The Trump Vote and Covid-19 Vaccination Across US States, US Counties, and Connecticut Towns

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James W. McGuire[a]

[a]Department of Government, Wesleyan University, Middletown, CT, USA

Contact: James W. McGuire jmcguire@wesleyan.edu

Abstract

In the United States over the past 40 years national issues and allegiances have increasingly displaced state and local concerns and identities in shaping the preferences of voters and the internal processes of political parties. This study finds that such nationalization has also manifested itself in health-related behavior, specifically in the takeup of Covid-19 vaccines. Despite the heterogeneities of US states, counties, and towns, the share of the vote that Trump received in the 2020 US presidential election is found at each level to be a strong and robust predictor of a lower June 2022 Covid-19 vaccination initiation rate, even after adjusting for sociodemographic composition, spatial effects, and diverse provisioning- and takeup-related factors. At each of the three subnational levels, the Trump 2020 vote share was also correlated more closely than the Trump 2016 vote share or the Romney 2012 vote share with the June 2022 Covid-19 vaccination initiation rate.

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Disclosure statement

For much of the 20th century the United States stood out among industrialized democracies for the degree to which national voter choice was independent of subnational voter choice (Hjorth and Hopkins 2020: 9). Since the early 1980s, however, voter preferences and party processes have become increasingly nationalized. Nationalization of public opinion occurs through 'a multifaceted, mass-level process through which voters care less about state and local politics and use the same criteria to pick candidates across the federal system' (Hopkins 2018: 135). Nationalization of party processes means a rise in 'the homogeneity of each party's positioning across subnational units' (Hopkins, Schickler, and Azizi 2022: 2).

The political consequences of the nationalization of voter preferences and internal party processes include diminished accountability of state and local incumbents to their electorates and the conversion of certain states from 'laboratories of democracy' to 'laboratories of democratic backsliding' as national parties 'use the states that they control to rig the game in their favor by limiting the ability of their political enemies to participate' (Grumbach 2022: 10-12).

Similar nationalization has taken place in health-related behavior, which is becoming increasingly predictable by voter preference despite the remarkable territorial heterogeneity of US states, counties, and towns. National leaders of the Republican Party and their allies in the national media have disparaged Covid-19 vaccines, deriding them as ineffective or harmful. The statements of these national party leaders and of their allies in the national mass media have, on the one hand, encouraged Republican governors and Republican-controlled state legislatures to limit the takeup of Covid-19 vaccines, notably by banning vaccine mandates, and, on the other, persuaded Republican voters to reject available vaccines. As Sides et al. (2022: 252) note, despite having approved federal subsidies for vaccine development and despite being vaccinated himself, 'Trump sowed distrust in the vaccine...citizens' views about the pandemic showed a

'follow the leader' dynamic, whereby Democratic and Republican voters responded to what their party's leaders said about the risks of the virus and the measures needed to fight it.'

In addition to confirming the findings of existing research on the nationalization of US voter attitudes and party activity (Hopkins 2018, Grumbach 2022), the study of the takeup of Covid-19 vaccines has important implications for public health. Between December 12, 2020, when the CDC approved the Pfizer-BioNTech vaccine for adult usage, and November 30, 2022, Covid-19 vaccines in the United States are estimated to have prevented 120 million infections, 18 million hospitalizations, and 3.26 million deaths (Fitzpatrick et al. 2022) -- more than four times as many as the 0.78 million Covid-19 deaths actually recorded in the United States during that period (CDC 2022a). In Florida and Ohio -- two states in which it is possible to link death certificates to voter registration records -- the monthly rate of excess deaths between March 2020 and November 2021 was 76 percent higher for Republicans than for Democrats. After April 5, 2021, when Covid-19 vaccines were authorized for all adults, the figure rose to 153 percent (Wallace et al. 2022: 3). Dr. Peter Hotez of the Baylor College of Medicine called the refusal of Covid-19 vaccines 'the greatest self-immolation in American history' (Hiltzik 2022).

The analyses reported below explore the statistical association between support for Donald Trump and the Covid-19 vaccination initiation (first dose) rate. The findings support both the nationalization thesis and the conjecture that demand rather than supply problems are chiefly responsible for low Covid-19 vaccination takeup in the United States. Across US states, US counties, and Connecticut towns alike, Trump's share of the vote in the 2020 presidential election was associated in June 2022 with a lower Covid-19 vaccination initiation rate, even after adjusting for population composition, the prevalence of Covid-19 cases and deaths, general vaccine hesitancy, the quality of health care infrastructure, the political party in control of

vaccination policy, and interactions with nearby subnational units. The low vaccination rate, in turn, is one of the most important reasons why the United States has had higher Covid-19 infection and mortality rates than many other industrialized (and some developing) countries.

A strong bivariate association is known to exist across US states and counties between a higher Trump 2020 vote share and a lower Covid-19 vaccination rate, but few studies have attempted to control for potential confounders, and fewer still have adjusted for interactions among territorial units. Regression coefficients often change in magnitude, precision, and even sign when the same association is tested at different levels of analysis, such as across countries, provinces, or municipalities (Soifer 2019). If the findings hold at a variety of levels, our confidence in their generalizability rises (Giraudy, Moncada, and Snyder 2019). This study finds a strong and robust association between the Trump 2020 vote share and a low Covid-19 vaccination initiation rate across the 50 US states plus Washington DC, 3,032 US counties, and 166 Connecticut towns alike, adjusting for a wide range of confounders and for spatial effects.

1. The Trump Effect

Vaccine takeup will be lower to the extent that the unvaccinated believe that a pathogen is either unlikely to infect them or unlikely to harm them. US President Donald Trump and his media and government allies began to encourage such beliefs about Covid-19 a few months after the pandemic hit, apparently hoping that talking down the transmissibility of the virus and the severity of the disease would help Trump get re-elected in November 2020. Trump and his allies minimized the danger of Covid-19, discouraged testing, spread misinformation, opposed mask-wearing and physical distancing, and organized superspreading events.

By early 2021 Trump had lost the presidency, vaccines had become available, and pro-Trump politicians and news celebrities had begun to tout refusal to get immunized against Covid-19 as a signal of commitment to the freedom to do anything one wants, regardless of its consequences for others. As with facemasks in 2020, 'pro-Trump America...decided that vaccine refusal is a statement of identity and a test of loyalty' (Frum 2021). Republicans in the House of Representatives accused the Biden administration of unleashing 'Needle Nazis' to force people to get vaccinated, foreshadowing a campaign to confiscate peoples' guns and bibles (Lybrand and Subramaniam 2021). In the summer and fall 2021 a dozen states with Republican-controlled legislatures passed laws prohibiting vaccine mandates in various situations (KFF 2021). In conservative areas of Missouri people pleaded with health workers to keep their vaccinations quiet, or donned disguises to get vaccinated (Elamroussi 2021). In Alaska violence confronted contact-tracers, led some pharmacies to stop offering Covid-19 vaccinations, and caused some emergency-room personnel to stop asking about vaccination status (Berman and Krakow 2021).

Skepticism of science and devotion to conspiracy theories have gained ground among Republicans in recent years (Mooney 2005, Rosenblum and Muirhead 2020). In August 2021, 59 percent of Republicans surveyed by CNN/SSRS (2021) reported that 'believing that Trump won the 2020 election' was either very important or somewhat important 'to what being a Republican means to you.' The short-hand term used here to describe the set of processes that led to these shifts in 'what it means to be a Republican' is the Trump effect. Represented here by the Trump 2020 vote share, the Trump effect is found to be associated with lower Covid-19 vaccine takeup.

Like resistance to face masks, resistance to vaccination by Trump supporters has resulted from both bottom-up and top-down processes. Trump and his collaborators chose to politicize the pandemic, putting political advantage ahead of public health (Gadarian et al. 2022). The Trump

effect has a bottom-up dimension -- many Trump supporters proudly reject masks and Covid-19 vaccinations -- but pro-Trump politicians and media celebrities pander to and inflame such rejection. Trump personally is not the only source of the processes behind the Trump effect: the rightward drift of the Republican Party began in the 1990s (Hemmer 2022), and affective polarization -- loathing for opposing partisans -- took hold even earlier (Iyengar et al. 2012). However, fealty to Trump is a common denominator of most putatively principled resistance to face masks and to Covid-19 vaccination in the United States.

Experimental studies have found that the public pronouncements of US politicians can affect attitudes toward Covid-19 vaccines (Hornsey et al. 2020, Kreps and Kriner 2021, Pink et al. 2021). The analyses reported here corroborate these results and support the view that voter preferences are becoming conditioned increasingly by national-level issues and diminishingly by subnational heterogeneities (Hopkins 2018). To the extent that the latter are represented by territorial sociodemographic characteristics such as age, gender, race, ethnicity, education, and rurality, it is noteworthy, and consistent with the nationalization thesis, that across US states, US counties, and Connecticut towns alike, controlling for sociodemographic factors did not perturb the strong and robust association between the Trump 2020 vote share and the vaccination initiation rate. Suggesting a rise in influence of national over state and local issues, at the state, county, and town levels alike, the Trump 2020 vote share was correlated more closely than the Trump 2016 or Romney 2012 vote shares with the June 2022 vaccination initiation rate.

2. Materials and Methods

The Covid-19 vaccination initiation rate is the cumulative share of a population recorded as having received at least one dose of a Covid-19 vaccine as of June 3, 2022 (June 1, 2022, for

Connecticut towns). To identify the statistical impact of the Trump effect on this rate, its influence must be isolated from the impact of confounders. In this study, such isolation is approximated by adjusting for age, gender, race, ethnicity, education, and rural residence. These six sociodemographic factors are used as control variables when testing the Trump effect hypothesis, represented by the Trump 2020 vote share, against alternative hypotheses.

A drawback of territorial comparisons is that individual behavior is tricky to infer from territorial associations. This ecological inference problem diminishes, however, with the quantity, smallness, and homogeneity of the units being compared (King 1997: 50; Morgenstern 1982: 1342; Robinson 1950: 356). Territorial studies provide a useful complement to surveys and experiments. As Gadarian et al. (2022: 75) point out, 'COVID-19 is a community disease requiring community-level responses.' Covid-19 vaccination campaigns are usually deployed geographically, so territorial analysis is critical to fighting the pandemic. Spatial effects can be taken into account only across territories, and some factors likely to influence the Covid-19 vaccination rate, like the political party in control of health care policy and the quality of health care infrastructure, are typically measured at the territorial level. Accordingly, it useful to observe how such factors have affected the Covid-19 vaccination rate across the territories that the health care policies and health care infrastructure were designed to serve.

The first analysis reported here investigates the association between the Trump 2020 vote share and the vaccination initiation rate across the 50 US states plus Washington, DC. US states are few in number, demographically heterogeneous, and have a median population of about 6,500,000. The second analysis observes the association across 3,032 US counties and county-equivalents, which are numerous and usually more demographically homogeneous than states. However, counties range in population from 86 (Kalawao, HI) to 10,039,107 (Los Angeles, CA),

with a standard deviation thirteen times the median population of about 25,000, and some are demographically quite diverse. The third analysis explores the association across the 169 Connecticut towns, which have a median population of about 15,000 and range from 839 (Union) to 144,399 (Bridgeport), with a standard deviation only twice the median (Census Bureau 2021a, 2021c). Accordingly, ecological inference is most problematic for US states and least problematic for Connecticut towns, with US counties occupying a middle position.

To estimate the magnitude and significance of the association between the Trump effect and Covid-19 vaccine takeup, the percentage of a state's, county's, or town's population that had initiated vaccination as of June 3, 2022 (June 1 for Connecticut towns) was regressed on Trump's 2020 vote share, the six sociodemographic variables, another takeup- or provisioning-related factor where data were available, and a spatial error or spatial lag term. Incorporating spatial effects is crucial because 'it is precisely in the subnational context where we might expect territorial boundaries to be permeable and geographic units to be dependent – and therefore spatial analysis to be especially relevant' (Harbers and Ingram 2019: 68).

Spatial autocorrelation operates like time series autocorrelation, but is generated by observations' geographic rather than temporal proximity. To analyze spatial effects, weighting matrices are designed to reflect how far spatial influence is thought to extend, and how steeply it is thought to decay as territories are located farther apart. It is assumed that spatial influence across states, counties, and towns is better represented by distance than by adjacency (contiguity), so spatial autocorrelation is modeled using inverse distance matrices, which assume that spatial effects are inversely proportional to the proximity of geographical centroids. When spatial autocorrelation affects the dependent variable, a spatial lag model is appropriate. When spatial autocorrelation affects the error term, a spatial error model is appropriate. Lagrange

multiplier and robust Lagrange multiplier tests were used to decide whether an ordinary least squares, a spatial lag, or a spatial error model was appropriate, following Anselin and Rey's (2014: 110) decision tree. Stata SE v17 was used for the state and town analyses; Stata MP v17 for the county analyses, and GeoDa 1.20.0.8 for most county robustness checks.

The spatdiag command (Pisati 2001) implemented in Stata/SE 17.0 for Mac and the spatial regression commands in GeoDa 1.20.0.8 (Anselin 2022) were used to diagnose the presence or absence of spatial autocorrelation, and to decide whether the spatial effects in the data were best modeled by a spatial lag or spatial error approach. Spatial correlation was detected at all three levels. A spatial error model was found to be appropriate for the states and counties analysis; a spatial lag model was appropriate for the towns analysis. Except in some of the county-level robustness checks, where GeoDa's diagnostics, weighting matrices, and maximum likelihood estimates were used, the models were estimated using Stata's spregress command, opting either for either a spatial lag or spatial error term, as Lagrange multiplier and robust Lagrange multiplier tests recommended. The coefficients reported are based on total effects (both direct and indirect), which are reported in the Stata diagnoses but not in the GeoDa diagnoses, which report only direct effects. In the Stata analyses, the spatial generalized least squares procedure (g2sls option) was chosen because it is more robust than a maximum likelihood (ml) procedure (used in the GeoDa analyses) when the error term, representing omitted variables, is other than normally distributed (StataCorp LLC 2021: 48).

3. Outcome

The outcome predicted is the Covid-19 vaccination initiation rate. The 'at least one dose' share is preferred to the fully vaccinated share because the Trump effect is conjectured to act

mainly on the decision to initiate vaccination. A March 2021 CDC study found that only 3

percent of people who had gotten one shot of the two-dose Pfizer and Moderna vaccines did not

eventually receive a second shot, although 12 percent did not receive a second shot within the

prescribed time frame (3 and 4 weeks respectively) (Kriss et al. 2021: 393). Reasons for skipping

or delaying the second shot ranged from fear of side effects, to a belief that one shot would be

sufficiently protective, to providers running out of the right type of vaccine (Robbins 2021). The

Trump effect is not thought to have been directly involved in any of these deterrents.

To operationalize a Covid-19 vaccination initiation rate it is necessary to decide which

age groups belong in the denominator. US states staggered Covid-19 vaccine eligibility by age

on different timelines (Hubbard 2021), so the total population is the optimal denominator of the

vaccination initiation rate, eliminating a source of potential measurement error (age group

assignment) and homogenizing the denominator of the vaccination initiation rate with that of the

most widely-utilized Covid-19 infection and death rates. Sensitivity analyses reported in the

supplemental material for this article found that controlling for the under-12 share of the

population had no effect on the magnitude or significance of the coefficient of the Trump 2020

vote share. The over-65 share of a town's population is included as part of the baseline model.

4. Hypotheses

If the Trump effect matters for vaccine takeup, the Trump 2020 vote share should remain

robustly associated with a lower Covid-19 vaccination initiation rate even after controlling for

potentially confounding factors that might affect either the provisioning or takeup of a Covid-19

vaccine. On the provisioning side, states with high proportions of Trump voters might have

worse (or better) public health infrastructure, or have Republican governors or Republican-

controlled legislatures, which have tended to be more reluctant than Democratic ones to facilitate and encourage Covid-19 vaccination. On the takeup side, Trump voters could tend more than Biden voters to belong to sociodemographic categories that tend to underutilize preventive health services, or to be more averse to any kind of vaccine, or to reside in places with low case or death rates, giving residents less incentive to get vaccinated. Also, if the Trump effect matters, the statistical impact of a Republican presidential candidate's vote share on the Covid-19 vaccination initiation rate should be largest for Trump's 2020 vote share (after the pandemic began), next-largest for Trump's 2016 vote share (before the pandemic began), and smallest for Romney's 2012 vote share (before Trump entered electoral politics).

Multiple regression models with controls for spatial effects are used to compare the plausibility of the Trump effect hypothesis to the plausibility of these alternative hypotheses. Because of data constraints, the complete set of five provision- and takeup-related hypotheses is tested only at the state level, but the sociodemographic and case and death rate hypotheses are tested at the state, county, and town levels alike.

On the provisioning side, a first alternative to the Trump effect hypothesis is that Trump-supporting states have lower vaccine takeup because they tend to have weaker public health infrastructure, reducing the supply of vaccines. The strength of public health infrastructure in each state is measured using two indicators from 2019 National Health Security Preparedness Index: the overall index and 'Countermeasure Management,' a sub-index that includes the storage and deployment of vaccines (NHSPI 2019). If health security preparedness were to predict vaccine takeup as well as or better than Trump's share of the 2020 presidential vote, or if the inclusion of health security preparedness in a regression model were to make Trump's vote

share insignificant as a predictor of the vaccination initiation rate, then health care infrastructure rather than the Trump effect might be the critical determinant of Covid-19 vaccine takeup.

The second alternative hypothesis on the provisioning side involves Republican control of state vaccination policy. State governors and state legislatures have responsibility for most public health policies, including policies related to vaccination. States with Republican governors were slower than states with Democratic governors to implement movement restrictions in response to the pandemic, and quicker to lift them (Adolph et al. 2021a,b). In Florida and Texas Republican governors issued executive orders prohibiting local governments and businesses that get state government funding from requiring their employees to show proof of vaccination as a condition of employment. In May 2021 the Republican governor of Montana signed a bill prohibiting the state's hospitals from requiring that their employees be vaccinated against any diseases, not just Covid-19 (Montana 2021). As of mid-July 2021, Republican legislators had introduced similar bills in some 40 other states (NASHP 2021).

To measure Republican control of state policy, dummy (0/1) variables indicate whether Republicans as of February 1, 2022, controlled, respectively, the governorship and/or both state legislative houses (NCSL 2022). If Republican control of governorships and state legislatures were to make the Trump 2020 vote share insignificant as a predictor of the vaccination rate, then Republican control of state government, rather than some aspect of the Trump effect (which is thought to affect vaccine takeup more than vaccine provisioning), could be responsible for lower vaccination rates in states with higher Trump 2020 vote shares.

On the takeup side, one alternative to the Trump effect hypothesis is the population composition hypothesis. Age, education, gender, race, ethnicity, and rural residence influence

Covid-19 vaccine takeup. These six sociodemographic factors have been featured in recent surveys of Covid-19 vaccine takeup and hesitancy at the individual level (Beleche et al. 2021, Hamel et al. 2021). The same six factors serve here both as control variables when assessing other hypotheses, and as a 'population composition' alternative to the Trump effect hypothesis.

Age. In all states people aged 65 and older were among the first to be authorized to receive Covid-19 vaccines. The longer one has been eligible for vaccination, the more likely one is to be vaccinated. Being 65 or older is also a risk factor for Covid-19 hospitalization and death, so the elderly have a special incentive to get vaccinated. Hence, the 65 and older share of a state's, county's, or town's population is expected to be positively associated with its Covid-19 vaccination initiation rate. Individual-level data confirm that age is positively associated with the vaccination initiation rate. A September 2021 survey found that 85 percent of US residents aged 65 and older had initiated Covid-19 vaccination, compared to 72 percent of 50-64 year-olds, 66 percent of 30-49 year-olds, and 68 percent of 18-29 year-olds (KFF 2021).

Education. College graduates tend to know more than non-graduates about virus transmission and disease severity. More highly educated people are sometimes found to be more susceptible to motivated reasoning (more skilled at mustering reasoned arguments for interpreting information in a way consistent with their prior beliefs), but they are also more adept at filtering out misinformation (Allcott and Gentzkow 2017). A September 2021 survey found that 82 percent of respondents with a college degree had received at least one dose of a Covid-19 vaccine, compared to 67 percent of respondents without a college degree (KFF 2021). Higher percentages of state, county, or town residents with a bachelor's degree are thus expected to be associated with higher vaccination initiation rates.

Gender. As of July 21, 2021, females outnumbered males by 51 to 46 percent among those receiving at least one dose of a Covid-19 vaccine (calculated from CDC 2021 and Census Bureau 2021b). In a September 2021 survey 74 percent of adult females, but only 69 percent of adult males, reported having received at least one dose of a Covid-19 vaccine (KFF 2021). The female share of the population is thus expected to be associated with a higher vaccination initiation rate.

Race and Ethnicity. An analysis of data from 38 states reporting vaccination initiation rates by race and ethnicity found that vaccination initiation rates in April 2022 were 65 percent among Hispanics, 63 percent among Whites, and 57 percent among Blacks (Ndugga et al. 2022). The territorial analyses are expected to reflect these racial and ethnic discrepancies.

Rural residence. Vaccination sites tend to be located in areas with dense populations. Accordingly, the information and activity costs of vaccination against Covid-19 are higher in sparsely-populated rural areas. As of May 22, 2021, 57 percent of residents of US metropolitan counties, but only 44 percent of residents of micropolitan and noncore counties, had received at least one dose of a Covid-19 vaccine (Diesel et al. 2021: 926). Hence, takeup of a Covid-19 vaccine is expected to be lower in states with a higher percentage of rural residents, in counties scoring higher on an ordinal scale where 1 is most urban and 9 is most rural (USDA 2013), and in towns designated 'rural' by the Connecticut Office of Rural Health (CORH 2021).

Alongside the sociodemographic composition of a territory's population, a second alternative hypothesis on the takeup side involves general vaccine hesitancy. To explore whether such hesitancy might outperform the Trump 2020 vote share in explaining state-to-state variation in vaccination initiation, the share of a state's population that had by June 3, 2021 received at

least one dose of a Covid-19 vaccine is regressed on the Trump 2020 vote share, the six sociodemographic variables, and either the percentage of the state's population that had been vaccinated against seasonal flu in 2019-20, or the percentage of the state's 13-17 year-olds who had received at least one dose of the human papillomavirus (HPV) vaccine in 2019.

The third alternative hypothesis on the takeup side involves high cumulative and recent levels of Covid-19 cases and deaths. The higher the number of cases and deaths, the more frequently the unvaccinated will have a personal connection to someone suffering from Covid-19, and the more media outlets will report on the prevalence and dangers of the disease. That should give more unvaccinated people an incentive to get a Covid-19 vaccine.

5. Results from US States

State-level analyses face a 'small-N' problem (only 51 cases) as well as an ecological inference problem, but state-level associations dominate news about 'Red/Blue' differences in Covid-19 vaccination rates. Exploring hypotheses using multiple regression, even of a small number of cases, beats observing the raw data, noting that Trump won almost all of the states with low vaccination rates, and speculating about why this remarkable association might exist.

Across the 50 United States and Washington, DC, on June 3, 2022, a 10 percentage-point higher Trump 2020 vote share was associated with a 4.49 percentage-point lower rate of Covid-19 vaccination initiation, controlling for the six sociodemographic variables and for spatial autocorrelation of the error term (Figure 1). Together, these factors explained 79 percent of the cross-state variance in the vaccination initiation rate. The only socioeconomic variable that outperformed the Trump vote as a predictor of the vaccination initiation rate was the percentage of the population with a bachelor's degree, which as predicted was associated with a higher rate

of Covid-19 vaccine takeup. The Black share of the population was associated with a slightly lower vaccination initiation rate, and the Latino share, 65 and older share, and female share with a higher rate. The latter two associations were statistically insignificant, however, and the rural share of the state population had no significant association with the vaccination initiation rate.

[Figure 1]

The state-level association between the Republican share of the presidential vote and a lower rate of vaccine initiation was strongest with the 2020 Trump vote share, next strongest with the Trump 2016 vote share, and weakest with the Romney 2012 vote share (Figure 2). The Trump 2020 vote share coefficient exceeded the Romney 2012 vote share coefficient by 44 percent, supporting the conjecture that the Trump effect grew stronger from 2012 to 2016 to 2020 and suggesting that health-related behaviors are becoming more and more nationalized.

[Figure 2]

The takeup-related (demand-side) alternative hypotheses involve population composition (discussed above), general vaccine hesitancy, and the cumulative and recent prevalence of Covid-19 cases and deaths. Flu vaccine takeup was associated positively and significantly with Covid-19 vaccine takeup after adjusting for the state's sociodemographic composition and for spatial autocorrelation of the error term, but neither flu nor HPV vaccine takeup did much to affect the association between the Trump 2020 vote and Covid-19 vaccine takeup (Figure 3).

[Figure 3]

To find out whether levels of Covid-19 infection or mortality could account for the strong negative state-level association between the Trump 2020 vote share and the Covid-19

vaccination initiation rate, controls for cumulative and recent (September 23, 2021 to June 3, 2022) Covid-19 case and death rates were added singly to the baseline model. Of the four case and death rate variables, only recent Covid-19 deaths were associated significantly across states with the vaccination initiation rate. The association was negative and strong: a 10 percentage-point higher recent Covid-19 death rate yielded an 8.5 percentage-point lower Covid-19 vaccination initiation rate (Figure 4). A simple explanation for this finding is reverse causation: states with low Covid-19 vaccination initiation rates in June 2022 had displayed similarly low rates over the previous nine months, contributing to more Covid-19 deaths. In any case, adding the recent Covid-19 death rate to the model weakened but did not eliminate the statistically significant association between the Trump 2020 vote and Covid-19 vaccine takeup. No matter which of the four case or death rates was added to the baseline model, the Trump 2020 vote share remained associated with a 3.28-4.73 percentage-point lower vaccination initiation rate (Figure 4).

[Figure 4]

The provisioning (supply-side) hypotheses that are juxtaposed here to the Trump effect hypothesis involve health care infrastructure and Republican control of state governorships and legislatures. As of early June 2022, no significant state-level association existed between health care infrastructure and Covid-19 vaccine takeup, controlling for the Trump 2020 vote share, six sociodemographic variables, and spatial autocorrelation of the error term (Figure 5). Nor did adjusting for infrastructure quality do much to affect the association between the Trump 2020 vote share and the June 2022 vaccination initiation rate. After controlling for state health care infrastructure quality, a 10 percentage-point higher Trump 2020 vote share was still associated with an estimated 4.73-4.77 percentage-point lower vaccination initiation rate.

[Figure 5]

Unadjusted for potential confounders, the Covid-19 vaccination initiation rate on June 3, 2022, averaged 88 percent of the population in the 17 states where, as of February 1, 2022, Democrats controlled both state legislative houses (DC included), but only 70 percent in the 32 states where Republicans controlled both houses (Nebraska included). The average was 82 percent in the 23 states plus DC with a Democratic governor (mayor in DC), but only 73 percent in the 32 states with a Republican governor (calculated from CDC 2022b and NCSL 2022). Controlling for the Trump 2020 vote share and for the six sociodemographic variables, Republican control of both houses of the state legislature was associated with a 3.64 percent smaller share of the population initiating vaccination; having a Republican governor was associated with a 2.38 percentage-point smaller share. Even after adjusting for Republican control of state legislatures and governorships, however, the Trump 2020 vote share was still associated significantly with a 3.32 to 3.65 percentage-point lower Covid-19 vaccination initiation rate (Figure 6). The resilience of the Trump vote coefficient indicates the importance of takeup regardless of provisioning, testifying to the nationalization of voter preferences.

[Figure 6]

To summarize, the state-level analyses found that the Trump 2020 vote share remained a statistically and substantively significant predictor of a lower Covid-19 vaccination initiation rate even after adjusting for a state's sociodemographic composition, general vaccine hesitancy, Covid-19 cases and deaths, quality of health care infrastructure, and Republican control of the state legislature and governorship, as well as for spatial autocorrelation of the error term. Among the six sociodemographic factors, only the bachelor's degree share exerted a stronger statistical

influence on the Covid-19 vaccination initiation rate than the Trump 2020 vote share. Also, the Trump 2020 vote share had a stronger association with the state Covid-19 vaccination initiation rate than either the Trump 2016 or Romney 2012 vote shares.

6. Results from US Counties

The United States has 3,142 counties and county equivalents, but conventional spatial analysis requires matrices with no missing elements, and only 3,032 counties had complete data on the vote shares of Romney 2012, Trump 2016, and Trump 2020, as well as on the June 3, 2022 vaccination initiation rate. Across these 3,032 counties, controlling for the six sociodemographic variables and for spatial autocorrelation of the error term, a 10 percentage-point higher Trump 2020 vote share was associated with a 5.84 percentage-point lower Covid-19 vaccination initiation rate (Figure 7).

[Figure 7]

Across counties the age 65 and older, bachelor's degree, and Latino population shares predicted a higher Covid-19 vaccination initiation rate, whereas the Black non-Hispanic and (unexpectedly) female shares, along with the county's degree of rurality, predicted a lower rate. So did the Trump 2020 vote share, whose statistical influence on the Covid-19 vaccination initiation rate was stronger than any of the sociodemographic variables.

Similar findings have emerged from six other county-level studies of the association between the Trump 2020 vote share and the Covid-19 vaccination rate, although each of the six used the "fully vaccinated" rate rather than, as in the present study, the first-dose rate. Both the Trump 2020 vote share and the Covid-19 vaccination rate are measured in percentages, so as in

the present analysis, the coefficient on the Trump variable multiplied by ten yields the estimated percentage-point reduction in vaccine takeup generated by a ten percentage-point higher Trump 2020 vote share. In the present analysis a 10 percentage-point higher Trump county vote share yielded a 5.84 percentage-point lower first-dose vaccination rate, near the upper end of the range of the six studies' estimates for the fully-vaccinated rate, which ranged in percentage points from -3.3 (Albrecht 2022: 8) to -4.3 (Jung and Lee 2021: 10) to -4.6 (Pepinsky 2021) to -5.1 (Chopra and Wydick 2022: 29) to -6.3 (Sun and Monnat 2021: 3) to -6.8 (Morgan and Sul 2021: 5). The homogeneity of findings across the six studies, and their similarity to the findings of the present study, are consistent with Hopkins's (2018: 230) conclusion that political behavior in the United States is becoming increasingly nationalized, such that 'similar people are likely to respond to similar information in similar ways, irrespective of their place of residence.'

In the state-level analysis reported in Figure 2, a 10 percentage-point higher Trump 2020 vote was associated with a 4.49 percentage-point lower vaccination initiation rate. The state-level figures for the Trump 2016 and Romney 2012 vote shares were 3.79 and 3.11 percentage points respectively. In the county-level analysis reported in Figure 8, a 10 percentage-point higher Trump 2020 vote was associated with a 5.84 percentage-point lower vaccination initiation rate; the figures for the Trump 2016 and Romney 2012 voter shares were 5.32 and 4.32 percentage points respectively. In the county-level analysis the Trump 2020 vote share coefficient exceeded the Romney 2012 coefficient by 35 percentage points -- less than in the state-level analysis (44 percentage points), but consistent with the Trump effect growing stronger from 2012 to 2016 to 2020. Studies by Jung and Lee (2021) and Morgan and Sul (2021) have found similarly.

[Figure 8]

To find out whether Covid-19 infection or mortality could account for the strong negative county-level association between the Trump 2020 vote share and the June 3, 2022 vaccination initiation rate, controls for cumulative and recent (previous 9 months) Covid-19 case and death rates were added singly to the baseline model. As in the US states analysis, Covid-19 case rates were associated with higher levels of vaccination initiation, and Covid-19 death rates were associated with lower levels. High case rates on balance seem to encourage people to get vaccinated, whereas high death rates on balance seem simply transmit the effects of vulnerable people having been previously unvaccinated. In any case, across US counties, no matter which case or death rate was added to the baseline model, the Trump 2020 vote share was always associated with a 5.64 to 5.84 percentage-point lower vaccination initiation rate (Figure 9).

[Figure 9]

Summarizing, the US county-level analysis found that the Trump 2020 vote share had a stronger association with the June 3, 2022 vaccination initiation rate than any of the six sociodemographic variables, and a stronger association with that rate than either the Trump 2016 or Romney 2012 vote shares. The quality of health care infrastructure, the political party heading the local government, and takeup of other vaccines could not be measured across counties, but neither cumulative nor recent Covid-19 case nor death rates had a significant impact on the cross-county association between the Trump 2020 vote share and the vaccination initiation rate.

7. Results from Connecticut Towns

Connecticut is a small and densely populated state. Its 3.6 million residents live in 169 towns in a territory spanning 180 kilometers east to west and 110 kilometers north to south. Some towns are governed by Democrats and others by Republicans, but vaccination policy is set

almost entirely at the state level, leaving town officials little flexibility in policy design or implementation. Some US county governments, such as those of Leon County, Florida and Douglas County, Colorado, have defied state policies on vaccination mandates, but Connecticut town governments have not (Brown 2021). Connecticut towns differ widely on health care infrastructure, but no legal obstacles and few practical barriers prevent a resident of one town from getting vaccinated in another town. In Connecticut in May 2021 about 25 percent of urban dwellers and more than 50 percent of rural dwellers got their first dose of a Covid-19 vaccine in another *county*, giving Connecticut one of the highest shares of residents crossing county boundaries to get vaccinated (Murthy et al. 2021). Connecticut has 169 towns but only eight counties. With Rhode Island, it is one of two states with no county government at all.

Covid-19 vaccination initiation rates in Connecticut towns were not expected to be influenced by differences in town health infrastructure, such as having a hospital. Nor were they expected to be influenced by differences in town vaccination policies, such as offering gift cards or amusement park tickets to get vaccinated (anyone who got vaccinated at a site offering such incentives received the benefit, regardless of town of residence). Relative homogeneity on the provisioning side yields a largely unobstructed view of takeup-related factors influencing Covid-19 vaccination, making Connecticut towns a largely provisioning-purged 'universe' within which to examine whether the Trump 2020 vote share remained associated strongly and robustly with the vaccination initiation rate, even after taking into account health care infrastructure (effectively the same in all Connecticut towns), public health policy (effectively the same in all towns), and population composition (represented by the six sociodemographic variables).

On the other side of the identification ledger Connecticut ranks fourth among the 50 states in population density, making it especially prone to spillovers from town to town. No legal

barrier keeps a resident of one town from getting vaccinated in another town, and most towns blend imperceptibly into others. States and counties are interdependent in many of these ways as well, but not as much as Connecticut's densely-packed towns. Town-to-town spillovers can potentially influence both the dependent variable (the vaccination rate) and the error term (which picks up unmeasured but possibly causal attributes like attitudes and values). Spatial autocorrelation was expected not only in the dependent variable, because people often get vaccinated away from their town of residence and not infrequently get their residence misreported (see the supplemental material for this article), but also in the error term, because people are influenced by unmeasured attributes of the town in which they work, the towns in which they grew up, the towns in which their relatives live, and so on. Lagrange Multiplier and Robust Lagrange Multiplier tests showed nonetheless that a spatial lag model was most appropriate for the Connecticut towns data, so that was the model used. In a robustness check reported in the supplemental material for this article, adjusting for spatial autocorrelation in the error term as well as in the dependent variable had little effect on the magnitude or significance of the negative coefficient on the Trump 2020 vote share.

Predictions for the six sociodemographic variables in the Connecticut towns analysis were the same as such predictions in the US states and US counties analyses. To measure rurality, however, each town was identified with an indicator variable. Towns that the Connecticut Office of Rural Health (CORH 2021) designated 'rural' got a '1' (rescaled to 100 to facilitate comparison to the variables expressed in percentage points); other towns got a '0'. Statistical artifacts exaggerated vaccination initiation rates in Canaan and Derby and understated them in Mansfield (see the supplemental material for this article), so those three towns were dropped from the analysis.

Figure 10 summarizes the statistical associations across 166 Connecticut towns between the Covid-19 vaccination initiation rate, the Trump 2020 vote share, the six sociodemographic variables, and a spatial lag term. A higher share of females, of bachelor's degree recipients, and of over-65 year-olds were each associated with a higher town Covid-19 vaccination initiation rate, but the Black and Latino shares and the rural designation had no statistically significant association with the outcome. The female, bachelor's degree, and over-65 shares raised the Covid-19 vaccination initiation rate more than the Trump 2020 vote share reduced it, but even taking these sociodemographic factors into account, a town with a 10 percent higher Trump 2020 vote share still had an estimated 2.03 percentage-point lower vaccination initiation rate.

[Figure 10]

If a Trump effect operated in Connecticut towns as well as in US counties and states, a lower town vaccination initiation rate would be associated, in descending order of predictive power, with the vote shares of Trump in 2020, Trump in 2016, and Romney in 2012. The Trump 2020 vote share would also be expected to outperform a town's Republican voter registration percentage. That is what the Connecticut towns data show (Figure 11). Only 31 states register voters by party, so no analogous comparison is possible among a full set of US states or counties.

[Figure 11]

As in the US states and US counties analyses, higher Covid-19 case rates, but not death rates, were associated across Connecticut towns with higher vaccination initiation rates, adjusting for the six sociodemographic variables, the Trump 2020 vote share, and spatial effects. This finding is consistent with the conjecture that high case rates on balance encourage vaccination, whereas high death rates on balance mostly reflect previously low vaccination rates.

Controlling for cumulative and recent case and death rates raised the magnitude of the estimated statistical impact of the Trump 2020 vote share on the Covid-19 vaccination initiation rate, from -2.03 percentage points in the baseline analysis (Figure 10) to -2.92 to -3.31 percentage points in the models with the cumulative and new case and death counts (Figure 12).

[Figure 12]

The analysis of Connecticut towns found that the Trump 2020 vote share statistically lowered the June 3, 2022 vaccination initiation rate more than the Trump 2016 vote share, the Romney 2012 vote share, the 2016 Republican voter registration share, or the 2020 Republican voter registration share (Figure 11). Controlling for cumulative and recent Covid-19 case and death rates only strengthened the association between the Trump 2020 vote share and the vaccination initiation rate (Figure 12), by about 30 percent relative to the baseline analysis (Figure 10). Across Connecticut towns age, gender, and education outperformed the Trump vote, but race and ethnicity did not. More importantly from the standpoint of the present inquiry, the Trump 2020 vote share remained robustly significant in the presence of six sociodemographic control variables, cumulative and recent case and death counts, and a spatial lag effect.

8. Conclusion

This study has found that the Trump 2020 vote share retained a statistically significant and substantively important association with the Covid-19 vaccination initiation rate across US states, US counties, and Connecticut towns alike. After adjusting for age, gender, education, race, ethnicity, and rurality, as well as for spatial effects, a 10 percentage-point higher Trump 2020 vote share was associated with a 4.5 percentage-point lower Covid-19 vaccination initiation rate across 50 US states plus DC, a 5.8 percentage-point lower vaccination rate across 3,032 US

counties, and a 2.0 percentage-point lower vaccination rate across 166 Connecticut towns. Each finding withstood sensitivity checks involving universe of cases, statistical technique, dependent variable, and independent variables (see the supplemental material for this article). One such check involved replacing the share of the population with a bachelor's degree with the share of the population in poverty. Had the poverty share replaced the bachelor's degree share, the Trump 2020 vote would have depressed the vaccination initiation rate by 5.7 percentage points across US states, 6.9 percentage points across US counties, and 7.3 percentage points across Connecticut towns.

Most previous work on the statistical association between the Trump 2020 vote share and the Covid-19 vaccination rate has been carried out at the US county level using ordinary least squares (OLS) multiple regression. When the units of analysis are spatially correlated, however, OLS is inefficient at generating point estimates and is biased and inconsistent in estimating standard errors. Spatial autocorrelation was detected at each of the three subnational levels (US states, US counties, and Connecticut towns). The present analysis is among the first to include spatial terms that control for the specific types of spatial autocorrelation detected.

Also confirmed across US states, US counties, and Connecticut towns alike is that the Covid-19 vaccination initiation rate was depressed most by the Trump 2020 vote share, next-most by the Trump 2016 vote share, and least by the 2012 Romney vote share. Across Connecticut towns, the vaccination initiation rate was also more closely associated with the Trump 2020 vote share than with the Republican share of voter registrations in either 2016 or 2020.

Gadarian et al. (2022: 255) used six national surveys from March 2020 to April 2021, each with from 1,871 to 3,000 respondents, to find out 'whether levels of vaccine hesitancy varied by party, race, income, or education.' Their conclusion was that 'partisanship matters more than any other variable we have measured.' The evidence reported in this study suggests that the same is true across the subnational units for which most public health interventions are programmed. In terms of the statistical effect on the vaccination initiation rate, the bachelor's degree share outperformed the Trump 2020 vote share across the US states plus DC, as well as across Connecticut towns, but the Trump 2020 vote share outperformed the bachelor's degree share across US counties, and also outperformed race, ethnicity, and rurality across US states and Connecticut towns. The study's findings are consistent with the claim that national rather than local issues are increasingly shaping US political behavior (Hopkins 2018).

From a policy standpoint, it is important to know whether the main challenge to higher Covid-19 vaccination rates lies more with provisioning (pro-Trump politicians restricting vaccine availability) or with takeup (pro-Trump voters refusing available vaccines). Provision and takeup influence each other, but understanding how, and how much, can help to identify critical points at which politicians and the public can intervene to reduce the spread of Covid-19. Citizens rather than politicians appear to be mainly responsible for lower Covid-19 vaccination rates. It might be viewed as 'simplistic' to argue that 'people who voted for former President Donald Trump just won't get the vaccine. But...the vote is just a proxy. The underlying policies in these states are also to blame' (Ranney 2021). This study has found that even when public health policies and health care provision infrastructure were held roughly constant, as was effectively the case across Connecticut towns, and even after adjusting for sociodemographic

composition and Covid-19 case and death rates, as was done at all three territorial levels, the Trump 2020 vote share remained stubbornly associated with a lower Covid-19 vaccination rate.

Lerner et al. (2017) found that across 852 US counties and county-equivalents, a 10 percent lower share of the presidential vote going to Obama in 2012 was associated with a 2 percent lower takeup of Affordable Care Act (ACA) health insurance subsidies, adjusting for other factors pertinent to ACA takeup. A decade later, across 3,032 US counties, a 10 percent higher share of the presidential vote going to Trump in 2020 was associated with a nearly 6 percent lower July 2022 Covid-19 vaccination rate, controlling for diverse sociodemographic factors (Figure 10). These estimates show that the displacement of subnational by national issues as determinants of voter preference persists. Even after controlling for sociodemographic, infrastructural, and other factors specific to states, counties, and towns, health-related behavior is being influenced significantly, and increasingly, by national-level issues and concerns -- in the case of Covid-19 vaccination initiation, by the receptivity of Republican voters to disinformation and misinformation about Covid-19 vaccines emitted by Republican politicians with national followings and by right-wing media outlets with national reach.

Improving vaccine delivery and health infrastructure has a role to play in raising vaccination rates, but in places where Trump had strong electoral support in 2020, the demand side of the effort will remain crucial. Strategically, culturally-appropriate strategies have raised vaccination rates in certain hard-hit localities (Foxworth et al. 2021). Tactically, Lerner et al. (2017) suggested that framing Affordable Care Act health insurance subsidies as private sector-friendly might attract Republicans, but it is hard to see how Covid-19 vaccines could be similarly framed. Another tactical approach could be for public officials and media outlets to do more to 'prebunk' false or misleading claims by exposing people, immunization-style, to weakened

versions of misinformation and disinformation, allowing them to build up resistance in their own

ways (McGuire 1961, Roozenbeek et al. 2022). Although not a magic bullet, prebunking could

be a useful component of a broader strategy to raise demand for life-saving Covid-19 vaccines.

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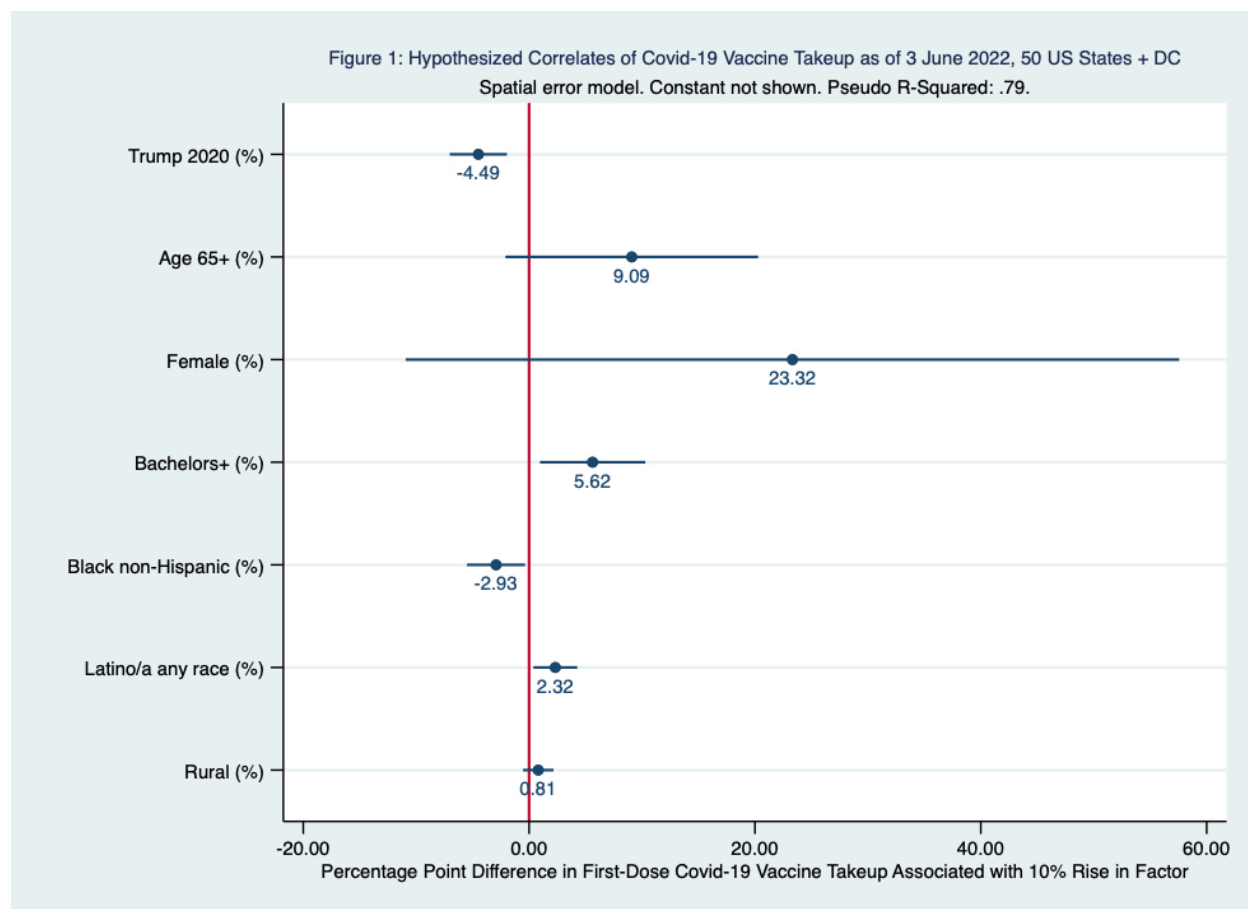
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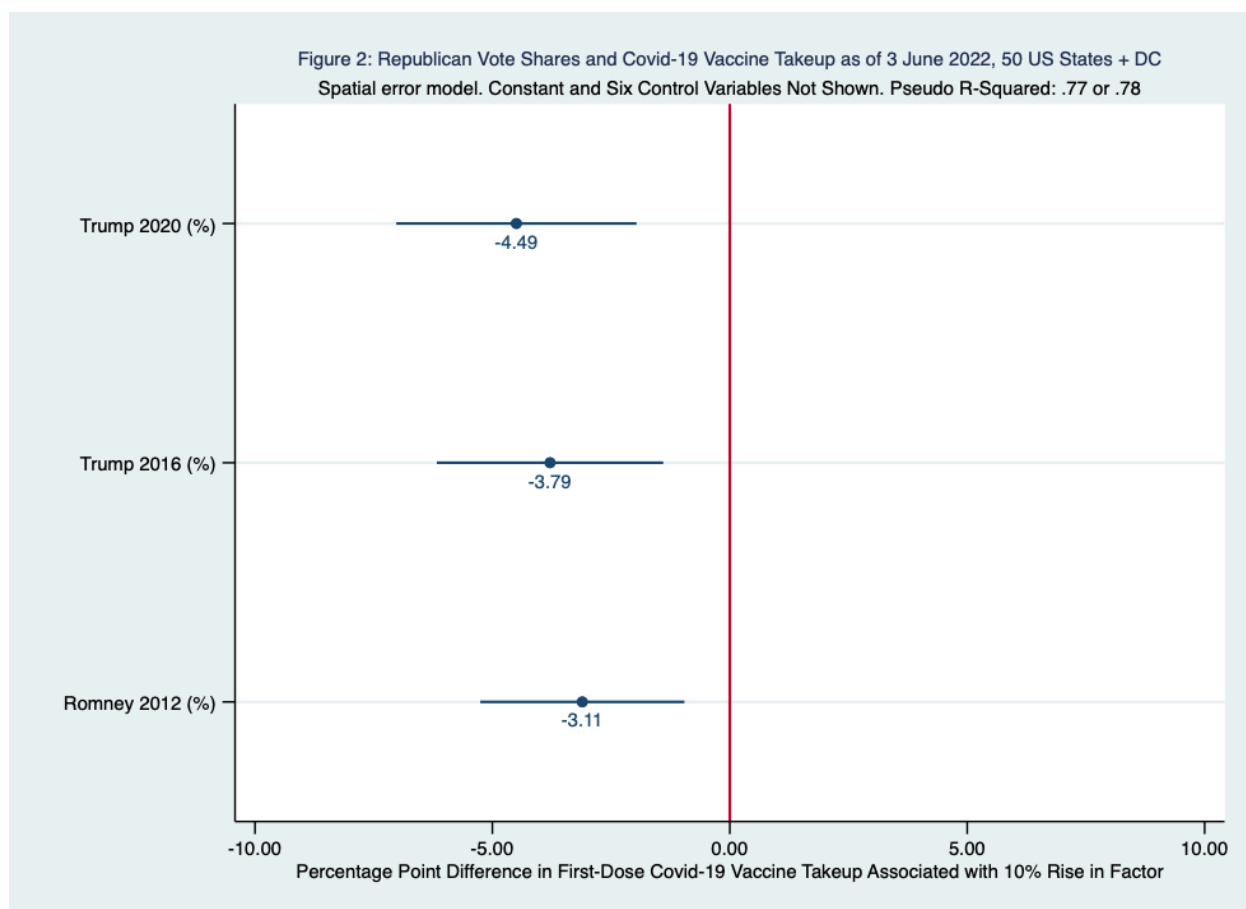
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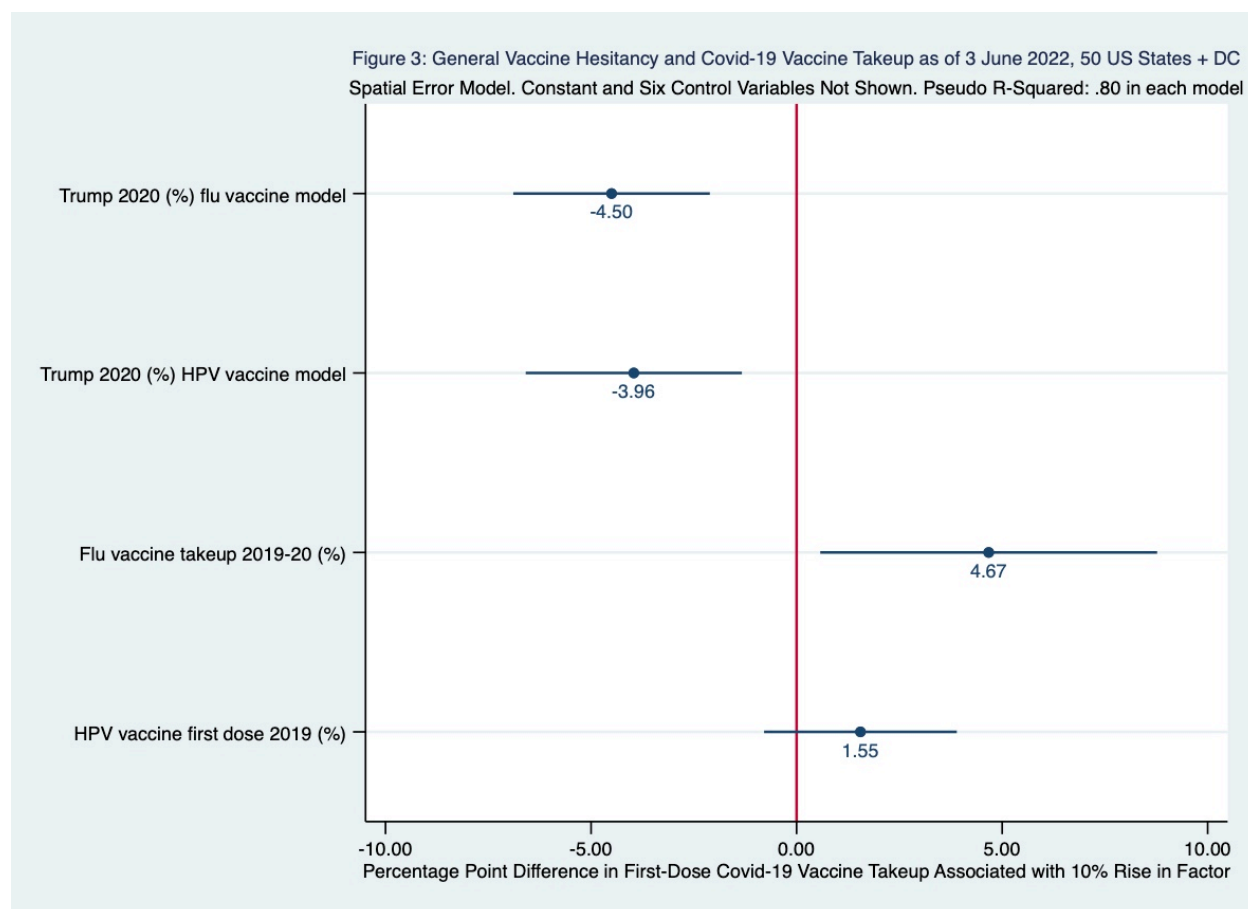30512. September. http://www.nber.org/papers/w30512

Figure 1: Hypothesized Correlates of Covid-19 Vaccine Takeup as of 3 June 2022, 50 US States + DC. Spatial error model. Constant not shown. Pseudo R-Squared: .79.

Figure 2: Republican Vote Shares and Covid-19 Vaccine Takeup as of 3 June 2022, 50 US States + DC
Spatial error model. Constant and Six Control Variables Not Shown. Pseudo R-Squared: .77 or .78

Figure 3: General Vaccine Hesitancy and Covid-19 Vaccine Takeup as of 3 June 2022, 50 US States + DC
Spatial Error Model. Constant and Six Control Variables Not Shown. Pseudo R-Squared: .80 in each model
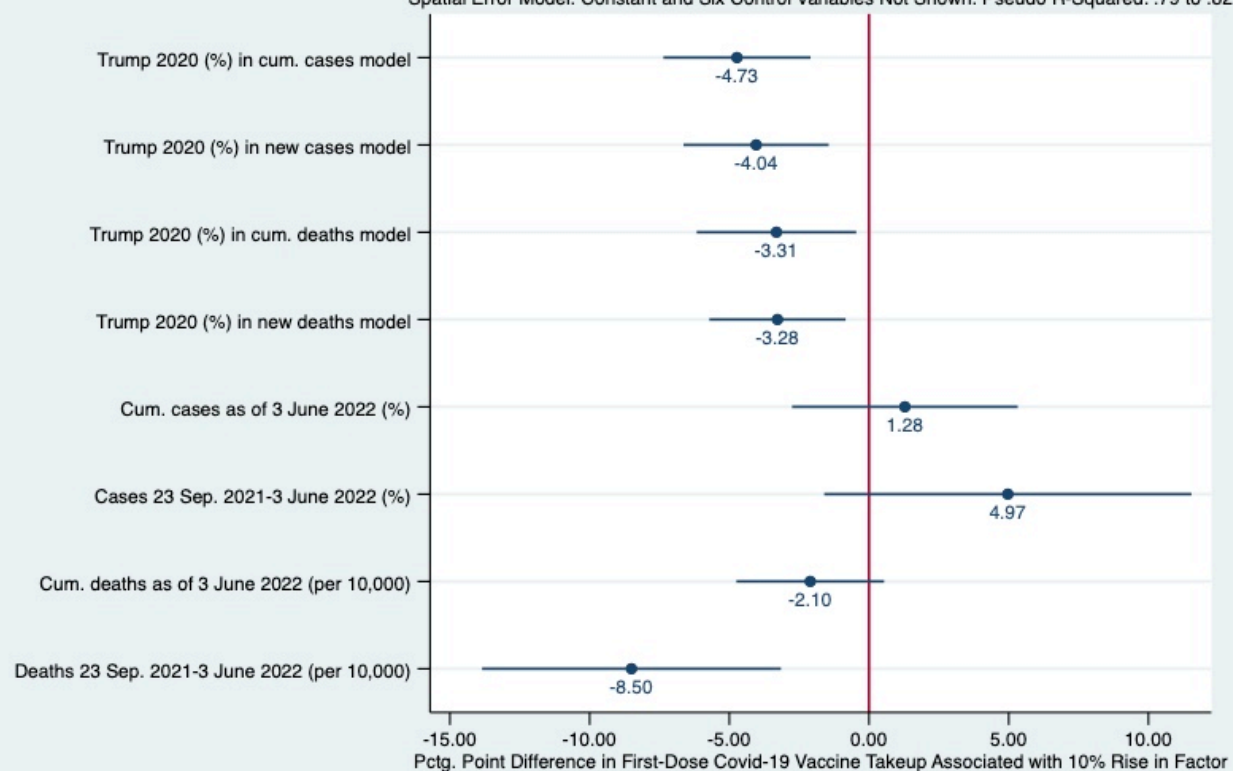
Figure 4: Did Case or Death Rates as of June 2022 Change the Statistical Impact
of the Trump 2020 Vote on the Vaccination Initiation Rate Across the 50 US States + DC?

Spatial Error Model. Constant and Six Control Variables Not Shown. Pseudo R-Squared: .79 to .82
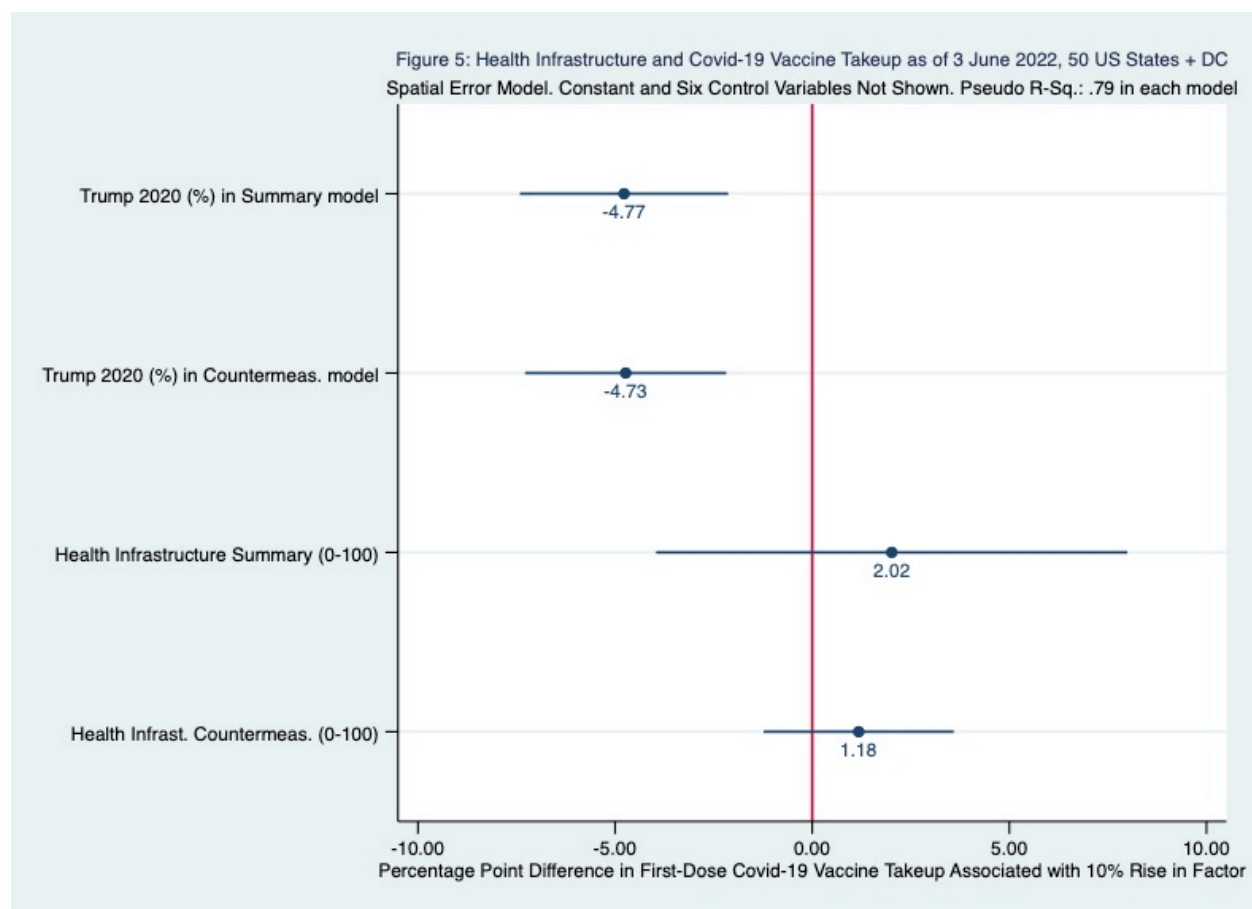
Figure 5: Health Infrastructure and Covid-19 Vaccine Takeup as of 3 June 2022, 50 US States + DC
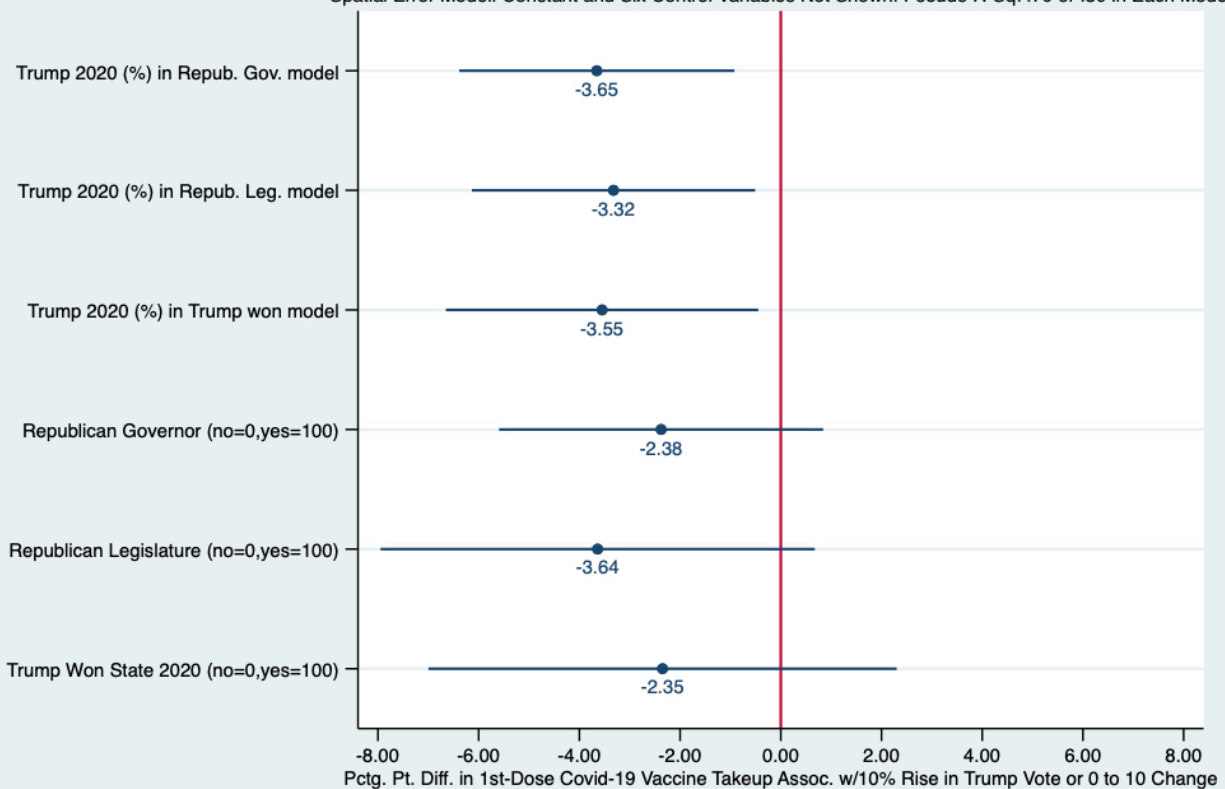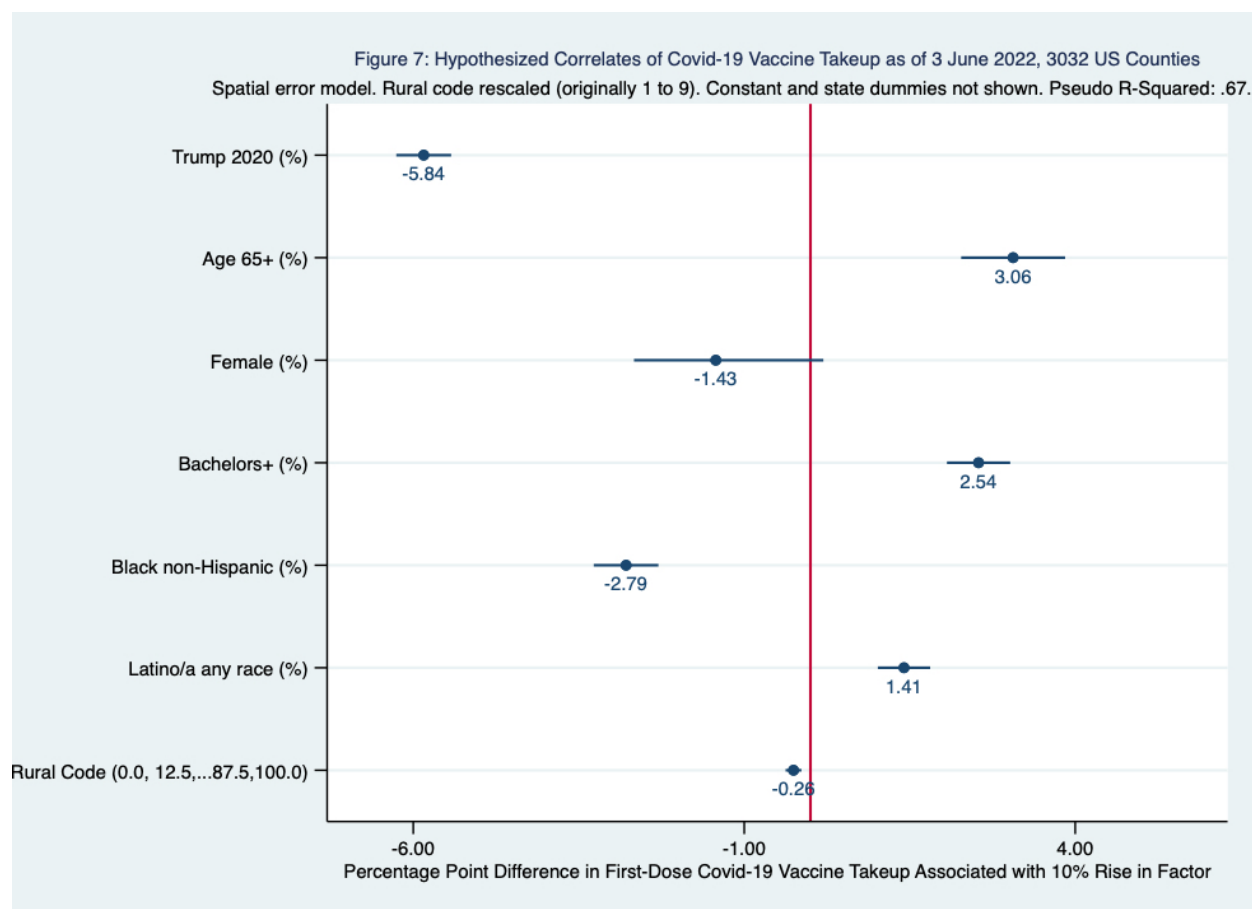Spatial Error Model. Constant and Six Control Variables Not Shown. Pseudo R-Sq.: .79 in each model
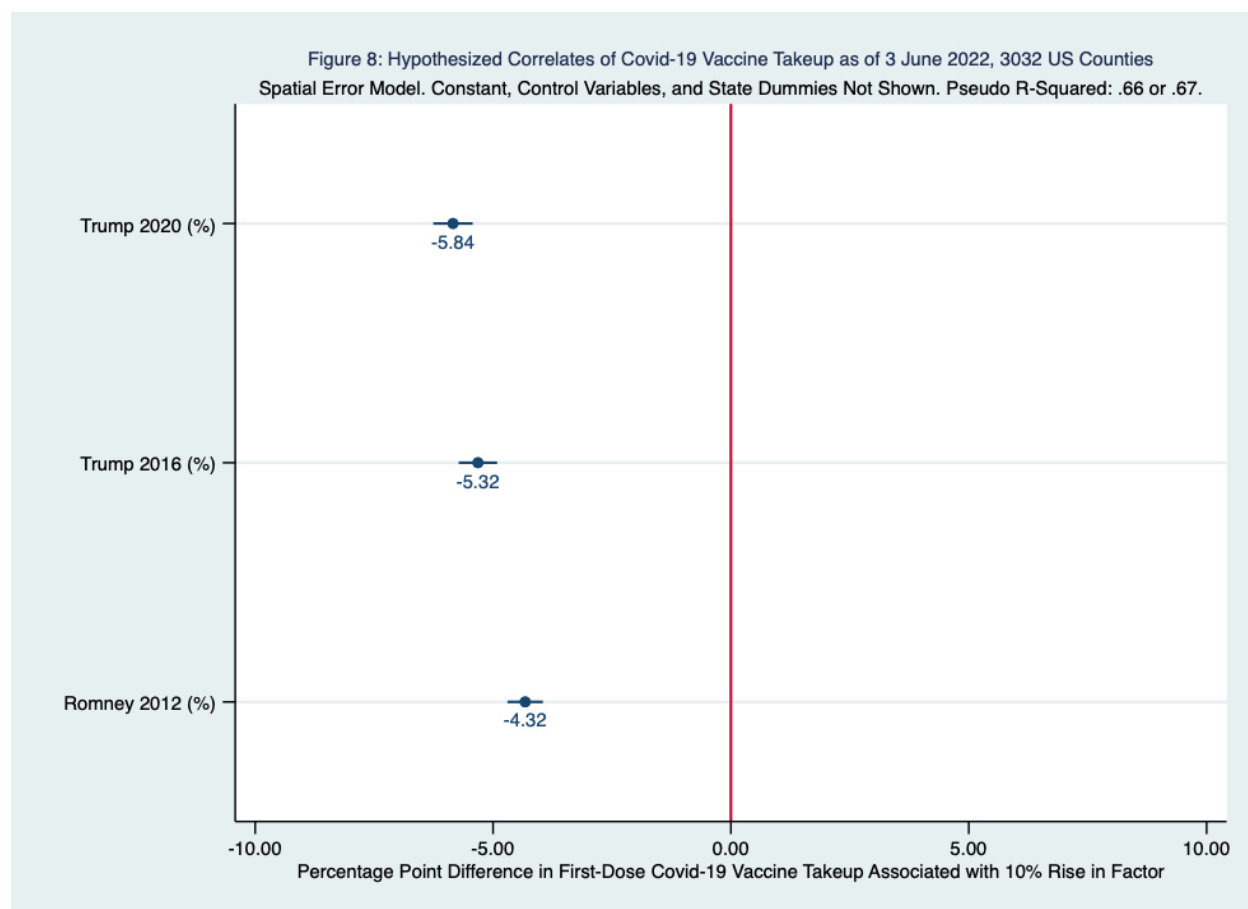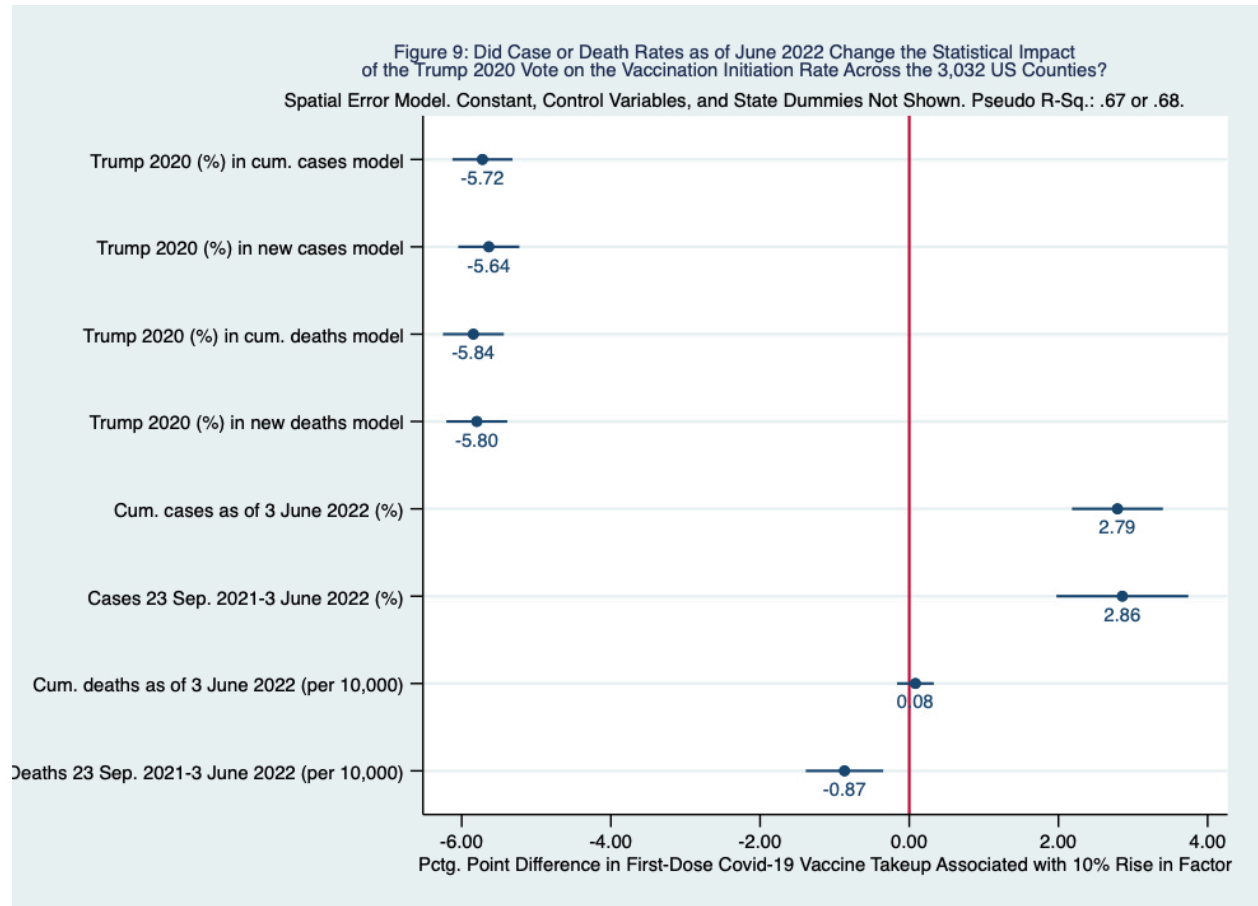
Figure 6: Republican Political Strength & Covid-19 Vaccine Takeup as of 3 June 2022, 50 US States + DC
Spatial Error Model. Constant and Six Control Variables Not Shown. Pseudo R-Sq: .79 or .80 in Each Model

Figure 7: Hypothesized Correlates of Covid-19 Vaccine Takeup as of 3 June 2022, 3032 US Counties
Spatial error model. Rural code rescaled (originally 1 to 9). Constant and state dummies not shown. Pseudo R-Squared: .67.

Figure 8: Hypothesized Correlates of Covid-19 Vaccine Takeup as of 3 June 2022, 3032 US Counties
Spatial Error Model. Constant, Control Variables, and State Dummies Not Shown. Pseudo R-Squared: .66 or .67.

Figure 9: Did Case or Death Rates as of June 2022 Change the Statistical Impact
of the Trump 2020 Vote on the Vaccination Initiation Rate Across the 3,032 US Counties?

Spatial Error Model. Constant, Control Variables, and State Dummies Not Shown. Pseudo R-Sq.: .67 or .68.

Figure 10: Hypothesized Correlates of Covid-19 Vaccine Takeup as of 1 June 2022, 166 Connecticut Towns
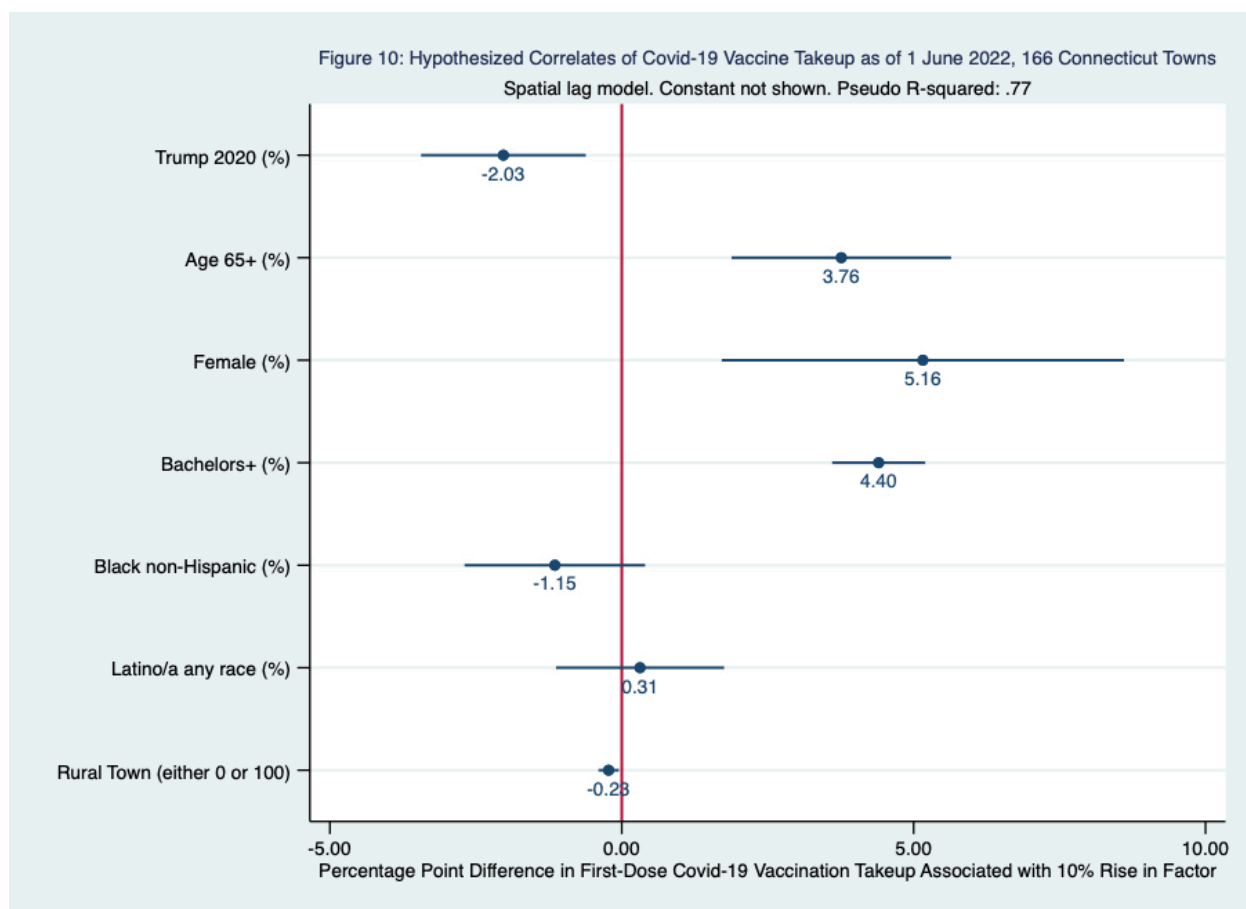Spatial lag model. Constant not shown. Pseudo R-squared: .77

Figure 11: Republican Registration and Vote Shares and Covid-19 Vaccine Takeup as of 1 June 2022, 166 Connecticut Towns
Spatial Lag Model. Constant and Six Control Variables Not Shown. Pseudo R-Squared: .75, .76, or .77
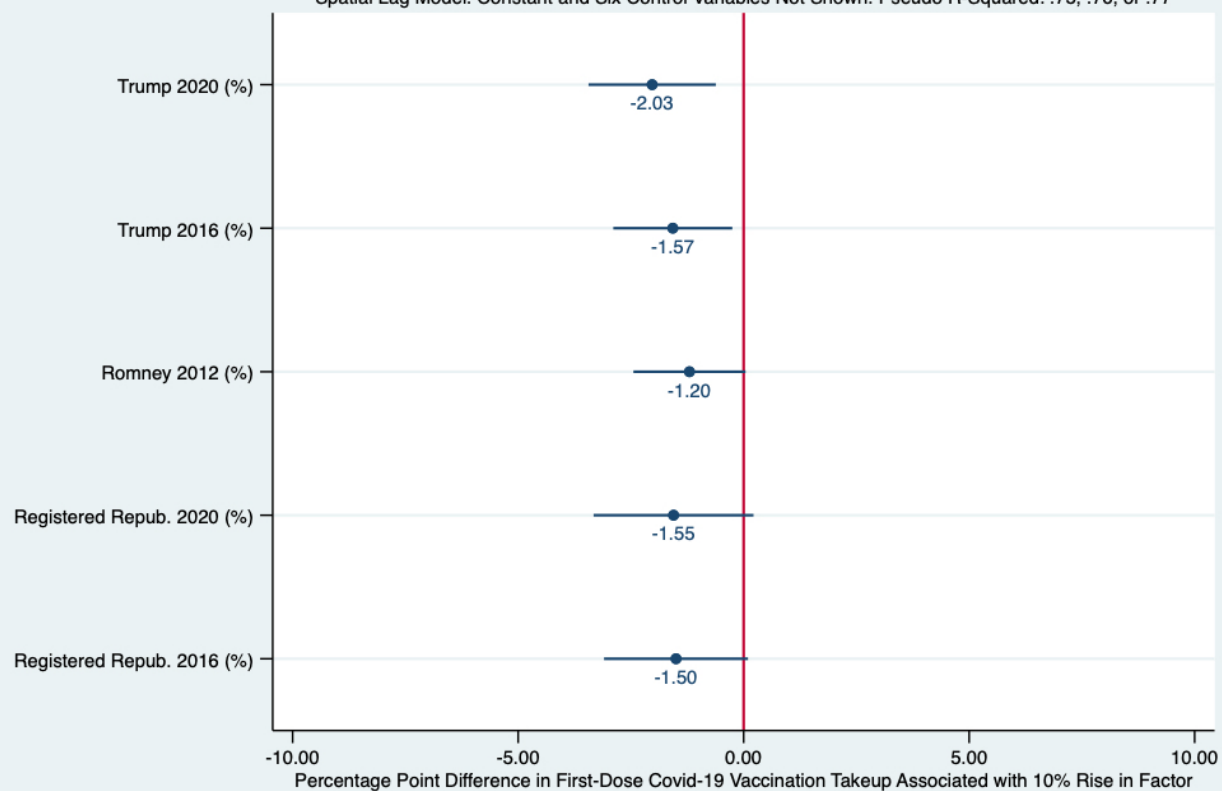
Figure 12: Did Case or Death Counts as of June 2022 Change the Statistical Impact of the Trump 2020 Vote on the Vaccination Initiation Rate Across 166 Connecticut Towns?