Senior Project

Department of Economics



Elimination of the ACA Individual Mandate Penalty and its Effect on Healthcare Costs

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Abstract

This study uses a two-way fixed effects difference-in-differences (TWFE DID) regression analysis to estimate the causal effect of the elimination of the federal individual mandate penalty on individual-level healthcare expenditures. The federal individual mandate penalty was a key feature of the Affordable Care Act of 2010 and was in effect from 2014 through 2018. The Tax Cuts and Jobs Act of 2017 effectively ended the mandate beginning January 1, 2019. This study uses individual-level data from the Medical Expenditure Panel Survey's 2018-2019 panel to conduct its analysis. Treatment and control groups are determined by the type of health insurance coverage a person held in 2018. Results are estimated across four model specifications using linear and log forms, and two outcome variables of total healthcare expenditures and total out-of-pocket spending. Across both a simple and advanced DID specification, the results do not provide robust evidence that the elimination of the mandate penalty increased healthcare costs for the treatment group. The one statistically significant finding, observed in the advanced DID specification, indicates a reduction in total healthcare expenditures for insured individuals in the treatment group, which is directionally opposite to the adverse selection prediction and may reflect reduced healthcare utilization following coverage disruption. These findings suggest that other ACA market stabilization mechanisms may have impacted the effects of the mandate's repeal in the short run, and that further study should be conducted.

I. Introduction

In 2009, the CDC reported that 58.5 million Americans had been uninsured for at least part of the year, and that the percentage of adults aged 18-64 years who lacked coverage increased from 19.7% in 2008 to 21.1% in 2009 (Cohen et al., 2009). Major healthcare reform became one of the largest priorities of the Obama administration.

The most comprehensive piece of healthcare legislation passed under President Obama includes several individual policies that were created to reach its objectives. The Patient Protection and Affordable Care Act of 2010 (ACA) was passed with 3 primary goals: to increase access to health insurance among uninsured Americans, improve the quality of care received by patients, and to reduce overall healthcare costs for Americans (ASPA, 2022). One of the ACA's key features in attaining these goals was known as the individual mandate penalty, which was a federal tax penalty that applied to individuals and households who did not have qualifying healthcare coverage beginning in 2014 (Mach, n.d.). By imposing a tax on uninsured people, lawmakers were able to incentivize more Americans to buy health insurance.

This mandate penalty was in effect for five years, 2014 through 2018, and ended beginning January 1, 2019 due to the passage of the Tax Cuts and Jobs Act of 2017.

My research addresses the current gap in the literature by focusing on the federal individual mandate penalty and its direct effect on out-of-pocket healthcare costs at the individual level, which is a specific policy and variable-of-interest pairing that has not been previously studied by researchers.

Using individual-level data from the Medical Expenditure Panel Survey and a two-way fixed effects difference-in-differences design, this study finds that the elimination of the mandate penalty did not produce a robust or statistically significant increase in healthcare expenditures or

out-of-pocket spending for individuals in the self-insured insurance market. Where statistically significant effects are detected, they point to a reduction in total expenditures for the insured treatment subgroup, a finding that is more consistent with reduced utilization following coverage disruption than with the cost increases predicted by adverse selection theory. These results suggest that the ACA's remaining market stabilization mechanisms may have absorbed much of the shock from the mandate's repeal in the short run and contribute to a broader understanding of how individual mandate policies shape healthcare costs and insurance market behavior.

II. Literature Review

The literature surrounding the mandate penalty and ACA's effect on various economic variables is abundant, especially regarding insurance enrollment. One of the first studies to be published is a predictive paper, using forecasting techniques to study the mandate's effect on insurance enrollments and premiums. They find that the mandate increases insurance coverage and enrollment, that 19% of people would not have bought insurance if there was no mandate in effect, and that people with lower incomes and education levels were the most likely to choose to remain uninsured (Fung et al., 2019). Although these conclusions were drawn from forecasts, other studies conducted later that utilized existing data found similar results. One study found that low-income adults were 24% more likely, year over year, to become uninsured if they faced no mandate penalty (Soni, 2022) and another concluded that the mandate penalty increased overall healthcare coverage among Americans (Lurie et al., 2021). This literature shows that the individual mandate has specifically led to higher insurance enrollment, especially among low-income populations. In the related literature, the most popular outcome variable to study seems to be insurance enrollment, with the consensus that the ACA and its specific policies have increased enrollment in the US (Glied et al., 2020; Lurie et al., 2021, Barber, 2018; Tolbert et al., 2018; Bailey and Dave, 2019; Soni, 2022; Fung et al., 2019).

Many researchers have also studied other aspects of the ACA, or the ACA in general, on out-of-pocket healthcare costs and spending. Studies that have focused on specific aspects of the ACA, like Medicaid expansions and state-level health insurance benefit mandates, have concluded that those ACA features were responsible for overall lower out-of-pocket healthcare costs among Americans in the affected groups (Bailey, 2022; Gotanda et al., 2020; Tolbert et al, 2016). One study focused on the federal dependent coverage mandate (Lenhart and Shrestha, 2017) and another on state-level mandates (Soni, 2022) that came after the federal mandate ended. Studies that focused on the ACA in general also concluded that it lowered overall out-of-pocket spending (Glied et al., 2020).

Overall, the existing literature surrounding the ACA and health insurance-related variables suggests that the 2010 legislation has been successful in achieving its primary goals of increasing access to healthcare to uninsured populations, lowering overall healthcare costs, and improving the quality of care that patients in the US receive.

III. Data

The main data source I use is the Medical Expenditure Panel Survey, a set of large-scale surveys of families and individuals, their medical providers, and employers across the United States. MEPS also provides data on the cost and use of health care and health insurance coverage. This data is accessed through the IPUMS organization.

MEPS has two components for data collection. The first is their insurance component, which comes from surveying U.S.-based employers to collect health insurance plan information. The second is their household component, which is a nationally representative survey of the U.S. civilian noninstitutionalized population. The sampling frame is drawn from respondents to the

National Health Interview Survey (NHIS) and collects data from a nationally representative sample of households. A new panel of households is selected each year, and each household is interviewed five times over two years, gathering information at the individual and household level.

There are several variables that have been extracted from MEPS that are used in my research, primarily for identifying the insurance status for individuals and their medical expenditures. The first set of variables that were extracted capture healthcare expenditures. The first variable is total expenditures, which is the sum of direct payments for care provided during the year, including out-of-pocket payments and payments made by private and public insurance. The other variable is for total out-of-pocket (OOP) healthcare spending which shows the annual total direct out-of-pocket health care payments made by an individual or family. Below are the summary statistics for these two expenditure variables for two panels of data, 2017-2018 and 2018-2019 (the 2017-2018 panel is used in a pseudo-DID test that will be discussed later).

Table 1: Healthcare Expenditure Summary Statistics, 2018-2019

Variable	Obs	Mean	Median	Min	Max
Total Healthcare Exp.	29,896	$6,247.96	$1,243.00	0	$797,307.00
Total OOP Exp.	29,896	$761.43	$121.00	0	$210,918.00

Source: IPUMS MEPS (2026) and own calculations.

Table 2: Healthcare Expenditure Summary Statistics, 2017-2018

Variable	Obs	Mean	Median	Min	Max
Total Healthcare Exp.	29,896	$5,691.51	$1,013.00	0	$807,611.00
Total OOP Exp.	29,896	$650.01	$94.00	0	$221,100.00

Source: IPUMS MEPS (2026) and own calculations.

The second set of variables I extracted from MEPS are the expenditure variables, which serve as the outcome variables of interest for this study. Four variables related to health insurance status were extracted, all indicating whether or not an individual held the specific coverage type or not, and are as follows: employer-based, public, self-insured, and exchange/marketplace insurance.

I conducted an extensive data cleaning process to establish the treatment and control groups for this study. Since MEPS collects each individual's coverage status at the monthly level, the data was aggregated to capture insurance coverage levels for the entire year. Treatment and control groups were established after this point. There are two treatment groups in this study. The first treatment group is also referred to as the insured treatment group and includes all individuals who held insurance through self-employment, exchange, or marketplace for at least 6 months out of the 2018 calendar year. The second treatment group is also referred to the uninsured treatment group and includes all individuals who did not hold any type of insurance during the calendar year of 2018. These were chosen based off of the assumption that these individuals would have been the ones most exposed to both the mandate penalty itself and its elimination. The control group includes all individuals who held insurance through the government, as in Medicare or Medicaid, or employer-based insurance for at least 6 months out of the calendar year. Having this established, the insured treatment group includes 371 observations, the uninsured treatment group includes 4,163 observations, and the control group includes 9,933 observations. All other observations were dropped, which resulted in 6.95% of all observations being dropped. This same process was used to the analysis in my pseudo-DID test, which will be discussed later, though the tables for both analyses are shown below.

Table 3: Treatment and Control Group Breakdown, 2017

Control Group (Public/Employer Based)	Treatment Group (Exchange/Self-Employed Insurance, No Insurance)												
# of Months	0	1	2	3	4	5	6	7	8	9	10	11	12
0	4576	8	14	10	18	36	6	10	13	10	22	16	233
1	66	0	0	0	0	0	0	0	0	0	0	1	2
2	103	0	0	2	0	1	0	0	0	4	0	1	1
3	124	0	0	1	0	2	0	2	1	1	6	1	3
4	183	0	1	0	1	1	1	1	1	2	0	0	1
5	263	0	0	0	0	1	0	0	7	0	0	0	2
6	144	0	0	0	0	2	2	6	0	0	0	0	3
7	139	0	0	0	1	2	1	2	2	2	0	0	0
8	221	2	1	1	2	11	0	1	1	0	0	0	2
9	221	0	0	3	7	0	0	0	1	1	0	0	0
10	215	0	4	5	1	0	1	2	2	0	1	0	0
11	222	0	1	0	0	1	0	1	1	0	0	0	3
12	8657	1	0	7	10	16	2	1	8	3	7	8	50

Source: IPUMS MEPS (2026) and own calculations.

Table 4: Treatment and Control Group Breakdown, 2018

Control Group (Public/Employer Based)	Treatment Group (Exchange/Self-Employed Insurance, No Insurance)												
# of Months	0	1	2	3	4	5	6	7	8	9	10	11	12
0	4163	21	6	10	26	15	6	3	5	9	13	16	319
1	77	0	0	1	0	0	0	0	0	0	0	3	1
2	98	0	1	1	0	2	0	0	1	0	1	1	1
3	146	0	0	1	0	0	0	0	2	2	3	1	0
4	167	0	1	1	0	0	0	7	0	3	0	3	1
5	207	0	0	1	1	2	0	1	4	0	1	2	2
6	142	0	0	1	0	2	1	1	2	0	0	0	0
7	173	0	0	0	1	2	1	1	2	0	0	4	2
8	207	1	0	0	1	1	1	0	2	0	1	1	2
9	250	0	0	2	8	0	2	0	0	0	0	0	3
10	242	0	1	4	3	1	0	1	1	0	1	1	1
11	229	2	1	3	1	0	0	1	4	0	3	1	3
12	8690	2	10	4	7	8	2	1	4	4	0	6	55

Source: IPUMS MEPS (2026) and own calculations.

IV. Theory

This study is grounded in the theory of adverse selection in health insurance markets and how both utility-maximizing consumers and profit-maximizing insurers decision-making is

affected by the elimination of the mandate penalty. In competitive insurance markets, insurers may not be able to perfectly observe an individual's risk of illness and therefore price their premiums at the average risk level across all demographics. Low-risk individuals may exit their insurance arrangements to save on premium costs they may not actually need to have (Rothschild and Stiglitz, 1976). Because people who are considered healthier will drop their coverage, the demand for health insurance will decrease, and with less business in the market, insurers will increase their premiums to maintain profits. High-risk individuals remain insured, and the actions of both groups deteriorate the risk pool (Akerlof, 1970).

The individual mandate was implemented to address adverse selection through enacting a penalty if an individual chose to remain uninsured; higher enrollment and competition in the market would lead to lower premiums and overall costs. There is empirical evidence to suggest that the individual mandate was successful in reducing adverse selection and increasing welfare in the health insurance market (Hackmann et al., 2015).

Since this penalty was effectively ended beginning in 2019, how premium costs have been affected is determined by several factors. Firstly, low-risk individuals may choose to end their coverage when they no longer face the mandate penalty, which would deteriorate the risk pool. How insurers have responded to enrollment and risk pool changes will reflect pricing changes in the market, as previously mentioned. If insurers chose to adjust premiums for both individually purchased plans and employer-based coverage, then premiums may increase for both my treatment and control groups, showing that both groups may have been treated through insurance repricing (Dafny, 2010; CBO 2017). A more direct adverse selection prediction is that healthier individuals disproportionately exit the individual, non-group market, where coverage decisions are more elastic with respect to mandate penalties. If risk pool deterioration occurs, insurers may

raise premiums specifically for individually purchased plans while employer-based premiums remain relatively stable (Fung, et al., 2019). In this case, the elimination of the mandate has a positive effect on the premium costs of the treatment group.

The theoretical effect of eliminating the federal individual mandate penalty on out-of-pocket healthcare spending is also important. Insurance coverage lowers the marginal cost of care at the point of service and increases healthcare utilization. When individuals are insured, they consume more preventive and routine medical services because cost-sharing is reduced. Conversely, when insurance coverage declines, the marginal cost of care rises (Manning et al., 1987). When individuals forgo coverage, they become fully exposed to the financial consequences of illness, injury, or hospitalization. Removing the mandate penalty lowers the incentives to purchase insurance, potentially increasing the number of uninsured individuals who face large medical bills when adverse health events occur. This can lead to an increase in out-of-pocket spending (Cutler and Zeckhauser, 2000). Empirical evidence suggests that gaining insurance reduces out-of-pocket spending risk (Glied et al., 2020; Gotanda et al., 2020).

It is also plausible to assume that ending the individual mandate has had an ambiguous effect on out-of-pocket healthcare costs. Individuals without coverage may behave more cautiously or avoid receiving preventative care (Lenhart and Shrestha, 2017). If such behavioral adjustments meaningfully lower the probability of accidents or illness, reductions in medical events could partially offset increased exposure to financial risk. The overall effect on out-of-pocket spending is therefore theoretically ambiguous.

Overall, my research will provide insight into what type of effect eliminating the mandate penalty had on total healthcare and out-of-pocket costs. Based on core economic theories, empirical evidence, and the existing literature, the elimination of the federal individual mandate

penalty is expected to increase premiums in the individual health insurance market and increase average out-of-pocket spending among affected individuals.

V. Methodology

To empirically estimate the causal effect of eliminating the ACA's federal individual mandate penalty on healthcare costs, I use a two-way fixed effects difference-in-differences (TWFE DID) model using data from 2018-2019. By identifying the treatment group as individuals who hold insurance coverage and are self-employed, and the control group as individuals who hold public coverage or are covered through their employer, I compare outcomes after the mandate was effectively ended. The inclusion of fully uninsured individuals in their own treatment group is motivated by their exposure to the individual mandate penalty prior to its repeal. Although these individuals chose to remain uninsured while the penalty was in effect, they were still subject to its financial pressure, and its elimination reduced any remaining incentive to obtain coverage. As a result, their post-repeal healthcare expenditure behavior is relevant for identifying how the removal of the mandate altered incentives and outcomes among those most directly affected by the policy change.

In my analysis, I use both the linear and log versions of the model. To utilize the log models in my analysis, I conducted a log transformation for both of the expenditure variables. Log(Y+1) was used to conduct log transformations on both the total expenditures and out-of-pocket spending variables, accounting for the zeros in the data. Since the expenditure data is heavily right-skewed, the log transformations address this.

The linear and log econometric models are:

$$Y_{it} = \beta_0 + \beta_1 DID1_{it} + \beta_2 DID2_{it} + \delta_i + \gamma_t + \epsilon_{it} \qquad (1)$$

$$Log_Y_{it} = \beta_0 + \beta_1 Log_DID1_{it} + \beta_2 Log_DID2_{it} + \delta_i + \gamma_t + \epsilon_{it} \qquad (2)$$

In this model, Y_{it} represents the outcome variable for an individual *i* at time *t*. DID1 indicates the post-treatment period for the first, insured treatment group. DID2 indicates the post-treatment period for the second, uninsured treatment group. δ_i captures all individual fixed effects, controlling for time-invariant differences across individuals, such as baseline health status or long-term preferences for medical care. γ_t captures all yearly fixed effects, capturing shocks common to all individuals in a given year, such as nationwide changes in health insurance premiums or overall health care costs. ϵ_{it} is the error term. The coefficient of interest, β_1, measures the average causal effect of the mandate repeal on the outcome variable for self-employed individuals relative to the control group.

VI. Results

The main results of this study are presented across two specifications and two outcome variables, creating four total models. There is a linear and log model for each outcome variable of interest. Both models include individual and year fixed effects throughout. Overall model significance reflects the absorption of individual- and year-level variation by the fixed effects structure and does not speak to the significance of the DID treatment effect specifically. Models 1 and 2 are both linear models, with Model 1 using total healthcare expenditures and Model 2 using total out-of-pocket spending as the outcome variable. Models 3 and 4 replicate this structure in log form, with Model 3 using log total healthcare expenditures and Model 4 using log total out-of-pocket spending.

Table 5: Main Analysis Results

Regressors	Linear Total Ex.	Linear OOP Ex.	Log Total Ex.	Log OOP Ex.
DID1	-1,585.64**	-97.02	-0.17	-0.06
	(782.14)	(115.72)	(0.15)	(0.15)
DID2	-392.43	-52.49	0.03	-0.04
	(323.92)	(55.74)	(0.05)	(0.05)
Observations	29,896	29,896	29,896	29,896
Individual and Year Fixed Effects?	Yes	Yes	Yes	Yes
Adjusted R-Squared	0.7131	0.6896	0.5083	0.8333
Overall Significance	2.21***	1.98***	4.15***	4.46***

Sources: IPUMS MEPS (2026) and own calculations.

Notes: Robust standard errors are in parentheses. *, **, *** indicate 10%, 5%, 1% significance levels, respectfully.

In Model 1, DID1 is negative and statistically significant at the 5% level, indicating that insured individuals assigned to the insured treatment group in 2018 experienced approximately $1,586 per capita less in total healthcare expenditures relative to the control group following the mandate's repeal in 2019. The corresponding DID1 coefficient in Model 2 for total out-of-pocket spending is negative but insignificant, suggesting the reduction in total expenditures observed in Model 1 was not concentrated in out-of-pocket costs specifically. The log models in Models 3 and 4 give DID1 coefficients of −0.17 (SE = 0.15) and −0.06 (SE = 0.15), both insignificant, indicating that the significant level effect in Model 1 does not persist under log transformation. DID2 is insignificant across all four models, suggesting that the fully uninsured subgroup did not experience a statistically distinguishable change in either total or out-of-pocket expenditures relative to the control group. Given that the linear model for total expenditures produced statistical significance but the log model for the same variable did not, we must call the

robustness of DID1 into question. No outlier sensitivity analysis was conducted and thus provides a limitation to this study.

The direction of the significant finding in the advanced DID Model 1 runs counter to the primary adverse selection prediction that eliminating the mandate penalty would increase healthcare costs for the treatment group. Rather than observing higher expenditures, the estimate points to a reduction in total healthcare expenditures for the insured treatment subgroup, a pattern that is consistent with reduced healthcare utilization following coverage disruption. Individuals who dropped or shifted coverage in response to the mandate's repeal may have foregone routine and preventive care, lowering measured total expenditures in the short run even as their underlying financial exposure to adverse health events increased. The absence of a significant effect on out-of-pocket spending in Model 2, and the lack of significance in the log models, further suggests that any expenditure reduction was driven by changes in overall utilization rather than shifts in the cost-sharing burden borne directly by individuals. It is also possible that other ACA market stabilization mechanisms had an impact on the adverse selection dynamics predicted by theory, limiting observable cost increases within the sample and time window of this study. Overall, the results do not provide robust evidence that the elimination of the federal individual mandate penalty increased healthcare expenditures for the treatment group in the short run, though the heterogeneity revealed by the advanced DID specification suggests meaningful differences across treatment subgroups that merit further investigation.

A balance of regressors and parallel trends tests are not the most suitable for this study due to the limits that 2-year panels create and because of the fact that both my treatment and control groups would have had ‘treatment’ administered beginning in 2014 due to the implementation of the mandate itself. In place of these tests, I conducted a pseudo-DID test for the panel 2017-

2018, which is directly before my main period of study (2018-2019). As previously stated, the same data extraction and cleaning processes were conducted for this test, as well as how the treatment and control groups were established. In this framework, pDID1 equals 1 for individuals in the treatment group, identified by the insurance type (self-employed or exchange-based coverage) they held in 2017, while pDID2 equals 1 for individuals who held no insurance at all in 2017. Models 1 and 2 are linear models and models 3 and 4 are log models. Models 1 and 3 used total healthcare expenditures for the outcome variable, while models 2 and 4 used total out of pocket spending for the outcome variable. The results of this test can be seen below.

Table 5: Pseudo-DID Test Results

Regressors	Linear Total Ex.	Linear OOP Ex.	Log Total Ex.	Log OOP Ex.
pDID1	-510.95	-11.33	-0.10	0.13
	(1,229.90)	(113.14)	(0.17)	(0.15)
pDID2	-760.92**	65.09	0.05	-0.03
	(304.43)	(68.38)	(0.05)	(0.05)
Observations	29,896	29,896	29,896	29,896
Individual and Year Fixed Effects?	Yes	Yes	Yes	Yes
Adjusted R-Squared	0.7308	0.6177	0.8165	0.8274
Overall Significance	2.45***	1.47***	3.99***	4.34***

Sources: IPUMS MEPS (2026) and own calculations.

Notes: Robust standard errors are in parentheses. *, **, *** indicate 10%, 5%, 1% significance levels, respectfully.

Statistical insignificance is present in all of the models except for the first linear model, which estimated the causal effect on total expenditures for the uninsured treatment group. Because the mandate penalty was still in effect throughout this entire period, the statistically significant effect observed here suggests that pre-existing differences in trends between the groups are driving the main results, which would undermine the parallel trends assumption. In

other words, this test has failed and provides an additional limitation to the results, analysis, and policy implications for this study.

VII. Conclusion

This study examines the economic effects of eliminating the federal individual mandate penalty that was originally implemented under the Affordable Care Act. The mandate penalty was designed to mitigate adverse selection in health insurance markets by incentivizing individuals to maintain health insurance coverage. When the Tax Cuts and Jobs Act of 2017 effectively reduced the penalty to zero beginning in 2019, it removed a central mechanism intended to stabilize insurance risk pools. Understanding how this policy change affects healthcare spending and out-of-pocket costs is therefore an important question for evaluating the broader consequences of the ACA's partial repeal.

The analysis in this study uses individual-level data from the Medical Expenditure Panel Survey (MEPS) framework to estimate the causal impact of the policy change. By comparing individuals more directly exposed to the individual insurance market, including those who are self-employed or obtain insurance through non-group plans, to individuals covered through employer-based or public insurance programs, the empirical design attempts to isolate the effect of the mandate's elimination on healthcare expenditures and out-of-pocket spending. This approach allows the analysis to control for time-invariant individual characteristics as well as nationwide trends in healthcare costs that affect all individuals simultaneously.

The results of this study do not provide robust evidence that the elimination of the federal individual mandate penalty increased healthcare expenditures or out-of-pocket spending for the treatment group in the short run. Across all four model specifications in the simple DID, the treatment effect is consistently negative and statistically insignificant. The advanced DID

specification, which constructs the treatment group into insured non-group individuals and the fully uninsured, reveals one statistically significant finding: insured individuals in the treatment group experienced an estimated reduction of approximately $1,586 in total healthcare expenditures in the post-repeal period relative to the control group. This effect does not persist in the out-of-pocket spending models or under log transformation, and the fully uninsured subgroup shows no significant effect across any specification. The direction of these findings is opposite to what adverse selection theory predicts and is more consistent with reduced healthcare utilization among individuals who dropped or shifted coverage in response to the mandate's repeal, as individuals without stable coverage may forgo routine and preventive care, lowering measured expenditures in the short run even as their financial vulnerability to adverse health events increases. It is also possible that other ACA market stabilization mechanisms impacted the adverse selection dynamics that the mandate was designed to prevent.

The findings of this research have important policy implications for ongoing debates about healthcare reform in the United States. The absence of a significant increase in costs following the mandate's repeal may offer some reassurance that the broader ACA framework provides a degree of market stability even without a federal penalty in place. However, the significant reduction in total expenditures observed for the insured treatment subgroup raises questions about whether lower measured costs reflect genuine savings or instead reflect reduced access to care, a distinction with meaningful consequences for individual health and financial wellbeing. Future research using longer time horizons and more coverage data would help clarify whether the null and negative effects observed here persist over time or whether adverse selection dynamics emerge more slowly than a single-panel study can capture.

In summary, this study contributes to a deeper understanding of how policy incentives shape insurance market behavior and the financial wellbeing of individuals in the United States and shows the importance of examining individual-level expenditure outcomes when evaluating the consequences of federal health insurance policy.

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Appendix A: Pseudo-DID SAS Codes

```
/* Expenditures 2017-2018 Dataset */
proc import datafile="/home/u64112821/MySAS/Health Expenditures 2017-18.xlsx"
    out=work.EXPpre
    dbms=xlsx
    replace;
    getnames=yes;
    sheet="FinalPanelObs";
run;
/* Coverage Types 2017-2018 Dataset */
proc import datafile="/home/u64112821/MySAS/Insurance Coverage 2017-18.xlsx"
    out=work.COVpre
    dbms=xlsx
    replace;
    getnames=yes;
    sheet="Sheet3";
run;
```

```
Proc sort data=COVpre;
        by MEPSID;
Run;
Data COVpre;
        Set COVpre;
        Keep MEPSID Keep CG Zero;
Run;
Data Only18;
        Set COVpre;
        Keep MEPSID Keep CG Zero;
Run;
Data COV2pre;
   Merge COVpre Only18;
   By MEPSID;
   Keep MEPSID Keep CG Zero;
Run;
Data COV2pre;
   Set COV2pre;
```

```
    Where Keep=1;
    Treatment = 1-CG;
    Treatment1 = (1-CG)*(1-Zero);
    Treatment2 = (1-CG)*Zero;
Run;
Proc sort data=EXPpre;
          by MEPSID;
Run;
/* Psuedo-DID Test */
/* Merge Data sets */
/* Create psuedo and DID dataset with all necessary variables  */
data Combinedpre;
    merge EXPpre COV2pre;
    by MEPSID;
    Log_EXPTOT     = Log(EXPTOT + 1);
    Log_EXPSELFPAY = Log(EXPSELFPAY + 1);
    if Year = "2017" then pDID1 = 0;
    else if Year = "2018" & Treatment1=1 then pDID1 = 1;
```

```
   else pDID1 = 0;
   if Year = "2017" then pDID2 = 0;
   else if Year = "2018" & Treatment2=1 then pDID2 = 1;
   else pDID2 = 0;
   Keep Year MEPSID pDID1 pDID2 EXPTOT EXPSELFPAY Log_EXPTOT
Log_EXPSELFPAY;
run;
/* MODEL 1: Linear and Total Expenditures */
ods output ParameterEstimates=PEforModel1 ModelDescription=ObsModel1
                    FitStatistics=AdjRsqModel1 FixedEffectsTest=OverallSigModel1;
Proc Panel Data = Combinedpre plots=none;
   ID MEPSID Year;
   Model EXPTOT = pDID1 pDID2 / FIXTWO HCCME=2 Cluster;
   Title "Model 1: Linear Psuedo-DID Test for Total Expenditures";
Run;
/* MODEL 2: Linear and Out of Pocket Expenditures */
ods output ParameterEstimates=PEforModel2 ModelDescription=ObsModel2
                    FitStatistics=AdjRsqModel2 FixedEffectsTest=OverallSigModel2;
Proc Panel Data = Combinedpre plots=none;
```

```
   ID MEPSID Year;
   Model EXPSELFPAY = pDID1 pDID2 / FIXTWO HCCME=2 Cluster;
   Title "Model 2: TWFE DID Test for Expenditures";
Run;
/* MODEL 3: Log and Total Expenditures */
ods output ParameterEstimates=PEforModel3 ModelDescription=ObsModel3
        FitStatistics=AdjRsqModel3 FixedEffectsTest=OverallSigModel3;
Proc Panel Data = Combinedpre plots=none;
   ID MEPSID Year;
   Model Log_EXPTOT = pDID1 pDID2 / FIXTWO HCCME=2 Cluster;
   Title "Model 3: TWFE DID Test for Total Expenditures";
Run;
/* MODEL 4: Log and Out of Pocket Expenditures */
ods output ParameterEstimates=PEforModel4 ModelDescription=ObsModel4
        FitStatistics=AdjRsqModel4 FixedEffectsTest=OverallSigModel4;
Proc Panel Data = Combinedpre plots=none;
   ID MEPSID Year;
   Model Log_EXPSELFPAY = pDID1 pDID2 / FIXTWO HCCME=2 Cluster;
```

```
    Title "Model 4: TWFE DID Test for OOP Expenditures";

Run;
```

Appendix B: Main DID SAS Codes

```
/* Expenditures 2018-2019 Dataset */

proc import datafile="/home/u64112821/MySAS/Health Expenditures 2018-2019.xlsx"

   out=work.EXP

   dbms=xlsx

   replace;

   getnames=yes;

   sheet="FinalPanelObs";

run;

/* Coverage Types 2018-2019 Dataset */

proc import datafile="/home/u64112821/MySAS/Health Insurance Coverage Types 2018-
19.xlsx"

   out=work.COV

   dbms=xlsx

   replace;

   getnames=yes;

   sheet="Sheet2";

run;

Proc sort data=COV;
```

```
        by MEPSID;
Run;
Data COV;
        Set COV;
        Drop Keep CG;
Run;
proc import datafile="/home/u64112821/MySAS/Health Insurance Coverage Types 2018-
19.xlsx"
    out=work.Only18
    dbms=xlsx
    replace;
    getnames=yes;
    sheet="2018Only";
run;
proc import datafile="/home/u64112821/MySAS/Health Insurance Coverage Types 2018-
19.xlsx"
    out=work.Only19
    dbms=xlsx
    replace;
```

```
    getnames=yes;
    sheet="2019Only";
run;
Data Only18V1;
        Set Only18;
        Keep MEPSID Keep CG Zero;
Run;
Data Only18V2;
        Set Only18;
        Keep Year MEPSID OutcomeZero;
        OutcomeZero=Zero;
Run;
Data Only19;
        Set Only19;
        Keep Year MEPSID OutcomeZero;
Run;
Data COV2;
        Merge COV Only18V1;
```

```
        By MEPSID;
Run;
Data COV3;
        Merge COV2 Only18V2 Only19;
        By MEPSID Year;
Run;
Data COV3;
        Set COV3;
        Where Keep=1;
        Treatment = 1-CG;
        Treatment1 = (1-CG)*(1-Zero);
        Treatment2 = (1-CG)*Zero;
Run;
Proc sort data=EXP;
        by MEPSID;
Run;
/* TWFE DID Regression */
/* Create TWFE dataset */
```

```
data Combined;
   merge EXP COV3;
   by MEPSID;
   if Year = "2018" then DID = 0;
   else if Year = "2019" & Treatment=1 then DID = 1;
   else DID = 0;
   Log_EXPTOT      = Log(EXPTOT + 1);
   Log_EXPSELFPAY  = Log(EXPSELFPAY + 1);
   if Year = "2018" then DID1 = 0;
   else if Year = "2019" & Treatment1=1 then DID1 = 1;
   else DID1 = 0;
   if Year = "2018" then DID2 = 0;
   else if Year = "2019" & Treatment2=1 then DID2 = 1;
   else DID2 = 0;
   Keep MEPSID DID DID1 DID2 EXPTOT EXPSELFPAY Log_EXPTOT
Log_EXPSELFPAY OutcomeZero Year Treatment2;
run;
/* Advanced DID Models */
/* MODEL 1: Linear and Total Expenditures */
```

```
ods output ParameterEstimates=PEforModel1 ModelDescription=ObsModel1
                    FitStatistics=AdjRsqModel1 FixedEffectsTest=OverallSigModel1;
Proc Panel Data = Combined;
   ID MEPSID Year;
   Model EXPTOT = DID1 DID2 / FIXTWO HCCME=2 Cluster;
Run;
/* MODEL 2: Linear and Out of Pocket Expenditures */
ods output ParameterEstimates=PEforModel2 ModelDescription=ObsModel2
                    FitStatistics=AdjRsqModel2 FixedEffectsTest=OverallSigModel2;
Proc Panel Data = Combined;
   ID MEPSID Year;
   Model EXPSELFPAY = DID1 DID2 / FIXTWO HCCME=2 Cluster;
   Title "Model 2: TWFE DID Test for Expenditures";
Run;
/* MODEL 3: Log and Total Expenditures */
ods output ParameterEstimates=PEforModel4 ModelDescription=ObsModel4
        FitStatistics=AdjRsqModel4 FixedEffectsTest=OverallSigModel4;
Proc Panel Data = Combined;
```

```
   ID MEPSID Year;
   Model Log_EXPTOT = DID1 DID2 / FIXTWO HCCME=2 Cluster;
   Title "Model 3: TWFE DID Test for Total Expenditures";
Run;
/* MODEL 4: Log and Out of Pocket Expenditures */
ods output ParameterEstimates=PEforModel5 ModelDescription=ObsModel5
        FitStatistics=AdjRsqModel5 FixedEffectsTest=OverallSigModel5;
Proc Panel Data = Combined plots=none;
   ID MEPSID Year;
   Model Log_EXPSELFPAY = DID1 DID2 / FIXTWO HCCME=2 Cluster;
   Title "Model 4: TWFE DID Test for OOP Expenditures";
Run;
*****************************;
/* Building the results table */
*****************************;
Data Table_Long;
        length Model $10;
        length Variable $30;
```

```
set PEforModel1 PEforModel2 PEforModel3 PEforModel4

indsname=M;

Where (Estimate ne 0)

        and (substr(VarName,1,5) ne "state")

        and (substr(VarName,1,3) ne "ind");

if      M="WORK.PEFORMODEL1" then Model="Model1";

        else if M="WORK.PEFORMODEL2" then Model="Model2";

        else if M="WORK.PEFORMODEL3" then Model="Model3";

        else if M="WORK.PEFORMODEL4" then Model="Model4";

Length Star $3;

if Probt le 0.01 then Star="***";

        else if Probt le 0.05 then Star="**";

        else if Probt le 0.1 then Star="*";

        else Star="";

Results=Estimate;

EditedResults=Cats(Put(Results,comma16.2),star);

output;

Results=StdErr;
```

```
        EditedResults=Cats("(",Put(Results,comma16.2),")");
        output;
        keep Model VarName EditedResults;
run;
proc sort data=Table_Long out=Table_Long_Sorted;
        by Model VarName;
run;
data Model1Results (rename=(EditedResults=Model1))
                Model2Results (rename=(EditedResults=Model2))
                Model3Results (rename=(EditedResults=Model3))
                Model4Results (rename=(EditedResults=Model4));
        set Table_Long_Sorted;
        if Model="Model1" then output Model1Results;
                else if Model="Model2" then output Model2Results;
                else if Model="Model3" then output Model3Results;
                else if Model="Model4" then output Model4Results;
        drop Model;
run;
```

```
data Table_Wide;
        merge Model1Results Model2Results Model3Results Model4Results;
        by VarName;
        /* establish the order of the variables represented in the table: */
        length Order 3; /* is 3 because that is the number of variables in the table */
        If VarName="DID" then Order=1;
                else if VarName="Intercept" then Order=2;
                else Order=3;
        if mod(_n_,2)=1 then Regressors=VarName;
run;
proc sort data=Table_Wide out=Table_Wide_Sorted(drop=Order VarName);
        by Order;
run;
Data NumofObs;
   Merge ObsModel1 (rename=(nValue1=NVModel1) drop=cValue1 drop=Model)
        ObsModel2 (rename=(nValue1=NVModel2) drop=cValue1 drop=Model)
        ObsModel3 (rename=(nValue1=NVModel3) drop=cValue1 drop=Model)
        ObsModel4 (rename=(nValue1=NVModel4) drop=cValue1 drop=Model);
```

```
    Where Label1="Number of Observations";
    Model1=put(NVModel1, comma16.);
    Model2=put(NVModel2, comma16.);
    Model3=put(NVModel3, comma16.);
    Model4=put(NVModel4, comma16.);
    Keep Label1 Model1 Model2 Model3 Model4;
Run;
Data AdjRsq;
        Merge AdjRsqModel1 (rename=(Cvalue1=Model1))
                AdjRsqModel2 (rename=(Cvalue1=Model2))
                AdjRsqModel3 (rename=(Cvalue1=Model3))
                AdjRsqModel4 (rename=(Cvalue1=Model4));
        Where Label1="Adjusted R-Square";
        Keep Label1 Model1 Model2 Model3 Model4;
Run;
Data OSM1 (rename=(EditedValue=Model1))
    OSM2 (rename=(EditedValue=Model2))
    OSM3 (rename=(EditedValue=Model3))
```

```
 OSM4 (rename=(EditedValue=Model4));
Set OverallSigModel1 OverallSigModel2 OverallSigModel3 OverallSigModel4
indsname=M;
/* Removed Where Effect="Model" since FixedEffectsTest may only have one row */
Label1="Overall Significance";
Length Star $3;
if ProbF le 0.01 then Star="***";
   else if ProbF le 0.05 then Star="**";
   else if ProbF le 0.1 then Star="*";
   else Star="";
EditedValue=Cats(Put(FValue,comma20.2),star);
If M="WORK.OVERALLSIGMODEL1" then output OSM1;
   Else If M="WORK.OVERALLSIGMODEL2" then output OSM2;
   Else If M="WORK.OVERALLSIGMODEL3" then output OSM3;
   Else If M="WORK.OVERALLSIGMODEL4" then output OSM4;
Keep Label1 EditedValue;
Run;
Data OverallSig;
```

```
        Merge OSM1 OSM2 OSM3 OSM4;
Run;
Data OtherStat;
        Set NumofObs AdjRsq OverallSig;
        Rename Label1=Regressors;
Run;
Data OtherInfo;
        length Regressors Model1 Model2 Model3 Model4 $35;
        Regressors="Individual and Year Fixed Effects?";
        Model1="Yes";
        Model2="Yes";
        Model3="Yes";
        Model4="Yes";
        output;
run;
Data Table_Wide_Sorted_WithStats;
        Set Table_Wide_Sorted OtherInfo OtherStat;
Run;
```

```
/* Print the clean results table */

/* Change Title # once I know which # it should be */

ods excel file="/home/u64112821/MySAS/FinalResultsAdvDID.xlsx"
options(Embedded_Titles="ON" Embedded_Footnotes="ON");

Title "Table X: Main Advanced DID Results";

Footnote1 Justify=Left "Sources: IPUMS MEPS (2026) and own calculations.";

Footnote2 J=L "Notes: Robust standard errors are in parentheses.
                    *, **, *** indicate 10%, 5%, 1% significance levels, respectfully.";

Proc print data=Table_Wide_Sorted_WithStats noobs;
    Var Regressors;
    Var Model1 Model2 Model3 Model4
    / style(header)={Just=Center} style(data)={Just=Center tagattr="type:String"};
    format Regressors $VariableName.;
Run;

ods excel close;
```