Commodity Prices and Mortality*

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Abstract

The US Midwest, home to over 20 percent of Americans, depends heavily on agriculture. We look at the relationship between commodity prices—corn and soybean prices, the dominant commodities in the Midwest—and mortality in a sample of 485 Midwestern counties for the period 1980 to 2016. As outcome variables, we look at crude or age-adjusted all-cause death rates. Commodity prices are only available at the state or global level, so we interact (i) state-level or global commodity prices with (ii) how much of each commodity is grown within each county. Our treatment variable thus captures how, for each commodity, revenues from that commodity within a given county change in response to changes in commodity prices. For identification, we combine the exposure design just described with a two-way, county and year fixed effects design as well as with several robust panel data estimators. On average, a decrease in commodity prices is associated with increased mortality across all counties: A 10-percent decrease in either corn or soybean revenues is associated with an increase in the crude death rate of about 0.2 percent, or 0.205 additional deaths per 1,000 persons in a county, a result driven by rural counties and seemingly mediated by cardiovascular disease and suicides. For robustness, we estimate specifications in which we instrument revenues from each commodity with measures of drought severity, and we conduct falsification tests.

Classification: Social Sciences, Environmental Sciences
Keywords: Commodity Prices, Economic Shocks, Mortality

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1 Introduction

Economic theory defines producer welfare as depending on profits, which depend on output and input prices. Similarly, economic theory defines consumer welfare as depending on indirect utility, which depends on income as well as on the prices of the various goods consumed. So if one is to take economic theory seriously, one should also take seriously the notion that price changes, both positive and negative, cause changes in the welfare of producers and consumers, and thus in aggregate societal welfare.

Can the negative shocks to welfare caused by price changes go so far as to cause mortality? We look at one side of this question—the supply side, or production channel—by looking at whether negative shocks to output prices for economically important commodities are associated with increased mortality.

To do so, we study the relationship between commodity prices and all-cause mortality in the Midwest, whose population of nearly 69 million represents over a fifth of the US population. Because the Midwest is heavily dependent on agriculture, and because the effects of shocks to the agricultural sector is more easily identifiable than that of shocks to the industrial or services sectors, we focus on agricultural commodities—specifically, on corn and soybeans, the dominant agricultural commodities in the Midwest (United States Department of Agriculture, 2024).

Agricultural producers are entrepreneurs whose livelihood and welfare depend in large part on their revenues, which themselves depend on the product of two variables: (i) how much of each crop a producer grows and sells, and (ii) at what price she does so. In the Midwest, most agricultural producers tend to produce exclusively for the market instead of for their own subsistence, and while they have some control over how much they produce (and thus over how much they can sell), all of them are price takers with no control over commodity prices.[1] Unexpected negative commodity price changes decrease

[1] Though there are a number of financial instruments agricultural producers can use to hedge against price fluctuations (e.g., futures and options or insurance Tack and Yu (2021)), we focus here on the residual effects of agricultural commodity price fluctuations. That is, we focus on the effects of agricultural

the revenues of agricultural producers and thus cause unanticipated welfare losses which, should they be severe enough, may lead to health issues, both mental (e.g., depression) and physical (e.g., heart attacks), which can ultimately lead to death. Less obviously, the effects of commodity price shocks may be felt not just by agricultural producers, but for others whose livelihoods also depend on how well the agricultural sector, both in rural as well as in urban areas.

Specifically, we study the relationship between commodity prices and mortality at the county level for the period 1980 to 2016 in a sample of 485 counties (both rural and urban to begin with for a total of $N = 17,945$ county-year observations, and then split into $N = 11,137$ rural and $N = 6,808$ urban county-year observations) out of a total of 1,055 counties across the 12 Midwestern US states.[2,3] As outcome variables, we look at both crude and age-adjusted all-cause death rates.[4] As treatment, we interact (i) state-level or global prices for corn and soybeans, the dominant commodities in the Midwest, with (ii) how much of each commodity is grown within a county. By interacting a measure of local exposure to commodity prices with a plausibly exogenous measure commodity prices, our treatment variables thus capture the revenues from each of corn and soybeans within a given county in a given year.[5]

In this sense, we rely on an exposure design, and our treatment variable is similar to a Bartik or shift-share design (Goldsmith-Pinkham, Sorkin and Swift, 2020; Borusyak, Hull and Jaravel, 2022), except that instead of using the interaction between our plausibly ex-

commodity price fluctuations net of any hedging or insurance.

[2]The counties we retain for analysis are those for which we have data on both our treatment and outcome variables for the period 1980 to 2016. The 12 states for which we have data are Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin.

[3]We stop at 2016 because starting in early 2017 when Donald Trump became president, the farm sector (and thus rural counties) experienced a sort of structural break when the Trump administration started a trade war with China but exploited the USDA's market facilitation program to mitigate Chinese retaliatory tariffs, especially in Republican-leaning counties (Choi and Lim, 2023).

[4]For readers unfamiliar with age-adjusted death rates, they are simply death rates that are adjusted *ex ante* for the age distribution in the population of interest.

[5]To assess the robustness of our findings as well as to avoid the bad control problem—each price being dependent on the other given complementarities between corn and soybeans—we look separately at the relationship between mortality and corn revenues and the relationship between mortality and soybean revenues.

ogenous shift (i.e., the price of commodity) and our endogenous share (i.e., area under cultivation for each commodity) as an instrumental variable, we use the shift-share interaction directly as our treatment variable.[6] For identification, we further rely on a two-way, county and time fixed effects strategy which we supplement with a number of robust panel-data estimators recently discussed by Millimet and Bellemare (2024). This allows looking at how changes in commodity prices—commodity price shocks, as it were—are associated with all-cause mortality.[7,8]

We find a robust, statistically significant, and persistent negative relationship between commodity prices and mortality that appears driven by corn prices and rural counties. For the average county-year in our data, we find that a 10-percent decrease in corn revenues is associated with an increase in the crude (age-adjusted) death rate of about 0.2 (0.02) percent. Similarly, we find that a 10-percent increase in soybean revenues is associated with an increase in the crude (age-adjusted) death rate of 0.2 (0.17) percent. Overall, we find that 10-percent decrease in either corn or soybean revenues is associated with an increase in the crude death rate of about 0.2 percent, or 0.205 additional deaths per 1,000 persons (10.24 crude deaths per 1,000 persons $\times$ 0.2 = 0.205). Given that the average US county had 104,435 inhabitants in 2019, this translates into about 21 more deaths.

[6]While there is a possibility that commodity prices at the state level may not be plausibly exogenous to within-county mortality, our use of global commodity prices serves to further exogenize our treatment variable by further exogenizing its shift component.

[7]Commodity prices also affect consumers, who typically benefit from a price decrease while producers are hurt by it, and vice versa. This is another reason why we interact commodity prices at either the state or global levels with how much of each commodity is grown in a given county: It allows focusing on the effects of those changes in the prices of those commodities *via the production channel*, abstracting from their effects via the consumption channel, the latter being much more difficult to identify because the foods that rely on corn and soybeans as ingredients are often highly processed (and thus require many more inputs than just corn or soybeans) and thus storable, which makes identifying the effects on consumer welfare of the changing prices of commodities such as corn and soybeans much more difficult.

[8]While some data sets allow looking directly at farm revenue, using those data sets would be second-best to the approach we use in this paper. The US Census of Agriculture has detailed longitudinal information on farms, but it is conducted only every five years, which would seriously reduce the statistical power of our analysis. Similarly, the US Department of Agriculture's Agricultural Risk Management Survey (ARMS) has detailed financial information on the farms it samples, it is not a longitudinal data set. Moreover, neither the Census of Agriculture nor ARMS are publicly available, which limits the transparency and replicability of any empirical work done using either source. Similarly, while the National Longitudinal Mortality Study has information on mortality and occupation from 1970 to 2010, the limitation of the (public-use) data is that those data can only identify residency at the state level.

For robustness, we also estimate specifications in which we instrument revenues from corn and soybeans with a measure of drought severity. Those results also support the notion that negative commodity price changes are associated with rural mortality, and falsification tests further support that finding. Finally, we show that the relationship between commodity prices and rural mortality appears to be driven by cardiovascular disease. We also find that suicides drive the relationship between commodity prices and mortality, but they do so less robustly given that suicides appear to operate via soybean prices.

There is a well-known literature on the relationship between economic conditions and mortality. Ruhm (2000) finds that most sources of mortality in his data are pro-cyclical, with suicide being an exception, and with smoking and obesity appearing to be important mechanisms. Ruhm (2015), however, finds that more recently, mortality went from being pro-cyclical to being at best weakly related to economic conditions, and he cautions researchers against using fewer than 15 years of data to study the association between economic conditions and mortality.[9] Summarizing the literature on economic conditions and mortality, Ruhm (2016) concludes that national recessions translate into improved health conditions.[10]

Turning specifically to the agricultural sector, the literature on adverse shocks and mortality often focuses on producer suicides and other self-inflicted deaths. Carleton (2017), for instance, establishes a causal link between high temperatures and farmer suicides in India, and Christian, Hensel and Roth (2019) establish a similar link between agricultural productivity changes and farmer suicides in Indonesia.[11] More recently, Proctor and Hopkins (2024) have looked at the relationship between stress and alcohol use in a sample of US farmers and found that higher stress is associated with binge-drinking

[9]In our analysis, we have more than twice as many years of data.

[10]More recently, Hollingsworth, Ruhm and Simon (2017) have found a positive relationship between increases in the unemployment rate at the county level and deaths from opioid use.

[11]While Carriere, Marshall and Binkley (2019) also look at farmer suicides, their analysis remains does not include a research design, which makes it more descriptive as it cannot establish a causal relationship.

behavior, among other findings.

More broadly in terms of time, geography, or both, Brueckner and Schwandt (2015) find that rising incomes lead to growing populations via reductions in infant mortality. Using data on the Swedish agricultural revolution that took place between 1750 and 1860, Dribe, Olsson and Svensson (2017) find that mortality responds to harvest fluctuations, especially to harvest failures, and to fluctuations in the prices of staple crops. Fishback (2017) concludes that the spending and lending policies adopted by Franklin D. Roosevelt's administration in the 1930s as part of the New Deal decreased the incidence of various types of mortality. Finally, in an analysis that is perhaps the closest in spirit to ours, Singhal and Tarp (2024) look at the impacts of coffee price volatility on the well-being of coffee producer in Uganda and find that an increase in the volatility of the international price of coffee is associated with an increase in the psychological distress of coffee producers, a finding that appears mediated by increased alcohol consumption, a greater cognitive load, worsened expectations about the future, and a reduction in social capital.

We contribute to the literature on economic shocks and mortality by focusing on the impacts of economic shocks (here, changes in commodity prices) on mortality in the US by focusing on shocks that affect the supply side of the economy, or producers and others whose welfare is correlated with that of producers. To our knowledge, while some studies have focused on a direct relationship between commodity prices and welfare for a narrowly defined group (e.g., coffee prices and coffee producers in Vietnam, as in Singhal and Tarp (2024)), no other study has looked at commodity price shocks as they affect mortality via producers *in society at large*. This matter because while the effects of commodity price shocks affect the producers of those commodities directly, they also affect those who depend on those commodities indirectly. In the context we study, while changes in the prices of corn and soybeans certainly affect the producers of those commodities, they also affect those whose livelihoods of others, such as agricultural laborers, agricultural implement dealers, agricultural loan officers, agricultural extension agents, and so on.

The remainder of this paper is organized as follows. We begin in section 2 by presenting our empirical framework, discussing our estimation and identification strategies. Section 3 presents the data we use in our analysis as well as some summary statistics. In section 4, we present and discuss our core estimation results, and we report the results of a number of robustness checks. Section 5 summarizes and offers some concluding thoughts.

2 Empirical Framework

In this section, we first discuss our estimation strategy, and then discuss our identification strategy. In doing so, we also discuss the various robustness checks and falsification tests we conduct as well as the additional analyses we run to determine which cause of death appears to drive the relationship between commodity prices and mortality.

2.1 Estimation Strategy

We estimate the following core equation using data on a sample of 485 counties across 12 Midwestern states for the period 1980 to 2016 ($N = 17,945$ county-year observations) by ordinary least squares:

$$y_{it} = \alpha + \beta \ln(p_{ct} \times q_{ict}) + \gamma x_{ict} + \delta_i + \tau_t + \epsilon_{ict}, \tag{1}$$

where y is the death rate (either crude or age-adjusted, depending on the specification) in county i in year t, p_{ct} denotes the price (either state-level or global, depending on the specification) of commodity c (corn or soybeans, depending on the specification) in year t, q_{ict} denotes how much of crop c is grown in county i in year t, x_{ict} is a vector of control variables (i.e., the proportion of commodity acreage planted in each county, and the average commodity values in neighboring counties), δ is a vector of county fixed effects, τ is a vector of year fixed effects, and ϵ is an error term with mean zero.

Beyond the proportion of commodity acreage planted in each county, and the average commodity values in neighboring counties, we do not include additional control variables (e.g., whether a county has a medical doctor as medical examiner, availability of health services, etc.) because most of those time-variant controls are largely controlled for by the several specifications we estimate that are variants of the first differences estimator (e.g., first differences, twice first-differenced, rolling first differences, and twice rolling first-differenced; see below for a discussion), all of which compare each year with the one immediately before, in which case those time-variant controls matter are dealt with better than with a standard fixed effects estimator. Moreover, control variables in a difference-in-differences design or with a two-way fixed effect estimator do not do what most people think they do and, as such, are not as useful as they are commonly thought to be.[12]

We estimate several variants of Equation 1. First, in addition to the two-way fixed effects (TWFE) specification in Equation 1, to properly account for the passage of time, we also estimate versions of Equation 1 with (i) a linear time trend, (ii) a quadratic time trend, (iii) county-specific linear time trends, (iv) county-specific quadratic time trends, (v) state-specific linear time trends, and (vi) state-specific quadratic time trends.

Second, and consistent with the recommendations in Millimet and Bellemare (2024), who note that the identification assumptions required by the fixed effects (FE) estimator are increasingly unlikely to hold the longer the time period under consideration, we also present results for the first differences (FD), twice first-differenced (Twice FD), rolling first differences (RFD), and twice rolling first-differenced (Twice RFD) estimators.

[12]As Huntington-Klein (2023) notes: "For time-varying covariates, adding them to [a two-way fixed effects estimator] in effect means that you only control for the change in those covariates. If the reason you're controlling for a variable is because you think the counterfactual path of the outcomes depends *on the level of the covariate*, you're out of luck ... You end up with a strange treatment effect average. Your overall estimate will heavily reflect the effects of treated groups that have covariate values that are super uncommon relative to the untreated group."

Third, since corn and soybeans are complements in production, we estimate separate versions of Equation 1 for corn prices and for soybean prices for robustness.[13]

Fourth, and also for robustness, we estimate different versions of Equation 1 using the crude death rate and the age-adjusted death rate.

Fifth, we estimate different versions of Equation 1 for state-level commodity prices and for global commodity prices since the latter, by virtue of not being dependent on local economic conditions, are less likely than the former to suffer from bias arising from reverse causality.

Sixth, in order to rule out possible violations of the stable unit treatment value assumption (Morgan and Winship, 2015), we estimate versions of Equation 1 with a measure of commodity price changes in neighboring counties.[14]

Finally, in an effort to further exogenize our treatment variable, we also estimate versions of Equation 1 where we instrument our treatment variable (i.e., $\ln(p_{ct} \times q_{ict})$) with a measure of recent drought severity in county i.

Given the observational nature of our data and our TWFE research design, we follow the recommendations in Abadie et al. (2023) and MacKinnon, Nielsen and Webb (2023) and cluster standard errors at the county level throughout. The only exception to that rule is our analysis of mechanisms, wherein we explore stress-related causes of death that drive the relationship between commodity prices and mortality. Because data on specific causes of death is only available at the state level and we only have 12 states in our analysis, we apply bootstrapped cluster standard errors with 1,000 replications at the state level to address the concern of having too few clusters (Cameron, Gelbach and Miller, 2008; Cameron and Miller, 2015).

In addition to estimated coefficients, we report estimated elasticities at means which, because we regress a level on a logarithm, are equal to $\frac{\beta}{y}$ and can be computed by dividing

[13]It is a well-known agronomic fact that when corn and soybeans are grown in rotation, soybeans replenish the soil nitrogen depleted by corn.

[14]This allows ruling out between-county contemporaneous spillovers, or that changes to farm revenues in neighboring county j cause changes in the death rate in county i in year t.

β by the mean of the relevant dependent variable. This allows quantifying the economic significance of our results.

For all estimates of β obtained from Equation 1 and the various specifications just discussed, we test the null hypothesis that H_0: $\beta = 0$ versus the alternative hypothesis that H_A: $\beta \neq 0$. Rejecting the null hypothesis in favor of the alternative hypothesis and finding that $\hat{\beta}$ is negative and statistically significant would lend support to the hypothesis that decreases in commodity prices are associated with increases in mortality.

2.2 Identification Strategy

Our core equation consists of (i) an exposure design combined with (ii) a TWFE estimator the latter of which is, as Wooldridge (2021) notes, equivalent to an estimator that pools a linear regression that includes unit-specific time averages and time-period specific cross-sectional averages—the so-called two-way Mundlak estimator.

A major issue with the TWFE estimator is that if the treatment effect of interest—here, the relationship between commodity prices and mortality—is heterogeneous across groups (here, counties) or over time (here, years), then TWFE estimates may be biased (de Chaisemartin and D'Haultfoeuille, 2020).

Against that possibility, Jakiela (2021) offers simple diagnostics, but only for the case in which the treatment variable is binary. In our application, the treatment variable—a proxy for farm revenues from corn or soybeans within a county—is continuous. Consequently, the best guide for the type of analysis we conduct in this paper is the article by Callaway, Goodman-Bacon and Sant'Anna (2021), which considers difference-in-differences and TWFE estimators with continuous treatment, including for cases such as ours where there is no treatment group to speak of, and where there are more than two time periods.[15] From Sun and Shapiro (2022), we know that if there is heterogeneity in the treatment ef-

[15] Our approach is not the same as what is discussed by de Chaisemartin and D'Haultfoeuille (2022), which is better suited for cases where there are more than one treatment variable. Here, we only consider a single treatment variable.

fect of interest, the TWFE may not return an average (weighted or not) of county-level estimated treatment effects unless there are units entirely unaffected by the treatment. As it turns out, there is no county-year in our sample that reports a zero value of either crop or soybean revenues, and so our TWFE results are presented under the caveat that they are only valid in the absence of treatment heterogeneity.

For that reason, and because in recent work, Millimet and Bellemare (2024) note that the longer the time period considered, the less useful the FE estimator when it comes to identification because longer time periods assume that more heterogeneity remains constant over time for each unit, we supplement our core TWFE results with FD, Twice FD, RFD, and Twice RFD estimation results. In simulations, Millimet and Bellemare (2024) find that those additional estimators perform better than the FE estimator in terms of reducing bias.

Finally, we also present the results of two-stage least squares (2SLS) specifications in which we rely on measures of drought severity (i.e., dummies for whether a given county has experienced an exceptional drought in a given year, for whether it has experienced extreme drought in the same year, or both, and the number of months a county has experienced an exceptional drought, the number of months it has experienced extreme drought, or both) as instruments for corn and soybean revenues in a given county in a given year. While the relevance of these instrumental variables (IVs) is testable, whether they meet the exclusion restriction—that is, whether the occurrence or duration of drought affects mortality only through commodity prices—-is not. Here, we argue that once county-specific time-invariant heterogeneity and year-specific county-invariant heterogeneity is accounted for, the only way drought affects mortality is through corn and soybean revenues. In other words, we assume that when county-specific time-invariant and year-specific county-invariant characteristics are held constant, drought conditions do not affect mortality through, say, wildfires or respiratory illnesses. While we realize that this is a strong assumption, we view our IV results as complementary to our core results.

3 Data and Summary Statistics

The data we use for our analysis come from various sources for the period 1980 to 2016. Mortality data at the county level are from the Compressed Mortality File (CMF) offered by US Centers for Disease Control and Prevention's (CDC) National Center for Health Statistics (NCHS).[16] We use crude as well as age-adjusted death rates for all ages and causes in our core analysis, but we look at specific causes of death (e.g., death from cardiovascular disease) when assessing the mechanisms whereby our core results might be caused. We also use death rates due to certain infections and parasitic diseases and due to congenital malformations, deformations, and chromosomal abnormalities for the purpose of implementing a placebo outcome test (Eggers, Tuñón and Dafoe, 2021).

Data on corn and soybeans in the US Midwest (i.e., price, production, and planted acres) are from the US Department of Agriculture's National Agricultural Statistics Service. Annual commodity prices are only available at the state level, but annual commodity production and planted acres are available at the county level. International primary commodity price data are from the International Monetary Fund's (IMF) Primary Commodity Price System. We use IMF prices for corn and soybeans for our primary analysis. We use the GDP deflator from the World Bank to express nominal prices in real (i.e., 2015 US dollar) prices.

For droughts, we use the monthly Palmer Drought Severity Index (PDSI) at the county level provided by the Cooperative Institute for Climate and Satellites-North Carolina. The PDSI is a standardized index that measures relative dryness, which is estimated via temperature and precipitation data. The PDSI ranges from -10 to $+10$, from dry to wet. We calculate the average monthly data to determine the annual drought. The drought classification is based on the US Drought Monitor.

To define rural versus urban counties, we use 1990, 2006, and 2013 data from the

[16] The CMF consists of county-level mortality and population files. Deaths of nonresident aliens and fetal deaths are not included.

Urban-Rural Classification Scheme provided by the CDC's NCHS. We define urban counties as counties classified as urban in either 1990, 2006, or 2013. Every other county in our data is defined as rural.

Table A1 presents descriptive statistics for the 485 counties we retain for analysis for the period 1980 to 2016 for our outcomes of interests (i.e., crude and age-adjusted death rates), for our variables of interest (i.e., commodity prices and values for corn and soybeans), for our instrumental variables (i.e., drought severity and drought duration), and for our control variables. Table A2 presents descriptive statistics for the variables we use for our mediation analyses as well as for our falsification tests (i.e., tests in which we use a "fake" outcome to test whether our core results are spurious). Tables A3 and A4 present detailed descriptions of the variables we use in our analysis.

Before establishing whether there is a statistical relationship between commodity price changes and mortality, we present some visual representations of our data. Figures I and II show the spatial distribution of within-county corn and soybean average values over time. Unsurprisingly given the fact that corn and soybeans are often complements in production, there is an obvious correlation between corn and soybean revenues across counties.

Figures III to VI plot the relationship between mortality and commodity prices (Figures III and IV), and then the relationship between mortality and commodity values (Figures V and VI). In both cases, and for both corn and soybeans, there seems to be an unconditional negative relationship between commodity prices (or values) and crude death rates.

4 Results and Discussion

In this section, we first discuss our core TWFE results. We then move on to discuss the results of the many robustness checks we run on our core results before discussing the results of regressions looking at specific causes of deaths and the results of falsification (i.e., placebo outcome) tests.

4.1 Core Results

Figures VII to IX present our core results. In Figure VII, results for crude death rates are on the left, and results for age-adjusted death rates are on the right. Corn values are represented by triangles, and soybean values are represented by squares. A full shape represents values obtained from state-level prices, and a hollow shape represents values obtained from global prices. In almost all cases, TWFE estimates of the relationship between prices and mortality show a statistically significant, negative relationship between prices and mortality, with only the results for corn and age-adjusted death rates not being statistically significant.

Table I presents the estimation results used to make Figure VII. Those results control for crop values in neighboring counties to help rule out the possibility that results are driven by a violation of the stable unit treatment value assumption (SUTVA) wherein a commodity price change in a neighboring county translates into changing mortality in a given county within a given year.[17]

In terms of economic significance, the results in Table I suggest that a 10-percent decrease in corn revenues is associated with 0.23 percent increase in the crude death rate (columns 1 and 2) and with a 0.02 percent increase in the age-adjusted death rate (columns 5 and 6). Similarly, the results in Table I suggest that a 10-percent decrease in soybean revenues is associated with a 0.17 percent increase in the crude death rate (columns 3 and 4) and with a 0.17 percent increase in the age-adjusted death rate (columns 7 and 8).

[17] There are two other possible SUTVA violations in this context. The first would occur if the treatment variable changing in a given year affects the outcome variable in a future year within a given county. The second would occur if the treatment variable changing in a given year in a given county affects the outcome variable in a future year in a different county. Addressing both those potential SUTVA violations would require specifically modeling those possibilities, which would require strong assumptions about dynamics or cross-county effects. Because we are not willing to make such assumptions, we do not look at those other potential SUTVA violations.

In Figures VIII and IX we split our core results between rural ($N = 11,137$) and urban ($N = 6,808$) counties. In Figure VIII, which presents results for values derived from state-level prices, results for crude death rates are on the left, and results for age-adjusted death rates are on the right. Rural counties are represented by triangles, and urban counties are represented by squares. A full shape represents values obtained for corn, and a hollow shape represents values for soybeans. The relationship between corn values and the crude death rate is negative and statistically significant in three out of four cases. In the fourth case, that relationship is still negative, but not statistically significant. Similarly, the relationship between soybean values and the crude death rate is negative in three out of four cases but significant in only one of those cases. In the fourth case, that relationship is positive but not statistically significant.

Similarly, in Figure IX, which presents results for values derived from global prices, results for crude death rates are on the left, and results for age-adjusted death rates are on the right. Rural counties are represented by circles, and urban counties are represented by diamonds. A full shape represents values obtained for corn, and a hollow shape represents values for soybeans. The relationship between corn values and the crude death rate is negative and statistically significant in three of four cases. In the fourth case, that relationship is still negative, but not statistically significant. Similarly, the relationship between soybean values and the crude death rate is negative in three out of four cases but significant in only one of those cases. In the fourth case, that relationship is positive but not statistically significant.

Overall, these results suggest that there is a negative relationship between commodity price changes and mortality—that is, as prices decrease, mortality increases—and that, by and large, that relationship holds for rural counties but not urban ones. This is consistent with the hypothesis that commodity price changes can cause rural mortality.

4.2 Robustness Checks

Columns 2 to 7 of Table II (corn) and III (soybeans) present the robustness checks suggested in Millimet and Bellemare (2024) in addition to core TWFE results for reference in column 1. The first panel of each of Tables II and III presents results for state-level prices and crude death rates; the second panel, state-level prices and age-adjusted death rates; the third panel, global prices and crude death rates; the fourth panel, global prices and age-adjusted death rates. The results in Table II show a robust negative relationship between corn prices and rural mortality: The estimated coefficient is negative in all 28 cases, and statistically significant in 18 out of 28 cases. In all four panels, we reject the null hypothesis that the FE and FD estimators return similar estimates.

The results in Table III, for their part, show that the results for soybeans are not robust. While all 28 estimated coefficients are negative, only six out of 28 are statistically significant, and four of those are for the FE estimator. Given that we fail to reject the null of equality between estimated coefficients from the FE and FD estimators but that the former are significant, we conclude that our core results for soybean values are not robust.

Tables IV to IX take a closer look at the difference in results between rural and urban counties. Table IV shows the estimation results behind Figure VIII, which focus on state-level prices. Tables V and VI explore the robustness of those results by presenting results for the estimators discussed by Millimet and Bellemare (2024) as being more robust than the FE estimator. The results for corn (Table V) show a robust negative relationship between corn price changes and rural mortality, whether one measures mortality using crude death rates (top panel) or using age-adjusted death rates (bottom panel). The results for soybeans (Table VI), however, support the conclusion that the relationship between soybean price changes and rural mortality, while negative across all specifications, is not robust given the lack of statistical significance across different panel-data estimators.

Table VII shows the estimation results behind Figure IX, which we have already discussed. Table VII shows the estimation results behind Figure IX, which focus on global prices. Tables VIII and IX explore the robustness of those results by presenting results for the estimators discussed by Millimet and Bellemare (2024) as being more robust than the FE estimator. The results for corn (Table VIII) show a robust negative relationship between corn price changes and rural mortality, whether one measures mortality using crude death rates (top panel) or using age-adjusted death rates (bottom panel). The results for soybeans (Table IX), however, show that the relationship between soybean price changes and rural mortality, while negative across all specifications, is not robust, since only one estimated coefficient—that for the FE specification for age-adjusted death rates in the bottom panel—is significant out of 14 such coefficients.

Appendix Tables A5 to A20 present robustness checks on our core results that treat time differently than via year fixed effects (column 1), by incorporating instead a linear time trend (column 2), a quadratic time trend (column 3), county-specific linear time trends (column 4), county-specific quadratic time trends (column 5), state-specific linear time trends (column 6), and state-specific quadratic time trends (column 7) for corn price changes (Appendix Tables A5, A7, A9, A11, A13, A14, A17, and A18) and soybean price changes (Appendix Tables A6, A8, A10, A12, A15, A16, A19, and A20) for crude death rates (Appendix Tables A5, A6, A9, A10, A13, A14, A15, and A16) and age-adjusted death rates (Appendix Tables A7, A8, A11, A12, A17, A18, A19, and A20), for state-level prices (Appendix Tables A5 to A8 and A13 to A20) and global prices (Appendix Tables A9 to A12), and for all counties (Appendix Tables A5 to A12), rural counties (Appendix Tables A13, A15, A17, and A19), and urban counties (Appendix Tables A14, A16, A18, and A20). We summarize those many tables by noting that our core result that negative commodity price changes are associated with increases in overall mortality are robust across specifications, and that this is driven by rural counties.

Tables X to XIII present results for our 2SLS specifications using drought as an instrument for crop values. Table X shows results for crude death rates using drought levels as

IVs. Columns 1 and 2 use a dummy for exceptional drought as IV for commodity value; columns 3 and 4 use dummies for exceptional or extreme drought as IVs for commodity values. The F-statistics for tests of weak instruments exceed the usual threshold of 10 to 13 in three out of four specifications, but in all cases, the 2SLS estimate of the relationship between commodity price changes and rural mortality is negative and statistically significant. Using the results in columns 2 and 4 of Table X to assess economic significance and giving the estimated coefficients a LATE interpretation,[18] one would conclude that a 10-percent decrease in corn revenues is associated with a 0.69 percent increase in crude death rate in those counties where corn revenues declined in response to drought conditions, and that a 10-percent decrease in soybean revenues is associated with a 1.66 percent increase in the crude death rate again in those counties where soybean revenues declined in response to drought conditions.

Table XI is identical to Table X except that it uses age-adjusted death rates as dependent variables. Unsurprisingly given the identical first stage regressions in this and the previous table, F-statistics for tests of weak instruments exceed the usual threshold of 10 to 13 in three out of four specifications. While the 2SLS estimate of the relationship between commodity price changes and rural mortality is negative across all four specifications, it is only statistically significant when using both drought dummies as IVs.

Tables XII and XIII reproduce the results in Tables X and XI, but instead of relying on drought dummies as IVs, they rely on the number of months in each drought category. In both tables, the F-statistics for tests of weak instruments exceed the usual threshold of 10 to 13 in three out of four specifications. While the 2SLS estimate of the relationship between commodity price changes and rural mortality is negative across all eight specifications in Tables XII and XIII, it is significant in only three out of eight cases.

Finally, Appendix Table A21 shows results for spatial autoregressive (SAR) TWFE estimators. The SAR model offers another way to account for potential spillover effects

[18]In addition to the IV meeting the exclusion restriction and being relevant, this also assumes that drought has a monotonic effect on crop revenues.

from neighboring counties.[19] Except for the coefficients for the relationship between corn prices (either at the state level or global) and the age-adjusted death rate, which are not statistically significant, there is a statistically significant, negative relationship between commodity prices and mortality.

4.3 Mechanisms

Tables XIV and XV present estimation results that explore a potential mechanism whereby commodity price changes and rural mortality are associated. In this case, mortality due to cardiovascular disease (CVD) serves as the dependent variable, and results are presented for our core TWFE estimator as well as for the other, more robust panel-data estimators discussed by Millimet and Bellemare (2024). The results that are significant in Tables XIV and XV suggest that CVD is a likely mechanism whereby commodity price changes can lead to increased rates of mortality.

Appendix Tables A22 to A31 present additional results exploring potential mechanisms for corn (Appendix Tables A22, A24, A26, A28, and A30) and soybean (Appendix Tables A23, A25, A27, A29, and A31) price changes for strokes (Appendix Tables A22 and A23), mental issues (Appendix Tables A24 and A25), suicide (Appendix Tables A26 and A27), drug use (Appendix Tables A28 and A29), and alcohol (Appendix Tables A30 and A31). Of these various other mechanisms behind our core results, only suicides hold any robust significance, and only for soybean price changes (Appendix Table A27).

4.4 Falsification Tests

Finally, Appendix Tables A32 and A33 present the results of falsification tests in which we regress mortality from causes which should not be affected by commodity price changes (i.e., deaths from parasitic diseases or from birth defects) on the same right-hand side

[19] For SAR models, we create inverse-distance weighting matrices to account for these spillover effects (StataCorp, 2017). In our core results, we include average commodity values of neighboring counties (i.e., counties adjacent to each other).

variables as in our core specifications using our core TWFE specification (column 1) and the robust panel-data estimators discussed in Millimet and Bellemare (2024) (columns 2 to 7).[20] Appendix Table A32 presents results for corn price changes, and Appendix Table A33 presents results for soybean price changes. The overall lack of statistical significance across the 56 coefficients reported in Appendix Tables A32 and A33 suggests that our core results are not spurious.

5 Summary and Concluding Remarks

We have looked at the relationship between commodity prices and mortality in the Midwest for the period 1980 to 2016. To do so, we have relied on a combination of an exposure design (i.e., a shift-share design in which the interaction between the shift and the share is included directly in the regression of interest instead of used as an instrument) and a two-way (i.e., county and year) fixed effects estimator to look at the relationship between corn or soybean prices at the state or global level on the one hand and crude or age-adjusted death rates on the other hand for all, then for rural versus urban counties. Because the TWFE may be biased when there is treatment effect heterogeneity, we have also supplemented our core TWFE results with those of several robust panel-data estimators, as suggested by Millimet and Bellemare (2024).

We find a robust, statistically significant, and negative relationship between commodity prices and mortality. That is, as commodity prices decrease, mortality increases. While this relationship holds for all-cause mortality and across all counties, we find that it is driven by corn prices, by rural counties, and by cardiovascular disease.

Overall, we find that 10-percent decrease in either corn or soybean revenues is associated with an increase in the crude death rate of about 0.2 percent, or 0.205 additional

[20]Strictly speaking, and to use the terminology put forth by Eggers, Tuñón and Dafoe (2021), this is a *placebo outcome test*, i.e., a test which replaces the outcome variable with a variable which should not be affected by the treatment if our identification assumptions—what Eggers, Tuñón and Dafoe (2021) refer to as bias assumptions—are met.

deaths per 1,000 persons (10.24 crude deaths per 1,000 persons $\times$ 0.2 = 0.205). Given that the average US county had 104,435 inhabitants in 2019, this translates into about 21 more deaths. This is consistent with the hypothesis that economic shocks can cause mortality, and with the findings in Carleton (2017), Christian, Hensel and Roth (2019), and Singhal and Tarp (2024). Our core finding is robust to instrumenting our treatment variable with measures of drought and to a spatially autoregressive TWFE specification. Moreover, falsification tests in which we replace all-cause mortality with deaths from parasitic diseases or birth defects show that our core results are unlikely to be spurious.

Our work is limited both in terms of internal validity and of external validity. On the internal validity front, while we do find a robust negative relationship between commodity prices and mortality, our work relies on observational data, and our results thus fall short of the gold standard of experimental evidence and should be treated as such. Moreover, an important recent literature has questioned the usefulness of TWFE designs in the presence of treatment effect heterogeneity. Against that, we have presented the results of several robust panel-data estimators, as suggested by Millimet and Bellemare (2024). On the external validity front, our results are only valid for the US Midwest for the period 1980 to 2016, and they are unlikely to apply to other contexts.

The limitations above notwithstanding, if one were to grant internal validity to our findings, those findings would have clear implications for policy. Given our finding that commodity price decreases seem to translate into increased mortality from cardiovascular disease in rural areas, one obvious policy implication would be to invest in the early detection and subsequent treatment of cardiovascular disease in rural areas.[21] Less obviously, it might be possible to invest in income-support programs for farmers in the Midwest, but nothing in our findings suggests that the adverse effects of commodity price shocks are limited to farmers, and given data limitations, we cannot identify which groups of individuals are the ones more likely to suffer from increase mortality because

[21]In a recent study, Proctor and Hopkins (2024) have found that health care challenges and stigma were associated with higher stress, which is a driver of cardiovascular disease.

of commodity price shocks.

The limitations above also have implications for future research. While it seems unlikely that one can improve on the internal validity of our results in the absence of data at a level below that of the county or of an experimental design,[22] it is certainly possible to improve in terms of external validity by conducting similar studies in other contexts.

[22]While it would certainly be possible to design a randomized controlled trial (RCT) wherein farmers receive additional income support when commodity prices decrease, such a research project would be expensive to implement in the US. One could also design an RCT wherein farmers are randomly assigned to health screenings aimed at detecting cardiovascular disease. Unfortunately, neither of the RCTs just described would satisfy the clinical equipoise criterion (Josephson and Michler, 2023): In both cases, we have good reasons to believe the intervention would almost surely make the treated significantly better off.

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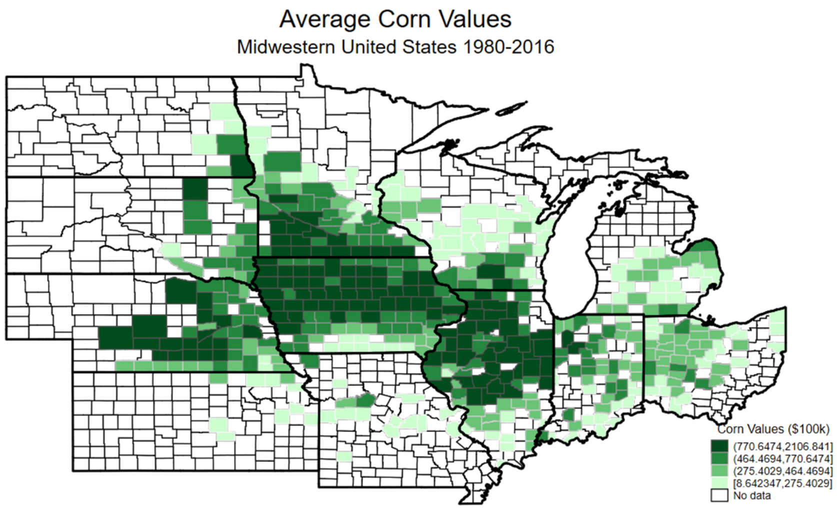

FIGURE I: Within-County Average Farm Revenues from Corn, 1980-2016.

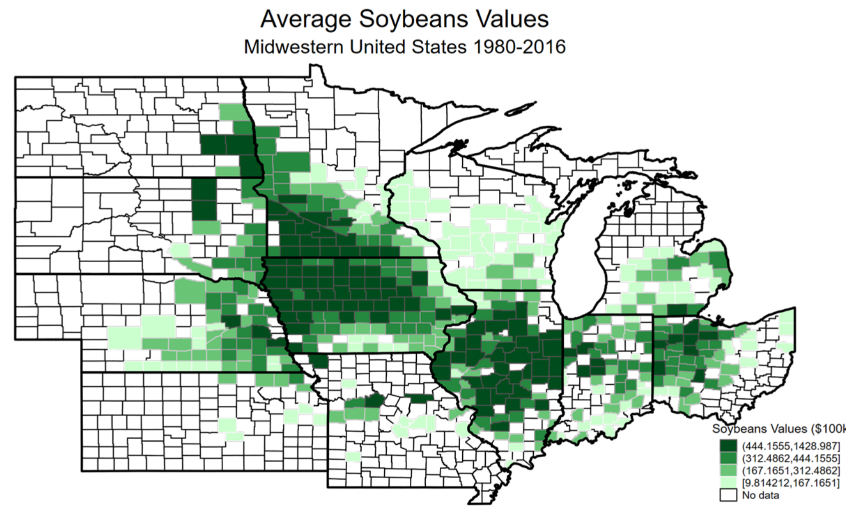

FIGURE II: Within-County Average Farm Revenues from Soybeans, 1980-2016.

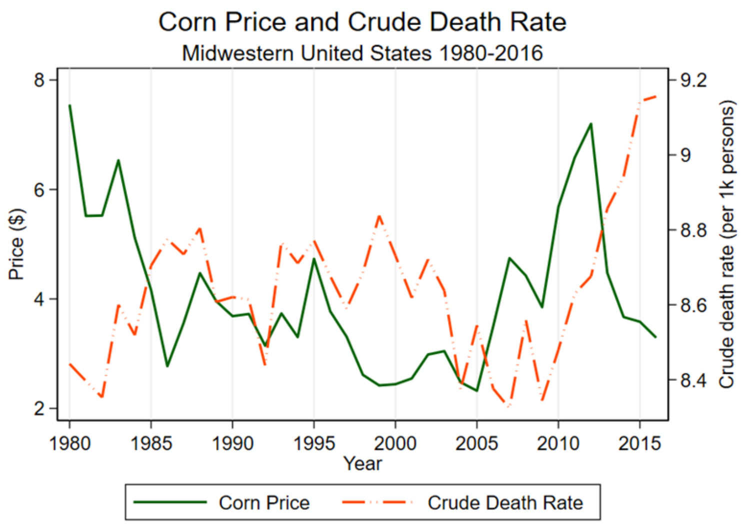

FIGURE III: Corn Price and Crude Death Rate, 1980-2016.

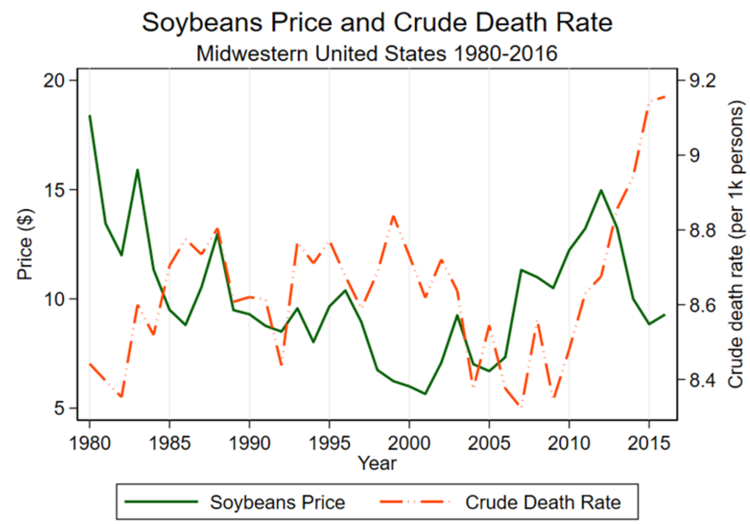

FIGURE IV: Soybeans Price and Crude Death Rate, 1980-2016.

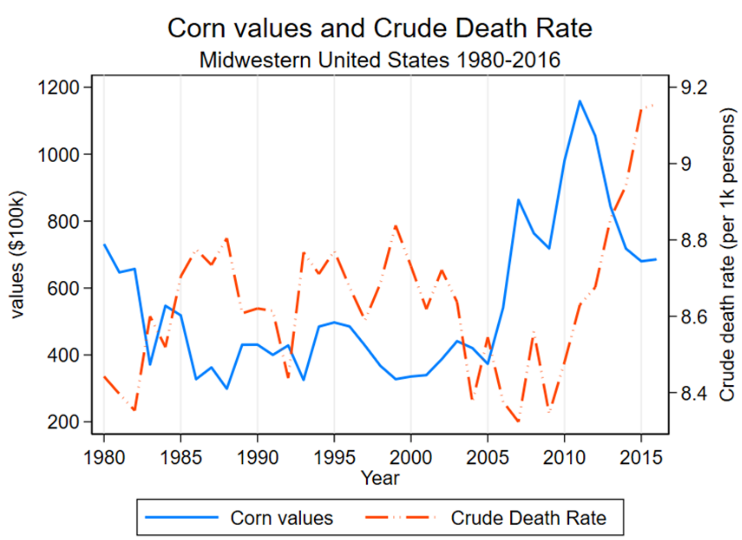

FIGURE V: Corn Values and Crude Death Rate, 1980-2016.

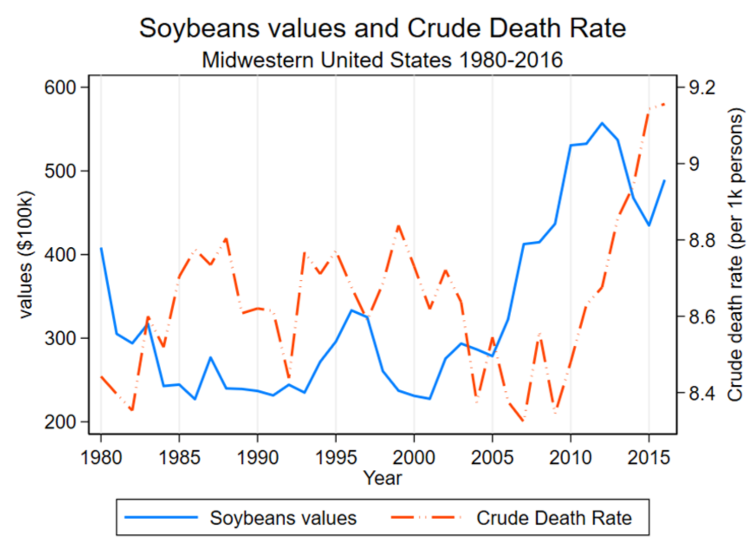

FIGURE VI: Soybeans Values and Crude Death Rate, 1980-2016.

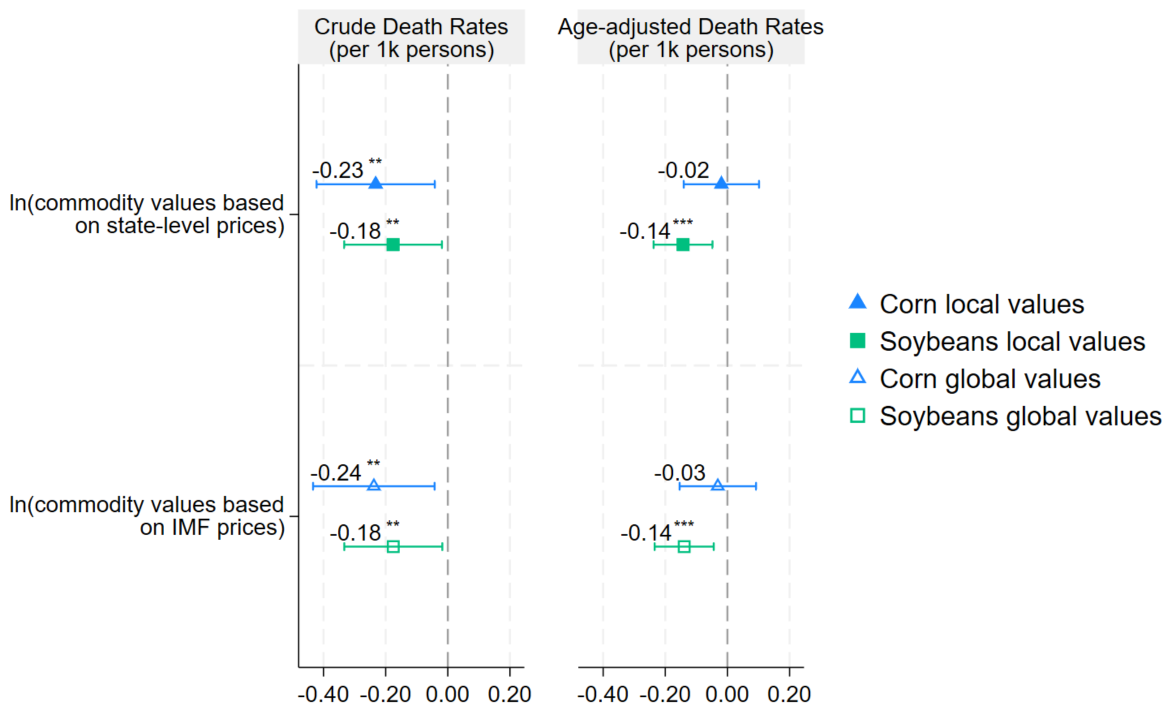

FIGURE VII: TWFE for relationship between mortality rates and commodity values, 1980-2016.

Notes: The bars represent 95 percent confidence intervals, and standard errors are clustered at the county level.

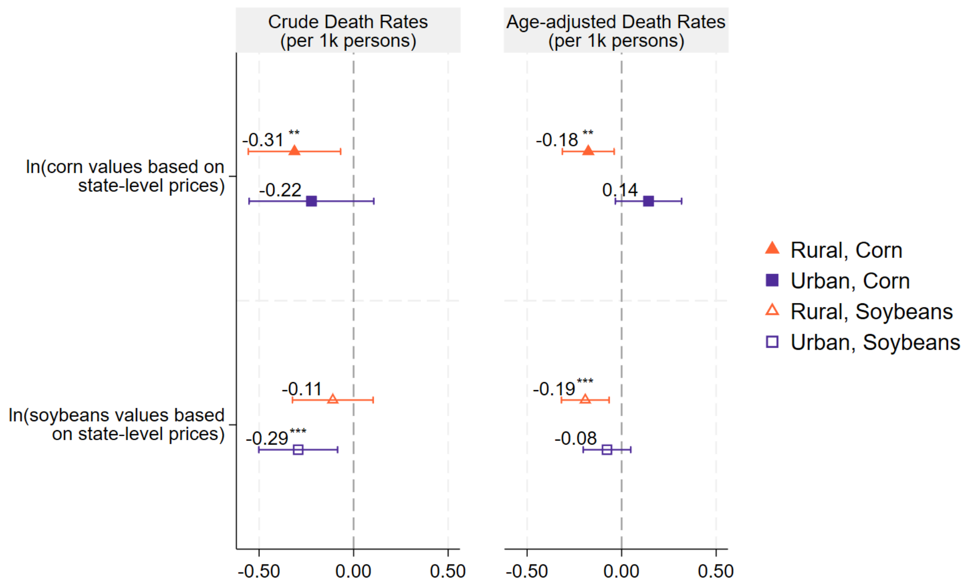

FIGURE VIII: TWFE for relationship between mortality rates and local commodity values by rural, 1980-2016.

Notes: The bars represent 95 percent confidence intervals, and standard errors are clustered at the county level.

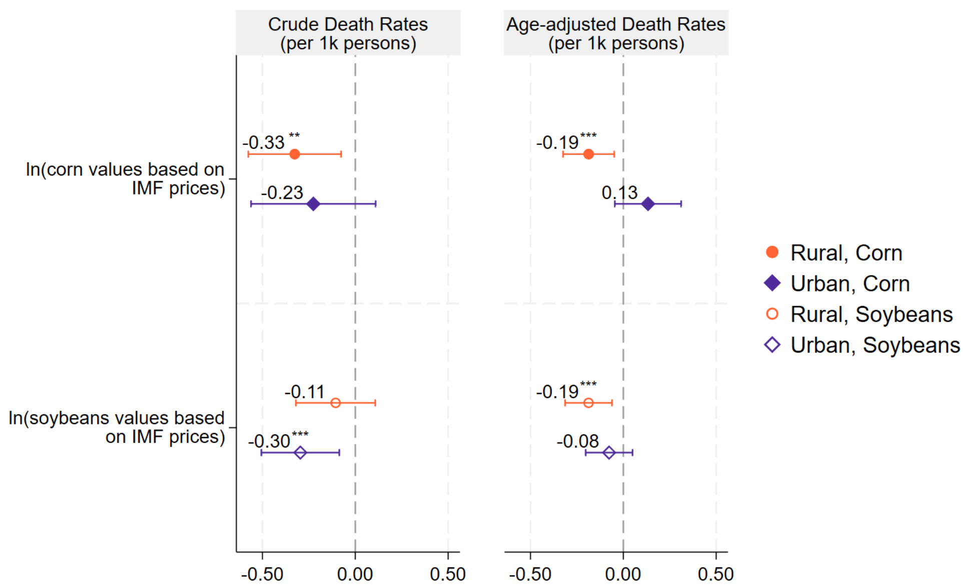

FIGURE IX: TWFE for relationship between mortality rates and global commodity values by rural, 1980-2016.

Notes: The bars represent 95 percent confidence intervals, and standard errors are clustered at the county level.

TABLE I: TWFE estimation for relationship between mortality rates and commodity values from 1980 to 2016

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Corn		Soybeans		Corn		Soybeans	
	Dep Var: Crude death rates (per 1k persons)				Age-adjusted death rates (per 1k persons)			
ln(Commodity values based on state-level prices)	–0.232**		–0.176**		–0.019		–0.143***	
	(0.097)		(0.080)		(0.062)		(0.048)	
ln(Neighbor commodity values based on state-level prices)	–0.077		0.020		0.093		0.098*	
	(0.128)		(0.107)		(0.079)		(0.056)	
ln(Commodity values based on IMF prices)		–0.238**		–0.175**		–0.031		–0.139***
		(0.100)		(0.080)		(0.063)		(0.048)
ln(Neighbor commodity values based on IMF prices)		–0.064		0.020		0.108		0.094*
		(0.132)		(0.107)		(0.080)		(0.056)
Proportion of commodity planted acreage (%)	0.140***	0.141***	0.072***	0.072***	0.043*	0.045**	0.031***	0.031***
	(0.049)	(0.048)	(0.024)	(0.024)	(0.023)	(0.023)	(0.007)	(0.007)
Constant	15.109***	14.993***	12.336***	12.314***	8.148***	8.091***	10.221***	10.230***
	(1.237)	(1.243)	(0.927)	(0.924)	(0.738)	(0.741)	(0.434)	(0.433)
Mean of Dep Var	10.235	10.235	10.235	10.235	8.311	8.311	8.311	8.311
Elasticity	-.023	-.023	-.017	-.017	-.002	-.004	-.017	-.017
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17,945	17,945	17,945	17,945	17,945	17,945	17,945	17,945
R^2	0.063	0.063	0.064	0.064	0.483	0.483	0.484	0.484

Notes: Standard errors clustered at the county level in parentheses. With a 1% increase in commodity revenues, elasticity shows the related percentage change in the mortality rate for every 1,000 individuals. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE II: The effects of corn values on mortality rates from 1980 to 2016

	(1) FE	(2) FD	(3) Twice FD	(4) RFD (cons)	(5) RFD (no cons)	(6) Twice RFD (cons)	(7) Twice RFD (no cons)
	Dep Var: Crude death rates (per 1k persons)						
ln(Corn values based on state-level prices)	-0.232**	-0.141*	-0.159*	-0.111	-0.155**	-0.126*	-0.166**
	(0.097)	(0.074)	(0.090)	(0.067)	(0.067)	(0.068)	(0.067)
LW Test		p=0.011					
	Dep Var: Age-adjusted death rates (per 1k persons)						
ln(Corn values based on state-level prices)	-0.019	-0.108*	-0.120*	-0.068	-0.108*	-0.088	-0.115**
	(0.062)	(0.057)	(0.068)	(0.052)	(0.054)	(0.054)	(0.055)
LW Test		p=0.000					
	Dep Var: Crude death rates (per 1k persons)						
ln(Corn values based on IMF prices)	-0.238**	-0.140*	-0.155*	-0.120*	-0.115	-0.130*	-0.116
	(0.100)	(0.073)	(0.088)	(0.068)	(0.072)	(0.067)	(0.073)
LW Test		p=0.009					
	Dep Var: Age-adjusted death rates (per 1k persons)						
ln(Corn values based on IMF prices)	-0.031	-0.113**	-0.129*	-0.079	-0.069	-0.102*	-0.085
	(0.063)	(0.056)	(0.067)	(0.054)	(0.057)	(0.055)	(0.058)
LW Test		p=0.000					

Notes: FE = county and year fixed effects. FD = first-differences. RFD = rolling first differences. LW test for the equality of FE and FD (Laporte and Windmeijer, 2005). The term "cons" refers to including a constant in the specification. Year-fixed effects are included in all models. Controls include the proportion of commodity planted acreage (%) and neighboring commodity values. Standard errors clustered at the county level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

TABLE III: The effects of soybeans values on mortality rates from 1980 to 2016

	(1) FE	(2) FD	(3) Twice FD	(4) RFD (cons)	(5) RFD (no cons)	(6) Twice RFD (cons)	(7) Twice RFD (no cons)
	Dep Var: Crude death rates (per 1k persons)						
ln(Soybeans values based on state-level prices)	-0.176**	-0.079	-0.078	-0.060	-0.067	-0.082	-0.106*
	(0.080)	(0.073)	(0.094)	(0.065)	(0.061)	(0.065)	(0.062)
LW Test		p=0.341					
	Dep Var: Age-adjusted death rates (per 1k persons)						
ln(Soybeans values based on state-level prices)	-0.143***	-0.073	-0.077	-0.053	-0.068	-0.067	-0.088*
	(0.048)	(0.058)	(0.076)	(0.050)	(0.048)	(0.047)	(0.045)
LW Test		p=0.740					
	Dep Var: Crude death rates (per 1k persons)						
ln(Soybeans values based on IMF prices)	-0.175**	-0.055	-0.053	-0.048	-0.046	-0.061	-0.080
	(0.080)	(0.073)	(0.093)	(0.069)	(0.069)	(0.070)	(0.073)
LW Test		p=0.277					
	Dep Var: Age-adjusted death rates (per 1k persons)						
ln(Soybeans values based on IMF prices)	-0.139***	-0.056	-0.057	-0.041	-0.050	-0.049	-0.068
	(0.048)	(0.058)	(0.075)	(0.053)	(0.052)	(0.049)	(0.052)
LW Test		p=0.854					

Notes: FE = county and year fixed effects. FD = first-differences. RFD = rolling first differences. LW test for the equality of FE and FD (Laporte and Windmeijer, 2005). The term "cons" refers to including a constant in the specification. Year-fixed effects are included in all models. Controls include the proportion of commodity planted acreage (%) and neighboring commodity values. Standard errors clustered at the county level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

TABLE IV: TWFE estimation for relationship between mortality rates and commodity values based on state-level prices by rural from 1980 to 2016

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Corn		Soybeans		Corn		Soybeans	
	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
	Dep Var: Crude death rates (per 1k persons)				Age-adjusted death rates (per 1k persons)			
ln(Commodity values based on state-level prices)	–0.313**	–0.223	–0.110	–0.293***	–0.176**	0.142	–0.192***	–0.078
	(0.124)	(0.167)	(0.108)	(0.106)	(0.070)	(0.089)	(0.064)	(0.064)
ln(Neighbor commodity values based on state-level prices)	0.029	–0.161	–0.108	0.258*	0.202**	–0.057	0.133*	0.039
	(0.167)	(0.199)	(0.145)	(0.137)	(0.098)	(0.103)	(0.070)	(0.084)
Proportion of commodity planted acreage (%)	0.065	0.526***	0.068***	0.084*	0.029	0.126**	0.034***	0.019
	(0.042)	(0.174)	(0.022)	(0.047)	(0.031)	(0.062)	(0.007)	(0.011)
Constant	15.650***	14.409***	14.269***	8.849***	8.896***	8.045***	10.315***	10.355***
	(1.567)	(1.842)	(1.209)	(1.386)	(1.010)	(0.974)	(0.519)	(0.690)
Mean of Dep Var	11.147	8.744	11.147	8.744	8.240	8.426	8.240	8.426
Elasticity	–0.028	–0.026	–0.010	–0.034	–0.021	0.017	–0.023	–0.009
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11,137	6,808	11,137	6,808	11,137	6,808	11,137	6,808
R^2	0.061	0.105	0.061	0.096	0.406	0.633	0.408	0.631

Notes: Standard errors clustered at the county level in parentheses. With a 1% increase in commodity revenues, elasticity shows the related percentage change in the mortality rate for every 1,000 individuals. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE V: The effects of corn values based on state-level prices on mortality rates by rural from 1980 to 2016

	(1) FE	(2) FD	(3) Twice FD	(4) RFD (cons)	(5) RFD (no cons)	(6) Twice RFD (cons)	(7) Twice RFD (no cons)
	Dep Var: Crude death rates (per 1k persons)						
Panel A: Rural							
ln(Corn values based on state-level prices)	-0.313**	-0.252**	-0.272**	-0.264**	-0.325***	-0.246**	-0.306***
	(0.124)	(0.108)	(0.133)	(0.102)	(0.097)	(0.101)	(0.097)
LW Test		p=0.037					
Panel B: Urban							
ln(Corn values based on state-level prices)	-0.223	0.027	0.031	0.041	0.017	0.017	0.014
	(0.167)	(0.077)	(0.091)	(0.051)	(0.054)	(0.055)	(0.063)
LW Test		p=0.173					
	Dep Var: Age-adjusted death rates (per 1k persons)						
Panel A: Rural							
ln(Corn values based on state-level prices)	-0.176**	-0.188**	-0.198**	-0.182**	-0.240***	-0.174**	-0.218***
	(0.070)	(0.080)	(0.096)	(0.079)	(0.075)	(0.077)	(0.074)
LW Test		p=0.136					
Panel B: Urban							
ln(Corn values based on state-level prices)	0.142	0.007	0.001	0.028	-0.005	-0.009	-0.012
	(0.089)	(0.064)	(0.079)	(0.044)	(0.049)	(0.053)	(0.059)
LW Test		p=0.002					

Notes: FE = county and year fixed effects. FD = first-differences. RFD = rolling first differences. LW test for the equality of FE and FD (Laporte and Windmeijer, 2005). The term "cons" refers to including a constant in the specification. Year-fixed effects are included in all models. Controls include the proportion of commodity planted acreage (%) and neighboring commodity values. Standard errors clustered at the county level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

TABLE VI: The effects of soybeans values based on state-level prices on mortality rates by rural from 1980 to 2016

	(1) FE	(2) FD	(3) Twice FD	(4) RFD (cons)	(5) RFD (no cons)	(6) Twice RFD (cons)	(7) Twice RFD (no cons)
	Dep Var: Crude death rates (per 1k persons)						
Panel A: Rural							
ln(Soybeans values based on state-level prices)	-0.110	-0.152	-0.188	-0.110	-0.131	-0.188*	-0.220**
	(0.108)	(0.109)	(0.137)	(0.096)	(0.090)	(0.109)	(0.104)
LW Test		p=0.716					
Panel B: Urban							
ln(Soybeans values based on state-level prices)	-0.293***	0.029	0.080	-0.010	0.005	0.070	0.072
	(0.106)	(0.076)	(0.109)	(0.064)	(0.060)	(0.071)	(0.072)
LW Test		p=0.246					
	Dep Var: Age-adjusted death rates (per 1k persons)						
Panel A: Rural							
ln(Soybeans values based on state-level prices)	-0.192***	-0.134	-0.171	-0.078	-0.112	-0.140*	-0.170**
	(0.064)	(0.084)	(0.108)	(0.071)	(0.068)	(0.077)	(0.075)
LW Test		p=0.621					
Panel B: Urban							
ln(Soybeans values based on state-level prices)	-0.078	0.018	0.061	-0.015	-0.001	0.047	0.047
	(0.064)	(0.066)	(0.092)	(0.055)	(0.052)	(0.065)	(0.066)
LW Test		p=0.618					

Notes: FE = county and year fixed effects. FD = first-differences. RFD = rolling first differences. LW test for the equality of FE and FD (Laporte and Windmeijer, 2005). The term "cons" refers to including a constant in the specification. Year-fixed effects are included in all models. Controls include the proportion of commodity planted acreage (%) and neighboring commodity values. Standard errors clustered at the county level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

TABLE VII: TWFE estimation for relationship between mortality rates and commodity values based on IMF prices by rural from 1980 to 2016

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Corn		Soybeans		Corn		Soybeans	
	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
	Dep Var: Crude death rates (per 1k persons)				Age-adjusted death rates (per 1k persons)			
ln(Commodity values based on IMF prices)	–0.327**	–0.226	–0.106	–0.296***	–0.187***	0.133	–0.188***	–0.077
	(0.127)	(0.170)	(0.109)	(0.106)	(0.070)	(0.091)	(0.064)	(0.064)
ln(Neighbor commodity values based on IMF prices)	0.053	–0.154	–0.111	0.263*	0.217**	–0.047	0.128*	0.038
	(0.171)	(0.208)	(0.145)	(0.137)	(0.099)	(0.107)	(0.071)	(0.084)
Proportion of commodity planted acreage (%)	0.067	0.526***	0.068***	0.084*	0.030	0.128**	0.034***	0.019
	(0.041)	(0.174)	(0.022)	(0.047)	(0.030)	(0.061)	(0.007)	(0.011)
Constant	15.475***	14.352***	14.254***	8.825***	8.815***	8.018***	10.322***	10.358***
	(1.574)	(1.861)	(1.205)	(1.381)	(1.014)	(0.974)	(0.518)	(0.687)
Mean of Dep Var	11.147	8.744	11.147	8.744	8.240	8.426	8.240	8.426
Elasticity	–0.029	–0.026	–0.010	–0.034	–0.023	0.016	–0.023	–0.009
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11,137	6,808	11,137	6,808	11,137	6,808	11,137	6,808
R^2	0.061	0.105	0.061	0.096	0.406	0.633	0.408	0.631

Notes: Standard errors clustered at the county level in parentheses. With a 1% increase in commodity revenues, elasticity shows the related percentage change in the mortality rate for every 1,000 individuals. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE VIII: The effects of corn values based on IMF prices on mortality rates by rural from 1980 to 2016

	(1) FE	(2) FD	(3) Twice FD	(4) RFD (cons)	(5) RFD (no cons)	(6) Twice RFD (cons)	(7) Twice RFD (no cons)
	Dep Var: Crude death rates (per 1k persons)						
Panel A: Rural							
ln(Corn values based on IMF prices)	-0.327**	-0.246**	-0.261**	-0.276**	-0.273**	-0.247**	-0.254**
	(0.127)	(0.106)	(0.130)	(0.102)	(0.104)	(0.100)	(0.105)
LW Test		p=0.032					
Panel B: Urban							
ln(Corn values based on IMF prices)	-0.226	0.018	0.021	0.025	0.030	-0.005	0.030
	(0.170)	(0.075)	(0.089)	(0.051)	(0.052)	(0.057)	(0.061)
LW Test		p=0.155					
	Dep Var: Age-adjusted death rates (per 1k persons)						
Panel A: Rural							
ln(Corn values based on IMF prices)	-0.187***	-0.189**	-0.202**	-0.199**	-0.193**	-0.186**	-0.187**
	(0.070)	(0.080)	(0.095)	(0.081)	(0.082)	(0.078)	(0.082)
LW Test		p=0.138					
Panel B: Urban							
ln(Corn values based on IMF prices)	0.133	-0.002	-0.013	0.015	0.019	-0.031	-0.003
	(0.091)	(0.063)	(0.078)	(0.044)	(0.046)	(0.055)	(0.056)
LW Test		p=0.002					

Notes: FE = county and year fixed effects. FD = first-differences. RFD = rolling first differences. LW test for the equality of FE and FD (Laporte and Windmeijer, 2005). The term "cons" refers to including a constant in the specification. Year-fixed effects are included in all models. Controls include the proportion of commodity planted acreage (%) and neighboring commodity values. Standard errors clustered at the county level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

TABLE IX: The effects of soybeans values based on IMF prices on mortality rates by rural from 1980 to 2016

	(1) FE	(2) FD	(3) Twice FD	(4) RFD (cons)	(5) RFD (no cons)	(6) Twice RFD (cons)	(7) Twice RFD (no cons)
	Dep Var: Crude death rates (per 1k persons)						
Panel A: Rural							
ln(Soybeans values based on IMF prices)	-0.106	-0.121	-0.155	-0.095	-0.103	-0.166	-0.186
	(0.109)	(0.110)	(0.136)	(0.100)	(0.099)	(0.112)	(0.117)
LW Test		p=0.611					
Panel B: Urban							
ln(Soybeans values based on IMF prices)	-0.296***	0.041	0.095	0.006	0.015	0.088	0.076
	(0.106)	(0.075)	(0.108)	(0.063)	(0.060)	(0.071)	(0.067)
LW Test		p=0.238					
	Dep Var: Age-adjusted death rates (per 1k persons)						
Panel A: Rural							
ln(Soybeans values based on IMF prices)	-0.188***	-0.112	-0.147	-0.062	-0.088	-0.122	-0.137
	(0.064)	(0.084)	(0.108)	(0.074)	(0.072)	(0.078)	(0.081)
LW Test		p=0.731					
Panel B: Urban							
ln(Soybeans values based on IMF prices)	-0.077	0.030	0.076	-0.003	0.005	0.063	0.049
	(0.064)	(0.065)	(0.091)	(0.054)	(0.049)	(0.064)	(0.060)
LW Test		p=0.588					

Notes: FE = fixed effects. FD = first-differences. RFD = rolling first differences. LW test for the equality of FE and FD (Laporte and Windmeijer, 2005). The term "cons" refers to including a constant in the specification. Year-fixed effects are included in all models. Controls include the proportion of commodity planted acreage (%) and neighboring commodity values. Standard errors clustered at the county level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

TABLE X: Instrumental variables estimation for the impact of commodity values on crude death rates from 1980 to 2016—using drought level as IV

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Corn		Soybeans		Corn		Soybeans	
	IV: Drought level in D4				IV: Drought level in D3 to D4			
	Dep Var: Crude death rates (per 1k persons)							
ln(Commodity values based on state-level prices)		–0.702**		–1.703*		–1.035***		–2.481**
		(0.333)		(0.926)		(0.336)		(1.053)
D4—exceptional drought	–0.582***		–0.240***		–0.586***		–0.242***	
	(0.064)		(0.055)		(0.064)		(0.055)	
D3—extreme drought					–0.119***		–0.052	
					(0.031)		(0.035)	
Proportion of commodity planted acreage (%)	0.319**	0.280**	0.129**	0.270	0.319**	0.386**	0.129**	0.370*
	(0.136)	(0.131)	(0.063)	(0.165)	(0.136)	(0.158)	(0.063)	(0.200)
Mean of Dep Var		10.235		10.235		10.235		10.235
Elasticity		-.069		-.166		-.101		-.242
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17,945	17,945	17,945	17,945	17,945	17,945	17,945	17,945
F-statistic (Weak Instrument Test)	82.232		19.043		48.922		9.637	

Notes: Standard errors clustered at the county level in parentheses. D4— exceptional drought is defined as an annual average PDSI of -5.0 or less, which may cause widespread crop losses. D3—extreme drought is an annual average PDSI between -4.0 to -4.9, which may cause major crop losses. With a 1% increase in commodity revenues, elasticity shows the related percentage change in the mortality rate for every 1,000 individuals. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE XI: Instrumental variables estimation for the impact of commodity values on age-adjusted death rates from 1980 to 2016—using drought level as IV

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Corn		Soybeans		Corn		Soybeans	
	IV: Drought level in D4				IV: Drought level in D3 to D4			
	Dep Var: Age-adjusted death rates (per 1k persons)							
ln(Commodity values based on state-level prices)		–0.281		–0.675		–0.409**		–0.981*
		(0.210)		(0.541)		(0.203)		(0.562)
D4—exceptional drought	–0.582***		–0.240***		–0.586***		–0.242***	
	(0.064)		(0.055)		(0.064)		(0.055)	
D3—extreme drought					–0.119***		–0.052	
					(0.031)		(0.035)	
Proportion of commodity planted acreage (%)	0.319**	0.140*	0.129**	0.105	0.319**	0.180**	0.129**	0.144
	(0.136)	(0.077)	(0.063)	(0.081)	(0.136)	(0.085)	(0.063)	(0.091)
Mean of Dep Var		8.311		8.311		8.311		8.311
Elasticity		-.034		-.081		-.049		-.118
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17,945	17,945	17,945	17,945	17,945	17,945	17,945	17,945
F-statistic (Weak Instrument Test)	82.232		19.043		48.922		9.637	

Notes: Standard errors clustered at the county level in parentheses. D4— exceptional drought is defined as an annual average PDSI of -5.0 or less, which may cause widespread crop losses. D3—extreme drought is an annual average PDSI between -4.0 to -4.9, which may cause major crop losses. With a 1% increase in commodity revenues, elasticity shows the related percentage change in the mortality rate for every 1,000 individuals. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE XII: Instrumental variables estimation for the impact of commodity values on crude death rates from 1980 to 2016—using number of months in drought as IV

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Corn		Soybeans		Corn		Soybeans	
	IV: Number of months in drought D4				IV: Number of months in drought D3 to D4			
	Dep Var: Crude death rates (per 1k persons)							
ln(Commodity values based on state-level prices)		–0.475		–1.498		–0.589***		–0.886**
		(0.295)		(1.143)		(0.226)		(0.377)
Number of months in D4—exceptional drought	–0.053***		–0.016**		–0.041***		–0.007	
	(0.005)		(0.007)		(0.005)		(0.007)	
Number of months in D3—extreme drought					–0.032***		–0.027***	
					(0.003)		(0.005)	
Proportion of commodity planted acreage (%)	0.318**	0.207*	0.129**	0.243	0.319**	0.244**	0.129**	0.165**
	(0.136)	(0.110)	(0.063)	(0.176)	(0.136)	(0.099)	(0.063)	(0.078)
Mean of Dep Var		10.235		10.235		10.235		10.235
Elasticity		-.046		-.146		-.058		-.087
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17,945	17,945	17,945	17,945	17,945	17,945	17,945	17,945
F-statistic (Weak Instrument Test)	98.213		6.064		99.170		17.634	

Notes: Standard errors clustered at the county level in parentheses. Number of months in D4—exceptional drought is defined as the number of months with a monthly PDSI equal to or less than -5.0. Number of months in D3—extreme drought is defined as the number of months with a monthly PDSI between -4.0 to -4.9. With a 1% increase in commodity revenues, elasticity shows the related percentage change in the mortality rate for every 1,000 individuals. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE XIII: Instrumental variables estimation for the impact of commodity values on age-adjusted death rates from 1980 to 2016—using number of months in drought as IV

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Corn		Soybeans		Corn		Soybeans	
	IV: Number of months in drought D4				IV: Number of months in drought D3 to D4			
	Dep Var: Age-adjusted death rates (per 1k persons)							
ln(Commodity values based on state-level prices)		–0.279		–0.872		–0.289*		–0.409
		(0.196)		(0.725)		(0.156)		(0.258)
Number of months in D4—exceptional drought	–0.053***		–0.016**		–0.041***		–0.007	
	(0.005)		(0.007)		(0.005)		(0.007)	
Number of months in D3—extreme drought					–0.032***		–0.027***	
					(0.003)		(0.005)	
Proportion of commodity planted acreage (%)	0.318**	0.139*	0.129**	0.130	0.319**	0.142**	0.129**	0.070*
	(0.136)	(0.075)	(0.063)	(0.108)	(0.136)	(0.065)	(0.063)	(0.041)
Mean of Dep Var		8.311		8.311		8.311		8.311
Elasticity		-.034		-.105		-.035		-.049
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17,945	17,945	17,945	17,945	17,945	17,945	17,945	17,945
F-statistic (Weak Instrument Test)	98.213		6.064		99.170		17.634	

Notes: Standard errors clustered at county level in parentheses. Number of months in D4—exceptional drought is defined as the number of months with a monthly PDSI equal to or less than -5.0. Number of months in D3—extreme drought is defined as the number of months with a monthly PDSI between -4.0 to -4.9. With a 1% increase in commodity revenues, elasticity shows the related percentage change in the mortality rate for every 1,000 individuals. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE XIV: Mediation analysis—estimation for state-level mortality due to CVD and corn values from 1980 to 2016

	(1) FE	(2) FD	(3) Twice FD	(4) RFD (cons)	(5) RFD (no cons)	(6) Twice RFD (cons)	(7) Twice RFD (no cons)
	Dep Var: Crude death rates due to CVD (per 1k persons)						
ln(Corn values based on state-level prices)	0.119	-0.071***	-0.072***	-0.032	-0.034	-0.025	-0.040
	(0.108)	(0.027)	(0.028)	(0.027)	(0.029)	(0.025)	(0.027)
LW Test		p=0.836					
	Dep Var: Age-adjusted death rates due to CVD (per 1k persons)						
ln(Corn values based on state-level prices)	-0.020	-0.064**	-0.068**	-0.028	-0.012	-0.017	-0.035
	(0.037)	(0.026)	(0.026)	(0.022)	(0.023)	(0.022)	(0.023)
LW Test		p=0.000					
	Dep Var: Crude death rates due to CVD (per 1k persons)						
ln(Corn values based on IMF prices)	0.112	-0.065**	-0.065**	-0.008	-0.031	-0.034	-0.031
	(0.101)	(0.026)	(0.028)	(0.023)	(0.027)	(0.022)	(0.024)
LW Test		p=0.775					
	Dep Var: Age-adjusted death rates due to CVD (per 1k persons)						
ln(Corn values based on IMF prices)	-0.031	-0.059**	-0.061**	-0.008	-0.012	-0.029	-0.020
	(0.034)	(0.025)	(0.027)	(0.019)	(0.023)	(0.019)	(0.019)
LW Test		p=0.000					

Notes: CVD represents the mortality due to cardiovascular diseases. FE = state and year fixed effects. FD = first-differences. RFD = rolling first differences. Year-fixed effects are included in all models. Controls include the proportion of corn planted acreage (%) and neighboring corn values. Standard errors, bootstrapped with 1,000 repetitions and clustered at the state level, are presented in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table XV: Mediation analysis—estimation for state-level mortality due to CVD and soybeans values from 1980 to 2016

	(1) FE	(2) FD	(3) Twice FD	(4) RFD (cons)	(5) RFD (no cons)	(6) Twice RFD (cons)	(7) Twice RFD (no cons)
	Dep Var: Crude death rates due to CVD (per 1k persons)						
ln(Soybeans values based on state-level prices)	0.007	-0.055*	-0.049	-0.068**	-0.068**	-0.066**	-0.057
	(0.139)	(0.029)	(0.032)	(0.027)	(0.027)	(0.030)	(0.035)
LW Test		p=0.750					
	Dep Var: Age-adjusted death rates due to CVD (per 1k persons)						
ln(Soybeans values based on state-level prices)	-0.047	-0.047	-0.048	-0.059**	-0.053*	-0.065**	-0.064**
	(0.081)	(0.030)	(0.031)	(0.025)	(0.028)	(0.027)	(0.031)
LW Test		p=0.048					
	Dep Var: Crude death rates due to CVD (per 1k persons)						
ln(Soybeans values based on IMF prices)	0.005	-0.053*	-0.045	-0.058**	-0.058*	-0.062**	-0.077***
	(0.135)	(0.028)	(0.030)	(0.027)	(0.031)	(0.028)	(0.028)
LW Test		p=0.831					
	Dep Var: Age-adjusted death rates due to CVD (per 1k persons)						
ln(Soybeans values based on IMF prices)	-0.050	-0.046	-0.044	-0.047*	-0.047*	-0.065**	-0.078***
	(0.080)	(0.029)	(0.029)	(0.025)	(0.028)	(0.025)	(0.026)
LW Test		p=0.053					

Notes: CVD represents the mortality due to cardiovascular diseases. FE = state and year fixed effects. FD = first-differences. RFD = rolling first differences. LW test for the equality of FE and FD (Laporte and Windmeijer, 2005). The term "cons" refers to including a constant in the specification. Year-fixed effects are included in all models. Controls include the proportion of soybeans planted acreage (%) and neighboring soybeans values. Standard errors, bootstrapped with 1,000 repetitions and clustered at the state level, are presented in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

TABLE A1: Sample statistics of the selected variables

Variables	Mean	Std. Dev.
Outcomes of Interest		
Crude death rates (per 1k persons)	10.24	2.43
Age-adjusted death rates (per 1k persons)	8.31	1.17
Commodity		
State-level corn prices ($/bu)	4.08	1.35
State-level soybeans prices ($/bu)	10.14	2.85
IMF corn prices ($/bu)	4.86	1.49
IMF soybean prices ($/bu)	10.67	2.89
Corn production (100k bu)	137.43	101.23
Soybeans production (100k bu)	33.42	24.30
Corn values based on state-level prices ($100k)	550.56	455.16
Soybeans values based on state-level prices ($100k)	329.63	253.07
Corn values based on IMF prices ($100k)	662.32	546.43
Soybeans values based on IMF prices ($100k)	347.47	267.39
Proportion of corn planted acreage (%)	1.62	1.24
Proportion of soybeans planted acreage (%)	1.74	1.99
Commodity in Neighboring Counties		
Neighbor corn prices ($/bu)	4.49	1.38
Neighbor soybean prices ($/bu)	10.14	2.85
Neighbor corn values based on state-level prices ($100k)	577.14	421.52
Neighbor soybeans values based on state-level prices ($100k)	315.77	211.27
Neighbor corn values based on IMF price ($100k)	630.07	471.59
Neighbor soybeans values based on IMF price ($100k)	333.72	224.72
County Characteristics		
Rural (0/1)	0.62	0.49
Local Disaster		
D4—exceptional drought (0/1)	0.00	0.04

Table A1: Sample statistics of the selected variables

Variables	Mean	Std. Dev.
D3—extreme drought (0/1)	0.01	0.09
Number of months in D4—exceptional drought	0.07	0.51
Number of months in D3—extreme drought	0.22	0.92
Observation (N*T)	17,945	

Note: Price and sales variables are adjusted to 2015 values.

TABLE A2: Sample statistics for mediation and falsification analysis

Variables	Mean	Std. Dev.
For Mediation Analysis		
Crude death rates due to CVD (per 1k persons)	2.720	0.609
Age-adjusted death rates due to CVD (per 1k persons)	2.612	0.811
Crude death rates due to stroke (per 1k persons)	0.394	0.097
Age-adjusted death rates due to stroke (per 1k persons)	0.373	0.113
Crude death rates due to mental issues (per 1k persons)	0.583	0.337
Age-adjusted death rates due to mental issues (per 1k persons)	0.515	0.256
Crude death rates due to suicide (per 1k persons)	0.121	0.019
Age-adjusted death rates due to suicide (per 1k persons)	0.122	0.019
Crude death rates due to drug (per 1k persons)	0.016	0.009
Age-adjusted death rates due to drug (per 1k persons)	0.017	0.009
Crude death rates due to alcohol (per 1k persons)	0.130	0.036
Age-adjusted death rates due to alcohol (per 1k persons)	0.128	0.030
Observation (N*T)	444	
For Falsification Test		
Crude death rates due to infection or birth defect (per 1k persons)	0.187	0.107
Age-adjusted death rates due to infection or birth defect (per 1k persons)	0.175	0.091
Observation (N*T)	8,497	

Note: Price and sales variables are adjusted to 2015 values. We use state-level data for mediation analysis and county-level data for falsification tests. Because of the data suppression, the number of observations for death rates due to drug is 335.

TABLE A3: Definition of Variables

Variables	Description
Outcomes of Interest	
Crude death rates (per 1k persons)	The number of deaths per 1,000 midyear population in the county. Crude death rate = (Number of deaths / Population) * 1,000.
Age-adjusted death rates (per 1k persons)	The weighted average number of age-specific death rates in the county. The weights are retrieved from the population by age group. The age groups include less than 1 year, 1-4, 5-14, 15-24, 25-34, . . . , and 85 years and over. Age-adjusted death rate = Sum of (Age Specific Death Rate * Standard Population weight) *1,000.
Commodity	
State-level corn prices ($/bu)	State-level grain corn prices received, measured in 2015 dollars/bushel.
State-level soybeans prices ($/bu)	State-level soybeans prices received, measured in 2015 dollars/bushel.
IMF corn prices ($/bu)	International corn prices, measured in 2015 dollars/bushel.
IMF soybean prices ($/bu)	International soybean prices, measured in 2015 dollars/bushel.
Corn production (100k bu)	County-level grain corn production, measured in bushel.
Soybeans production (100k bu)	County-level soybeans production, measured in bushel.
Corn values based on state-level prices ($100k)	County-level grain corn values based on state-level prices, measured in 2015 dollars Corn values based on state-level prices = State-level corn prices ($/bu) * corn production (bu)

TABLE A3: Definition of Variables

Variables	Description
Soybeans values based on state-level prices ($100k)	County-level soybeans values based on state-level prices, measured in 2015 dollars. Soybeans values based on state-level prices = State-level soybeans prices ($/bu) * soybeans production (bu)
Corn values based on IMF prices ($100k)	County-level grain corn values based on IMF prices, measured in 2015 dollars. Corn values based on IMF prices = IMF corn prices ($/bu) * Corn production (bu)
Soybeans values based on IMF prices ($100k)	County-level soybeans values based on IMF prices, measured in 2015 dollars. Soybeans values based on IMF prices = IMF soybeans prices ($/bu) * Soybeans production (bu)
Proportion of corn planted acreage (%)	The proportion of state grain corn acreage planted in the county.
Proportion of soybeans planted acreage (%)	The proportion of state soybeans acreage planted in the county.
Commodity in Neighboring Counties	
Neighbor corn prices ($/bu)	Average grain corn prices based on state-level prices in neighboring counties, measured in 2015 dollars.
Neighbor soybean prices ($/bu)	Average soybeans prices based on state-level prices in neighboring counties, measured in 2015 dollars.

TABLE A3: Definition of Variables

Variables	Description
Neighbor corn values based on state-level prices ($100k)	Average grain corn values based on state-level prices in neighboring counties, measured in 2015 dollars.
Neighbor soybeans values based on state-level prices ($100k)	Average soybeans values based on state-level prices in neighboring counties, measured in 2015 dollars.
Neighbor corn values based on IMF prices ($100k)	Average grain corn values based on IMF prices in neighboring counties, measured in 2015 dollars.
Neighbor soybeans values based on IMF prices ($100k)	Average soybeans values based on IMF prices in neighboring counties, measured in 2015 dollars.
County Characteristics	
Rural (0/1)	A county is defined as a rural area if it belongs to nonmetropolitan in 2013, 2006, and 2019 National Center for Health Statistics (NCHS) Urban-Rural Classification Scheme for Counties.
Local Disaster	
D4—exceptional drought (0/1)	Dummy variable of D4—exceptional drought which indicates that the county-level annual average of Palmer Drought Severity Index (PDSI) is -5.0 or less.

TABLE A3: Definition of Variables

Variables	Description
D3—extreme drought (0/1)	Dummy variable of D3—extreme drought which indicates that the county-level annual average of Palmer Drought Severity Index (PDSI) ranges from -4.0 to -4.9.
Number of months in D4 —exceptional drought	Number of months in D4—exceptional drought based on monthly average of PDSI.
Number of months in D3 —extreme drought	Number of months in D3—extreme drought based on monthly average of PDSI.

Table A4: Description for cause-specific mortality

Variables	Description
Deaths due to infection or birth defect	For sample from 1980 to 1998, deaths due to infection or birth defect includes ICD-9 Codes: 001-139 (Infectious and parasitic diseases); 740-759 (Congenital anomalies) For sample from 1999 to 2016, deaths due to infection or birth defect includes ICD-10 Codes: A00-B99 (Certain infectious and parasitic diseases); Q00-Q99 (Congenital malformations, deformations and chromosomal abnormalities)
Deaths due to CVD	For sample from 1980 to 1998, deaths due to CVD includes ICD-9 Codes: 391.8 (Other acute rheumatic heart disease); 391.9 (Acute rheumatic heart disease, unspecified); 393-398 (Chronic rheumatic heart disease); 402.0 (Malignant); 402.1 (Benign); 402.9 (Unspecified); 410-414 (Ischemic heart disease); 415.0 (Acutecor pulmonale); 415.1 (Pulmonary embolism and infarction); 416.0 (Primary pulmonary hypertension); 416.1 (Kyphoscoliotic heart disease); 416.8 (Other chronic pulmonary heart diseases); 416.9 (Chronic pulmonary heart disease, unspecified); 420-429 (Other forms of heart disease); 514 (Pulmonary congestion and hypostasis); 518.4 (Acute edema of lung, unspecified); 642.2 (Other pre-existing hypertension complicating pregnancy, childbirth, and the puerperium); 746.9 (Unspecified anomaly of heart)

TABLE A4: Description for cause-specific mortality

Variables	Description
Deaths due to CVD	For sample from 1999 to 2016, deaths due to CVD includes ICD-10 Codes: A39.5 (Meningococcal heart disease); E05.9 (Thyrotoxicosis, unspecified); I01.8 (Other acute rheumatic heart disease); I01.9 (Acute rheumatic heart disease, unspecified); I05-I09 (Chronic rheumatic heart diseases); I11.0 (Hypertensive heart disease with (congestive) heart failure); I11.9 (Hypertensive heart disease without (congestive) heart failure); I20-I25(Ischaemic heart diseases); I26-I28 (Pulmonary heart disease and diseases of pulmonary circulation); I30-I51 (Other forms of heart disease); J81 (Pulmonary oedema); M41.0 (Infantile idiopathic scoliosis); M41.1 (Juvenile idiopathic scoliosis); M41.2(Other idiopathic scoliosis); M41.3 (Thoracogenic scoliosis); M41.4 (Neuromuscular scoliosis); M41.5 (Other secondary scoliosis); M41.8 (Other forms of scoliosis); M41.9 (Scoliosis, unspecified); O10.1 (Pre-existing hypertensive heart disease complicating pregnancy, childbirth and the puerperium)
Death due to stroke	For sample from 1980 to 1998, deaths due to stroke includes ICD-9 Codes: 436 (Acute, but ill-defined, cerebrovascular disease); 437.0 (Cerebral atherosclerosis); 437.1 (Other generalized ischemic cerebrovascular disease); 437.2 (Hypertensive encephalopathy); 437.3 (Cerebral aneurysm, nonruptured); 437.4 (Cerebral arteritis); 437.5 (Moyamoya disease); 437.6 (Nonpyogenic thrombosis of intracranial venous sinus); 437.8 (Other); 437.9(Unspecified) For sample from 1999 to 2016, deaths due to stroke includes ICD-10 Codes: F01.0 (Vascular dementia of acute onset); I64 (Stroke, not specified as haemorrhage or infarction); I69.4(Sequelae of stroke, not specified as haemorrhage or infarction); X30 (Exposure to excessive natural heat)

Table A4: Description for cause-specific mortality

Variables	Description
Death due to mental issues	For sample from 1980 to 1998, deaths due to mental health issues includes ICD-9 Codes: 290-319 (Mental disorders); 320-389 (Diseases of the nervous system and sense organs) For sample from 1999 to 2016, deaths due to mental health issues includes ICD-10 Codes: F01-F99 (Mental and behavioural disorders); G00-G98 (Diseases of the nervous system)
Deaths due to suicide	For sample from 1980 to 1998, deaths due to suicide includes ICD-9 Codes: E950-E959 (Suicide and self-inflicted injury) For sample from 1999 to 2016, deaths due to suicide includes ICD-10 Codes: F20.4 (Post-schizophrenic depression); F32.3 (Severe depressive episode with psychotic symptoms); F60.3(Emotionally unstable personality disorder); U03.0 (Terrorism involving explosions and fragments); U03.9 (Terrorism by other and unspecified means); X60-X84 (Intentional self-harm)

TABLE A4: Description for cause-specific mortality

Variables	Description
Deaths due to drugs	For sample from 1980 to 1998, deaths due to drugs includes ICD-9 Codes: 292.0 (Drug withdrawal syndrome); 292.1 (Paranoid and/or hallucinatory states induced by drugs); 292.2(Pathological drug intoxication); 292.8 (Other specified drug-induced mental disorders); 292.9 (Unspecified drug-induced mental disorder); 304.0 (Opioid type dependence); 304.1 (Barbiturate and similarly acting sedative or hypnotic dependence); 304.2(Cocaine dependence); 304.3 (Cannabis dependence); 304.4 (Amphetamine and other psychostimulant dependence); 304.5 (Hallucinogen dependence); 304.6 (Other specified drug dependence); 304.7 (Combinations of opioid type drug with any other); 304.8(Combinations of drug dependence excluding opioid type drug); 304.9 (Unspecified drug dependence); 305.0 (Alcohol abuse); 305.1(Tobacco use disorder); 305.2 (Cannabis abuse); 305.3 (Hallucinogen abuse); 305.4 (Barbiturate and similarly acting sedative or hypnotic abuse); 305.5 (Opioid abuse); 305.6 (Cocaine abuse); 305.7 (Amphetamine or related acting sympathomimetic abuse); 305.8(Antidepressant type abuse); 305.9 (Other, mixed, or unspecified drug abuse); 796.0 (Nonspecific abnormal toxicological findings); E950.4 (Other specified drugs and medicinal substances); E950.5 (Unspecified drug or medicinal substance)

TABLE A4: Description for cause-specific mortality

Variables	Description
Deaths due to drug	For sample from 1999 to 2016, deaths due to drugs includes ICD-10 Codes: F11.0 (Mental and behavioural disorders due to use of opioids, acute intoxication); F11.1 (Mental and behavioural disorders due to use of opioids, harmful use); F11.2 (Mental and behavioural disorders due to use of opioids, dependence syndrome); F11.3 (Mental and behavioural disorders due to use of opioids, withdrawal state); F11.4 (Mental and behavioural disorders due to use of opioids, withdrawal state with delirium); F11.5 (Mental and behavioural disorders due to use of opioids, psychotic disorder); F11.6 (Mental and behavioural disorders due to use of opioids, amnesic syndrome); F11.7 (Mental and behavioural disorders due to use of opioids, residual and late-onset psychotic disorder); F11.8 (Mental and behavioural disorders due to use of opioids, other mental and behavioural disorders); F11.9 (Mental and behavioural disorders due to use of opioids, unspecified mental and behavioural disorder); F12.0 (Mental and behavioural disorders due to use of cannabinoids, acute intoxication); F12.1 (Mental and behavioural disorders due to use of cannabinoids, harmful use); F12.2 (Mental and behavioural disorders due to use of cannabinoids, dependence syndrome); F12.3 (Mental and behavioural disorders due to use of cannabinoids, withdrawal state); F12.4 (Mental and behavioural disorders due to use of cannabinoids, withdrawal state with delirium); F12.5(Mental and behavioural disorders due to use of cannabinoids, psychotic disorder); F12.6 (Mental and behavioural disorders due to use of cannabinoids, amnesic syndrome); F12.7 (Mental and behavioural disorders due to use of cannabinoids, residual and late-onset psychotic disorder); F12.8 (Mental and behavioural disorders due to use of cannabinoids, other mental and behavioural disorders); F12.9 (Mental and behavioural disorders due to use of cannabinoids, unspecified mental and behavioural disorder);

TABLE A4: Description for cause-specific mortality

Variables	Description
Deaths due to drugs	F13.0 (Mental and behavioural disorders due to use of sedatives or hypnotics, acute intoxication); F13.1 (Mental and behavioural disorders due to use of sedatives or hypnotics, harmful use); F13.2 (Mental and behavioural disorders due to use of sedatives or hypnotics, dependence syndrome); F13.3 (Mental and behavioural disorders due to use of sedatives or hypnotics, withdrawal state); F13.4 (Mental and behavioural disorders due to use of sedatives or hypnotics, withdrawal state with delirium); F13.5 (Mental and behavioural disorders due to use of sedatives or hypnotics, psychotic disorder); F13.6 (Mental and behavioural disorders due to use of sedatives or hypnotics, amnesic syndrome); F13.7 (Mental and behavioural disorders due to use of sedatives or hypnotics, residual and late-onset psychotic disorder); F13.8 (Mental and behavioural disorders due to use of sedatives or hypnotics, other mental and behavioural disorders); F13.9 (Mental and behavioural disorders due to use of sedatives or hypnotics, unspecified mental and behavioural disorder); F14.0 (Mental and behavioural disorders due to use of cocaine, acute intoxication); F14.1 (Mental and behavioural disorders due to use of cocaine, harmful use); F14.2 (Mental and behavioural disorders due to use of cocaine, dependence syndrome); F14.3 (Mental and behavioural disorders due to use of cocaine, withdrawal state); F14.4 (Mental and behavioural disorders due to use of cocaine, withdrawal state with delirium); F14.5 (Mental and behavioural disorders due to use of cocaine, psychotic disorder); F14.6 (Mental and behavioural disorders due to use of cocaine, amnesic syndrome); F14.7 (Mental and behavioural disorders due to use of cocaine, residual and late-onset psychotic disorder); F14.8 (Mental and behavioural disorders due to use of cocaine, other mental and behavioural disorders); F14.9 (Mental and behavioural disorders due to use of cocaine, unspecified mental and behavioural disorder);

TABLE A4: Description for cause-specific mortality

Variables	Description
Deaths due to drugs	F15.0 (Mental and behavioural disorders due to use of other stimulants, including caffeine, acute intoxication); F15.1 (Mental and behavioural disorders due to use of other stimulants, including caffeine, harmful use); F15.2 (Mental and behavioural disorders due to use of other stimulants, including caffeine, dependence syndrome); F15.3 (Mental and behavioural disorders due to use of other stimulants, including caffeine, withdrawal state); F15.4 (Mental and behavioural disorders due to use of other stimulants, including caffeine, withdrawal state with delirium); F15.5 (Mental and behavioural disorders due to use of other stimulants, including caffeine, psychotic disorder); F15.6 (Mental and behavioural disorders due to use of other stimulants, including caffeine, amnesic syndrome); F15.7 (Mental and behavioural disorders due to use of other stimulants, including caffeine, residual and late-onset psychotic disorder); F15.8 (Mental and behavioural disorders due to use of other stimulants, including caffeine, other mental and behavioural disorders); F15.9 (Mental and behavioural disorders due to use of other stimulants, including caffeine, unspecified mental and behavioural disorder); F16.0 (Mental and behavioural disorders due to use of hallucinogens, acute intoxication); F16.1 (Mental and behavioural disorders due to use of hallucinogens, harmful use); F16.2 (Mental and behavioural disorders due to use of hallucinogens, dependence syndrome); F16.3 (Mental and behavioural disorders due to use of hallucinogens, withdrawal state); F16.4 (Mental and behavioural disorders due to use of hallucinogens, withdrawal state with delirium); F16.5 (Mental and behavioural disorders due to use of hallucinogens, psychotic disorder); F16.6 (Mental and behavioural disorders due to use of hallucinogens, amnesic syndrome); F16.7 (Mental and behavioural disorders due to use of hallucinogens, residual and late-onset psychotic disorder); F16.8 (Mental and behavioural disorders due to use of hallucinogens, other mental and behavioural disorders); F16.9 (Mental and behavioural disorders due to use of hallucinogens, unspecified mental and behavioural disorder);

Table A4: Description for cause-specific mortality

Variables	Description
Deaths due to drugs	F19.0 (Mental and behavioural disorders due to multiple drug use and use of other psychoactive substances, acute intoxication); F19.1 (Mental and behavioural disorders due to multiple drug use and use of other psychoactive substances, harmful use); F19.2 (Mental and behavioural disorders due to multiple drug use and use of other psychoactive substances, dependence syndrome); F19.3 (Mental and behavioural disorders due to multiple drug use and use of other psychoactive substances, withdrawal state); F19.4 (Mental and behavioural disorders due to multiple drug use and use of other psychoactive substances, withdrawal state with delirium); F19.5 (Mental and behavioural disorders due to multiple drug use and use of other psychoactive substances, psychotic disorder); F19.6 (Mental and behavioural disorders due to multiple drug use and use of other psychoactive substances, amnesic syndrome); F19.7 (Mental and behavioural disorders due to multiple drug use and use of other psychoactive substances, residual and late-onset psychotic disorder); F19.8 (Mental and behavioural disorders due to multiple drug use and use of other psychoactive substances, other mental and behavioural disorders); F19.9 (Mental and behavioural disorders due to multiple drug use and use of other psychoactive substances, unspecified mental and behavioural disorder); F55 (Abuse of non-dependence-producing substances); R83.2 (Abnormal level of other drugs, medicaments and biological substances); R84.2 (Abnormal level of other drugs, medicaments and biological substances); R85.2 (Abnormal level of other drugs, medicaments and biological substances); R86.2 (Abnormal level of other drugs, medicaments and biological substances); R87.2 (Abnormal level of other drugs, medicaments and biological substances); R89.2 (Abnormal level of other drugs, medicaments and biological substances); X60 (Intentional self-poisoning by and exposure to nonopioid analgesics, antipyretics and antirheumatics); X61 (Intentional self-poisoning by and exposure to antiepileptic, sedative-hypnotic, antiparkinsonism and psychotropic drugs, not elsewhere classified); X63 (Intentional self-poisoning by and exposure to other drugs acting on the autonomic nervous system); X64 (Intentional self-poisoning by and exposure to other and unspecified drugs, medicaments and biological substances)

Table A4: Description for cause-specific mortality

Variables	Description
Deaths due to alcohol	For sample from 1980 to 1998, deaths due to alcohol includes ICD-9 Codes: 291.0 (Alcohol withdrawal delirium); 291.1 (Alcohol amnestic syndrome); 291.2 (Other alcoholic dementia); 291.3 (Alcohol withdrawal hallucinosis); 291.4 (Idiosyncratic alcohol intoxication); 291.5 (Alcoholic jealousy); 291.8 (Other specified alcoholic psychosis); 291.9 (Unspecified alcoholic psychosis); 293.0 (Acute delirium); 293.1 (Subacute delirium); 293.8 (Other specified transient organic mental disorders); 293.9 (Unspecified transient organic mental disorder); 294.0 (Amnestic syndrome); 297.0 (Paranoid state, simple); 297.1 (Paranoia); 297.2 (Paraphrenia); 297.3 (Shared paranoid disorder); 297.8 (Other specified paranoid states); 297.9 (Unspecified paranoid state); 301.0 (Paranoid personality disorder); 303 (Alcohol dependence syndrome); 305.0 (Alcohol abuse); 305.1 (Tobacco use disorder); 305.2 (Cannabis abuse); 305.3 (Hallucinogen abuse); 305.4 (Barbiturate and similarly acting sedative or hypnotic abuse); 305.5 (Opioid abuse); 305.6 (Cocaine abuse); 305.7(Amphetamine or related acting sympathomimetic abuse); 305.8 (Antidepressant type abuse); 305.9 (Other, mixed, or unspecified drug abuse); 357.5 (Alcoholic polyneuropathy); 425.5 (Alcoholic cardiomyopathy); 535.3 (Alcoholic gastritis); 571.0 (Alcoholic fatty liver); 571.1 (Acute alcoholic hepatitis); 571.2 (Alcoholic cirrhosis of liver); 571.3 (Alcoholic liver damage, unspecified); 571.5 (Cirrhosis of liver without mention of alcohol); 571.8 (Other chronic nonalcoholic liver disease); 571.9 (Unspecified chronic liver disease without mention of alcohol); 790.3 (Excessive blood level of alcohol); 796.0 (Nonspecific abnormal toxicological findings); E860.0 (Alcoholic beverages); E860.1 (Other and unspecified ethyl alcohol and its products); E860.2 (Methyl alcohol); E860.3 (Isopropyl alcohol); E860.4 (Fusel oil); E860.8 (Other specified alcohols); E860.9 (Unspecified alcohol); E947.3 (Alcohol deterrents)

TABLE A4: Description for cause-specific mortality

Variables	Description
Deaths due to alcohol	For sample from 1980 to 1998, deaths due to alcohol includes ICD-10 Codes: E24.4 (Alcohol-induced pseudo-Cushing syndrome); F10.0 (Mental and behavioural disorders due to use of alcohol, acute intoxication); F10.1 (Mental and behavioural disorders due to use of alcohol, harmful use); F10.2 (Mental and behavioural disorders due to use of alcohol, dependence syndrome); F10.3 (Mental and behavioural disorders due to use of alcohol, withdrawal state); F10.4 (Mental and behavioural disorders due to use of alcohol, withdrawal state with delirium); F10.5 (Mental and behavioural disorders due to use of alcohol, psychotic disorder); F10.6 (Mental and behavioural disorders due to use of alcohol, amnesic syndrome); F10.7 (Mental and behavioural disorders due to use of alcohol, residual and late-onset psychotic disorder); F10.8 (Mental and behavioural disorders due to use of alcohol, other mental and behavioural disorders); F10.9 (Mental and behavioural disorders due to use of alcohol, unspecified mental and behavioural disorder); G31.2 (Degeneration of nervous system due to alcohol); G62.1 (Alcoholic polyneuropathy); G72.1 (Alcoholic myopathy); I42.6 (Alcoholic cardiomyopathy); K29.2(Alcoholic gastritis); K70.0 (Alcoholic fatty liver); K70.1 (Alcoholic hepatitis); K70.2 (Alcoholic fibrosis and sclerosis of liver); K70.3 (Alcoholic cirrhosis of liver); K70.4 (Alcoholic hepatic failure); K70.9 (Alcoholic liver disease, unspecified);K71.0 (Toxic liver disease with cholestasis); K71.1 (Toxic liver disease with hepatic necrosis); K71.2 (Toxic liver disease with acute hepatitis); K71.3 (Toxic liver disease with chronic persistent hepatitis); K71.4 (Toxic liver disease with chronic lobular hepatitis); K71.5 (Toxic liver disease with chronic active hepatitis); K71.6 (Toxic liver disease with hepatitis, not elsewhere classified); K71.7 (Toxic liver disease with fibrosis and cirrhosis of liver); K71.8 (Toxic liver disease with other disorders of liver); K71.9 (Toxic liver disease, unspecified); K72.0 (Acute and subacute hepatic failure); K72.1 (Chronic hepatic failure); K72.9 (Hepatic failure, unspecified);

TABLE A4: Description for cause-specific mortality

Variables	Description
Deaths due to alcohol	K73.0 (Chronic persistent hepatitis, not elsewhere classified); K73.1 (Chronic lobular hepatitis, not elsewhere classified); K73.2 (Chronic active hepatitis, not elsewhere classified); K73.8 (Other chronic hepatitis, not elsewhere classified); K73.9 (Chronic hepatitis, unspecified); K74.0 (Hepatic fibrosis); K74.1 (Hepatic sclerosis); K74.2 (Hepatic fibrosis with hepatic sclerosis); K74.3 (Primary biliary cirrhosis); K74.4 (Secondary biliary cirrhosis); K74.5 (Biliary cirrhosis, unspecified); K74.6 (Other and unspecified cirrhosis of liver); K76.0 (Fatty (change of) liver, not elsewhere classified); K76.1 (Chronic passive congestion of liver); K76.2 (Central haemorrhagic necrosis of liver); K76.3 (Infarction of liver); K76.4 (Peliosis hepatis); K76.5 (Hepatic veno-occlusive disease); K76.6 (Portal hypertension); K76.7 (Hepatorenal syndrome); K76.8 (Other specified diseases of liver); K76.9 (Liver disease, unspecified); K85.2 (Alcohol-induced acute pancreatitis); K86.0 (Alcohol-induced chronic pancreatitis); R78.0 (Finding of alcohol in blood); X45 (Accidental poisoning by and exposure to alcohol); X65 (Intentional self-poisoning by and exposure to alcohol); Y15 (Poisoning by and exposure to alcohol, undetermined intent); Y57.3 (Alcohol deterrents)

TABLE A5: Robustness checks for relationship between crude death rates and corn values based on state-level prices from 1980 to 2016

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
				Corn			
				Dep Var: Crude death rates (per 1k persons)			
ln(Commodity values based on state-level prices)	–0.232**	–0.261***	–0.245**	–0.147**	–0.189***	–0.224**	–0.242**
	(0.097)	(0.096)	(0.097)	(0.059)	(0.064)	(0.098)	(0.099)
ln(Neighbor commodity values based on state-level prices)	–0.077	–0.067	–0.166	–0.129**	–0.163**	–0.012	–0.054
	(0.128)	(0.103)	(0.109)	(0.065)	(0.071)	(0.102)	(0.106)
Proportion of commodity planted acreage (%)	0.140***	0.168***	0.172***	0.040	0.073	0.134***	0.143***
	(0.049)	(0.055)	(0.056)	(0.044)	(0.053)	(0.047)	(0.048)
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	No	No	No	No	No	No
Linear time trend	No	Yes	No	No	No	No	No
Quadratic time trend	No	No	Yes	No	No	No	No
County specific linear time trend	No	No	No	Yes	No	No	No
County specific quadratic trend	No	No	No	No	Yes	No	No
State specific linear trend	No	No	No	No	No	Yes	No
State specific quadratic trend	No	No	No	No	No	No	Yes
Observations	17,945	17,945	17,945	17,945	17,945	17,945	17,945
R^2	0.063	0.027	0.029	0.246	0.307	0.064	0.076

Notes: Standard errors clustered at the county level in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table A6: Robustness checks for relationship between crude death rates and soybeans values based on state-level prices from 1980 to 2016

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Soybeans						
	Dep Var: Crude death rates (per 1k persons)						
ln(Commodity values based on state-level prices)	–0.176**	–0.170**	–0.170**	–0.132*	–0.186**	–0.165**	–0.171**
	(0.080)	(0.080)	(0.081)	(0.073)	(0.074)	(0.071)	(0.070)
ln(Neighbor commodity values based on state-level prices)	0.020	–0.062	–0.062	–0.125*	–0.108	0.055	0.088
	(0.107)	(0.096)	(0.101)	(0.074)	(0.075)	(0.087)	(0.090)
Proportion of commodity planted acreage (%)	0.072***	0.082***	0.082***	0.058***	0.054***	0.068***	0.066***
	(0.024)	(0.026)	(0.026)	(0.019)	(0.020)	(0.023)	(0.023)
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	No	No	No	No	No	No
Linear time trend	No	Yes	No	No	No	No	No
Quadratic time trend	No	No	Yes	No	No	No	No
County specific linear time trend	No	No	No	Yes	No	No	No
County specific quadratic trend	No	No	No	No	Yes	No	No
State specific linear trend	No	No	No	No	No	Yes	No
State specific quadratic trend	No	No	No	No	No	No	Yes
Observations	17,945	17,945	17,945	17,945	17,945	17,945	17,945
R^2	0.064	0.021	0.021	0.241	0.301	0.058	0.069

Notes: Standard errors clustered at the county level in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table A7: Robustness checks for relationship between age-adjusted death rates and corn values based on state-level prices from 1980 to 2016

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Corn						
	Dep Var: Age-adjusted death rates (per 1k persons)						
ln(Commodity values based on state-level prices)	–0.019	–0.059	–0.043	–0.221***	–0.209***	–0.084	–0.079
	(0.062)	(0.064)	(0.065)	(0.048)	(0.053)	(0.058)	(0.057)
ln(Neighbor commodity values based on state-level prices)	0.093	0.021	–0.083	0.114**	–0.041	0.032	–0.089
	(0.079)	(0.068)	(0.072)	(0.049)	(0.055)	(0.060)	(0.061)
Proportion of commodity planted acreage (%)	0.043*	0.080***	0.084***	–0.005	0.007	0.085**	0.103***
	(0.023)	(0.025)	(0.026)	(0.041)	(0.065)	(0.033)	(0.031)
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	No	No	No	No	No	No
Linear time trend	No	Yes	No	No	No	No	No
Quadratic time trend	No	No	Yes	No	No	No	No
County specific linear time trend	No	No	No	Yes	No	No	No
County specific quadratic trend	No	No	No	No	Yes	No	No
State specific linear trend	No	No	No	No	No	Yes	No
State specific quadratic trend	No	No	No	No	No	No	Yes
Observations	17,945	17,945	17,945	17,945	17,945	17,945	17,945
R^2	0.483	0.461	0.464	0.506	0.536	0.469	0.474

Notes: Standard errors clustered at the county level in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE A8: Robustness checks for relationship between age-adjusted death rates and soybeans values based on state-level prices from 1980 to 2016

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Soybeans						
	Dep Var: Age-adjusted death rates (per 1k persons)						
ln(Commodity values based on state-level prices)	–0.143***	–0.167***	–0.141***	–0.284***	–0.290***	–0.108***	–0.096**
	(0.048)	(0.048)	(0.048)	(0.097)	(0.110)	(0.040)	(0.040)
ln(Neighbor commodity values based on state-level prices)	0.098*	0.129**	0.060	0.127*	–0.007	0.103**	0.026
	(0.056)	(0.053)	(0.053)	(0.077)	(0.083)	(0.046)	(0.048)
Proportion of commodity planted acreage (%)	0.031***	0.034***	0.035***	0.068**	0.077**	0.016	0.023*
	(0.007)	(0.007)	(0.008)	(0.031)	(0.034)	(0.014)	(0.014)
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	No	No	No	No	No	No
Linear time trend	No	Yes	No	No	No	No	No
Quadratic time trend	No	No	Yes	No	No	No	No
County specific linear time trend	No	No	No	Yes	No	No	No
County specific quadratic trend	No	No	No	No	Yes	No	No
State specific linear trend	No	No	No	No	No	Yes	No
State specific quadratic trend	No	No	No	No	No	No	Yes
Observations	17,945	17,945	17,945	17,945	17,945	17,945	17,945
R^2	0.484	0.462	0.464	0.508	0.537	0.468	0.471

Notes: Standard errors clustered at the county level in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE A9: Robustness checks for relationship between crude death rates and corn values based on IMF prices from 1980 to 2016

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
				Corn			
			Dep Var: Crude death rates (per 1k persons)				
ln(Commodity values based on IMF prices)	–0.238**	–0.268***	–0.251**	–0.137**	–0.176***	–0.215**	–0.230**
	(0.100)	(0.098)	(0.099)	(0.060)	(0.065)	(0.100)	(0.100)
ln(Neighbor commodity values based on IMF prices)	–0.064	–0.029	–0.108	–0.105	–0.120*	0.008	–0.018
	(0.132)	(0.104)	(0.109)	(0.065)	(0.070)	(0.103)	(0.106)
Proportion of commodity planted acreage (%)	0.141***	0.168***	0.170***	0.040	0.075	0.131***	0.138***
	(0.048)	(0.054)	(0.054)	(0.044)	(0.054)	(0.046)	(0.047)
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	No	No	No	No	No	No
Linear time trend	No	Yes	No	No	No	No	No
Quadratic time trend	No	No	Yes	No	No	No	No
County specific linear time trend	No	No	No	Yes	No	No	No
County specific quadratic trend	No	No	No	No	Yes	No	No
State specific linear trend	No	No	No	No	No	Yes	No
State specific quadratic trend	No	No	No	No	No	No	Yes
Observations	17,945	17,945	17,945	17,945	17,945	17,945	17,945
R^2	0.063	0.025	0.027	0.244	0.305	0.062	0.074

Notes: Standard errors clustered at the county level in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE A10: Robustness checks for relationship between crude death rates and soybeans values based on IMF prices from 1980 to 2016

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Soybeans						
	Dep Var: Crude death rates (per 1k persons)						
ln(Commodity values based on IMF prices)	–0.175**	–0.167**	–0.167**	–0.120	–0.166**	–0.159**	–0.162**
	(0.080)	(0.080)	(0.081)	(0.074)	(0.076)	(0.071)	(0.070)
ln(Neighbor commodity values based on IMF prices)	0.020	–0.059	–0.060	–0.126*	–0.114	0.050	0.077
	(0.107)	(0.095)	(0.099)	(0.074)	(0.074)	(0.086)	(0.088)
Proportion of commodity planted acreage (%)	0.072***	0.081***	0.081***	0.057***	0.053***	0.067***	0.065***
	(0.024)	(0.026)	(0.026)	(0.019)	(0.020)	(0.023)	(0.023)
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	No	No	No	No	No	No
Linear time trend	No	Yes	No	No	No	No	No
Quadratic time trend	No	No	Yes	No	No	No	No
County specific linear time trend	No	No	No	Yes	No	No	No
County specific quadratic trend	No	No	No	No	Yes	No	No
State specific linear trend	No	No	No	No	No	Yes	No
State specific quadratic trend	No	No	No	No	No	No	Yes
Observations	17,945	17,945	17,945	17,945	17,945	17,945	17,945
R^2	0.064	0.021	0.021	0.241	0.301	0.058	0.069

Notes: Standard errors clustered at the county level in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table A11: Robustness checks for relationship between age-adjusted death rates and corn values based on IMF prices from 1980 to 2016

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Corn						
	Dep Var: Age-adjusted death rates (per 1k persons)						
ln(Commodity values based on IMF prices)	–0.031	–0.055	–0.034	–0.210***	–0.184***	–0.071	–0.060
	(0.063)	(0.064)	(0.066)	(0.050)	(0.055)	(0.059)	(0.057)
ln(Neighbor commodity values based on IMF prices)	0.108	0.021	–0.077	0.110**	–0.039	0.023	–0.090
	(0.080)	(0.068)	(0.072)	(0.050)	(0.056)	(0.060)	(0.060)
Proportion of commodity planted acreage (%)	0.045**	0.079***	0.082***	–0.006	0.007	0.082**	0.099***
	(0.023)	(0.025)	(0.025)	(0.041)	(0.067)	(0.033)	(0.030)
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	No	No	No	No	No	No
Linear time trend	No	Yes	No	No	No	No	No
Quadratic time trend	No	No	Yes	No	No	No	No
County specific linear time trend	No	No	No	Yes	No	No	No
County specific quadratic trend	No	No	No	No	Yes	No	No
State specific linear trend	No	No	No	No	No	Yes	No
State specific quadratic trend	No	No	No	No	No	No	Yes
Observations	17,945	17,945	17,945	17,945	17,945	17,945	17,945
R^2	0.483	0.461	0.464	0.506	0.535	0.468	0.473

Notes: Standard errors clustered at the county level in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table A12: Robustness checks for relationship between age-adjusted death rates and soybeans values based on IMF prices from 1980 to 2016

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Soybeans						
	Dep Var: Age-adjusted death rates (per 1k persons)						
ln(Commodity values based on IMF prices)	–0.139***	–0.159***	–0.132***	–0.271***	–0.272**	–0.101**	–0.089**
	(0.048)	(0.048)	(0.048)	(0.098)	(0.111)	(0.040)	(0.040)
ln(Neighbor commodity values based on IMF prices)	0.094*	0.115**	0.043	0.111	–0.023	0.085*	0.006
	(0.056)	(0.053)	(0.053)	(0.078)	(0.085)	(0.046)	(0.047)
Proportion of commodity planted acreage (%)	0.031***	0.034***	0.034***	0.066**	0.076**	0.017	0.024*
	(0.007)	(0.007)	(0.008)	(0.031)	(0.034)	(0.014)	(0.014)
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	No	No	No	No	No	No
Linear time trend	No	Yes	No	No	No	No	No
Quadratic time trend	No	No	Yes	No	No	No	No
County specific linear time trend	No	No	No	Yes	No	No	No
County specific quadratic trend	No	No	No	No	Yes	No	No
State specific linear trend	No	No	No	No	No	Yes	No
State specific quadratic trend	No	No	No	No	No	No	Yes
Observations	17,945	17,945	17,945	17,945	17,945	17,945	17,945
R^2	0.484	0.462	0.464	0.508	0.537	0.468	0.471

Notes: Standard errors clustered at the county level in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE A13: Robustness checks for relationship between crude death rates and corn values based on state-level prices in rural from 1980 to 2016

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Corn						
	Rural						
	Dep Var: Crude death rates (per 1k persons)						
ln(Commodity values based on state-level prices)	–0.313**	–0.343***	–0.341***	–0.184**	–0.261***	–0.317**	–0.342**
	(0.124)	(0.122)	(0.122)	(0.086)	(0.095)	(0.135)	(0.134)
ln(Neighbor commodity values based on state-level prices)	0.029	–0.036	–0.046	–0.174*	–0.085	0.002	0.046
	(0.167)	(0.134)	(0.140)	(0.095)	(0.106)	(0.142)	(0.144)
Proportion of commodity planted acreage (%)	0.065	0.094**	0.095**	–0.000	0.059	0.077**	0.086**
	(0.042)	(0.040)	(0.040)	(0.049)	(0.061)	(0.039)	(0.037)
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	No	No	No	No	No	No
Linear time trend	No	Yes	No	No	No	No	No
Quadratic time trend	No	No	Yes	No	No	No	No
County specific linear time trend	No	No	No	Yes	No	No	No
County specific quadratic trend	No	No	No	No	Yes	No	No
State specific linear trend	No	No	No	No	No	Yes	No
State specific quadratic trend	No	No	No	No	No	No	Yes
Observations	11,137	11,137	11,137	11,137	11,137	11,137	11,137
R^2	0.061	0.026	0.026	0.193	0.248	0.051	0.062

Notes: Standard errors clustered at the county level in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE A14: Robustness checks for relationship between crude death rates and corn values based on state-level prices in urban from 1980 to 2016

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Corn						
	Urban						
	Dep Var: Crude death rates (per 1k persons)						
ln(Commodity values based on state-level prices)	–0.223	–0.222	–0.223	–0.084	–0.089	–0.036	–0.073
	(0.167)	(0.170)	(0.166)	(0.068)	(0.064)	(0.121)	(0.125)
ln(Neighbor commodity values based on state-level prices)	–0.161	–0.031	–0.240	–0.060	–0.266***	–0.101	–0.260*
	(0.199)	(0.173)	(0.178)	(0.079)	(0.078)	(0.128)	(0.134)
Proportion of commodity planted acreage (%)	0.526***	0.563***	0.568***	0.246***	0.151**	0.251**	0.241**
	(0.174)	(0.173)	(0.168)	(0.087)	(0.065)	(0.097)	(0.098)
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	No	No	No	No	No	No
Linear time trend	No	Yes	No	No	No	No	No
Quadratic time trend	No	No	Yes	No	No	No	No
County specific linear time trend	No	No	No	Yes	No	No	No
County specific quadratic trend	No	No	No	No	Yes	No	No
State specific linear trend	No	No	No	No	No	Yes	No
State specific quadratic trend	No	No	No	No	No	No	Yes
Observations	6,808	6,808	6,808	6,808	6,808	6,808	6,808
R^2	0.105	0.047	0.067	0.413	0.483	0.153	0.179

Notes: Standard errors clustered at the county level in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE A15: Robustness checks for relationship between crude death rates and soybeans values based on state-level prices in rural from 1980 to 2016

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
				Soybeans			
				Rural			
				Dep Var: Crude death rates (per 1k persons)			
ln(Commodity values based on state-level prices)	–0.110	–0.089	–0.112	–0.093	–0.211**	–0.091	–0.109
	(0.108)	(0.109)	(0.110)	(0.104)	(0.105)	(0.096)	(0.094)
ln(Neighbor commodity values based on state-level prices)	–0.108	–0.235*	–0.175	–0.268**	–0.113	–0.114	–0.013
	(0.145)	(0.132)	(0.138)	(0.108)	(0.110)	(0.119)	(0.123)
Proportion of commodity planted acreage (%)	0.068***	0.082***	0.080***	0.075***	0.070***	0.062**	0.054**
	(0.022)	(0.029)	(0.028)	(0.020)	(0.019)	(0.029)	(0.025)
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	No	No	No	No	No	No
Linear time trend	No	Yes	No	No	No	No	No
Quadratic time trend	No	No	Yes	No	No	No	No
County specific linear time trend	No	No	No	Yes	No	No	No
County specific quadratic trend	No	No	No	No	Yes	No	No
State specific linear trend	No	No	No	No	No	Yes	No
State specific quadratic trend	No	No	No	No	No	No	Yes
Observations	11,137	11,137	11,137	11,137	11,137	11,137	11,137
R^2	0.061	0.020	0.021	0.187	0.245	0.042	0.055

Notes: Standard errors clustered at the county level in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE A16: Robustness checks for relationship between crude death rates and soybeans values based on state-level prices in urban from 1980 to 2016

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Soybeans						
	Urban						
	Dep Var: Crude death rates (per 1k persons)						
ln(Commodity values based on state-level prices)	–0.293***	–0.313***	–0.274**	–0.167***	–0.120**	–0.236**	–0.225**
	(0.106)	(0.104)	(0.108)	(0.064)	(0.057)	(0.095)	(0.096)
ln(Neighbor commodity values based on state-level prices)	0.258*	0.246**	0.143	0.104	–0.104	0.248**	0.158
	(0.137)	(0.115)	(0.125)	(0.071)	(0.065)	(0.100)	(0.104)
Proportion of commodity planted acreage (%)	0.084*	0.091*	0.089*	0.023	0.021	0.059**	0.067**
	(0.047)	(0.049)	(0.049)	(0.024)	(0.033)	(0.024)	(0.026)
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	No	No	No	No	No	No
Linear time trend	No	Yes	No	No	No	No	No
Quadratic time trend	No	No	Yes	No	No	No	No
County specific linear time trend	No	No	No	Yes	No	No	No
County specific quadratic trend	No	No	No	No	Yes	No	No
State specific linear trend	No	No	No	No	No	Yes	No
State specific quadratic trend	No	No	No	No	No	No	Yes
Observations	6,808	6,808	6,808	6,808	6,808	6,808	6,808
R^2	0.096	0.033	0.038	0.409	0.470	0.151	0.168

Notes: Standard errors clustered at the county level in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE A17: Robustness checks for relationship between age-adjusted death rates and corn values based on state-level prices in rural from 1980 to 2016

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Corn						
	Rural						
	Dep Var: Age-adjusted death rates (per 1k persons)						
ln(Commodity values based on state-level prices)	–0.176**	–0.227***	–0.196***	–0.339***	–0.301***	–0.200***	–0.182**
	(0.070)	(0.069)	(0.071)	(0.067)	(0.075)	(0.071)	(0.071)
ln(Neighbor commodity values based on state-level prices)	0.202**	0.201***	0.073	0.247***	0.061	0.178**	0.038
	(0.098)	(0.075)	(0.081)	(0.069)	(0.080)	(0.074)	(0.075)
Proportion of commodity planted acreage (%)	0.029	0.055**	0.059***	–0.023	–0.010	0.043*	0.065***
	(0.031)	(0.023)	(0.021)	(0.044)	(0.076)	(0.025)	(0.020)
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	No	No	No	No	No	No
Linear time trend	No	Yes	No	No	No	No	No
Quadratic time trend	No	No	Yes	No	No	No	No
County specific linear time trend	No	No	No	Yes	No	No	No
County specific quadratic trend	No	No	No	No	Yes	No	No
State specific linear trend	No	No	No	No	No	Yes	No
State specific quadratic trend	No	No	No	No	No	No	Yes
Observations	11,137	11,137	11,137	11,137	11,137	11,137	11,137
R^2	0.406	0.385	0.389	0.412	0.444	0.391	0.397

Notes: Standard errors clustered at the county level in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table A18: Robustness checks for relationship between age-adjusted death rates and corn values based on state-level prices in urban from 1980 to 2016

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Corn						
	Urban						
	Dep Var: Age-adjusted death rates (per 1k persons)						
ln(Commodity values based on state-level prices)	0.142	0.085	0.085	–0.078*	–0.082	0.001	–0.011
	(0.089)	(0.096)	(0.100)	(0.047)	(0.054)	(0.075)	(0.079)
ln(Neighbor commodity values based on state-level prices)	–0.057	–0.175*	–0.255**	–0.056	–0.177***	–0.122	–0.224**
	(0.103)	(0.099)	(0.105)	(0.055)	(0.061)	(0.082)	(0.088)
Proportion of commodity planted acreage (%)	0.126**	0.198***	0.200***	0.124**	0.103*	0.223***	0.242***
	(0.062)	(0.071)	(0.070)	(0.055)	(0.055)	(0.062)	(0.066)
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	No	No	No	No	No	No
Linear time trend	No	Yes	No	No	No	No	No
Quadratic time trend	No	No	Yes	No	No	No	No
County specific linear time trend	No	No	No	Yes	No	No	No
County specific quadratic trend	No	No	No	No	Yes	No	No
State specific linear trend	No	No	No	No	No	Yes	No
State specific quadratic trend	No	No	No	No	No	No	Yes
Observations	6,808	6,808	6,808	6,808	6,808	6,808	6,808
R^2	0.633	0.609	0.611	0.670	0.694	0.618	0.624

Notes: Standard errors clustered at the county level in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE A19: Robustness checks for relationship between age-adjusted death rates and soybeans values based on state-level prices in rural from 1980 to 2016

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Soybeans						
	Rural						
	Dep Var: Age-adjusted death rates (per 1k persons)						
ln(Commodity values based on state-level prices)	–0.192***	–0.225***	–0.195***	–0.347**	–0.362**	–0.153***	–0.141***
	(0.064)	(0.065)	(0.064)	(0.137)	(0.146)	(0.049)	(0.048)
ln(Neighbor commodity values based on state-level prices)	0.133*	0.185***	0.104	0.157	0.002	0.158***	0.067
	(0.070)	(0.069)	(0.068)	(0.111)	(0.117)	(0.056)	(0.057)
Proportion of commodity planted acreage (%)	0.034***	0.037***	0.039***	0.065*	0.066*	0.012	0.022
	(0.007)	(0.007)	(0.008)	(0.037)	(0.036)	(0.018)	(0.017)
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	No	No	No	No	No	No
Linear time trend	No	Yes	No	No	No	No	No
Quadratic time trend	No	No	Yes	No	No	No	No
County specific linear time trend	No	No	No	Yes	No	No	No
County specific quadratic trend	No	No	No	No	Yes	No	No
State specific linear trend	No	No	No	No	No	Yes	No
State specific quadratic trend	No	No	No	No	No	No	Yes
Observations	11,137	11,137	11,137	11,137	11,137	11,137	11,137
R^2	0.408	0.387	0.389	0.415	0.449	0.391	0.395

Notes: Standard errors clustered at the county level in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE A20: Robustness checks for relationship between age-adjusted death rates and soybeans values based on state-level prices in urban from 1980 to 2016

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Soybeans						
	Urban						
	Dep Var: Age-adjusted death rates (per 1k persons)						
ln(Commodity values based on state-level prices)	–0.078	–0.089	–0.069	–0.150***	–0.111**	–0.052	–0.036
	(0.064)	(0.062)	(0.063)	(0.048)	(0.053)	(0.057)	(0.056)
ln(Neighbor commodity values based on state-level prices)	0.039	0.040	–0.011	0.063	–0.042	0.028	–0.031
	(0.084)	(0.074)	(0.078)	(0.052)	(0.054)	(0.064)	(0.065)
Proportion of commodity planted acreage (%)	0.019	0.021*	0.020	0.072	0.098	0.030**	0.031***
	(0.011)	(0.012)	(0.012)	(0.052)	(0.063)	(0.013)	(0.012)
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	No	No	No	No	No	No
Linear time trend	No	Yes	No	No	No	No	No
Quadratic time trend	No	No	Yes	No	No	No	No
County specific linear time trend	No	No	No	Yes	No	No	No
County specific quadratic trend	No	No	No	No	Yes	No	No
State specific linear trend	No	No	No	No	No	Yes	No
State specific quadratic trend	No	No	No	No	No	No	Yes
Observations	6,808	6,808	6,808	6,808	6,808	6,808	6,808
R^2	0.631	0.606	0.607	0.669	0.690	0.614	0.617

Notes: Standard errors clustered at the county level in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE A21: TWFE spatial autoregressive results for relationship between commodity values and mortality rate

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Corn		Soybeans		Corn		Soybeans	
	Dep Var: Crude death rates (per 1k persons)				Age-adjusted death rates (per 1k persons)			
ln(Commodity values based on state-level prices)	–0.163***		–0.115***		0.033		–0.093***	
	(0.030)		(0.020)		(0.021)		(0.014)	
ln(Commodity values based on IMF prices)		–0.164***		–0.114***		0.032		–0.092***
		(0.030)		(0.020)		(0.020)		(0.014)
Proportion of commodity planted acreage (%)	0.091***	0.091***	0.060***	0.060***	0.035**	0.036**	0.029***	0.029***
	(0.025)	(0.025)	(0.008)	(0.008)	(0.017)	(0.017)	(0.006)	(0.006)
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17,945	17,945	17,945	17,945	17,945	17,945	17,945	17,945
Number of counties	4850	4850	4850	4850	4850	4850	4850	4850

Notes: Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE A22: Mediation analysis—estimation for state-level mortality due to stroke and corn values from 1980 to 2016

	(1) FE	(2) FD	(3) Twice FD	(4) RFD (cons)	(5) RFD (no cons)	(6) Twice RFD (cons)	(7) Twice RFD (no cons)
	Dep Var: Crude death rates due to stroke (per 1k persons)						
ln(Corn values based on state-level prices)	0.036	-0.016*	-0.018**	-0.006	-0.003	-0.008	-0.002
	(0.022)	(0.009)	(0.008)	(0.008)	(0.008)	(0.008)	(0.007)
LW Test		p=0.329					
	Dep Var: Age-adjusted death rates due to stroke (per 1k persons)						
ln(Corn values based on state-level prices)	0.013	-0.012	-0.013*	-0.009	-0.009	-0.008	-0.003
	(0.014)	(0.007)	(0.007)	(0.007)	(0.007)	(0.008)	(0.007)
LW Test		p=0.274					
	Dep Var: Crude death rates due to stroke (per 1k persons)						
ln(Corn values based on IMF prices)	0.034*	-0.013	-0.017**	-0.002	-0.005	-0.007	0.003
	(0.020)	(0.008)	(0.008)	(0.007)	(0.007)	(0.006)	(0.006)
LW Test		p=0.373					
	Dep Var: Age-adjusted death rates due to stroke (per 1k persons)						
ln(Corn values based on IMF prices)	0.012	-0.010	-0.013*	-0.004	-0.004	-0.006	0.001
	(0.014)	(0.007)	(0.007)	(0.006)	(0.006)	(0.005)	(0.006)
LW Test		p=0.222					

Notes: FE = state and year fixed effects. FD = first-differences. RFD = rolling first differences. LW test for the equality of FE and FD (Laporte and Windmeijer, 2005). The term "cons" refers to including a constant in the specification. Year-fixed effects are included in all models. Controls include the proportion of corn planted acreage (%) and neighboring corn values. Standard errors, bootstrapped with 1,000 repetitions and clustered at the state level, are presented in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

TABLE A23: Mediation analysis—estimation for state-level mortality due to stroke and soybeans values from 1980 to 2016

	(1) FE	(2) FD	(3) Twice FD	(4) RFD (cons)	(5) RFD (no cons)	(6) Twice RFD (cons)	(7) Twice RFD (no cons)
	Dep Var: Crude death rates due to stroke (per 1k persons)						
ln(Soybeans values based on state-level prices)	0.033	-0.011	-0.014	0.009	-0.002	-0.004	-0.007
	(0.025)	(0.008)	(0.009)	(0.009)	(0.009)	(0.008)	(0.009)
LW Test		p=0.718					
	Dep Var: Age-adjusted death rates due to stroke (per 1k persons)						
ln(Soybeans values based on state-level prices)	0.023	-0.010	-0.013	0.007	-0.003	-0.002	-0.005
	(0.020)	(0.008)	(0.009)	(0.008)	(0.008)	(0.007)	(0.008)
LW Test		p=0.457					
	Dep Var: Crude death rates due to stroke (per 1k persons)						
ln(Soybeans values based on IMF prices)	0.033	-0.010	-0.012	0.007	0.005	-0.004	0.011
	(0.024)	(0.008)	(0.008)	(0.008)	(0.009)	(0.008)	(0.009)
LW Test		p=0.815					
	Dep Var: Age-adjusted death rates due to stroke (per 1k persons)						
ln(Soybeans values based on IMF prices)	0.024	-0.008	-0.011	0.007	0.003	-0.002	0.007
	(0.019)	(0.008)	(0.008)	(0.007)	(0.008)	(0.008)	(0.008)
LW Test		p=0.531					

Notes: FE = state and year fixed effects. FD = first-differences. RFD = rolling first differences. LW test for the equality of FE and FD (Laporte and Windmeijer, 2005). The term "cons" refers to including a constant in the specification. Year-fixed effects are included in all models. Controls include the proportion of soybeans planted acreage (%) and neighboring soybeans values. Standard errors, bootstrapped with 1,000 repetitions and clustered at the state level, are presented in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

TABLE A24: Mediation analysis—estimation for state-level mortality due to mental issues and corn values from 1980 to 2016

	(1) FE	(2) FD	(3) Twice FD	(4) RFD (cons)	(5) RFD (no cons)	(6) Twice RFD (cons)	(7) Twice RFD (no cons)
	Dep Var: Crude death rates due to mental issues (per 1k persons)						
ln(Corn values based on state-level prices)	0.014	0.001	-0.006	0.011	0.010	0.005	0.008
	(0.024)	(0.012)	(0.012)	(0.007)	(0.009)	(0.009)	(0.009)
LW Test		p=0.517					
	Dep Var: Age-adjusted death rates due to mental issues (per 1k persons)						
ln(Corn values based on state-level prices)	-0.024	-0.000	-0.004	0.009	0.009	0.005	0.009
	(0.019)	(0.010)	(0.010)	(0.007)	(0.009)	(0.009)	(0.008)
LW Test		p=0.000					
	Dep Var: Crude death rates due to mental issues (per 1k persons)						
ln(Corn values based on IMF prices)	0.008	0.003	-0.001	0.011*	0.010	0.006	0.004
	(0.022)	(0.011)	(0.011)	(0.007)	(0.006)	(0.008)	(0.007)
LW Test		p=0.514					
	Dep Var: Age-adjusted death rates due to mental issues (per 1k persons)						
ln(Corn values based on IMF prices)	-0.026	0.002	0.000	0.010	0.008	0.006	0.006
	(0.017)	(0.009)	(0.009)	(0.007)	(0.007)	(0.008)	(0.006)
LW Test		p=0.000					

Notes: FE = state and year fixed effects. FD = first-differences. RFD = rolling first differences. LW test for the equality of FE and FD (Laporte and Windmeijer, 2005). The term "cons" refers to including a constant in the specification. Year-fixed effects are included in all models. Controls include the proportion of corn planted acreage (%) and neighboring corn values. Standard errors, bootstrapped with 1,000 repetitions and clustered at the state level, are presented in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

TABLE A25: Mediation analysis—estimation for state-level mortality due to mental issues and soybeans values from 1980 to 2016

	(1) FE	(2) FD	(3) Twice FD	(4) RFD (cons)	(5) RFD (no cons)	(6) Twice RFD (cons)	(7) Twice RFD (no cons)
	Dep Var: Crude death rates due to mental issues (per 1k persons)						
ln(Soybeans values based on state-level prices)	-0.000	-0.007	-0.010	-0.010	-0.012	-0.016**	-0.013
	(0.039)	(0.011)	(0.011)	(0.009)	(0.012)	(0.008)	(0.009)
LW Test		p=0.084					
	Dep Var: Age-adjusted death rates due to mental issues (per 1k persons)						
ln(Soybeans values based on state-level prices)	-0.031	-0.007	-0.009	-0.011	-0.017	-0.016**	-0.013
	(0.026)	(0.009)	(0.009)	(0.009)	(0.012)	(0.008)	(0.008)
LW Test		p=0.316					
	Dep Var: Crude death rates due to mental issues (per 1k persons)						
ln(Soybeans values based on IMF prices)	0.001	-0.003	-0.006	-0.008	-0.006	-0.013	-0.016*
	(0.037)	(0.011)	(0.011)	(0.008)	(0.013)	(0.008)	(0.009)
LW Test		p=0.126					
	Dep Var: Age-adjusted death rates due to mental issues (per 1k persons)						
ln(Soybeans values based on IMF prices)	-0.029	-0.004	-0.005	-0.009	-0.006	-0.012	-0.015
	(0.025)	(0.009)	(0.009)	(0.008)	(0.012)	(0.008)	(0.009)
LW Test		p=0.199					

Notes: FE = state and year fixed effects. FD = first-differences. RFD = rolling first differences. LW test for the equality of FE and FD (Laporte and Windmeijer, 2005). The term "cons" refers to including a constant in the specification. Year-fixed effects are included in all models. Controls include the proportion of soybeans planted acreage (%) and neighboring soybeans values. Standard errors, bootstrapped with 1,000 repetitions and clustered at the state level, are presented in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table A26: Mediation analysis—estimation for state-level mortality due to suicide and corn values from 1980 to 2016

	(1) FE	(2) FD	(3) Twice FD	(4) RFD (cons)	(5) RFD (no cons)	(6) Twice RFD (cons)	(7) Twice RFD (no cons)
	Dep Var: Crude death rates due to suicide (per 1k persons)						
ln(Corn values based on state-level prices)	0.014***	-0.002	-0.002	-0.006*	-0.006	-0.001	-0.003
	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
LW Test		p=0.000					
	Dep Var: Age-adjusted death rates due to suicide (per 1k persons)						
ln(Corn values based on state-level prices)	0.014***	-0.001	-0.002	-0.003	-0.004	-0.001	-0.003
	(0.005)	(0.004)	(0.004)	(0.004)	(0.003)	(0.004)	(0.003)
LW Test		p=0.000					
	Dep Var: Crude death rates due to suicide (per 1k persons)						
ln(Corn values based on IMF prices)	0.012**	-0.003	-0.004	-0.008**	-0.006	-0.001	-0.005
	(0.005)	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)	(0.004)
LW Test		p=0.000					
	Dep Var: Age-adjusted death rates due to suicide (per 1k persons)						
ln(Corn values based on IMF prices)	0.013**	-0.003	-0.003	-0.004	-0.003	-0.003	-0.005
	(0.006)	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)	(0.003)
LW Test		p=0.000					

Notes: FE = state and year fixed effects. FD = first-differences. RFD = rolling first differences. LW test for the equality of FE and FD (Laporte and Windmeijer, 2005). The term "cons" refers to including a constant in the specification. Year-fixed effects are included in all models. Controls include the proportion of corn planted acreage (%) and neighboring corn values. Standard errors, bootstrapped with 1,000 repetitions and clustered at the state level, are presented in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

TABLE A27: Mediation analysis—estimation for state-level mortality due to suicide and soybeans values from 1980 to 2016

	(1) FE	(2) FD	(3) Twice FD	(4) RFD (cons)	(5) RFD (no cons)	(6) Twice RFD (cons)	(7) Twice RFD (no cons)
	Dep Var: Crude death rates due to suicide (per 1k persons)						
ln(Soybeans values based on state-level prices)	0.001	-0.012***	-0.018***	-0.013***	-0.011***	-0.016***	-0.013***
	(0.006)	(0.004)	(0.004)	(0.004)	(0.003)	(0.004)	(0.003)
LW Test		p=0.000					
	Dep Var: Age-adjusted death rates due to suicide (per 1k persons)						
ln(Soybeans values based on state-level prices)	0.002	-0.011***	-0.017***	-0.009**	-0.007*	-0.013***	-0.011***
	(0.007)	(0.004)	(0.004)	(0.004)	(0.003)	(0.004)	(0.003)
LW Test		p=0.000					
	Dep Var: Crude death rates due to suicide (per 1k persons)						
ln(Soybeans values based on IMF prices)	0.001	-0.013***	-0.018***	-0.014***	-0.012***	-0.016***	-0.015***
	(0.006)	(0.004)	(0.004)	(0.004)	(0.003)	(0.004)	(0.003)
LW Test		p=0.000					
	Dep Var: Age-adjusted death rates due to suicide (per 1k persons)						
ln(Soybeans values based on IMF prices)	0.002	-0.011***	-0.017***	-0.010***	-0.008**	-0.013***	-0.014***
	(0.007)	(0.004)	(0.004)	(0.004)	(0.003)	(0.004)	(0.003)
LW Test		p=0.000					

Notes: FE = state and year fixed effects. FD = first-differences. RFD = rolling first differences. LW test for the equality of FE and FD (Laporte and Windmeijer, 2005). The term "cons" refers to including a constant in the specification. Year-fixed effects are included in all models. Controls include the proportion of soybeans planted acreage (%) and neighboring soybeans values. Standard errors, bootstrapped with 1,000 repetitions and clustered at the state level, are presented in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

TABLE A28: Mediation analysis—estimation for state-level mortality due to drug and corn values from 1980 to 2016

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	FE	FD	Twice FD	RFD (cons)	RFD (no cons)	Twice RFD (cons)	Twice RFD (no cons)
	Dep Var: Crude death rates due to drug (per 1k persons)						
ln(Corn values based on state-level prices)	-0.001	-0.002	-0.002	-0.003	-0.003	-0.002	-0.004**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)
LW Test		p=0.325					
	Dep Var: Age-adjusted death rates due to drug (per 1k persons)						
ln(Corn values based on state-level prices)	-0.001	-0.002	-0.002	-0.004**	-0.003	-0.002	-0.004**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)
LW Test		p=0.444					
	Dep Var: Crude death rates due to drug (per 1k persons)						
ln(Corn values based on IMF prices)	-0.002	-0.002	-0.002	-0.003*	-0.006***	0.001	-0.002
	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)
LW Test		p=0.298					
	Dep Var: Age-adjusted death rates due to drug (per 1k persons)						
ln(Corn values based on IMF prices)	-0.002	-0.002	-0.002	-0.002	-0.006***	0.000	-0.002
	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)
LW Test		p=0.410					

Notes: FE = state and year fixed effects. FD = first-differences. RFD = rolling first differences. LW test for the equality of FE and FD (Laporte and Windmeijer, 2005). The term "cons" refers to including a constant in the specification. Year-fixed effects are included in all models. Controls include the proportion of corn planted acreage (%) and neighboring corn values. Standard errors, bootstrapped with 1,000 repetitions and clustered at the state level, are presented in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table A29: Mediation analysis—estimation for state-level mortality due to drug and soybeans values from 1980 to 2016

	(1) FE	(2) FD	(3) Twice FD	(4) RFD (cons)	(5) RFD (no cons)	(6) Twice RFD (cons)	(7) Twice RFD (no cons)
	Dep Var: Crude death rates due to drug (per 1k persons)						
ln(Soybeans values based on state-level prices)	-0.002	-0.002	-0.004***	-0.001	-0.000	-0.001	-0.005**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
LW Test		p=0.125					
	Dep Var: Age-adjusted death rates due to drug (per 1k persons)						
ln(Soybeans values based on state-level prices)	-0.002	-0.002	-0.004***	-0.001	-0.000	-0.001	-0.005***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
LW Test		p=0.125					
	Dep Var: Crude death rates due to drug (per 1k persons)						
ln(Soybeans values based on IMF prices)	-0.002	-0.003	-0.004***	-0.001	0.001	-0.004**	-0.007***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)
LW Test		p=0.114					
	Dep Var: Age-adjusted death rates due to drug (per 1k persons)						
ln(Soybeans values based on IMF prices)	-0.002	-0.003	-0.004***	-0.001	0.001	-0.004*	-0.007***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)
LW Test		p=0.113					

Notes: FE = state and year fixed effects. FD = first-differences. RFD = rolling first differences. LW test for the equality of FE and FD (Laporte and Windmeijer, 2005). The term "cons" refers to including a constant in the specification. Year-fixed effects are included in all models. Controls include the proportion of soybeans planted acreage (%) and neighboring soybeans values. Standard errors, bootstrapped with 1,000 repetitions and clustered at the state level, are presented in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

TABLE A30: Mediation analysis—estimation for state-level mortality due to alcohol and corn values from 1980 to 2016

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	FE	FD	Twice FD	RFD (cons)	RFD (no cons)	Twice RFD (cons)	Twice RFD (no cons)
	Dep Var: Crude death rates due to alcohol (per 1k persons)						
ln(Corn values based on state-level prices)	0.004	-0.003	-0.001	0.001	-0.001	-0.007	-0.007
	(0.007)	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.004)
LW Test		p=0.001					
	Dep Var: Age-adjusted death rates due to alcohol (per 1k persons)						
ln(Corn values based on state-level prices)	0.002	-0.004	-0.002	-0.002	-0.005	-0.010*	-0.009*
	(0.007)	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)
LW Test		p=0.000					
	Dep Var: Crude death rates due to alcohol (per 1k persons)						
ln(Corn values based on IMF prices)	0.002	-0.001	0.001	0.003	0.001	-0.001	-0.003
	(0.007)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
LW Test		p=0.001					
	Dep Var: Age-adjusted death rates due to alcohol (per 1k persons)						
ln(Corn values based on IMF prices)	0.001	-0.002	-0.001	-0.001	-0.001	-0.002	-0.004
	(0.007)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
LW Test		p=0.000					

Notes: FE = state and year fixed effects. FD = first-differences. RFD = rolling first differences. LW test for the equality of FE and FD (Laporte and Windmeijer, 2005). The term "cons" refers to including a constant in the specification. Year-fixed effects are included in all models. Controls include the proportion of corn planted acreage (%) and neighboring corn values. Standard errors, bootstrapped with 1,000 repetitions and clustered at the state level, are presented in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table A31: Mediation analysis—estimation for state-level mortality due to alcohol and soybeans values from 1980 to 2016

	(1) FE	(2) FD	(3) Twice FD	(4) RFD (cons)	(5) RFD (no cons)	(6) Twice RFD (cons)	(7) Twice RFD (no cons)
	Dep Var: Crude death rates due to alcohol (per 1k persons)						
ln(Soybeans values based on state-level prices)	-0.007	-0.008*	-0.009**	-0.002	-0.004	-0.008	-0.007
	(0.009)	(0.005)	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)
LW Test		p=0.006					
	Dep Var: Age-adjusted death rates due to alcohol (per 1k persons)						
ln(Soybeans values based on state-level prices)	-0.008	-0.010**	-0.011**	-0.004	-0.005	-0.009*	-0.009*
	(0.010)	(0.005)	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)
LW Test		p=0.005					
	Dep Var: Crude death rates due to alcohol (per 1k persons)						
ln(Soybeans values based on IMF prices)	-0.007	-0.008*	-0.008**	-0.003	-0.001	-0.007	-0.009**
	(0.009)	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)
LW Test		p=0.006					
	Dep Var: Age-adjusted death rates due to alcohol (per 1k persons)						
ln(Soybeans values based on IMF prices)	-0.008	-0.009**	-0.010**	-0.005	-0.003	-0.007	-0.010**
	(0.010)	(0.005)	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)
LW Test		p=0.006					

Notes: FE = state and year fixed effects. FD = first-differences. RFD = rolling first differences. LW test for the equality of FE and FD (Laporte and Windmeijer, 2005). The term "cons" refers to including a constant in the specification. Year-fixed effects are included in all models. Controls include the proportion of soybeans planted acreage (%) and neighboring soybeans values. Standard errors, bootstrapped with 1,000 repetitions and clustered at the state level, are presented in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.10.

TABLE A32: Falsification analysis—estimation for cause-specific mortality and corn values from 1980 to 2016

	(1) FE	(2) FD	(3) Twice FD	(4) RFD (cons)	(5) RFD (no cons)	(6) Twice RFD (cons)	(7) Twice RFD (no cons)
	Dep Var: Crude death rates due to infection or birth defect (per 1k persons)						
ln(Corn values based on state-level prices)	0.011	0.006	-0.004	0.012*	0.011*	0.007	0.005
	(0.011)	(0.010)	(0.012)	(0.006)	(0.006)	(0.006)	(0.006)
LW Test		p=0.219					
	Dep Var: Age-adjusted death rates due to infection or birth defect (per 1k persons)						
ln(Corn values based on state-level prices)	0.007	0.004	-0.003	0.007	0.007	0.005	0.003
	(0.009)	(0.009)	(0.011)	(0.006)	(0.006)	(0.006)	(0.006)
LW Test		p=0.298					
	Dep Var: Crude death rates due to infection or birth defect (per 1k persons)						
ln(Corn values based on IMF prices)	0.013	0.006	-0.004	0.012*	0.011	0.010	0.008
	(0.011)	(0.010)	(0.012)	(0.006)	(0.006)	(0.006)	(0.006)
LW Test		p=0.214					
	Dep Var: Age-adjusted death rates due to infection or birth defect (per 1k persons)						
ln(Corn values based on IMF prices)	0.008	0.003	-0.004	0.007	0.006	0.006	0.005
	(0.009)	(0.009)	(0.011)	(0.006)	(0.006)	(0.006)	(0.006)
LW Test		p=0.301					

Notes: For the falsification test, we use death due to "Certain infections and parasitic diseases" and "Congenital malformations, deformations, and chromosomal abnormalities," which should not be correlated with commodity prices. FE = county and year fixed effects. FD = first-differences. RFD = rolling first differences. LW test for the equality of FE and FD (Laporte and Windmeijer, 2005). The term "cons" refers to including a constant in the specification. Year-fixed effects are included in all models. Controls include the proportion of corn planted acreage (%) and neighboring corn values. Standard errors clustered at the county level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

TABLE A33: Falsification analysis—estimation for cause-specific mortality and soybeans values from 1980 to 2016

	(1) FE	(2) FD	(3) Twice FD	(4) RFD (cons)	(5) RFD (no cons)	(6) Twice RFD (cons)	(7) Twice RFD (no cons)
	Dep Var: Crude death rates due to infection or birth defect (per 1k persons)						
ln(Soybeans values based on state-level prices)	-0.003	0.003	-0.003	0.006	0.007	0.004	0.006
	(0.007)	(0.010)	(0.014)	(0.006)	(0.006)	(0.006)	(0.006)
LW Test		0.045					
	Dep Var: Age-adjusted death rates due to infection or birth defect (per 1k persons)						
ln(Soybeans values based on state-level prices)	-0.003	0.002	-0.003	0.002	0.003	-0.000	0.000
	(0.006)	(0.008)	(0.012)	(0.006)	(0.006)	(0.006)	(0.006)
LW Test		0.093					
	Dep Var: Crude death rates due to infection or birth defect (per 1k persons)						
ln(Soybeans values based on IMF prices)	-0.002	0.004	-0.002	0.006	0.007	0.005	0.007
	(0.007)	(0.010)	(0.014)	(0.006)	(0.006)	(0.006)	(0.006)
LW Test		0.037					
	Dep Var: Age-adjusted death rates due to infection or birth defect (per 1k persons)						
ln(Soybeans values based on IMF prices)	-0.002	0.003	-0.002	0.002	0.003	0.001	0.002
	(0.006)	(0.008)	(0.013)	(0.006)	(0.006)	(0.006)	(0.006)
LW Test		0.078					

Notes: For the falsification test, we use death due to “Certain infections and parasitic diseases” and “Congenital malformations, deformations, and chromosomal abnormalities,” which should not be correlated with commodity prices. FE = county and year fixed effects. FD = first-differences. RFD = rolling first differences. LW test for the equality of FE and FD (Laporte and Windmeijer, 2005). The term "cons" refers to including a constant in the specification. Year-fixed effects are included in all models. Controls include the proportion of soybeans planted acreage (%) and neighboring soybeans values. Standard errors clustered at the county level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.