recovery, even though these variables positively correlate with religious organizations. Conversely, the coefficient for religious organizations is still positive, statistically significant, and within one standard deviation of the coefficient reported in column (1).

In column (5), we add to our last specification religious adherence. We find that both religious adherence and religious organizations positively affect post-disaster recovery. This finding suggests that beyond the classical "club good" benefits that could foster recovery through both emotional and social insurance (Chen, 2010; Dehejia et al., 2007; Auriol et al., 2020; Berman, 2000), the benefits of religious organizations spill over to the community. Our results are thereby in line with studies showing that churches in the United States provide community services similar to those the government provides and can even substitute for government activities (Hungerman, 2005; Gruber and Hungerman, 2007), thereby fostering recoveries.

Finally, in column (6), we additionally include ancestors' experience with natural disasters. Strikingly, we find that all three aspects of religion are significant in fostering economic

Table 6: Religious and other networks

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable			Ln(Productivity)			
Post × Wind Speed	-0.0001**	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Post × Religious Organizations	-0.0025	-0.0036	-0.0030	-0.0038	-0.0058	-0.0038
	(0.0036)	(0.0037)	(0.0035)	(0.0036)	(0.0037)	(0.0035)
Post × Religious Organizations × Wind Speed	0.0004*	0.0004**	0.0004**	0.0004**	0.0003*	0.0003*
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Post × Rent-Seeking		0.0174**		0.0152*	0.0138	0.0106
		(0.0081)		(0.0084)	(0.0087)	(0.0093)
Post × Rent-Seeking × Wind Speed		-0.0001		-0.0001	-0.0001	0.0001
		(0.0004)		(0.0004)	(0.0004)	(0.0004)
Post × Non-Rent-Seeking			0.0155*	0.0132	0.0101	0.0112
			(0.0083)	(0.0084)	(0.0084)	(0.0082)
Post × Non-Rent-Seeking × Wind Speed			-0.0000	-0.0000	0.0001	0.0001
			(0.0004)	(0.0004)	(0.0004)	(0.0004)
Post × Religion					0.0052	-0.0000
					(0.0058)	(0.0057)
Post × Religion × Wind Speed					0.0005**	0.0006***
					(0.0002)	(0.0002)
Post × Ancestors' Experience						-0.0330***
						(0.0083)
Post × Wind Speed× Ancestors' Experience						0.0008**
						(0.0004)
Est. FE	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓
Industry×Year FE	✓	✓	✓	✓	✓	✓
State×Year FE	✓	✓	✓	✓	✓	✓
Fully interacted county controls	✓	✓	✓	✓	✓	✓
Observations	42,847,343	42,847,343	42,847,343	42,847,343	42,847,343	42,847,343
Counties	1,081	1,081	1,081	1,081	1,081	1,081
Adjusted R-squared	0.911	0.911	0.911	0.911	0.911	0.911

This table shows regression results for equation (3). Ln(Productivity) is the dependent variable. Standard errors are clustered at the county level. ***, ** and * denote significance at 1, 5 and 10 percent levels, respectively. See section OA1 of the online appendix for a detailed description of every variable.

recovery. Thereby, the general effect of religion that we presented has different sources that broadly come from adherence, ancestors' experiences with natural disasters combined with inter-generational ties, and institutionalized features of religion that can provide needed help in times of crises.

6 Aggregate-county dynamics

In this last section, we explore whether the granular effects that we estimate so far at the establishment level affect aggregate numbers at the county level, too. In order to investigate this hypothesis, we estimate the following equation.

$$
\begin{aligned}
Y_{j,s,t} = {} & \beta(\text{Post}_t \times \text{Wind Speed}_j) \\
& + \gamma_0(\text{Post}_t \times \text{Wind Speed}_j \times \text{Religion}_j) + \eta_0(\text{Post}_t \times \text{Religion}_j) + \\
& + \sum_{m=1}^{6} \left[\gamma_m(\text{Post}_t \times \text{Wind Speed}_j \times \text{X}_{m,j}) + \eta_m(\text{Post}_t \times \text{X}_{m,j})\right] + \\
& + (\alpha_s \times \alpha_t) + \alpha_j + \epsilon_{j,s,t}
\end{aligned} \tag{4}
$$

Y stands for different dependent variables that we measure at the county level. In particular, in order to estimate the effect of religious adherence on post-disaster recovery, we consider four alternative variables that we measure in natural logarithm: the number of new establishments, the number of establishments that go out of business, the total number of establishments, and the county population. The right-hand side of equation (4) mirrors equation (3) but for the county level. Again, we demean all county characteristics (except Wind Speed).

We report our findings in table 7.[4] Column (1) shows that after the 2005 hurricane season, the number of new establishments in average counties increases by 0.21 percentage points for each Wind Speed unit. At the same time, a one standard-deviation-increase in religious adherence (0.19) further increases this positive effect by 0.13 percentage points per unit of Wind Speed.

[4] In unreported results we show that the hurricane season of 2005 leads to a significant relative increase in aggregate productivity in more religious counties, too. However, the effect is rather short-lived being significant only for 2005 and 2006.

Table 7: Aggregate effects

	(1)	(2)	(3)	(4)
Dependent variable	New	Closed Establishments	Total	Population
Post × Wind Speed	0.0021***	0.0018***	-0.0004	-0.0005
	(0.0006)	(0.0006)	(0.0004)	(0.0005)
Post × Religion	-0.2766***	-0.1901***	-0.1898***	-0.1382***
	(0.0629)	(0.0599)	(0.0300)	(0.0278)
Post × Wind Speed × Religion	0.0071**	0.0028	0.0028*	0.0042**
	(0.0029)	(0.0030)	(0.0017)	(0.0019)
County FE	✓	✓	✓	✓
State×Year FE	✓	✓	✓	✓
Fully interacted county controls	✓	✓	✓	✓
Observations	11,891	11,891	11,891	11,891
Counties	1,081	1,081	1,081	1,081
Adjusted R-Squared	0.983	0.982	0.999	0.999

This table shows regression results for equation (4) for different dependent variables mentioned in the second row and using aggregate county data. We further interact with pre-2005 proxies for religion on the county level. Standard errors are clustered at the county level. ***, **, *: denote significant at 1, 5 and 10 percent levels, respectively. See section OA1 of the online appendix for a detailed description of every variable.

Column (2) shows that after the 2005 hurricane season, the number of new establishments that go out of business increases by 0.18 percentage points. However, the triple-interaction coefficient with religious adherence is not statistically significant.

In line with Schumpeter's "creative destruction process" theory (Schumpeter, 1942), an increasing number of new firms is expected to affect the size of the economy positively, leading to an increase in economic growth. Column (3) shows the cross-development of establishments in more treated counties. Overall, we find no difference in the total number of establishments between more or less treated counties. However, counties with higher religious adherence rates (a one-standard-deviation increase) saw a relative increase of the total number of establishments of about 0.05 percentage points. Taken together, the results from columns (1) to (3) show that more religious counties manage to increase relatively the number of establishments after 2005 by having significantly more new ones while holding those going out of business relatively constant to the other counties.

Finally, column (4) shows that the population remains relatively constant in average treated counties. However, counties with higher religious adherence rates (about one standard deviation) saw a relative increase in the population of about 0.08 percentage points per unit of Wind Speed. It is an important finding since migration is an essential determinant of regional recovery after a natural disaster (Strobl, 2011; Hornbeck and Naidu, 2014; Mahajan and Yang, 2017).

7 Robustness

This section provides robustness checks on our results from running regressions of equations (2) and (3). We provide all the tables from this section in the online appendix with a more detailed explanation of each test.

Placebo test. We consider a placebo test for our treatment variable to rule out the possibility that county characteristics unrelated to the severity of the 2005 hurricane season drive the estimation results reported in table 2. Therefore, we run a "placebo estimation" in which we analyze the period 1990-2000, and we estimate equation (2) using as placebo event the period 1995-2000 (Post Placebo). We report estimation results in table OA5. In our preferred specification reported in column (3), we do not find any evidence on the effect of Wind Speed on establishment productivity. This supports our assumption that county characteristics unrelated to the severity of the 2005 hurricane season do not drive our results. Furthermore, jointly with the yearly treatment effects from equation (1) that we report in figure 2 showing the absence of significant coefficients in the run-up period to the 2005 hurricane season, the results corroborate the hypothesis that the timing of the event is also exogenous.

Alternative fixed effects specifications. Tables OA6 and OA7 show that our coefficients of interest maintain the same sign and statistical significance of our preferred specification when we propose alternative fixed-effect specifications. More specifically, in column (1) of both tables, we show that the significant adverse treatment effect and the positive triple interaction with religious adherence remain do not change when we drop fixed effects from the regression. In column (2), we introduce establishment fixed effects. In column (3), we remove establishment fixed effects and introduce county and year fixed effects. In terms of magnitude, the coefficients are greater concerning the saturated specifications that we present as our main findings.

Alternative ways in clustering standard errors. In our preferred specification, we consider the most conservative choice and cluster standard errors at the county level; that is, the level at which the shock occurs. Tables OA8 and OA9 show that our results are not sensitive to alternative ways of clustering standard errors. More specifically, our results remain statistically significant when we cluster standard errors at the industry level (column (1)), at the establishment level (column (2)), and at the year level (column (3)).

Alternative treatment variables. Our measure of hurricanes' severity is the maximum wind speed ("gust") recorded in a county as in 2005. In a battery of robustness checks, we show that our results do not change when we propose alternative treatment variables. First, we consider maximum "sustained" wind speed and we report estimation results from equations (2) and (3) in column (1) of tables OA10 and OA11. We find that a one-unit-increase in this variable is associated with a decrease in productivity equal to 0.02 percentage points after 2005. On the other side, one standard deviation increase in Religion boosts recovery by 0.017 percentage points.

Second, we propose county maximum-duration wind at or above 20 m/s (in hours) in 2005. We also use county maximum sustained duration wind at or above 20 m/s (in hours) in 2005. We report estimation results in columns (2) and (3) of tables OA10 and OA11.

We find a negative effect of wind duration over 20 m/s on establishment productivity. More specifically, an increase from the 5th to the 95th of the distribution of these variables (an increase from 0 to 22 and 9, respectively) is associated with a decrease in productivity equal to 0.4 percentage points. A one-standard-deviation increase in religion fosters post-disaster productivity recovery by, respectively, 0.2 and 0.5 percentage points for these areas.

Next, very similar to Gropp et al. (2019) and Barrot and Sauvagnat (2016), we use as treatment variable disaster damages as a percentage of county income in 2005.[5] A potential concern with this variable is that damages could be theoretically correlated with local economic county characteristics.

[5] The data on damages come from the Spatial Hazard Events and Losses Database for the United States (Sheldus).

We find that an increase from the 5th to the 95th of the distribution of this variable (an increase from 0 to 0.14) is negatively associated with establishment productivity, even if the coefficient is not statistically significant. In column (4) of table OA11, we analyze how religion affects productivity recovery. A one-standard-deviation increase in the religion adherence rate is associated with increased productivity of 0.4 percentage points (after a decrease in productivity of 0.6 percentage points caused by an increase from the 5th to the 95th of the distribution of the ratio of county damages to county income).

Like Schüwer et al. (2019), we additionally classify a county as affected (a value equal to one) if, after the hurricanes, it is eligible for individual and public disaster assistance from the Federal Emergency Management Agency (FEMA). We further consider a county unaffected (a value equal to 0) if it is not eligible for public or individual disaster assistance. Finally, counties eligible for public disaster assistance but not eligible for individual disaster assistance receive a value equal to 0.5. A possible concern with this measure is that the political environment could influence FEMA disaster payments (Garrett and Sobel, 2003).

We estimate equations (2) and (3) and we report estimation results in column (5) of tables OA10 and OA11. We find that when the FEMA variable is equal to 1, productivity decreases by 0.7 percentage points. A one-standard-deviation increase in local religious adherence fosters post-disaster productivity by 0.3 percentage points in these areas.

Alternative measures of the dependent variable. Mitton (2021) argues that variable transformation and the treatment of outliers are the methodological decisions that have more statistical significance on the coefficients of interest in empirical corporate finance. For this reason, these choices have to be well motivated on a theoretical basis. In our primary regressions, we consider the natural logarithm of our main independent variable of interest (Productivity) to deal with this variable's skewness (about 30). Tables OA12 and OA13 show estimation results when we winsorize Ln(Productivity) at the 1st and 99th percentile in column (1), when we use the raw ratio of Productivity in column (2), and when we deal with the skewness of Productivity by winzorising it at the 1st and 99th percentile in column (3). We find that our main results remain intact when we further winsorize Ln(Productivity) or used the winsorized version of the raw Productivity ratio. Only when we use the non-winsorized version of Productivity does the baseline treatment effect loses its significance. However, the triple-interaction effect of religious adherence remains intact. In essence, we believe that the highly skewed raw measure of Productivity keeps us from finding the effect with the same precision that we have with the logged or winsorized version of Productivity.

8 Conclusions

A growing amount of literature analyzes the relationship between economic growth and religion. We advance this literature by focusing on the role of religion in post-disaster periods. We investigate how the 2005 hurricane season affects establishment-level productivity and find that the hurricanes in the United States have a significant and long-lasting adverse effect. More critically, we find that higher religious adherence mitigates the adverse effects on productivity from high-impact disasters such as the 2005 hurricane season. Our results further suggest that a particular religious denomination does not drive the effect. We show that different aspects of religion, such as adherence, shared experiences from ancestors, and institutionalized structures, jointly drive religion's beneficial effect on recovery. Last, we find that the positive effects at the establishment-level spill over to the aggregate. We show that the effects of the disaster on migration and economic activity are significantly less severe in counties with greater religious adherence. Our results matter because they underline the importance of cultural features such as religion during and after economic crises.

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Online Appendix

This appendix is for online publication and provides further details on the data and the results of the paper "Cultural Resilience, Religion and Economic Recovery: Evidence from the 2005 Hurricane Season".

OA1 Database and Variables

Establishment data

Our source of information about establishments is the National Establishment Time Series (NETS) database, an establishment-level panel covering both employer and non-employer businesses. Created and maintained by Walls and Associates, these data are available to researchers for a fee.

The entire NETS database contains information on 71,498,225 establishments in the United States. The number of observations for these establishments is 786,480,475 for the period 2000-2010. Our empirical analysis considers only establishments located in the southeast United States during the 2005 hurricane season. The number of observations for this sample is 61,265,622 (5,569,602 establishments). We remove establishments for which information on sales and employment is missing (13,718,017 observations). After this step, our database contains non-missing information for 5,504,748 establishments (47,547,605 observations). We also remove establishments that operate in the financial and regulated sectors (*NAICS two-digit codes equal to 52, 53 and 94*; 4,679,377 observations). At this point, our database includes 4,964,197 establishments and 42,868,228 observations. In the last step, we remove singleton observations. Our final database is composed by 42,847,343 observations and 4,943,312 establishments located in 1,081 counties.

Our measure of establishment performance is the natural logarithm of the ratio between establishment sales per employees (Productivity).

Hurricane exposure

We obtained data on tropical cyclone wind exposure from the "hurricaneexposure" (version 0.1.1) packages in R. This package is described in detail in Anderson et al. (2017) and used in other papers (Anderson et al., 2020; Parks et al., 2021). The package includes functions for interpolating hurricane tracks and for modeling wind speeds. Storm events are from the NOAA Storm Events Database.

The wind-modeling process implemented by this package can be summarized in the following steps. First, it imputes location and maximum wind speed from hurricane track data. Second, it allows calculating all the inputs for the Willoughby and Rahn (2004) wind speed model (forward speed, the direction of forward motion of the storm, gradient-level wind speed, radius of maximum winds, and parameters for decay of winds away from the storm's center). Next, for each county, it estimates surface-level sustained wind and three-second wind gusts at all storm observation points along the interpolated storm track. This step includes measuring the distance to the county from the storm center, calculating tangential gradient wind components and direction, calculating surface wind speed and direction, and adding storm forward motion back into the surface wind estimate. In this way, it helps determine the maximum sustained winds and wind gust speeds at any point on the storm's track, as well as the duration of sustained and wind gust.

We obtain this information for each hurricane that hit the southeast United States in 2005 (the hurricanes Arlene, Cindy, Dennis, Emily, Katrina, Ophelia, Rita, Tammy, Twenty-Two, and Wilma). Therefore, we build and use the following variables in our empirical analysis:

Wind = Maximum 10-m one-minute wind gust in the county in 2005.

Wind (Sustained) = Maximum 10-m one-minute sustained wind in the county in 2005.

Wind Duration = Maximum wind gust duration at or above 20 m/s (in hours) in the county in 2005.

Wind Duration (Sustained) = Maximum sustained wind duration at or above 20 m/s (in hours) in the county in 2005.

County characteristics

We collect information on several economic and cultural county characteristics. A detailed description of each variable and its source is available below.

Religion = Rate of religious adherence in the county as in 2000. Adherents are defined as "all members, including full members, their children, and the estimated number of other regular participants." This information comes from the Association of Religion Data Archive (ARDA) database.

Catholics = Rate of religious adherence to Catholicism in the county as in 2000. Adherents are defined as "all members, including full members, their children, and the estimated number of other regular participants." This information comes from the Association of Religion Data Archive (ARDA) database.

Protestants = Rate of religious adherence to Protestantism (Mainline and Evangelical) in the county as in 2000. Adherents are defined as "all members, including full members, their children, and the estimated number of other regular participants." This information comes from the Association of Religion Data Archive (ARDA) database.

Jewish = Rate of religious adherence to Judaism in the county as in 2000. Adherents are "all members, including full members, their children, and the estimated number of other regular participants." This information comes from the Association of Religion Data Archive (ARDA) database.

Islam = Rate of religious adherence to Islamism in the county as in 2000. Adherents are "all members, including full members, their children, and the estimated number of other regular participants." This information comes from the Association of Religion Data Archive (ARDA) database.

Social Capital = Principal component analysis of two variables that capture the strength of local cooperative norms (voter turnover and the county-level census response rate) and two variables that capture the ramification of social norms (the number of associations and the number of non-profit organizations) measured at the county level as in 2005. This information comes from the Northeast Regional Center for Rural Development (NRCRD) database.

Human Capital = Share of adults age 25 and older with a degree or higher in the county in 2000. This information comes from the census.

Minority = Proportion of the county population that is African American in 2005. This information comes from the census population estimates.

Democrats = Share of people who voted for the Democrat Party in the county during the 2004 presidential election. This information comes from the MIT Election Lab database.

Income = Natural logarithm of county income per capita in 2005. This information comes from the Bureau of Economic Analysis (BEA).

Urban = Natural logarithm of the county population per square mile in the county as in 2000. This information comes from the census.

New Establishments = Natural logarithm of the number of new establishments in the county. This information comes from the NETS database.

Closed Establishments = Natural logarithm of the number of establishments that close in the county. This information comes from the NETS database.

Population = Natural logarithm of the estimated population in the county. This information comes from the Bureau of Economic Analysis (BEA).

Total Establishments = Natural logarithm of the counts of establishments in the county.

This information comes from the Bureau of Economic Analysis (BEA).

Religious Organizations = Number of religious organizations per 1,000 population. This information comes from the Northeast Regional Center for Rural Development (NRCRD) database.

Rent-Seeking Organizations = Number of rent-seeking organizations per 1,000 population. We define as rent-seeking the following membership organizations: political organizations, labor organizations, business organizations, and professional organizations. This information comes from the Northeast Regional Center for Rural Development (NRCRD) database.

Non-Rent-Seeking Organizations = Number of non-rent-seeking organizations per 1,000 population. We define as non-rent-seeking the following membership organizations:civic organizations, bowling centers, golf clubs, and fitness centers. This information comes from the Northeast Regional Center for Rural Development (NRCRD) database.

Ancestors' natural disaster experience

The 2005 American Community Survey (ACS) provides information on individuals' ancestry and their geographical location. The number of observations is 2,878,380. The respondents' stated ancestry not always directly corresponds to a foreign country given current borders. Even if no direct mapping exists, we have been able to merge some populations to a country (for example, we merge "Basque" with Spain). We omit from the sample individuals for whom ancestry is not reported or for whom it is not possible to identify a specific country of provenance (e.g., those individuals that reported "mixture ancestry" or "other") (570,620 observations deleted).

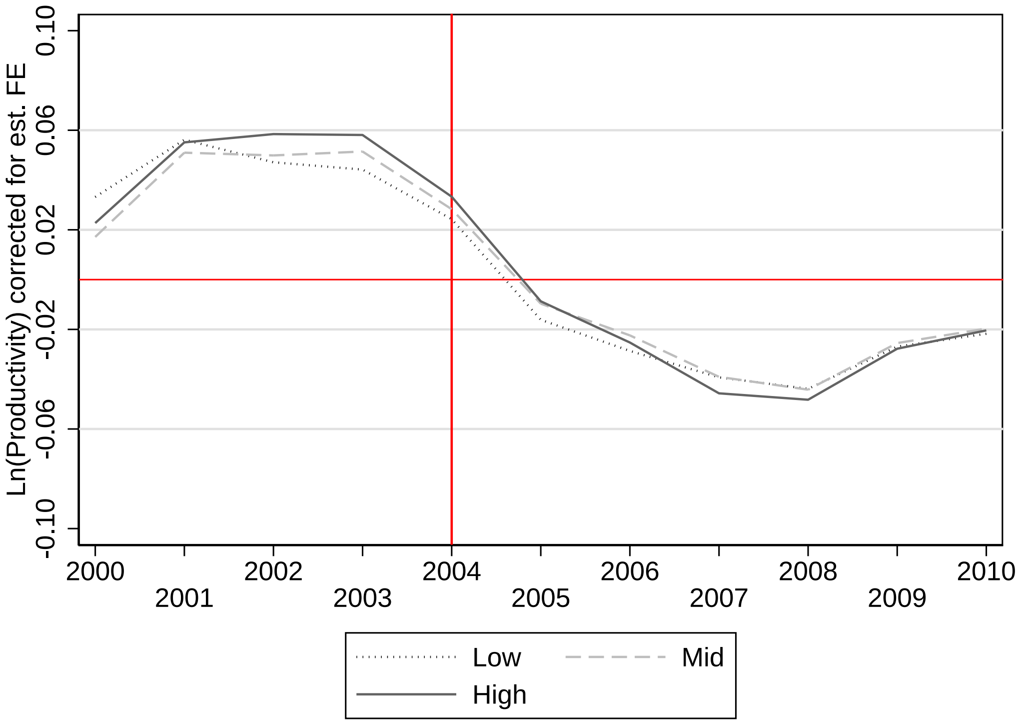
Next, we merge ancestry information with the natural disaster "EM-DAT" database, which contains universal coverage on all the natural disasters worldwide starting from the year 1900 and an evaluation of their impact. A disaster is included in the dataset if one of the following criteria is fulfilled: (a) at least 10 people have been killed, (b) 100 people have been reported affected, (c) a state of emergency is declared, or (d) international assistance is required. Using this dataset, we consider natural disaster damages by country. We normalized it with the country's population of origin. We merged the "natural disaster risk" measure with ancestors' country-of-origin information in the ACS.

We took the average of these individuals' values to measure the local cultural experience of dealing with natural disasters. The smallest geographic unit we can observe in the ACS is the PUMA (a group of counties). We use the PUMA-County Crosswalk to merge these values with our main database.

OA2 Tables and Figures

Productivity trends. Figure OA1 shows the mean of Ln(Productivity) corrected for establishment fixed effects for three groups of establishments: establishments residing in counties where 2005 Wind Speed is in the lowest 5% (Low), the interquartile range (Mid), and the top 5% (High) area of the distribution. The figure shows that before 2005 the three groups follow the same productivity trends. However, after 2005, the productivity of the establishments in the top 5% of the Wind Speed distribution go from top to bottom concerning the comparison groups. The event-study analysis also confirms these patterns, which we plot in figure 2 in the main text.

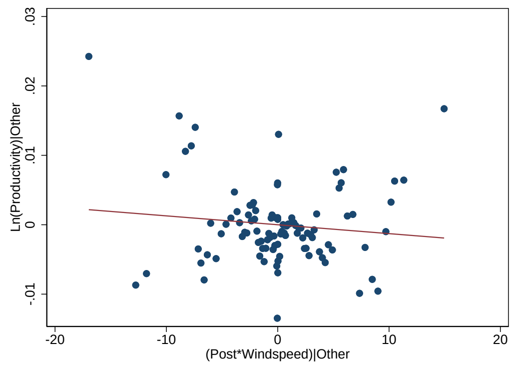
Figure OA1: Productivity Trends



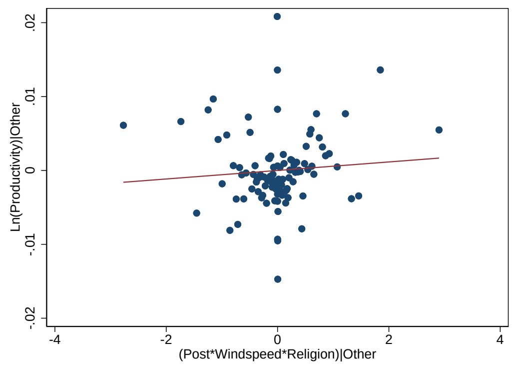
Notes: Figure OA1 shows the mean of Ln(Productivity) corrected for establishment fixed effects for three groups of establishments: establishments residing in counties with Wind Speed in 2005 in the lowest 5% (Low), the interquartile range (Mid), and the top 5% (High) of the distribution. See section OA1 of the online appendix for a detailed description of every variable.

Added Value Plots. Figure OA2(a) shows the binned added value plot from equation (1) for the interaction term between Wind Speed and Post. Figure OA2(b) shows the binned added value plot from equation (3) for the interaction term between Wind Speed, Post, and Religion. The figure shows the influence of the independent variable on the dependent variable while simultaneously accounting for the influence of all the other independent variables. Importantly, the added value plots do not indicate that outliers drive our estimated effects.

Figure OA2: Added Value Plots



(a) Hurricane and productivity



(b) Religion and post-disaster productivity recovery

Notes: Figure OA2(a) shows the added value plot from equation (1) with establishment, year times state and year times industry fixed effects for the interaction term between Wind Speed and Post. Figure OA2(b) shows the added value plot from equation (3) for the interaction term between Wind Speed, Post, and Religion. The dependent variable is Ln(Productivity).

Summary statistics. Table OA1 reports the mean, the standard deviation, the 5th percentile, the median, and the 95th percentile of all the variables in our empirical analysis.

Table OA1: Summary statistics

	Mean	SD	Percentiles		
			5th	50th	95th
Establishment-level					
Ln(Productivity)	11.12	0.78	9.90	11.09	12.43
Productivity	100288.76	221824.99	20000	65788	250000
County-level					
Wind Speed	18.89	11.69	2.83	17.02	41.64
Religion	0.70	0.19	0.40	0.69	1.03
Social Capital	-0.84	0.97	-2.11	-0.92	0.62
Human Capital	14.47	6.55	7.80	12.50	27.70
Democrats	0.37	0.13	0.19	0.36	0.61
Income	10.17	0.19	9.91	10.14	10.51
Urban	3.94	1.25	1.76	3.87	6.14
Minority	0.19	0.19	0.00	0.12	0.57
Ancestors' Experience	0.57	0.11	0.37	0.58	0.74
Mainline	0.10	0.05	0.03	0.09	0.19
Evangelical	0.37	0.16	0.11	0.37	0.62
Protestant	0.46	0.17	0.17	0.46	0.74
Catholic	0.07	0.13	0.00	0.02	0.38
New Establishments	5.41	1.49	3.13	5.29	8.09
Closed Establishments	4.60	1.43	2.56	4.44	8.66
Total Establishments	6.48	1.29	4.66	6.31	8.91
Population	10.33	1.27	8.31	10.18	12.61
Rent-Seeking Organizations	0.14	0.12	0	0.11	0.34
Non-Rent-seeking Organizations	0.19	0.12	0	0.18	0.41
Religious Organizations	0.91	0.38	0.38	0.88	1.52
Wind (Sustained)	12.68	7.85	1.90	11.43	27.94
Duration	5.02	8.75	0	0	22
Duration (Sustained)	1.08	3.18	0	0	9
Damages	0.03	0.12	0	0	0.14
FEMA	0.36	0.31	0	0.50	1.00

This table shows summary descriptive statistics for all variables we use in our analyses. See section OA1 of the online appendix for a detailed description of every variable.

County cross-correlation. Table OA2 shows the cross-correlation table of the Religion variable with the other variables in the county database. The table shows that Religion is positively correlated with Social Capital and Minority and negatively correlated with Income, Density, and Human Capital.

Table OA2: County cross-correlation table

Variable	Religion	Social Capital	Human Capital	Democrats	Income	Urban	Minority
Religion	1.000						
Social Capital	0.329	1.000					
	(0.000)						
Human Capital	-0.103	0.281	1.000				
	(0.000)	(0.000)					
Democrats	-0.065	-0.229	-0.069	1.000			
	(0.000)	(0.000)	(0.000)				
Income	-0.015	0.356	0.712	-0.269	1.000		
	(0.100)	(0.000)	(0.000)	(0.000)			
Urban	-0.319	-0.203	0.481	0.191	0.404	1.000	
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		
Minority	0.151	-0.116	-0.070	0.635	-0.181	0.116	1.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	

This table shows correlation of the Religion variable with the other county characteristics. See section OA1 of the online appendix for a detailed description of every variable.

Collinearity test. Table OA3 shows a collinearity test between the variables that we use in our empirical analysis. The Variance Inflation Factor (VIF) is in column (2). It shows that these values are much smaller than the conventional critical value of 10, suggesting that multicollinearity is not an issue. The same is suggested by the squared VIF, the tolerance value, and the R-squared.

Table OA3: Collinearity test

Variable	VIF	SQRT VIF	Tolerance	R-Squared
Religion	1.39	1.18	0.7203	0.2797
Social Capital	1.63	1.28	0.6122	0.3878
Human Capital	3.27	1.81	0.3055	0.6945
Democrats	2.13	1.46	0.4697	0.5303
Income	3.22	1.79	0.3107	0.6893
Urban	2.66	1.63	0.3760	0.6240
Black	2.30	1.52	0.4344	0.5656
Wind	1.36	1.17	0.7344	0.2656
Ancestors' Experience	2.07	1.44	0.4822	0.5178

This table tests for the collinearity among the variables we used in equation (3). VIF is the Variance Inflation Factor. See section OA1 of the online appendix for a detailed description of every variable.

Considering alternative shares of different religious branches. In table 4, we estimate equation (3) inserting shares of different religious branches. In detail, we use rates for Catholic (Catholics) and Protestant (Protestants) adherence and the mainline and evangelical subgroups. We further investigate this direction by including in the model rates for Judaism (Jewish) and Islamic (Islam) adherence. Table OA4 shows our estimation results. The findings reported in Table 4 are not affected. The triple-interaction coefficients of Jewish and Islam with Post and Wind Speed are positive, even if not statistically significant. A possible explanation is that their adherence rate in the United States is too small to draw any real inference.

Table OA4: Treatment effect from different religious groups

	(1)	(2)
Dependent variable	Ln(Productivity)	
Post × Wind Speed	-0.0002***	-0.0002***
	(0.0001)	(0.0001)
Post × Protestants	0.0056	
	(0.0063)	
Post × Protestants × Wind Speed	0.0009***	
	(0.0003)	
Post × Catholics	0.0214***	0.0210***
	(0.0066)	(0.0066)
Post × Catholics × Wind Speed	0.0006**	0.0006**
	(0.0003)	(0.0003)
Post × Mainline		-0.0146
		(0.0195)
Post × Mainline × Wind Speed		0.0028***
		(0.0010)
Post × Evangelical		0.0108
		(0.0065)
Post × Evangelical × Wind Speed		0.0006*
		(0.0003)
Post × Islam	-0.4457*	-0.4521
	(0.2575)	(0.2842)
Post × Islam × Wind Speed	0.0165	0.0175
	(0.0105)	(0.0113)
Post × Jewish	-0.0968	-0.1133
	(0.1061)	(0.1054)
Post × Jewish × Wind Speed	0.0021	0.0029
	(0.0019)	(0.0019)
Est. FE	✓	✓
Year FE	✓	✓
Industry×Year FE	✓	✓
State×Year FE	✓	✓
Fully interacted county controls	✓	✓
Observations	42,847,343	42,847,343
Counties	1,081	1,081
Adjusted R-squared	0.911	0.911

This table shows regression results for equation (3) using different religious adherence rates. Ln(Productivity) is the dependent variable. Standard errors are clustered at the county level. ***, **, and * denote significance at 1, 5, and 10 percent levels, respectively. See OA1 for a detailed description of every variable.

Placebo test. We consider a placebo test for our treatment variable to rule out the possibility that county characteristics unrelated to the severity of the 2005 hurricane season drive the estimation results in table 2. Therefore, we run a ”placebo estimation” in which we analyze the spanning period 1990-2000, and we estimate Equation (2) using as placebo event the period 1995-2000 (Post Placebo). We report estimation results in table OA5. In our preferred specification reported in column (3), we do not find any evidence on the effect of Wind Speed on establishment productivity. This finding supports our assumption that our results are not driven by county characteristics unrelated to the severity of the 2005 hurricane season. Jointly with the yearly treatment effects from equation (1) that we report in figure 2 showing the absence of significant coefficients in the run-up period to the 2005 hurricane season, the table corroborates the hypothesis that the timing of the event is also exogenous.

Table OA5: Placebo test

	(1)	(2)	(3)
Dependent variable		Ln(Productivity)	
Post Placebo × Wind Speed	0.0000	0.0001*	0.0000
	(0.0000)	(0.0000)	(0.0000)
Establishment FE	✓	✓	✓
Year FE	✓	✓	✓
Industry×Year FE		✓	✓
State×Year FE			✓
Observations	24,822,398	24,822,398	24,822,398
Counties	1,081	1,081	1,081
Adjusted R-squared	0.893	0.894	0.894

This table shows regression results for equation (2) using as placebo the period 1990-2000. Post Placebo is a dummy variable equal to one for the period 1995-2000 and 0 for the period 1990-1994. Ln(Productivity) is the dependent variable. Standard errors are clustered at the county level. ***, **, and * denote significance at 1, 5, and 10 percent levels, respectively. See section OA1 of the online appendix for a detailed description of every variable.

Alternative fixed effects specifications. Tables OA6 and OA7 show that our coefficients of interest maintain the same sign and statistically significance of our preferred specification when we propose alternative fixed-effect specifications. More specifically, in column (1), we show estimation results do not change when we do not include any fixed effects. In column (2), we introduce establishment fixed effects. In column (3), we remove establishment fixed effects and introduce county and year fixed effects. In terms of magnitude, the coefficients are greater concerning our preferred specification.

Table OA6: Variations of fixed effects: Equation (2)

	(1)	(2)	(3)
Dependent variable		Ln(Productivity)	
Post	-0.0969***	-0.0724***	
	(0.0028)	(0.0015)	
Wind Speed	0.0005		
	(0.0005)		
Post × Wind Speed	-0.0004***	-0.0002***	-0.0004***
	(0.0001)	(0.0001)	(0.0001)
Constant	11.1666***		
	(0.0102)		
Est. FE		✓	
Year FE			✓
County FE			✓
Observations	42,847,343	42,847,343	42,847,343
Counties	1,081	1,081	1,081
Adjusted R-squared	0.00437	0.909	0.00986

This table shows regression results for equation (2). Ln(Productivity) is the dependent variable. Standard errors are clustered at the county level. ***, **, and * denote significance at 1, 5, and 10 percent levels, respectively. See section OA1 of the online appendix for a detailed description of every variable.

Table OA7: Variations of fixed effects: Equation (3)

	(1)	(2)	(3)
Dependent variable		Ln(Productivity)	
Post	-0.1012***	-0.0732***	
	(0.0019)	(0.0014)	
Wind Speed	0.0000		
	(0.0003)		
Post × Wind Speed	-0.0001*	-0.0001**	-0.0002**
	(0.0001)	(0.0000)	(0.0001)
Religion	0.1301***		
	(0.0482)		
Post × Religion	-0.0087	-0.0026	-0.0073
	(0.0121)	(0.0070)	(0.0127)
Wind Speed × Religion	-0.0039*		
	(0.0023)		
Post × Wind Speed × Religion	0.0012**	0.0008***	0.0013**
	(0.0005)	(0.0002)	(0.0006)
Constant	11.1774***		
	(0.0064)		
Est. FE		✓	
Year FE			✓
County FE			✓
Fully interacted county characteristics	✓	✓	✓
Observations	42,847,343	42,847,343	42,847,343
Counties	1,081	1,081	1,081
Adjusted R-squared	0.00714	0.909	0.00990

This table shows regression results for equation (3). Ln(Productivity) is the dependent variable. Standard errors are clustered at the county level. ***, **, and * denote significance at 1, 5, and 10 percent level respectively. See section OA1 of the online appendix for a detailed description of every variable.

Alternative ways in clustering standard errors. In our preferred specification, we consider the most conservative choice and cluster standard errors at the county level, that is, the level at which the shock affects our independent variable of interest. Tables OA8 and OA9 show that our results are not sensitive to alternative ways in clustering standard errors. More specifically, our results remain statistically significant when we cluster standard errors at the sector level (column (1)), at the establishment level (column (2)), and the year level (column (3)).

Table OA8: Variations of clustering standard errors: Equation (2)

	(1)	(2)	(3)
Dependent variable		Ln(Productivity)	
Post × Wind Speed	-0.0001***	-0.0001***	-0.0001***
	(0.0000)	(0.0000)	(0.0000)
Est. FE	✓	✓	✓
Year FE	✓	✓	✓
Industry×Year FE	✓	✓	✓
State×Year FE	✓	✓	✓
SE clustering	Estab lishment	Industry	Year
Observations	42,847,343	42,847,343	42,847,343
Counties	1,081	1,081	1,081
Adjusted R-squared	0.911	0.911	0.911

This table shows regression results for Equation (2). Ln(Productivity) is the dependent variable. Standard errors are clustered at the establishment, industry and year levels, respectively. ***, **, and * denote significance at 1, 5, and 10 percent levels, respectively. See section OA1 of the online appendix for a detailed description of every variable.

Table OA9: Variations of clustering of standard errors: Equation (2)

	(1)	(2)	(3)
Dependent variable		Ln(Productivity)	
Post × Wind Speed	-0.0002***	-0.0002***	-0.0002***
	(0.0000)	(0.0000)	(0.0000)
Post × Religion	0.0047	0.0047*	0.0047
	(0.0048)	(0.0025)	(0.0033)
Post × Religion × Wind Speed	0.0006**	0.0006***	0.0006***
	(0.0003)	(0.0001)	(0.0001)
Est. FE	✓	✓	✓
Year FE	✓	✓	✓
Industry×Year FE	✓	✓	✓
State×Year FE	✓	✓	✓
Fully interacted county characteristics	✓	✓	✓
SE clustering	Industry	Estab lishment	Year
Observations	42,847,343	42,847,343	42,847,343
Counties	1,081	1,081	1,081
Adjusted R-squared	0.911	0.911	0.911

This table shows regression results for equation (3). Ln(Productivity) is the dependent variable. Standard errors are clustered at the county level. ***, **, and * denote significance at 1, 5, and 10 percent levels, respectively. See section OA1 of the online appendix for a detailed description of every variable.

Alternative treatment variables. In a battery of robustness checks, we show that our results do not change when we propose alternative treatment variables. First, we propose county maximum duration wind at or above 20 m/s (in hours) in 2005. We also use county maximum sustained duration wind at or above 20 m/s (in hours) in 2005. We estimate equations (2) and (3) and we report estimation results in columns (2) and (3) of tables OA10 and OA11.

Second, very similar to Gropp et al. (2019) and Barrot and Sauvagnat (2016), we use as treatment variable disaster damages as a percentage of county income for 2005. [6] A potential concern with this variable is that damages could be theoretically correlated with county economic characteristics.

Finally, and similar to Schüwer et al. (2019), we classify a county as affected (a value equal to one) if, after the 2005 hurricane season, it is eligible for individual and public disaster assistance from the Federal Emergency Management Agency (FEMA). We further consider a county unaffected (a value equal to 0) if it is not eligible for public or individual disaster assistance. Finally, counties eligible for public disaster assistance but not eligible for individual disaster assistance receive a value equal of 0.5. A possible concern with this measure is that the political environment could influence FEMA disaster payments (Garrett and Sobel, 2003).

[6] The data on damages come from the Spatial Hazard Events and Losses Database for the United States (Sheldus).

Table OA10: Alternative treatment measures: Equation (2)

	(1)	(2)	(3)	(4)	(5)
Dependent variable			Ln(Productivity)		
Post × Wind (Sustained)	-0.0002**				
	(0.0001)				
Post × Duration		-0.0002**			
		(0.0001)			
Post × Duration (Sustained)			-0.0005***		
			(0.0002)		
Post × Damages				-0.0035	
				(0.0034)	
Post × FEMA					-0.0071***
					(0.0023)
Est. FE	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓
Industry×Year FE	✓	✓	✓	✓	✓
State×Year FE	✓	✓	✓	✓	✓
Observations	42,847,343	42,847,343	42,847,343	42,847,343	42,847,343
Counties	1,081	1,081	1,081	1,081	1,081
Adjusted R-squared	0.911	0.911	0.911	0.911	0.911

This table shows regression results for equation (2). Ln(Productivity) is the dependent variable. Standard errors are clustered at the county level. ***, **, and * denote significance at 1, 5, and 10 percent levels, respectively. See section OA1 of the online appendix for a detailed description of every variable.

Table OA11: Alternative treatment measures: Equation (3)

	(1)	(2)	(3)	(4)	(5)
Dependent variable			Ln(Productivity)		
Post × Wind (Sustained)	-0.0002***				
	(0.0001)				
Post × Religion	0.0047	0.0108***	0.0115***	0.0113***	0.0064
	(0.0056)	(0.0036)	(0.0033)	(0.0031)	(0.0044)
Post × Wind (Sustained) × Religion	0.0009**				
	(0.0004)				
Post × Duration		-0.0001**			
		(0.0000)			
Post × Duration × Religion		0.0004			
		(0.0003)			
Post × Duration (Sustained)			-0.0003***		
			(0.0001)		
Post × Duration (Sustained) × Religion			0.0024***		
			(0.0008)		
Post × Damages				-0.0464***	
				(0.0148)	
Post × Damages × Religion				0.1382**	
				(0.0601)	
Post × FEMA					-0.0072***
					(0.0018)
Post × FEMA × Religion					0.0159**
					(0.0078)
Est. FE	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓
Industry×Year FE	✓	✓	✓	✓	✓
State×Year FE	✓	✓	✓	✓	✓
Fully interacted county characteristics	✓	✓	✓	✓	✓
Observations	42,847,343	42,847,343	42,847,343	42,847,343	42,847,343
Counties	1,081	1,081	1,081	1,081	1,081
Adjusted R-squared	0.911	0.911	0.911	0.911	0.911

This table shows regression results for equation (3). Ln(Productivity) is the dependent variable. Standard errors are clustered at the county level. ***, **, and * denote significance at 1, 5, and 10 percent levels, respectively. See section OA1 of the online appendix for a detailed description of every variable.

Alternative measures of the dependent variable, Mitton (2021) argues that variable transformation and outlier treatment are the methodological decisions that most affect the statistical significance of the coefficients of interest in empirical corporate finance. For this reason, these choices have to be theoretically motivated. In our primary regression, we consider the natural logarithm of our main independent variable of interest (Productivity) to deal with this variable's skewness. Tables OA12 and OA13 show estimation results when we winsorize at the first and last percentile the log(Productivity) variable in column (1), when we use Productivity in column (2) and when we winzorize at the first and last percentile the Productivity variable in column (3).

Table OA12: Alternative measures of the dependent variable: Equation (2)

	(1)	(2)	(3)
Dependent variable	Ln(Productivity) winsorized	Productivity	Productivity winsorized
Post × Wind Speed	-0.0001***	-3.3202	-19.6989***
	(0.0000)	(17.3946)	(7.4745)
Est. FE	✓	✓	✓
Year FE	✓	✓	✓
Industry×Year FE	✓	✓	✓
Observations	42,847,343	42,847,343	42,847,343
Counties	1,081	1,081	1,081
Adjusted R-squared	0.916	0.854	0.914

This table shows regression results for Equation (2). Ln(Productivity) is the dependent variable. Standard errors are clustered at the county level. ***, **, and * denote significant at 1, 5, and 10 percent level respectively. See Section OA1 of the Online Appendix for a detailed description of every variable.

Table OA13: Alternative measures of the dependent variable: Equation (3)

	(1)	(2)	(3)
Dependent variable	Ln(Productivity) winsorized	Productivity	Productivity winsorized
Post × Wind Speed	-0.0001***	-15.4525	-18.3490***
	(0.0000)	(10.8262)	(5.7834)
Post × Religion	0.0050	-1,568.2980	-937.5263
	(0.0053)	(2,392.8395)	(751.1840)
Post × Religion × Wind Speed	0.0005**	194.1916**	122.1677***
	(0.0003)	(95.5018)	(39.8531)
Est. FE	✓	✓	✓
Year FE	✓	✓	✓
Industry×Year FE	✓	✓	✓
Fully interacted county characteristics	✓	✓	✓
Observations	42,847,343	42,847,343	42,847,343
Counties	1,081	1,081	1,081
Adjusted R-squared	0.916	0.854	0.914

This table shows regression results for Equation (3). Ln(Productivity) is the dependent variable. Standard errors are clustered at the county level. ***, **, and * denote significant at 1, 5, and 10 percent level respectively. See Section OA1 of the Online Appendix for a detailed description of every variable.

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