The Causal Impact of Romneycare on Massachusetts' Mortality Rate using Synthetic Control

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Abstract

We utilize the panel dataset from Center for Disease Control (CDC) to investigate the effect of Romneycare on mortality rates. Our analysis uses Synthetic Control to find the optimal weights for each state that closely resembles Massachusetts. We present these weights as well as our model prediction of lower mortality rates post 2006, when Romneycare was passed. Although Massachusetts did not trend similarly to other states chosen by Synthetic Control prior to the passage of Romneycare in 2006, our model predicts a decline in mortality rate of .867 which matches the actual outcome almost exactly. The results of our Synthetic Control estimates confirm the conclusion of Sommers, Long, and Baicker.

1. Introduction

Access to healthcare through affordable health insurance remains one of the most divisive policy debates in the United States, with critics of a privatized system arguing in favor of a widespread, easily accessible option targeted at low income households to increase the quality and quantity of health care. However, some supporters of private insurance argue against such a system, stating that insurance provided by the federal government unfairly burdens taxpayers, many of whom opt for private coverage through their employers. Before the groundbreaking introduction of the Affordable Care Act in 2008, better known as "Obamacare", the state of Massachusetts passed its own state-provided health insurance program signed into law by Senator Mitt Romney in 2006. The program, dubbed "Romneycare" and the first of its kind in the U.S., provided free and heavily subsidized health insurance to the lowest income resident of the state, and mandated that nearly all residents obtain a minimal level of coverage. To aid in the provision of coverage to higher earners, the law also required every employer in the state with over ten full-time employees to provide a health insurance plan to workers. Before the program was heavily rolled back in favor of Obamacare in 2012, over 97% of Massachusetts residents had health insurance coverage. Many studies have investigated the effects of Romneycare and Obamacare on statistics such as health coverage, insurance utilization, and health care pricing, however, few have attempted to isolate the causal effect of mandated affordable health coverage on mortality rates. One of the reasons why this effect can be difficult to identify is due to the distribution of health care in the U.S. - as insurance is not randomly assigned to individuals but normally obtained through employers, low income individuals tend to have minimal coverage, if at all and sub-optimal quality of care. As a result, worse health outcomes tend to be correlated with individuals on the lower end of the socioeconomic spectrum, making any causal analysis particularly complex. However, using causal inference techniques such as Synthetic Control, we will be able to isolate the direct effect of Romneycare on mortality outcomes. Overall, we theorize that the nearly maximized population of residents with mandated health insurance coverage required by Romneycare will decrease mortality due to more individuals seeking both preventative and emergency care without the burden of uninsured pricing.

The paper is organized as follows. In Sect. 2, we provide a background understanding of the original work of Sommers, Long and Baicker's, and their research design of implementing propensity score framework. Descriptions of state-level data are presented in Sect. 3. Empirical model and estimation, as well as Synthetic Control are performed in Sect. 4. In Sect. 5, we present the results of our analysis and report overall ATTs. Finally, Sect. 6 concludes.

2. Previous Literature

In this report, we will attempt to replicate Sommers, Long and Baicker's 2014 study of changes in Massachusetts' mortality after the introduction of Romneycare and the Massachusetts Health Care Reform. In their analysis, the authors utilized a natural experiment by comparing population-level Massachusetts mortality obtained from the Center for Disease Control (CDC) following the implementation of Romneycare to counties covering approximately 25% of the United States. The counties included were selected to best match the racial makeup, gender balance, age cohorts, and baseline death rates found in Massachusetts. Using a propensity score framework, the authors use a regression-based methodology to "match" the untreated counties to Massachusetts based on pre-treatment characteristics and mortality rates.

The results, published in the American College of Physicians' Annals of Internal Medicine, found an overall annual decrease of 320 deaths per year in Massachusetts as compared to counties outside the state.

3. Data

To build the synthetic control, state-level annual time-series data was extracted from the Census Bureau covering the period between 2000 and 2010. Relevant data collected included gender balance; racial diversity split into White, Black, Asian, American Indian/Native, Hawaiian/Pacific Islander, and multiracial

as percent of population; age cohorts as percent of population; unemployment rate; poverty rate; median household income; and uninsured rate as the percent of residents without health insurance coverage. We agreed with the original authors' choice to exclude elderly individuals who would be eligible for Medicare from the sample, as we would not expect a policy primarily aimed at increasing health insurance coverage to have a substantial effect on those eligible for Medicare. Exact replication of the original authors' data set was difficult as they were able to obtain county level data with specific causes of death via a direct request to the CDC. The data available publicly from the CDC does not have cause of death broken down as granularly as the authors', so replicating their measure of "Healthcare-Amenable" mortality accurately wasn't feasible, and would have been a rough approximation at best. Thus, we chose to focus on replicating their measure of "All-cause-mortality", which we could be found from census panel data.

4. Methodology

Given that the implementation of "Romneycare", the Massachusetts Health Care Reform, was a unique policy event in the United States at the time, Synthetic Control seemed to be a very appropriate method for determining the policy's causal effect on mortality. It is very analogous to the original authors' propensity score matchin approach, but allowed us to use State-level data and make broader claims about Massachusetts in aggregate. Let Y_{it} be the mortality rate for state i at time period t and let $D_i \in (0, 1)$ denote the binary treatment indicator of state i. Our goal is to estimate the average treatment effect of introducing Romneycare on mortality rates in Massachusetts, or:

$$ATT_t = E[Y_{it}^1 - Y_{it}^0 | D_i = 1] = E[Y_{it}^1 | D_i = 1] - E[Y_{it}^0 | D_i = 1]$$

In words, the ATT can be calculated as the estimate of the difference in outcomes for the treated units in the world where they were treated versus the world where they were not treated. The key crux to this calculation lies in our ability to measure $Y_{it}^0 | D_i = 1$, or how the treated units would have performed had they not been treated. This is where the idea of Synthetic Control (SC) comes into play. The Synthetic Control estimator interpolates this unknown by using a weighted average of the untreated units to create a synthetic untreated unit with pre-treatment characteristics similar to those of the treated unit. In our analysis, we will use cross-sectional time-series mortality data from counties outside of Massachusetts that did not have affordable care laws that most closely match the demographic makeup of Massachusetts. Using SC, an optimized weighted average of these selected counties' mortality rates will serve as our untreated unit to compare to Massachusetts' mortality before and after Romneycare was enacted. In comparison to Sommers et al's approach which uses propensity score matching, synthetic control uses optimization of individual weights, which avoids the small sample bias that propensity score matching is susceptible to when only one treatment unit is used, the state of Massachusetts in our case.

5. Analysis

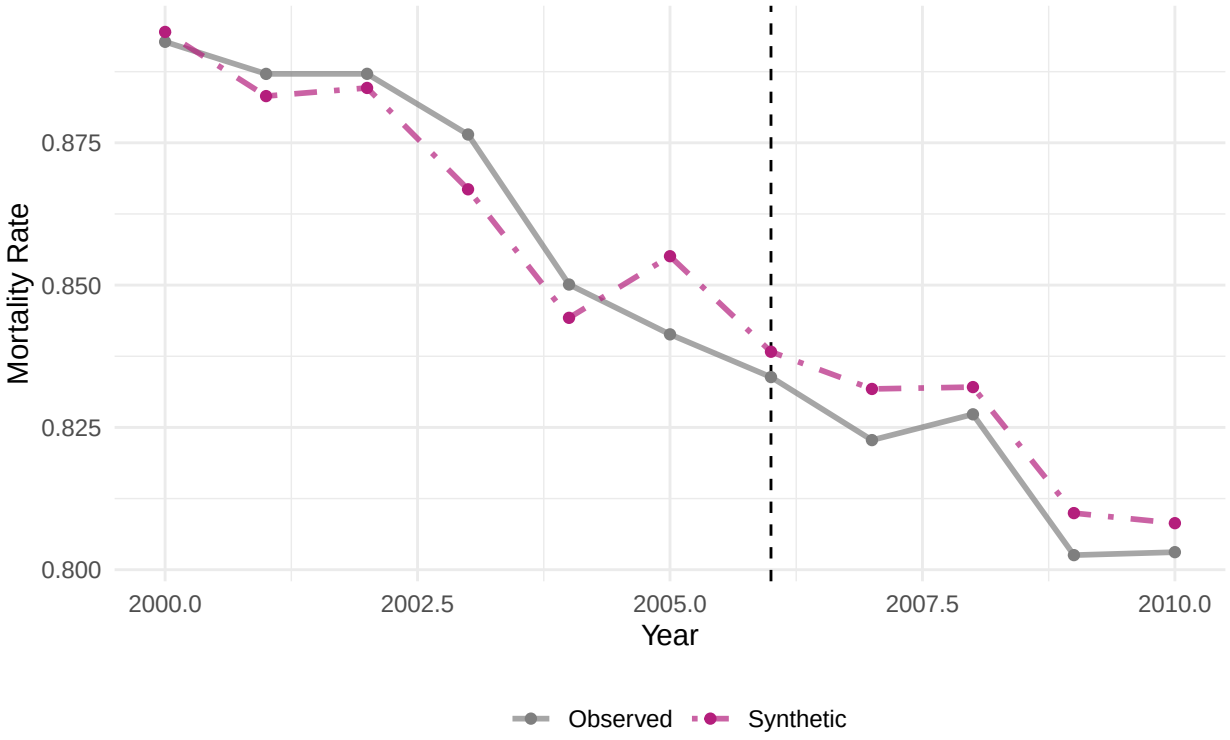
There were some notable features that stood our when running our synthetic control model. As displayed in Table 1, the model gave higher weights to states such as Rhode Island, Maryland and Connecticut. These states were determined to have the most similar characteristics to Massachusetts, perhaps stemming from their geographical proximity to each other. Using these weights, our model predicted higher mortality rates post 2005 as shown in Figure 1. This has some interesting implications for the efficacy of our model. Our event of interest takes place in 2006, a year after this hike in mortality rates. It would appear that Massachusetts is not following the same trends as states deemed most similar for this year. Figure 1 displays this more explicitly, showing how these states kink upwards from 2004 to 2005 but Massachusetts remains on a downward trend. Despite this, mortality rates in Massachusetts appear to be declining at a greater rate than our control in 2006. Furthermore, it is declining at a greater rate than the previous year as highlighted in Figure 3. Despite the fluctuations in trends prior the event, our synthetic control model did predict that mortality rates would decline post 2006. The control model's mortality rate was approximately .867 in 2006

while the actual outcome came out to be approximately .833. Therefore our ATT shows a decline of .034 deaths per 100,000.

Table 1: Synthetic Control: Weights of sampled states

State	Weight
Rhode Island	0.27630
Maryland	0.27614
Connecticut	0.23565
District of Columbia	0.11152
Minnesota	0.09388
Hawaii	0.00415
New Hampshire	0.00229
Virginia	0.00001
Delaware	0.00001
New Jersey	0.00000

Figure 1 − Time Series of the Sythetic and Observed Mortality Rate



Dashed line denotes the time of the intervention.

Figure 2 − Mortality Rate Trends for Heavily Weighted States (2003−2005)

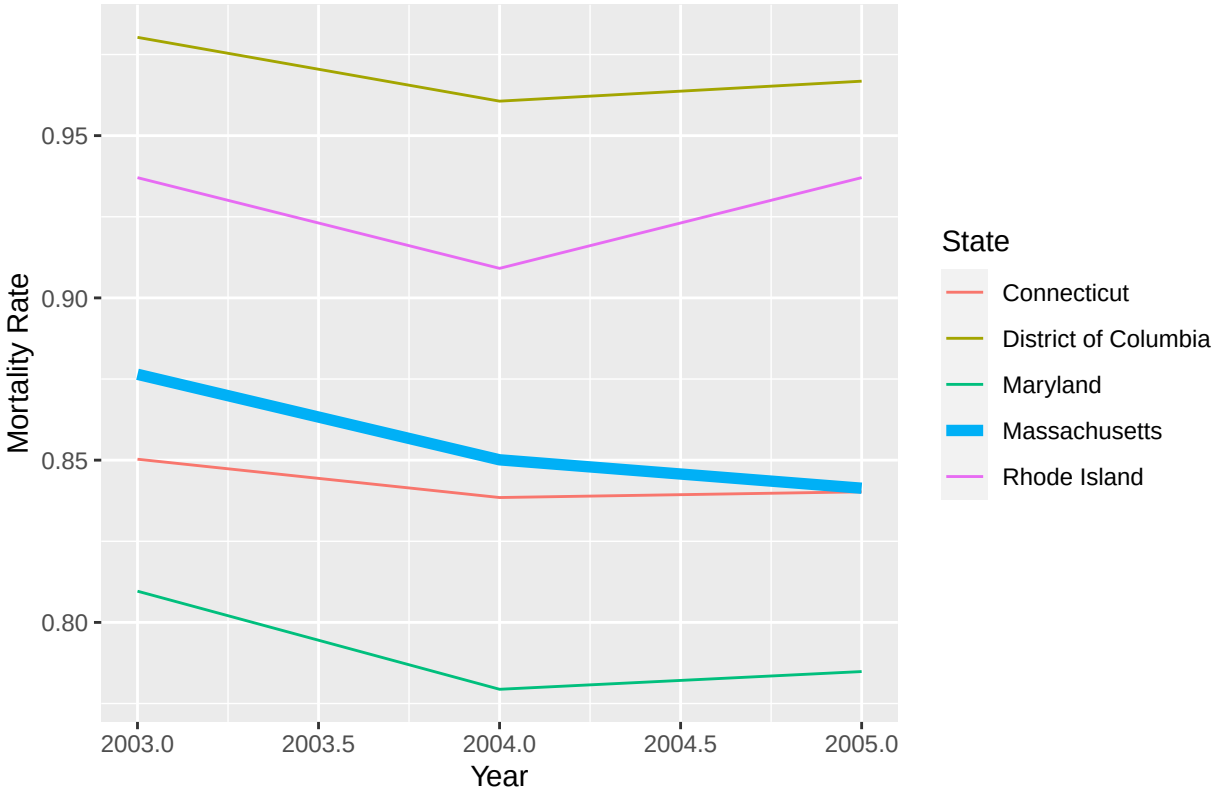
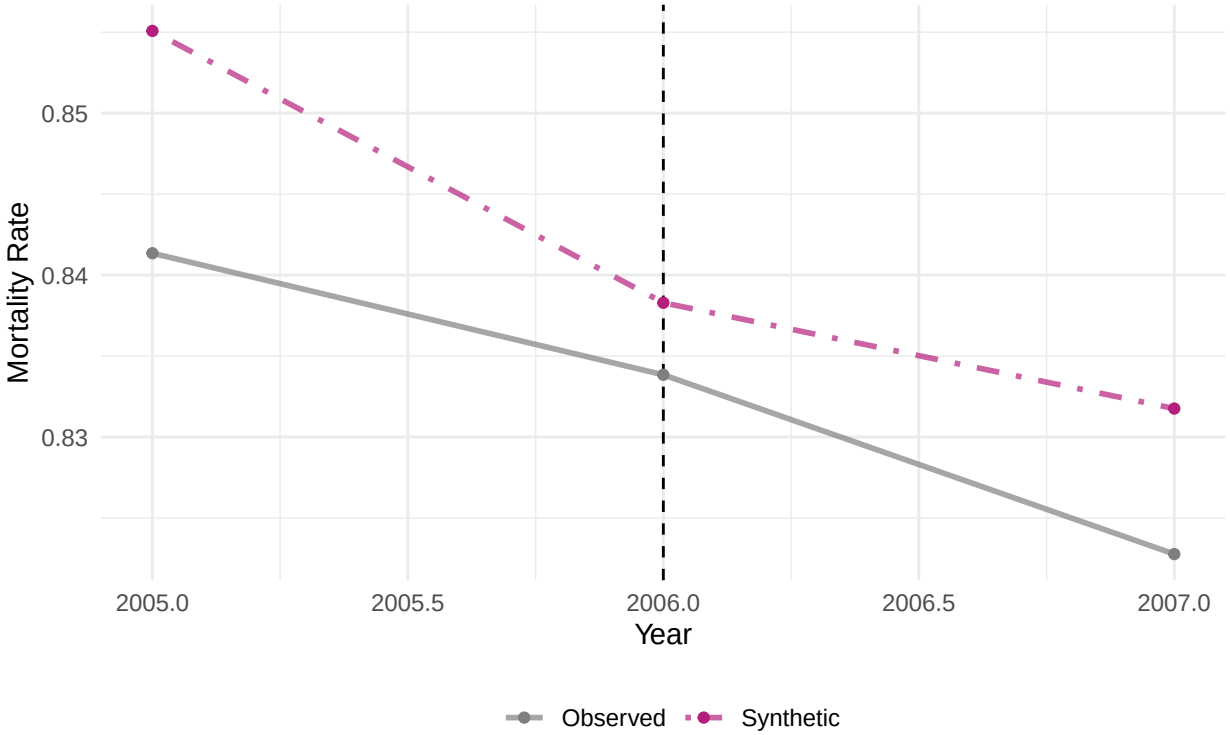
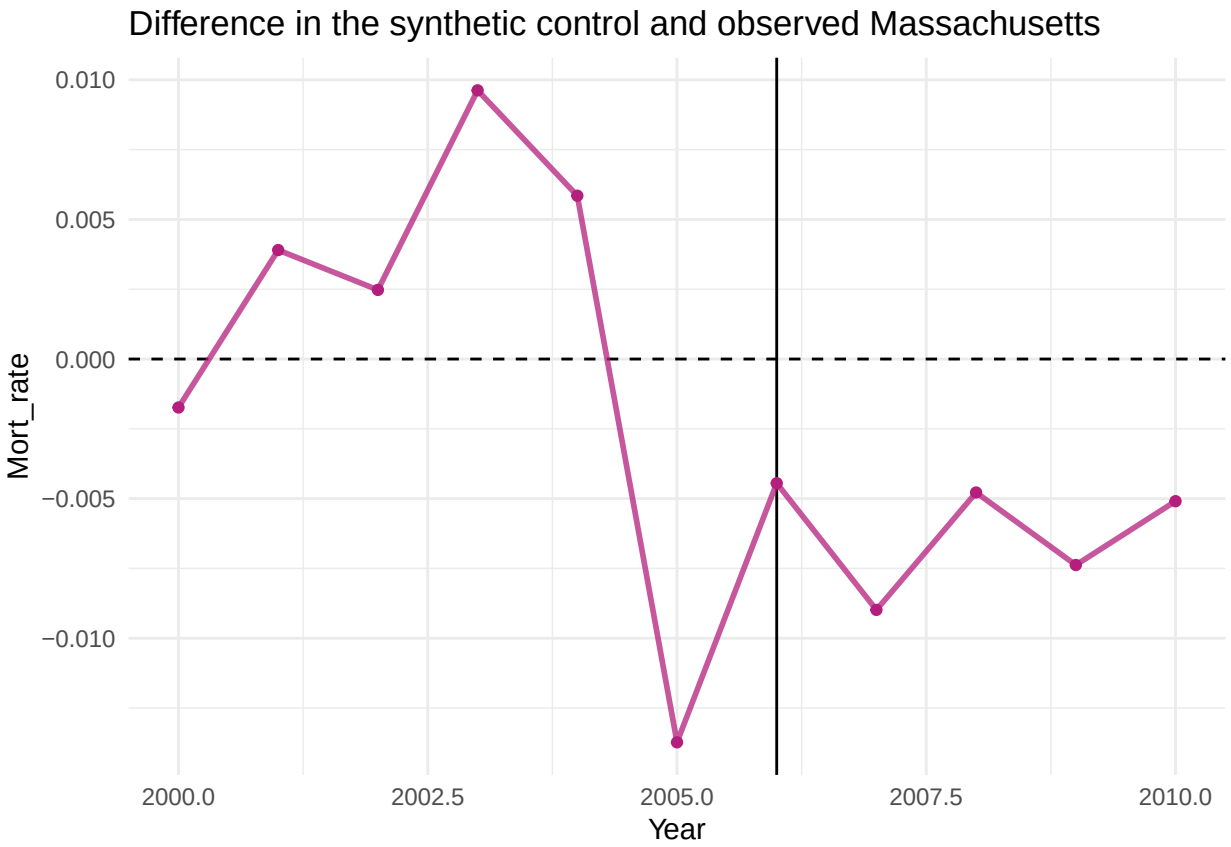


Figure 3 − Synthetic and Observed Mortality Rate at Event



Dashed line denotes the time of the intervention.

variable Massachusetts 1 mort_rate 0.8669595 time_unit Massachusetts 1 2000 0.8927411 2 2001 0.8871092 3 2002 0.8871150 4 2003 0.8764567 5 2004 0.8501031 6 2005 0.8413487 7 2006 0.8338424



6. Conclusion

Low income households are experiencing subpar quality of healthcare as well as the barriers to healthcare access as compared to their higher income counterparts. It is a pressing issue that demands a carefully crafted healthcare policy that can effectively promote better life quality. The passage of Romneycare in 2006 in Massachusetts allows us to estimate the effect of such health policy on mortality rates. States such as Rhode Island, Maryland and Connecticut, are chosen with higher weights to represent Massachusetts in the counterfactual world where it was not treated. Our analysis reveals a significant decline in mortality rates among nonelderly adults in Massachusetts. Although our results only define average treatment on the treated, as opposed to the average treatment effect for the entire population, since Massachusetts differs from other states in many aspects such as its geography or demography. Our research serves as a starting point for further analysis on the treatment effects of healthcare policies.

References

Sommers, Benjamin D., Sharon K. Long, and Katherine Baicker. "Changes in Mortality after Massachusetts Health Care Reform." Annals of Internal Medicine 160, no. 9 (May 6, 2014): 585. https://doi.org/10.7326/m13-2275.