

ABSTRACT

Title of Dissertation: THE POLICY IMPACT OF STATE
REINSURANCE PROGRAMS UNDER THE
ACA 1332 WAIVER

Ren Hao Wang, Doctor of Philosophy, 2024

Dissertation directed by: Assistant Professor Dahai Yue
Department of Health Policy and Management

Ten years after the implementation of the ACA, US families have been experiencing a continuing increase in the average premium for health insurance coverage. Although the case differs for the low-income population, providing affordable health insurance remains a significant policy issue. Section 1332 waiver of the ACA allows states to develop innovative strategies to provide affordable health insurance upholding the required high-quality care and basic protections. Seventeen states took the market-oriented approach of state reinsurance programs to stabilize the health insurance market and restrain premium increases. Using RWJF HIX data as well as public and restricted MEPS data, this dissertation investigated the policy impact of state reinsurance programs over premium reduction in the health exchange market, unintended consequence of crowding out Employer-Sponsored Insurance, as well as changes in out-of-pocket premium and insurance coverage on the consumer perspective.

THE POLICY IMPACT OF STATE REINSURANCE PROGRAMS UNDER THE ACA
1332 WAIVER

by

Ren Hao Wang

Dissertation submitted to the Faculty of the Graduate School of the
University of Maryland, College Park, in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
2024

Dr. Dahai Yue, Chair
Dr. Luisa Franzini
Dr. Michel Boudreaux
Dr. Neil Sehgal

Dr. Xin He

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Dedication

I dedicate this dissertation to my grandparents, parents, and my partner. My grandparents' poor experience with the healthcare system motivated me to develop my career in public health, and with my parents' full support, I started my journey as a researcher in the PhD program at the University of Maryland, College Park. Although they are no longer with me, I believe they would be proud that I can conduct meaningful health service research that can one day change the lives of other families. On many sleepless nights in the journey, my partner Ammi Cabrera gave me the courage to move on when facing setbacks and celebrated with me when I overcame all the difficulties. The accomplishment of this PhD and dissertation project also belongs to my family.

Acknowledgments

I want to acknowledge Dr. Dylan Roby, my previous advisor at the University of Maryland, College Park, for laying the foundation for this research project. Dr. Roby guided me into the realm of health policy research.

Additionally, I would like to express my most profound appreciation to Dr. Dahai Yue for being my advisor and the chair of the dissertation committee. His knowledge of rigorous research methods guided me through numerous difficulties in the process. Without his patient instruction and insightful comments, it would have been hard to imagine accomplishing this project by myself.

Lastly, I want to thank my committee members for their valuable comments and advice. It was a great pleasure for me to take their classes, work as a graduate assistant, as well as have them provide critical feedback on my dissertation project.

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Chapter 1: State reinsurance programs under the ACA 1332 waiver

Introduction

The average family premium for health insurance in the US has increased by 55% since 2010 and 22% since 2015 (KFF, 2020). Meanwhile, 8.6% of the US population, around 28 million people, were uninsured in 2021 (Keisler-Starkey & Bunch, 2021). Although combined out-of-pocket premium spending decreased by 16% for the population under 138% of the Federal Poverty Level after the implementation of the ACA (Goldman et al. 2018), around 11 million US adults remained experiencing catastrophic spending on record in 2017 (Liu et al., 2020). To address the instability of the insurance market during the transition in health care, the federal government implemented the reinsurance program from 2014 to 2016. After it ended, states started to experience decreased insurer participation and increased health plan premiums. (Schwab et al., 2018). In response, 17 states began using state reinsurance programs to replace the expired federal reinsurance under the ACA 1332 waiver. The primary function of these programs was to provide affordable health insurance coverage that can increase insurance coverage, especially for the population previously participating in off-market plans (Hadley, 2006; Bantlin & Simpson, 2021).

The section 1332 waiver of the Affordable Care Act (ACA) allows states to apply for State Innovation Waivers, providing their residents with affordable health insurance coverage that upholds the high quality and basic protections required by the ACA (CMS, 2021). A reinsurance program is a public insurance allocating risks among health insurance companies administered by either state or federal governments aiming to stabilize the health insurance market. In simple words, reinsurance programs are insurance for the insurer. An evaluation of state-based reinsurance programs in Alaska, Minnesota, and Oregon found that state reinsurance programs could stabilize individual market premiums, increase consumer enrollment, maintain insurer participation, and generate federal savings (Schwab et al., 2018). Maryland governor also

announced an average decrease of 13.2% for the individual market premium in 2019, associated with implementing a state reinsurance program (Maryland Insurance Administration, 2018). However, it remained unclear whether states' reinsurance programs caused the decrease in premiums. Although researchers found that improved health insurance coverage leads to better access to care for patients, it remains unknown whether the reinsurance program is associated with better access to healthcare services and utilization (Wen et al., 2015; Duku et al., 2015; Saloner et al., 2016). Additionally, the observed premium decrease was limited to countable states in a shorter period, and whether the program's effectiveness is long-lasting and nationally applicable is yet unknown. Recognizing covariates impacting premiums in the individual market and exploring the impact of waiver programs across the nations over a more extended period will help us evaluate the policy and develop future policies to promote the affordability of health insurance and expand access to care.

Literature Review

Health care is a service of necessity in modern American lives. Access to high-quality healthcare services at a reasonable cost for the entire society is the ultimate goal of all healthcare professionals. Nevertheless, cost and access remain limited. Health care in the US is too expensive for society and individuals. One issue in the US healthcare system is the affordability of premiums for health insurance plans. The ACA has provided many policy options to reform the US healthcare system to solve quality, costs, and access issues. Reinsurance has also been introduced as a health economic policy tool to address affordability and access issues. The reinsurance works as a special kind of insurance to spread out the risk of insurance companies. In other words, it is the insurance for the insurance company. In the traditional settings, the reinsurers were also classified as

insurance companies. They cover other insurers by accepting risk in exchange for their premium payment (Blazenko, 1986).

Reinsurance in ACA, State policies, and the health care system

The federal ACA reinsurance program was introduced as a component of the ACA. The program reimburses insurance companies for high-cost claims to reduce the premium in the health exchange market. It was created to stabilize the individual market for ACA implementation. From 2014 to 2016, it had several funding sources, including the federal government, insurance companies, and administrators representing self-insured group health plans (Nicholson & Gruwell, 2018; Jacobs et al., 2017; Winkelman et al., 2012).

Defined by the ACA, the national aggregate contributions from the federal government were different each year. The amount was \$10 billion in 2014, \$ 6 billion in 2015, and 4 billion in 2016. The US treasury contributed \$2 billion in the first two years and \$1 billion last year. (HHS, 2012). It allowed the state to collect extra fees to fund administrative expenses or additional reinsurance payments. When there is a substantial high-cost claim, the federal government provides the state with the funds to pay 80% of the cost over \$100,000. This mechanism limited the financial risk insurers experience when covering patients with potentially high medical costs (Busch and Houchens, 2017). The federal reinsurance program raised its attachment point from \$ 45,000 to \$ 90,000 in 2016. The attachment point is similar to a deductible of regular health insurance policies, in which reinsurance is triggered. The federal reinsurance program payment cap remained the same at \$250,000 throughout the program (Drake et al., 2019).

Although federal reinsurance ended in 2016, reinsurance remains an impactful health policy. After the end of the temporary reinsurance program of the federal government, the states started to pursue their reinsurance programs through 1332 waivers (Nicholson & Gruwell, 2018).

When states' waiver application is approved, they can seek pass-through federal funding or the amount of federal spending saved in Marketplace subsidies to fund the state-based reinsurance program. Essentially, the federal government hands over the amount that would have been paid for subsidies to the states upon states' application if a state can prove that its proposed program is more cost-effective than the status quo (Busch & Houchens, 2017; Drake et al. 2019).

At the state level, the reinsurance program collects contributions called assessment fees from all health plans sold in the state health insurance exchange (HIX). These funds are pooled together with the federal funding mentioned previously to pay for the costs of substantially high claims of patients from the providers. In the past, researchers have found that reinsurance has successfully solved the most severe problems (Barry et al., 2012). These programs are financed through payments from the individual market, group markets, and stop-loss (reinsurance) insurers (Abraham et al., 2019).

Reinsurance programs were not limited to the commercial health insurance market. Medicare also used reinsurance to cover 80% of the drug expenditure when it was above the catastrophic threshold. Medicare Part D introduced a reinsurance program to promote insurers' participation by protecting their plans from financial risks. Specifically, in 2013, 8 percent of Medicare Part D enrollees exceeded the catastrophic threshold. This population made up 47 percent of the total expenditure (MedPAC, 2016). Reinsurance has become the primary source of plan reimbursements for Medicare Part D (Jung and Feldman, 2018). In a study, researchers found that reinsurance payment for Medicare Part D decreases premiums on the cost of rising plan-level moral hazard (Jung and Feldman, 2018).

There are two possible designs for establishing reinsurance programs. The first design is conventional. An insurance company pays a premium to be covered by a reinsurance program to

receive reimbursement covering a portion of its substantially high claims from healthcare providers (Blewett, 2018; State Health Access Data Assistance Center, 2018). The second design is condition-specific. The reinsurance program would pay 100% of all claims for the individuals covered by insurers with specific medical conditions (CMS, 2017; Drake et al., 2019).

Reinsurance in Economic Theories

Reinsurance is not new and has been widely used in the commercial insurance market. However, the Medicare program adopted it more thoroughly after recognizing its effect on risk management. The commercial market has a minor portion of total spending used on reinsurance, whereas Medicare reinsurance is around 10%. Unlike Medicare Part D, only 1 percent of the commercial enrollees experienced reinsurance coverage before the ACA (Milliman, 2015). That difference is because commercial reinsurance often has a high attachment point before any benefits are paid.

The theory suggests that insurers typically view reinsurance as a tool of risk management. When an insurance company participates in a reinsurance program, it decreases the variability of the cash flows and financial leverage at the same time (Garven & Lamm-Tennant, 2011). In the past, researchers often modeled the demand of reinsurance in the framework of expected utility, and they have primarily focused on the risk management nature of reinsurance. It makes sense because sharing risks is the primary function (Borch, 1960), and it can provide additional capacity to the insurance market by spreading the risk among insurance companies (Blazenko, 1986). Economists have concluded that the reinsurance market results from an imperfectly competitive market where the financial risk of substantially high medical bills is not evenly distributed. Thus, insurance companies have an urgent and natural need for a reinsurance program (Blazenko, 1986).

Unevenly distributed risk in the insurance market has remained a significant concern for health insurance plans in the relatively more minor individual marketplace. As suggested, the top 1 percent of health plan enrollees contribute between 22 and 29 percent of all medical expenditures (Conwell and Cohen, 2005; Zhu et al., 2013). An insurance company may suffer the risk of enrolling costly enrollees from a smaller risk pool due to random variation or adverse selection. Reinsurance can shield plans from these risks caused by the skewness of health expenditure distribution. Since reinsurance focuses on a smaller portion of the population and claims with high medical costs, it can drastically reduce insurers' financial risk without decreasing insurers' incentives. Reinsurance can often offset its costs through significant risk reduction (Layton et al. 2016). When the cost associated with high-risk patients is offset, an insurer has more incentive to return to the market (Nicholson & Gruwell, 2018).

Many theories were borrowed from the conventional economic field when addressing insurer participation and high premiums in the health insurance market through reinsurance. As introduced by Abraham et al. (2019), states established reinsurance to reduce the financial risk of health insurance companies from substantially high medical claims, which further stabilizes and restrains the increase of premiums in the HIX, as well as attracts insurance companies to enter or stay in the HIX. A risk-averse insurer has low incentives to participate in a high-risk market. The lower participation of insurers imposes imperfect competition in the market. By pooling the costs of the highest medical claims among insurance plans, reinsurance randomizes the risk and addresses imperfect competition. Therefore, implementing reinsurance to increase insurers' participation in the market has social benefits (Layton et al., 2016).

Subsidized reinsurance, such as the ACA federal reinsurance from 2014 to 2016 or the states' variants after 2018, is an advanced version built on traditional commercial reinsurance with

government participation. It represents a governmental attempt to stabilize the insurance market. Subsidized reinsurance is evaluated as a policy tool. The evaluating standards include how efficiently it can reduce the risk for insurers, promote incentives for participation, promote care coordination, and control costs and premiums when given a set amount of funds to achieve these goals (Harlington, 2017; Jacobs, 2017). The American Academy of Actuaries estimated a 4 to 7 percent increase in premiums in overall HIX by 2017 to demonstrate the importance of the ACA federal reinsurance program (McClellan & Japinga, 2018).

However, some economists also argued that reinsurance would come with negative impacts. As described in Zeckhauser in 1970, reinsurance might decrease the incentives of insurance companies and loosen the practice of cost control for medical expenditure. Similar to individual health insurance, reinsurance might create moral hazards among insurers. The cost of risk reduction from reinsurance is that insurance companies also lose the liability and incentives to restrain their clients' spending. In 1963, Arrow suggested using reinsurance to provide risk protection was inefficient (Arrow, 1963; Layton et al., 2016). In addition, when implementing the reinsurance plan, the reinsurance payment across plans is not reflected in plans' out-of-pocket premiums. When insurance coverage expands, the premium paid by patients cannot truly reflect the plan's cost, meaning an insurance plan can receive a high reinsurance reimbursement while charging a low premium to enroll patients (Jung and Feldman, 2018)

Reinsurance in Empirical Studies

Before 2010, most studies used simulation rather than evaluation to study the impact of reinsurance on the financial risk of health insurance plans enrolling high-risk patients. Researchers modeled the profitability of health plans under simulated plan profits under different levels of reinsurance coverage. They suggested that a public reinsurance program that fully covers a health

plan for any medical claims higher than \$10,000 can reduce the financial losses of the insurance plan by 40 % for covering patients with high medical expenditures (Sappington et al., 2006 & Zhu, 2013).

Since the implementation of federal and state reinsurance programs, more studies have been conducted to evaluate and quantify the impact of these programs on the insurance market. Researchers recommended policy implication that a state can use a reinsurance program to create a more attractive marketplace for insurance companies to enter and stay in due to the decreased financial risk of enrolling patients with high medical expenditure (Abraham et al., 2019). Additionally, the state reinsurance programs based on 1332 waivers decreased MD, NJ, and WI individual market premiums in 2018 (Schwab et al., 2018; Drake et al., 2019).

Specifically, from 2014 to 2015, insurance companies with the 30% highest claim had a deficiency in cost and revenue of \$90–\$397 per enrollee per month before reinsurance. After the reimbursement from reinsurance was included, the deficiency turned into a surplus of \$0–\$49 per enrollee per month. Reinsurance balanced the financial performance disparity among insurance companies and addressed substantial differences. Insurers covered for the highest medical expenditure were the ones who benefited most from the insurance program, which successfully fulfills the purpose of reimbursing insurance companies that cover the most demanding patients. While insurers with the highest expenditure benefited most systematically from the reinsurance program, the insurers with the lowest expenditure remained to have a surplus of cost and revenue even after the payment to reinsurance was calculated. As researchers concluded, the ACA federal reinsurance program successfully addressed the disparity of financial performance among insurers facing different health risks (Jacobs et al., 2017).

As previously mentioned, private reinsurance has existed in the US health insurance market for years. The difference between private and public reinsurance programs lies in their coverage range. Government-sponsored programs start at much lower attachment points (Bovbjerg et al., 2008; Swartz, 2006; Zhu et al., 2013). Based on the previous examples, public reinsurance has the best effect on risk reduction if controlling the incentive to constrain utilization compared with other policies because reinsurance programs can target the insurers with patients having the highest medical expenditure. Researchers further found that reinsurance has a more minor effect on insurers' incentive to save money on high-cost claims because it only affects the marginal cost to the insurer for covering high-cost patients while not changing other aspects. Compared with other alternative policies with similar purposes, reinsurance dramatically outperforms them because it affects an insurer's risk at a comprehensive level by reimbursing the key individuals (Geruso and McGuire 2016; Layton et al. 2016).

Several studies used the fit of revenue to cost in the payment system for a health insurance plan through a generalized form of the R-squared measure on various factors, including age and premium, under the risk adjustment model (Geruso and McGuire, 2016; Zhu et al., 2013). They all found that reinsurance achieves a higher “fit” than other policy alternatives, including risk adjustment for any given level of power. Studies concluded that reinsurance policies are very effective at improving the fit of payment systems as they match a small portion of patients who spend a lot. When the attachment points of reinsurance increase, meaning that reinsurance programs cover fewer cases with high medical expenditure, the fit of the payment system decreases. Researchers further indicated that to have more functional health insurance markets, it is in the best interest of insurance companies to reduce the exposure to financial risks and for society to avoid incentives for adverse selection (Barry et al., 2012).

Additionally, there are other benefits to implementing reinsurance programs. They can address the underpayment for the worst financially performing health insurance plan. The positive effect of reinsurance also applies to plans that cover many patients with mental health conditions (Barry et al., 2012). Reinsurance makes sharing medical information, statistical expertise, and managerial experience possible among insurers. Researchers suggested that such cooperation could be beneficial for performance improvement (Dror, 2001).

Outside of the US, other countries that implemented reinsurance to improve their healthcare system also provided evidence indicating its advantages. Based on insurance claim data collected from Ireland, as the insurer's participation increases in the reinsurance pool, the group size of insurers increases, which would then decrease the community-rated premium payable. The study found that all participating insurance companies were able to achieve this. Researchers concluded that compared with the minimal capital needed to ensure the solvency of the insurance for all group sizes, having a reinsurance program is much more cost-effective to insurers. It is a safer and more promising practice for a government to establish public reinsurance (Dror & Armstrong, 2006). In the Netherlands, multiple studies have found parallel results regarding the cost-effectiveness of reinsurance in reducing risk from a small number of patients with substantial medical expenditure. Having reinsurance covering 90 percent of all costs exceeding 20,000 euros in the insurance market was not able to eliminate the risk selection incentives of the insurers. Still, it proved to be effective in reducing them (van Barneveld et al., 1998; van Vliet and van de Ven, 1992; Beebe, 1992; van de Ven and Schut, 2008; van de Ven, van Vliet, and Lamers, 2004).

Based on simulating the condition for lower-income countries, reinsurance was more favored as a financing mechanism in funding deficits from contingency reserves. Researchers found reinsurance was a more affordable option for governments in these countries than other

alternatives like those in the US or other developed nations. Although, when looking at the longer term, reinsurance programs can operate on a balanced budget, they do require enormous financial investment in the first several years after launch, which might cause political difficulties (Dror, 2001).

Not all studies found reinsurance entirely favorable. Dow et al. (2019) found that while reinsurance can decrease the community rating premium in the market and the actual out-of-pocket premium that people pay, the lower premium rating also decreases the profitability of an insurance plan. The study argued that reinsurance programs focused mainly on small groups of high medical expenditure, as well as using only ex-post information collected after actual spending occurred instead of ex-ante information to reflect future spending that is more applicable to the overall risk pool. This results in programs not addressing the issue of insurance cream-skimming, meaning insurance cherry-picking the enrollees who are less likely to file a claim. At the same time, reinsurance reduces insurers' incentive to contain moral hazards of insurers. States with riskier populations in their market risk pool might be disproportionately benefited (Drake et al. 2019). Insurers and patients might have lower incentives to reduce costs because of reinsurance (McClellan and Japinga, 2018).

Lastly, researchers argued that, with the effect of reinsurance, people might unknowingly enroll in plans with large excess reinsurance reimbursement when actively choosing the plan for lower premiums. The problem is that high excess reinsurance reimbursement is correlated with the use of expensive drugs in 2013. Therefore, the plan's moral hazard partially contributed to the excess reinsurance payment. When reinsurance reimbursement peaked, it indicated decreased plan liability for controlling the spending on expensive drugs (Jung and Feldman, 2018; Zhu et al., 2013).

Conceptual Framework

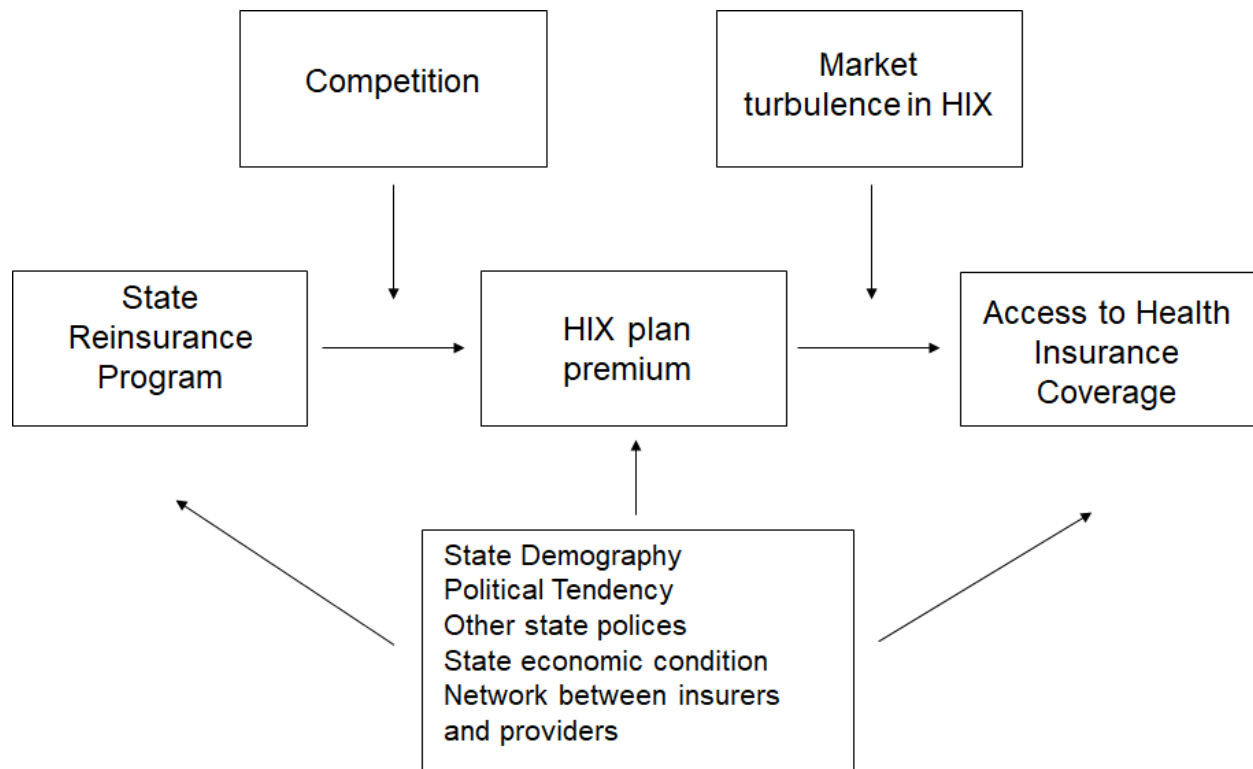
Building upon the previous literature that reflected the economic theories, functional mechanism, potential application, and effect of states implementing reinsurance programs, we have constructed the following conceptual framework for this proposed study based on the supply and demand theory of health economics. As suggested by theories and previous studies, a reinsurance program has the potential to promote insurer participation and decrease policies' premiums in the HIX. Implementing the reinsurance program would increase demand for (HIX) plans. The supply will increase, leading to a new market equilibrium. The HIX's overall quantity of health insurance plans will increase in this new market equilibrium. Due to the reinsurance programs, more individuals and insurers will participate in HIX for the lower premium. It may further cause unintended consequences by attracting participants from other sources of private insurance coverage, especially employer-sponsored insurance (ESI). Specifically, as a substitute for ESI, the increase in supply and demand for the HIX plans would lead to lower demand for ESI. In response, the ESI market would also move to reach a new equilibrium. This new equilibrium will result in less supply and demand in the ESI market. The dynamic change in the HIX and ESI market aligns with the theory of the crowding-out effect suggested by Frey in 1998, where due to the implementation of a state-subsidized reinsurance program, health plans available in the market would be cheaper, incentivizing some employers to stop providing Employer Sponsor Insurance to their employee (Frey, 1998; Chollet, 2004).

The analytical conceptual framework is presented in Figure 1.1. In the whole framework, state reinsurance programs are the enabling factors, and change in HIX premium is the outcome. In this causal relationship, the competition is the moderator. A reinsurance program is also an enabling factor for access to health coverage outcomes through the mediator of HIX premium. In

this second causal relationship, market turbulence is the moderator. Health insurance coverage access can be divided into supply and demand perspectives. In the overall relationships, there are multiple confounders, including state demography, the political tendency of a state, other parallel healthcare policies, state economic status, and network change between insurers and providers. We controlled these confounders using the fixed effects of state and calendar year.

Our research question is, “Did State Reinsurance Programs under the ACA 1332 Waiver improve affordability and access to health insurance?” We have three aims to answer our research question. First, to examine the heterogeneous policy effects of reinsurance programs on premiums in the individual markets of HIX among counties with differential levels of insurer participation. Second, to examine state reinsurance programs’ crowding-out effects over ESI provision by employers among states with differential policy implementation time. Third, to examine the policy effect of state reinsurance programs on individuals’ access to health coverage. We hypothesized that 1) state reinsurance programs implemented by 17 states decrease the premium of health plans more than their counterparts; 2) the implementation of reinsurance programs would crowd out the ESI supply as a government intervention in HIX; 3) state reinsurance programs decrease out-of-pocket premium for people participating in HIX plans, and shift people from the ESI coverage to HIX coverage.

Figure 1.1 Conceptual Framework



Chapter 2: Differential impacts of reinsurance program on health insurance premium by Individual Market competition.

Introduction

By 2020, the average family premium for health insurance in the United States had increased by 55% since 2010 (Ducat, 2020). While the implementation of the Affordable Care Act (ACA) led to a 16% decrease in combined out-of-pocket premium spending for the low-income population under the 138 % FPL (Goodman-Bacon, 2018), approximately 11 million U.S. adults continued to face catastrophic spending in 2017 (Keisler-Starkey & Bunch 2022). The ACA's requirement for insurers to enroll individuals regardless of pre-existing conditions and health status has introduced uncertainty in insurers' reimbursement costs and prompted them to avoid specific high-risk markets (Lueck, 2019). 17 states have implemented reinsurance programs by 2023 to mitigate risks for insurers, promote market participation, and reduce health plan premiums (Lueck, 2019; Polyakova et al., 2021; Sloan, 2019).

Reinsurance programs function as insurance for insurers, offering additional capacities to the insurance market by distributing the risk among insurance companies (Blazenko, 1986). These programs collect fees from participating insurers and utilize a pooled fund to reimburse insurance companies in the event of high-cost cases. Health plans have used similar commercial prototypes for years (Blazenko, 1986; Zhu et al., 2013). In commercial insurance, reinsurance has traditionally been recognized as a risk management tool, effectively reducing the variability of cash flows and financial leverage simultaneously (Garven & Lamm-Tennant, 2011). The federal reinsurance program was established as part of the ACA, explicitly addressing market instability during the transition period until 2017. Between 2014 and 2016, the ACA permitted states to collect additional fees to cover administrative expenses or provide supplementary reinsurance payments alongside federal contributions. Contributions from insurers and administrators representing self-

insured group health plans also contributed to the program's funding (Jacobs et al., 2017; Nicholson & Gruwell, 2018; Winkelman et al., 2022).

Following the conclusion of the federal reinsurance program, states began pursuing their own reinsurance programs through the ACA 1332 waivers, also known as State Innovation Waiver (Nicholson & Gruwell, 2018). The Waiver allows the state to pursue innovative strategies for providing residents with access to high-quality, affordable health insurance while maintaining the basic protections of the ACA. Upon approval, states can seek federal pass-through funding, which refers to the amount of federal spending saved in Marketplace subsidies, to finance their state-based reinsurance program. In 2018, three states launched reinsurance programs to replace the expired federal reinsurance, utilizing the ACA 1332 waiver (Nicholson & Gruwell, 2018). As of 2023, 17 states have announced their reinsurance programs. Like the federal reinsurance program, these state reinsurance programs collect contributions known as "assessment fees" from all health plans sold within the state. The pooled funds, combined with federal funding, are then used to cover the costs of significantly high claims from providers (Barry et al., 2012). All states with reinsurance except for Alaska and Maine have a cost-based design for their program, which reimburses insurers a percentage of high-cost claims exceeding the attachment point (like deductible). Alaska's condition-based design reimburses insurers based on specific health conditions, while Maine has a hybrid of condition- and cost-based design (CMS, 2021).

Three RAND evaluations of state-based reinsurance programs in Alaska, Minnesota, and Oregon have demonstrated their effectiveness in stabilizing individual market premiums (Liu et al., 2022; Rao et al., 2022; Timbie et al., 2022). These evaluations suggested that state reinsurance programs are associated with increased consumer enrollment, the maintenance of insurer participation, and the generation of federal savings (Schwab et al., 2018). Fung et al. (2023) found

a significantly reduced impact of state reinsurance programs on premiums and expenses, as well as increased efficiency using utilized insurer-level data and a difference-in-differences method. The study further suggested that state reinsurance programs reduce premiums without decreasing consumer efficiency in individual markets (Fung et al., 2023). Additionally, other researchers used an event study and confirmed that between 2018 and 2021, the states with reinsurance programs experienced a decline in premiums across metal tiers and found that the policy did not affect insurer participation (Oyeka & Wehby, 2023).

Previous evidence suggested that state reinsurance programs were associated with reductions in premiums across metal tiers (Oyeka & Wehby, 2023). Oyeka and Wehby use the number of insurers in a county as a dependent variable in their 2023 study to measure reinsurance programs' impact on insurer participation in the HIX. The study showed no significant changes in the number of participating insurers associated with the reinsurance program. Theoretically, the causal inference between premium reduction and insurer participation remains unclear. On the one hand, previous studies suggested reinsurance's capacity to improve insurer participation through reduced risk in the marketplace and decreased operational cost (Lueck, 2019; Polyakova et al., 2021; Sloan et al., 2019). On the other hand, the increasing number of insurers entering the health exchange market was also associated with decreased premiums (Abraham et al., 2017). The conflicting results of previous research make the relationship between state reinsurance programs, insurer participation, and health exchange premiums ambiguous. Therefore, this study's research question is whether reinsurance has a differential level of policy effects in counties with different health insurer competition.

In this quasi-experimental study, we examine the heterogeneous policy effects of reinsurance programs on premiums in the individual markets of HIX among counties with

differential levels of insurer competition. We used an event-study method with variation in treatment times. Given the importance of participation in the causal effect of reinsurance programs on health exchange premiums, the major contribution of this study is to further our understanding of the variation policy effect of state reinsurance programs under the 1332 State Innovation waiver.

Methods

Data and Sample

This study used the 2015-2023 Health Exchange Data (HIX) from the Robert Wood Johnson Foundation (RWJF). HIX is a public plan-level dataset reflecting details of insurance plans sold in the individual and small group insurance market in 50 states nationwide. This study's data set contains vital variables, including premiums of different age groups, rating area codes, detailed insurance plan information, number of carriers in a county, and copay/coinsurance information. Because participants in individual markets are more exposed to the impact of changes in premiums without employer contribution, the reinsurance program impacts the patients in the individual market the most. Therefore, we used the HIX individual market data for our analysis.

In addition, we used the supplemental document named “County to Rating Area Crosswalk” from the HIX official websites to match county FIPS code with an insurance plan through rating areas; a rating area refers to a geographic region containing one or more counties inside of the United States. By merging the crosswalk file and original data, we acquired a comprehensive dataset with necessary variables, including premium by age groups, county FIPS codes, and state FIPS codes. Finally, we merged into county-level socioeconomic variables in the AHRQ Social Determinants of Health database from 2015 to 2023.

We included all health insurance plans in gold, silver, and bronze tiers sold in the individual market across all 3142 counties in 50 states from 2015 to 2023 and excluded non-state territories.

Due to the limited sample size, we excluded the Platinum and Catastrophic health insurance plans in our primary analysis. Based on the RWJF HIX data, less than 200 unique counties have Platinum Health plans, and less than 500 unique counties have Catastrophic Health plans that have been sold in the individual market since 2017. Another reason is that around 1% of the individuals who purchased marketplace plans chose Platinum and Catastrophic Health Plans from 2017-2020 (CMS, 2017-2020).

Measures

The dependent variable is the premium of health insurance policies for an individual at the age of 27. We did not consider other premium variables reflecting different age groups and family composition because the ACA limited the influence of age to a 3:1 premium ratio. This means insurers could charge an adult aged 64 or older no more than three times the premium paid by a 21-year-old for the same coverage (Glied, 2018). As such, the difference in premiums for the same insurance sold to different age groups is proportional based on the 3:1 ratio; therefore, using premiums of other age groups is unnecessary.

Our primary independent variable is the implementation of state reinsurance programs. We created “event time” for these programs. The event times reflect the relative time difference between the year of the observation and the year of the implementation of the reinsurance program in a state. Note that each observation point in the consolidated dataset is at the plan level. We categorized these observations of each year based on the difference between the time of the observation and the year their state government adopted the reinsurance program. We have one control group and six treatment groups based on variation in treatment time. Specifically, in our study, the event time “-1” means the year the state government announced the reinsurance program, while event time 0 is the time the policy starts to have an effect because the premium of

an insurance plan is always calculated in the previous year (Miller et al. 2021). All observations from states that never implemented reinsurance would be marked as 0 in all our event time variables.

In the sensitivity analysis, we added several county-level time-varying socioeconomic variables as control covariates. These variables include the percentage of the population in poverty, the percentage of the population unemployed, the county median household income, the percentage of the population with less than a high school education, the percentage of the black population, the percentage of the Hispanic population, the percentage of the population does not speak English well.

Statistical Analyses

First, we did a descriptive analysis reflecting the average premium change and states' characteristics for states that implemented reinsurance programs from 2018 to 2023, as well as those never implemented. The states that individually implemented state reinsurance programs were our treatment groups, while those that never implemented the program were our control groups. We calculated the relative annual average premium change of these 2 categories of states every year between 2017 and 2023. We then applied a Difference-in-Differences (DiD) event study with variations in treatment timing. The main outcome of interest in this study was the premium of health insurance policies, and the main independent variable is the relative treatment time for implementation of the state reinsurance program. The following is our model equation:

$$P_{icy} = \alpha + Reinsurance * \sum_{\substack{t=-8 \\ t \neq -1}}^4 \beta_t I(y - y_i = t) + \lambda_y + \delta_c + \beta_m X_i + \epsilon_{icy}$$

Where, P_{ry} measures health insurance policy premiums each year, which serves as the dependent variable in the analysis. In the equation, the independent variable was presented as indicator variables $I(y - y_i = t)$, measuring the time relative to reinsurance implementation (t) determined by calendar year (yt) and policy implementation year (y_i). The event time was coded as zero for those within states that never adopted reinsurance programs. The advantage of using non-parametric independent variables is easy visualization and assessment of the pattern of outcome relative to the date of reinsurance implementation (Dobkin et al. 2018). We controlled for insurance county fixed effects (δ_c), calendar year fixed effects (λ_y), as well as insurance Metal Tier (β_m) (Athey & Imbens, 2022; Callaway, B & Sant’Anna, 2021; Miller et al., 2021). To Test the parallel assumption of the analysis, we tested the trend of the coefficient of “event time” from all models.

Our main analysis consisted of two phases; each phase contains two regression models. The first model estimates the overall impact of reinsurance on premiums among all national plans. The second model was a subgroup analysis based on the metal tiers of the policies. Both models included the state and calendar year of observation. We included the fixed effect of county and calendar year as controls.

In the first phase, we reviewed and compared our policy effect on health exchange premiums among different metal tiers in individual markets. We used similar but different analytical methods in this phase than previous studies. In the second phase, we investigate the differences in treatment effects between counties with and without competition. The competition was determined by the number of insurers in the county in 2017—the baseline year. We defined that counties without competition would have only one insurer in the individual market, while

counties with competition would have more than one insurer. We assessed the parallel assumption based on the coefficient of “event time” representing the period before policy implementation for all models, and all models had wild cluster bootstrap standard errors clustered at the state level (Cameron et al., 2008; Oyeka Wehby, 2018).

Sensitivity Analysis

We assessed our estimates’ sensitivity to controlling county-level sociodemographic variables. The reason for that is that these variables may change over time and thus confound our estimation. We analyzed all these controlling variables separately and collectively and then compared the coefficient of the estimated change caused by the reinsurance program under all these models. We applied the same statistical model as our main analysis in this sensitivity analysis.

To check the bias from the presence of heterogeneous treatment effects across cohorts that implemented reinsurance in different years, we used the interaction-weighted (IW) estimator established by Sun and Abraham in 2021. When the heterogeneity of treatment effects exists, the traditional TWFE methods can result in estimates with uninterpretable weights. The method evaluates the IW estimator for unbalanced panel data by estimating the interacted regression using all observations (Sun & Abraham, 2021).

Limitation

We acknowledge some limitations. First, our data only reflects the health insurance plan-level details. It does not contain information about the number of people enrolling in specific health insurance plans. Therefore, we could not pinpoint the impact of reinsurance programs on the total premiums without the information on the shares of each metal tier plan in the marketplace.

Although the Silver metal tier plan is popular in the market, the gold metal tier plans have gained popularity in recent years. For example, during the 2017–18 open enrollment period in California, 36.69 percent of re-enrollees moved into gold plans, compared to 9.55–12.21 percent in the previous period (Rasmussen et al., 2019).

Second, the data used in this study was limited to 2023, which might not fully capture the marketplace dynamic for health insurance. The ACA 1332 waiver for reinsurance is constantly available for state governments to apply and implement reinsurance programs. Therefore, given the data, we can only look at 6 implementation groups that consist of 17 states, with some treatment groups that would have only been in the post-period stage for only 1 year. This study might not be able to fully capture the effect of reinsurance that launched in recent years.

Third, our data source does not reflect each observation's market share. The most commonly used way to assess the competitiveness of an insurance market is to use the Herfindahl–Hirschman index (Arintoko et al., 2021; Dafny, 2020; Skuflic et al., 2011). However, acquiring county-level insurer market share is very difficult and limited by the data we use, so we could only use a binary competition variable that reflects the existence of competition versus none.

Results

Descriptive Statistics

Table 2.1 shows the characteristics of the counties in our data sample's never-treated and treated states. It shows the average plan premium and social-demographic factors based on the year of state reinsurance implementation. The average insurance premium in control counties is higher than treatment counties in general, and the difference ranges from 5.17 % (\$20.74) to 15.21% (\$61.03). Counties that adopted reinsurance programs between 2018 and 2021 tended to have a lower percentage of poor population, a lower unemployment rate, a higher average

household income, and a lower percentage of minority population relative to counties that did not adopt reinsurance. The counties from states that adopted reinsurance in 2022 had a higher percentage of the low-income population, a higher unemployment rate, a lower average household income, and a high percentage of the black population when compared to the counties in states that never adopted reinsurance and their treatment group counterparts.

Table 2.2 presents the number of counties that implemented state reinsurance programs throughout the years. In the first year of implementation, which is 2018, there were only 152 counties from 3 states in the treatment group. As time moved on, till 2023, there were 878 counties from 17 states in the treatment groups, making up more than 28% of the counties in the US.

Figure 1 illustrates that the overall premium changing trends were parallel between counties with competition and those without competition from 2015 to 2023., but counties with competition have almost always lower premiums, with one exception in 2022.

Regression results

Figure 2.2 presents the policy impact of the reinsurance program policy for health insurance plans from all metal tiers and specific metal tiers. The parallel trend assumption was all satisfied before the implementation of the reinsurance program. After the implementation of state reinsurance programs, we observed a statistically significant decrease ($p < 0.01$) in premiums for all of the health exchange insurance plans for both the general model and tier-specific model. The premium reduction effects were meaningful and sustained throughout the year of the treatment. On average, the reinsurance program was associated with a \$60.54 decrease in premiums in all the health exchange plans. Specifically, gold plans experienced the largest average premium decrease after the implementation of \$71.08, while silver plans experienced the smallest average premium decrease of \$48.14. All results are statistically significant ($p < 0.01$) and available in Table 2.4.

Figure 2.3 presents the policy impact of the reinsurance program policies on all health exchange insurance in general and tier-specific models, with a comparison between counties with and without competition. The parallel assumption for all models was satisfied, except for counties without competition in the Gold Tier-specific model. Following the first year of reinsurance implementation, we observed a statistically significant reduction in premiums for all models in both competition groups. The policy effect was also meaningful and sustained throughout the post-treatment period for counties with and without competition. There was heterogeneity in treatment effects among counties with different competition levels. In general, the reinsurance programs were associated with an extra \$21.11 decrease in the average premium among counties with competition compared to counties without competition (see Table 2.5). Although the difference is not precisely estimated, it carries significant public health impacts; it is equivalent to approximately 6 percent of the baseline premium. We found similar results in analysis stratified by metal tiers.

Results from sensitivity analyses

In order to test whether county fixed effect, time fixed effect, as well as metal tier information of the health plan were sufficient enough for covering county-varying social-demographic factors to provide stable results, we tested the coefficient with different sociodemographic factors. Figure 2.4 indicates that when these variables are collectively controlled, the event study estimates of policy effect on premium between these models and our analytical model in the main analysis are negligible. We observed a similar pattern of change throughout event times between our main and sensitive analyses. Detailed estimated coefficients can be found in Table 2.6. Such a result suggests that after controlling for county and time fixed

effect as well as metal tier of insurance plans, the control of other socioeconomic status covariates is not necessary in the analysis.

Table 2.6 is the estimated coefficient of the event study with the IW estimator. For counties with competition among more than one insurer, we observed that the pretreatment parallel assumption was violated as the counties without competition. We observed sustaining statistically significant policy effects in the event time after the policy treatment for plans from all metal tiers across counties with and without competition, similar to our main analysis. To address the concern of the violation of the parallel assumption in this analysis, we reviewed the distribution of observations, and we found them to be unevenly distributed during the pre-treatment period among counties without competition. Considering this methodology took into account heterogeneity among the cohorts, the differential distribution of observations can explain the violation.

Discussion

This paper analyzed the differential effects of state reinsurance programs under the ACA 1332 Waiver on health insurance premiums in the market from 2015 to 2023, leveraging the staggered implementation of state reinsurance programs as a quasi-experiment. The results indicated that the state reinsurance programs reduce premiums in the individual market in general, but compared with counties with only one insurer, counties with 2 more insurers experienced a larger reduction. Importantly, our study demonstrated that the effects of the premium reduction are different across the different Metal tiers of health insurance, with more considerable reductions for more expensive and generous plans. We also found that the heterogeneous treatment effect of reinsurance between different competition levels is larger in the more generous plans, specifically gold tier plans.

Our findings align with three previous studies by Liu et al., Rao et al., and Timmie et al. in 2022 that found reductions in premiums associated with states' reinsurance programs. In these three CMS evaluation reports conducted by RAND, researchers concluded that Alaska, Oregon, and Minnesota's waiver was associated with lower premiums across all plans offered in the marketplace, which correspond with our general findings in the national level data across all states (Liu et al., 2022; Rao et al., 2022; Timbie et al., 2022). Compared with Fung et al.(2023), our results are similar regarding the effect of reinsurance premium reduction on a general national level. Similar to the findings of Oyeka & Wehby (2023), our study report backs a statistically significant premium reduction effect over health insurance plans in the health exchange across different metal tiers. Furthermore, our study contributed to the literature by exploring treatment effects between counties with different insurer competition levels. Our study was able to provide evidence explaining the heterogeneity of the treatment effects.

The results of this study showed that, on the national level, the ACA 1332 waiver for states' reinsurance programs was able to decrease the market insurance premium for insurance policies by \$60.54 on average after the implementation. Additionally, the heterogeneous treatment effect by county insurer competition was around \$21.11. As was suggested in the Kaiser Family Foundation (KFF) report on the 2017 Premium change and Insurer participation (Cox et al., 2016), the decrease and increase are associated with the ACA marketplace stability. Our study indicates that the reinsurance programs of the 17 states could stabilize the insurance market on average. The effect of market stabilization would be larger if a country has more than one insurer. We also showed that the effect of reinsurance lasted in the years following the implementation, especially for more expensive metal-tier plans. A stable insurance market and lower premiums usually

encourage insurers' and patients' participation in the market (Cox et al., 2016; Chernew et al., 1997).

Second, we confirm that the effects of reinsurance programs vary across metal tier plans, which bears differential implications for patients with various health conditions across the state border, as indicated by previous studies. We furthered the discovery that heterogeneity in treatment effect caused by competition was different among metal tiers. As shown in the subgroup analysis, for more comprehensive and generous gold tier plans, the effect of premium reduction from reinsurance was long-lasting and much more prominent if a county had more than one insurer. This means that among all state individual marketplaces, the ones with more participants choosing more expansive and comprehensive insurance plans would benefit more from reinsurance than the ones with more people choosing cheaper and less comprehensive insurance plans. Based on the adverse selection theory, the elderly and sicker populations are more likely to choose more comprehensive and expansive plans (Hall & McCue, 2021). Therefore, the state reinsurance under the ACA1332 waiver impacted plans that are more likely to be chosen by the population that needs health care the most. Such policy effects would be more evident in the state than those with more competition. We can suggest that reinsurance is a valuable policy tool to improve access and coverage for their residents, especially if there is more competition. Notably, as we see more enrollment in gold metal tier plans (Rasmussen et al., 2019), the impact of the reinsurance program is potentially large at the population level.

In our study, we observed a "premium spike". There was a minor increase in the year before reinsurance programs were announced and not yet implemented from regression estimates after controlling for state and calendar year fixed effects in models from both phases. Although such a spike does not impact the validity of our study and is not statistically significant, we have several

plausible explanations for the observation. In the individual market, premiums are typically determined by insurance companies in the previous year, making premium changes influenced by state and federal policies, as well as market dynamics. One possible explanation is that the reinsurance policy was a state government's response to higher premiums (decided in year -1 but implemented in year 0) by enacting reinsurance programs (Giovannelli, 2020). Another contributing factor to the overall increasing premium trend could be attributed to inflation, rising healthcare spending, or the aging population (Dieleman et al., 2017; Telesfor et al., 2023). Additionally, the premium increase effect of silver loading, which resulted in higher premiums for silver plans, partially explains the observed premium spike, as silver plans contributed the most to this phenomenon in our analysis. As presented in Figure 2.1, we started to observe a drastic increase in premiums in 2017, which fit the silver pattern. These observations and their potential causes have not been previously discussed or addressed in existing studies, which merit future research.

In conclusion, our study suggests that publicly funded reinsurance programs implemented under the ACA 1332 waiver effectively stabilize the insurance marketplace and reduce monthly premiums, particularly for Gold, Silver, and Bronze metal tier plans. Policy effects are more significant if there is more competition for insurers in the county. States without this program should consider following those that have implemented reinsurance and strive for more stable and affordable health insurance, together with other policies encouraging the entry of insurance companies into the market. Future studies should explore the differential effects of reinsurance on different tiers of health insurance plans and investigate the direct impact of the reinsurance program on consumer affordability and enrollment.

Table 2.1 Descriptive Statistics of US Counties in 2017 by Reinsurance Implementation Year

Factor	Group of Counties Based on the Year of State Reinsurance Implementation							p-value
	No Reinsurance	2018	2019	2020	2021	2022	2023	
The average premium of counties (US \$)	401.11 (131.15)	376.34 (136.91)	380.37 (105.44)	354.61 (93.50)	340.08 (100.92)	374.21 (106.73)	362.95 (102.77)	<0.001
Percentage of Poor Population (%)	15.22 (5.87)	11.22 (4.33)	10.59 (3.79)	12.72 (5.39)	11.61 (3.40)	19.18 (6.74)	13.10 (5.26)	<0.001
Percentage of Unemployed Population (%)	6.05 (3.01)	5.69 (3.66)	4.99 (2.01)	4.33 (3.07)	5.48 (1.58)	7.19 (3.09)	5.51 (2.49)	<0.001
County Median Household Income (US\$)	50540.37 (12847.54)	59579.58 (12647.27)	63509.75 (17911.83)	56471.79 (13947.05)	57271.75 (11923.57)	46148.69 (13685.08)	56865.51 (19913.99)	<0.001
Percentage of Population less than High School (%)	13.88 (6.44)	8.97 (3.77)	8.85 (3.12)	8.85 (4.09)	9.93 (2.85)	17.71 (5.93)	13.15 (5.61)	<0.001
Percentage of Black Population (%)	8.71 (14.19)	1.48 (1.97)	6.54 (11.09)	1.38 (3.15)	4.26 (6.32)	28.36 (17.57)	14.05 (16.16)	<0.001
Percentage of Hispanic Population (%)	10.31 (15.42)	6.44 (6.28)	6.07 (7.14)	9.32 (11.58)	4.15 (4.57)	6.42 (5.41)	7.22 (8.12)	<0.001
Percentage of the Population Doesn't speak English well (%)	1.23 (1.81)	1.13 (1.49)	1.17 (1.58)	0.86 (1.20)	0.71 (0.72)	1.14 (1.33)	1.20 (1.67)	<0.001

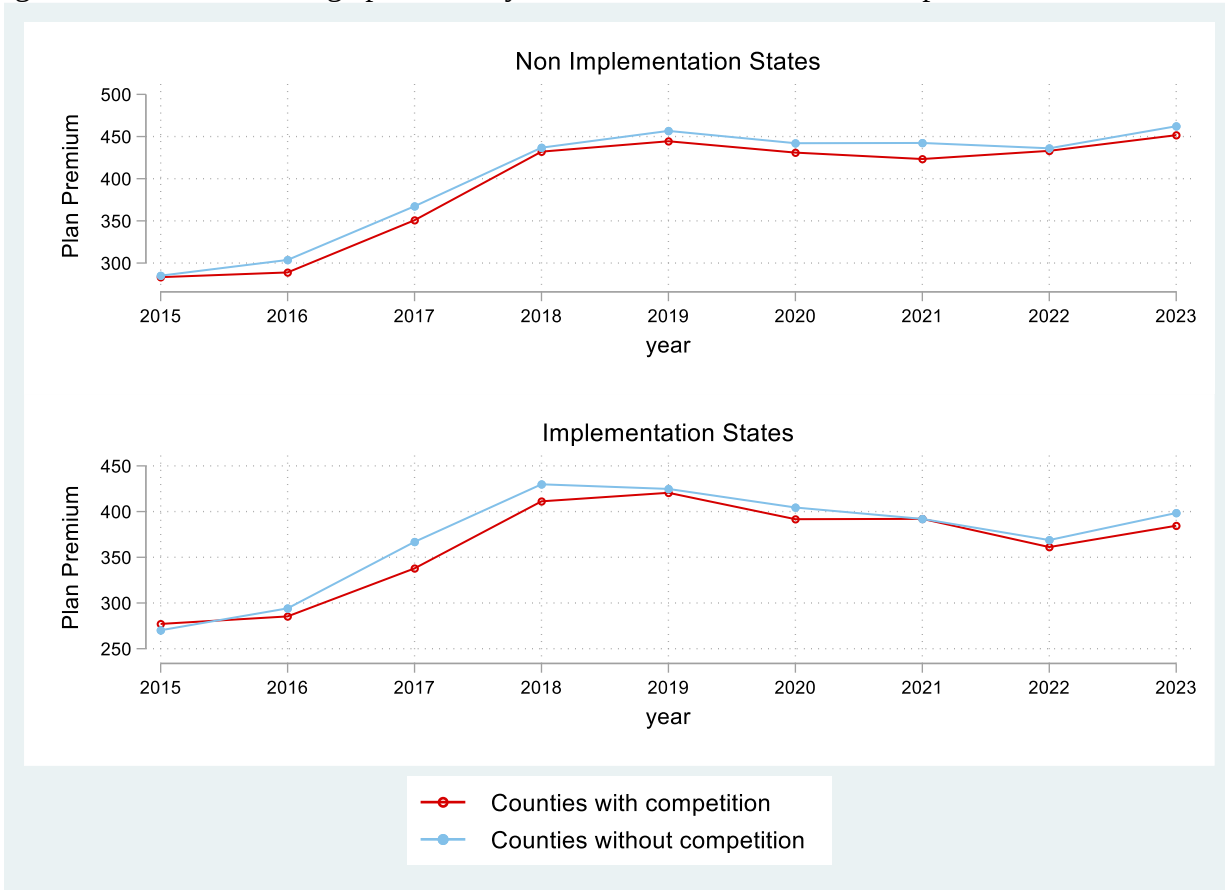
Note: The results of this table are unweighted and shown together with standard deviation in parentheses. Average premiums are from the Robert-Wood-Johnson Foundation, 2015–2023. All other variables are from county-year estimates based on the AHRQ's Social Determinants of Health data, 2015–2020. There are 6 control groups: 2018 reinsurance states include Alaska, Minnesota, and Oregon; 2019 reinsurance states include Maine, Maryland, New Jersey, and Wisconsin. 2020 reinsurance states include Colorado, Delaware, Montana, North Dakota, and Rhode Island. 2021 reinsurance states include Pennsylvania and New Hampshire. 2020 reinsurance state includes Georgia. 2023 reinsurance states include Idaho and Virginia. The rest of the states are in the control group.

Table 2.2 Number of US counties with State Reinsurance program, 2017-2023

Year	Number of Counties	Counties without reinsurance	Counties with reinsurance
2017	3117	3117	0
2018	3129	2977	152
2019	3128	2843	285
2020	3130	2664	466
2021	3075	2532	543
2022	3134	2433	701
2023	3133	2255	878

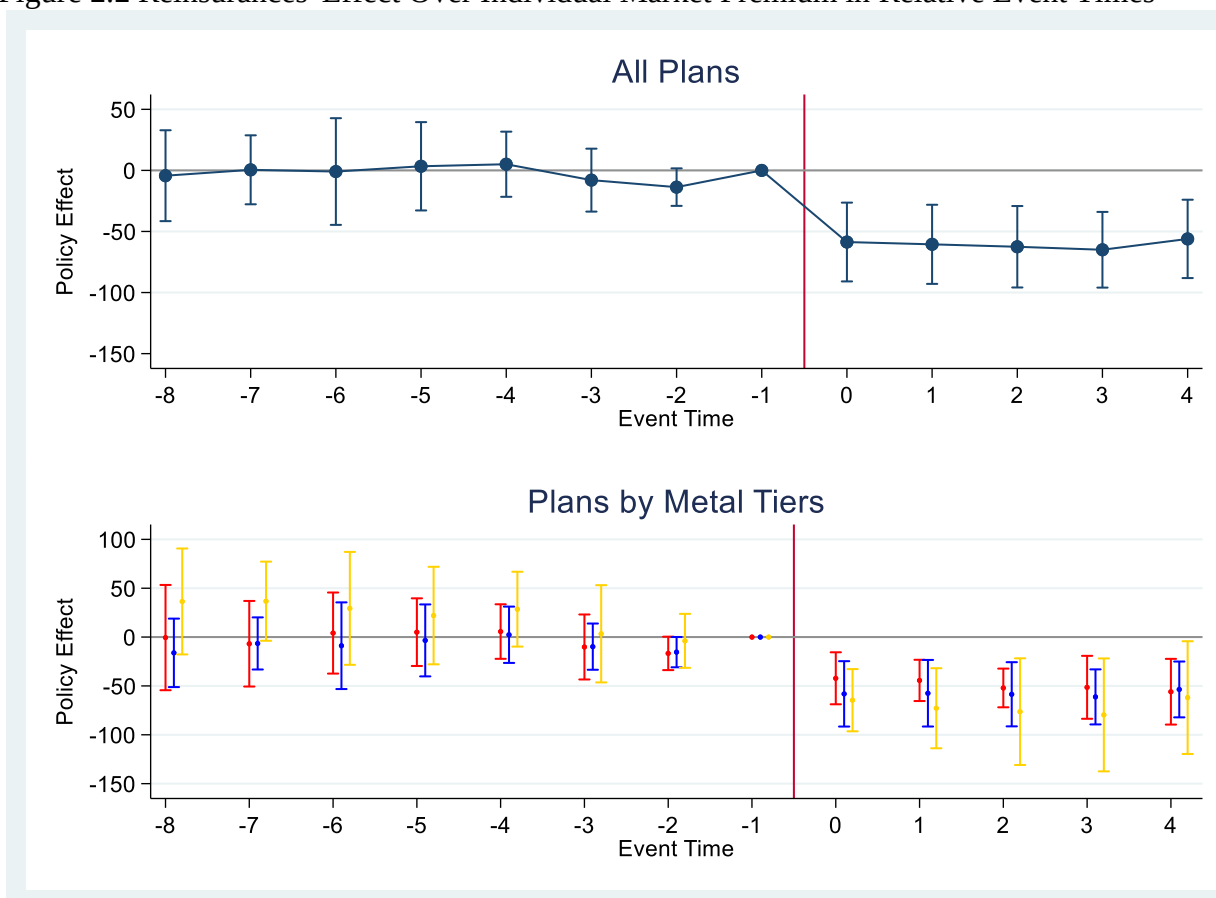
Note: The data are from the Robert-Wood-Johnson Foundation, 2015–2023. There are 6 control groups: 2018 reinsurance states include Alaska, Minnesota, and Oregon; 2019 reinsurance states include Maine, Maryland, New Jersey, and Wisconsin. 2020 reinsurance states include Colorado, Delaware, Montana, North Dakota, and Rhode Island. 2021 reinsurance states include Pennsylvania and New Hampshire. 2020 reinsurance state includes Georgia. 2023 reinsurance states include Idaho and Virginia. The rest of the states are in the control group.

Figure 2.1 Trends in average premium by counties with and without competition. 2015-2023



Note: The data are from the Robert-Wood-Johnson Foundation, 2015–2023. Counties’ competition was determined by whether a county had one or more insurers. Treatment states are Alaska, Minnesota, Oregon, Maine, Maryland, New Jersey, Wisconsin, Colorado, Delaware, Montana, North Dakota, Rhode Island, Pennsylvania, New Hampshire, Georgia, Idaho, and Virginia. The rest of the states are in the control group.

Figure 2.2 Reinsurances' Effect Over Individual Market Premium in Relative Event Times



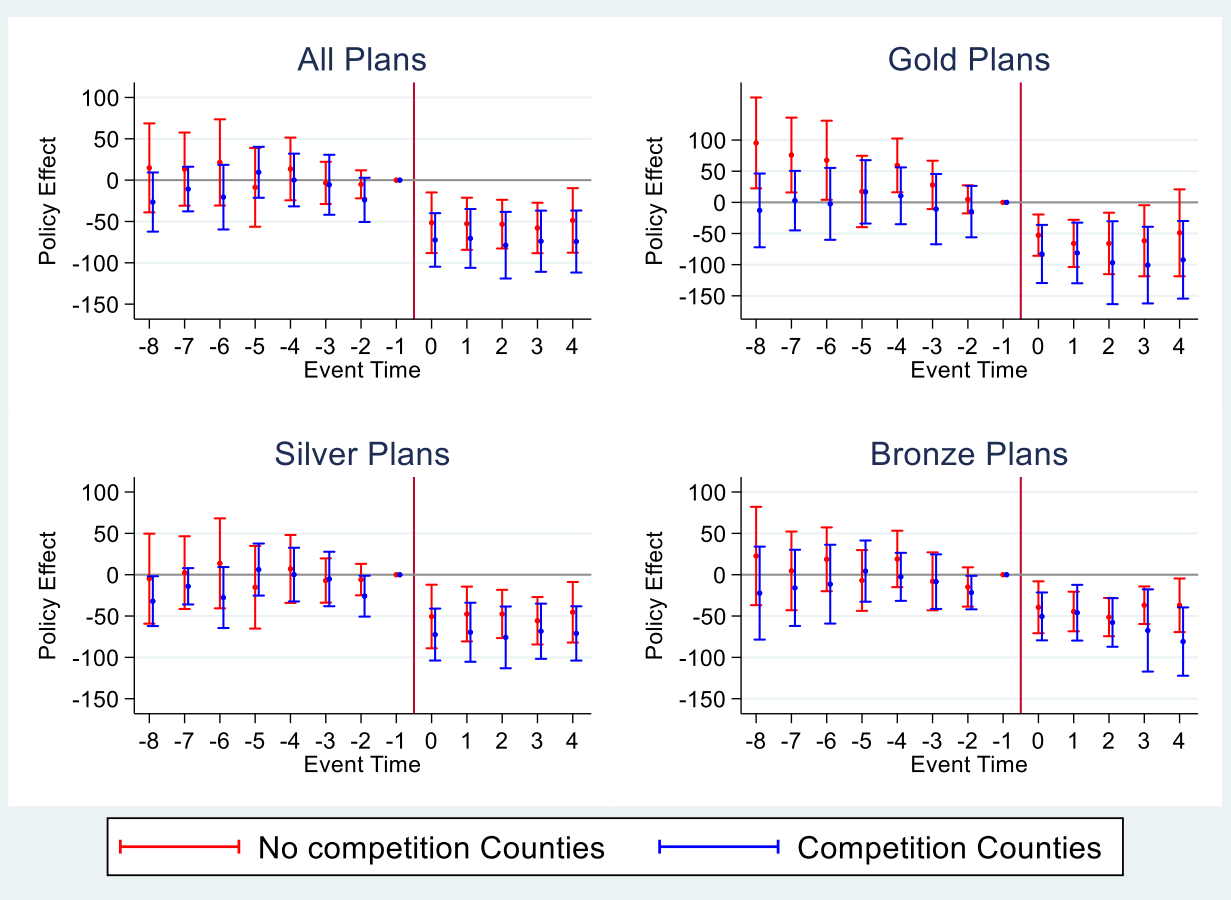
Note: In the lower panel, Gold, Silver, and Bronze metal tier plans were represented in the following order of colors: yellow, blue, and red. The data are from the Robert-Wood-Johnson Foundation, 2015–2023. There are 6 treatment groups: 2018 reinsurance states include Alaska, Minnesota, and Oregon; 2019 reinsurance states include Maine, Maryland, New Jersey, and Wisconsin. 2020 reinsurance states include Colorado, Delaware, Montana, North Dakota, and Rhode Island. 2021 reinsurance states include Pennsylvania and New Hampshire. 2022 reinsurance state includes Georgia. 2023 reinsurance states include Idaho and Virginia. The rest of the states are in the control group.

Table 2.3 Event Study Coefficient Examining the Impact of Reinsurance on Premium by Metal Tier

Event Time	Metal Tier			
	All Plans	Gold	Silver	Bronze
-8	-4.34	33.24	-21.31	-3.24
-7	0.48	38.70*	-8.65	-9.71
-6	-0.92	25.62	-15.51	-2.67
-5	3.37	19.07	-11.56	-6.09
-4	5.06	29.59	-3.21	1.07
-3	-7.96	-2.34	-16.95	-20.90
-2	-13.69*	-3.86	-12.69	-18.59
0	-58.64***	-77.12***	-65.26***	-49.04***
1	-60.51***	-81.57***	-63.59***	-53.26***
2	-62.52***	-81.92***	-63.98***	-53.99***
3	-64.97***	-82.27***	-66.72***	-57.04***
4	-56.08***	-57.14*	-53.44***	-54.19***

Note: The data are from the Robert-Wood-Johnson Foundation, 2015–2023. There are 6 treatment groups: 2018 reinsurance states include Alaska, Minnesota, and Oregon; 2019 reinsurance states include Maine, Maryland, New Jersey, and Wisconsin. 2020 reinsurance states include Colorado, Delaware, Montana, North Dakota, and Rhode Island. 2021 reinsurance states include Pennsylvania and New Hampshire. 2022 reinsurance state includes Georgia. 2023 reinsurance states include Idaho and Virginia. The rest of the states are in the control group. The rest of the states are in the control group. *** p<0.01, ** p<0.05, * p<0.1

Figure 2.3 Policy effect over premium in event times by Metal Tiers and competition



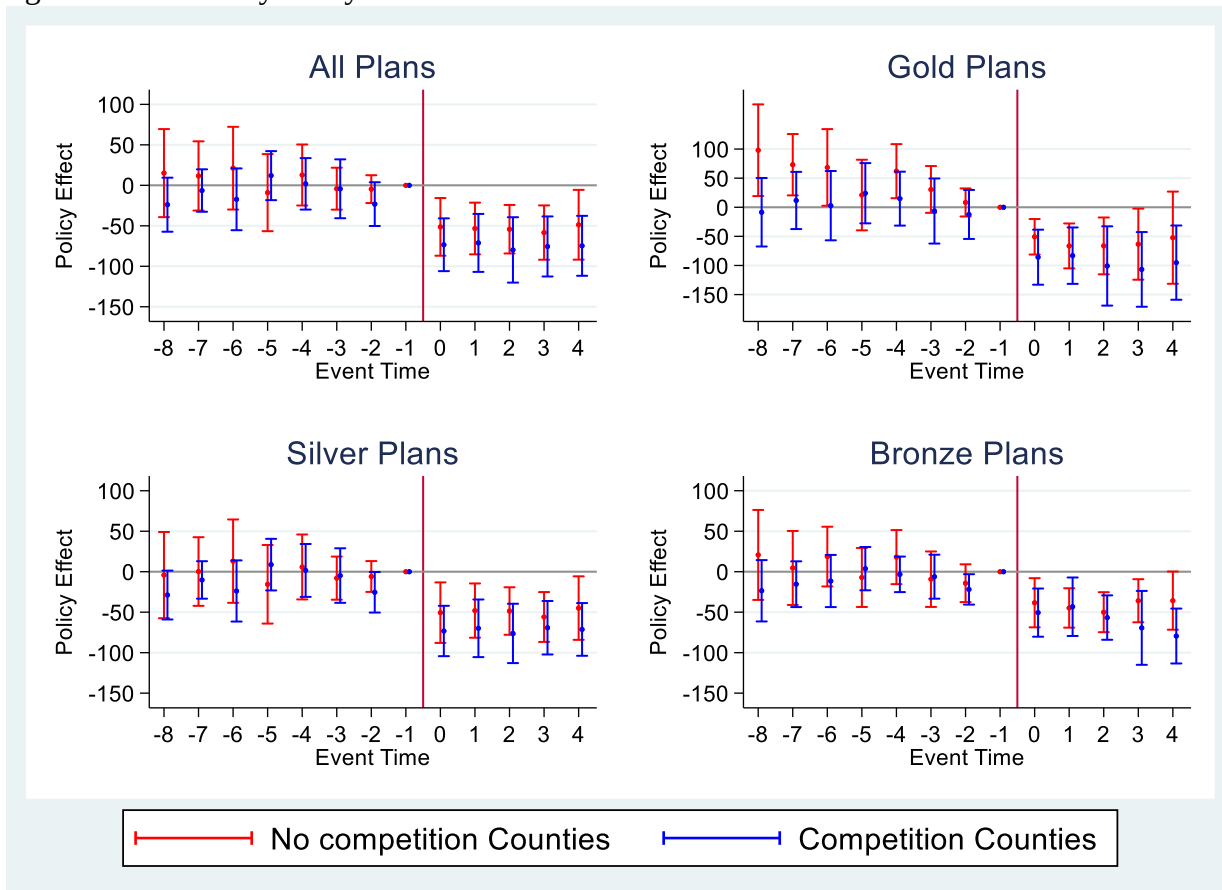
The data are from the Robert-Wood-Johnson Foundation, 2015–2023. There are 6 treatment groups: 2018 reinsurance states include Alaska, Minnesota, and Oregon; 2019 reinsurance states include Maine, Maryland, New Jersey, and Wisconsin. 2020 reinsurance states include Colorado, Delaware, Montana, North Dakota, and Rhode Island. 2021 reinsurance states include Pennsylvania and New Hampshire. 2022 reinsurance state includes Georgia. 2023 reinsurance states include Idaho and Virginia. The rest of the states are in the control group. The rest of the states are in the control group. Counties' competition was determined by whether a county had one or more insurers.

Table 2.4 Even Study Coefficient Examining the Impact of Reinsurance on Premium by Metal Tier and Competition levels

Event Time	All Plans		Gold		Silver		Bronze	
	Competition	No competition	Competition	No competition	Competition	No competition	Competition	No competition
-8	-26.49	14.82	-8.48	80.11**	-35.05**	-6.54	-14.75	13.14
-7	-10.77	13.34	17.92	72.16***	-9.15	-1.47	-4.26	-0.36
-6	-20.58	21.45	4.30	55.52	-24.54	-3.94	-9.75	9.24
-5	9.48	-8.71	3.53	38.13	-13.05	-14.36	-9.76	4.24
-4	0.15	13.54	6.06	64.74***	-11.31	6.05	-10.15	17.82
-3	-5.62	-3.37	-26.41	30.56*	-17.63	-12.69	-24.42	-6.23
-2	-23.88*	-5.07	-18.24	23.83***	-26.56*	7.33	-25.29*	-6.70
0	-72.35***	-51.56***	-90.94***	-57.23***	-85.73***	-55.12***	-61.96***	-37.26***
1	-70.48***	-52.74***	-92.86***	-63.02***	-79.64***	-53.11***	-55.47**	-42.99***
2	-78.71***	-53.26***	-110.50***	-56.96**	-87.59***	-49.59***	-65.96***	-40.38***
3	-73.87***	-57.87***	-98.98***	-60.65**	-73.72***	-59.69***	-70.66**	-40.08***
4	-74.26***	-48.72**	-69.45**	-35.07	-64.29***	-42.87**	-79.43***	-31.40**

Note: The data are from the Robert-Wood-Johnson Foundation, 2015–2023. There are 6 treatment groups: 2018 reinsurance states include Alaska, Minnesota, and Oregon; 2019 reinsurance states include Maine, Maryland, New Jersey, and Wisconsin. 2020 reinsurance states include Colorado, Delaware, Montana, North Dakota, and Rhode Island. 2021 reinsurance states include Pennsylvania and New Hampshire. 2022 reinsurance state includes Georgia. 2023 reinsurance states include Idaho and Virginia. The rest of the states are in the control group. The rest of the states are in the control group. Counties' competition was determined by whether a county had one or more insurers. *** p<0.01, ** p<0.05, * p<0.1

Figure 2.4 Sensitivity Analysis coefficient estimate with various controls.



Source: Data of analysis from the RWJF HIX and AHRQ SODH.

Notes: We controlled the metal tier in our main event study model. There are 6 treatment groups: 2018 reinsurance states include Alaska, Minnesota, and Oregon; 2019 reinsurance states include Maine, Maryland, New Jersey, and Wisconsin. 2020 reinsurance states include Colorado, Delaware, Montana, North Dakota, and Rhode Island. 2021 reinsurance states include Pennsylvania and New Hampshire. 2022 reinsurance state includes Georgia. 2023 reinsurance states include Idaho and Virginia. The rest of the states are in the control group. The rest of the states are in the control group. Counties' competition was determined by whether a county had one or more insurers.

Table 2.5. Sensitive Analysis Event Study Coefficient with All Covariates

Event Time	All Plans		Gold		Silver		Bronze	
	Competitio n	No competitio n	Competitio n	No competitio n	Competitio n	No competitio n	Competitio n	No competitio n
-8	-23.95	15.10	-8.54	98.02**	-28.81*	-4.18	-23.54	20.72
-7	-6.43	11.61	11.68	73.11***	-10.19	0.22	-15.43	4.60
-6	-17.27	21.21	2.77	68.41**	-23.79	13.03	-11.49	18.68
-5	11.99	-9.03	24.14	20.99	8.74	-15.54	3.77	-7.11
-4	1.86	12.78	14.82	62.04***	1.58	5.86	-3.27	18.05
-3	-4.29	-4.17	-6.45	30.59	-4.79	-7.93	-6.18	-9.23
-2	-23.22*	-4.68	-12.36	8.27	-25.42**	-5.95	-21.89**	-14.21
0	-73.41***	-51.32***	-85.77***	-50.75***	-73.24***	-50.56***	-50.53***	-38.36**
1	-71.10***	-53.32***	-83.17***	-66.37***	-69.91***	-48.02***	-43.27**	-44.76***
2	-79.80***	-54.21***	-100.85***	-66.35***	-76.22***	-48.58***	-56.66***	-50.03***
3	-75.53***	-58.34***	-106.77***	-63.41**	-69.20***	-55.93***	-69.38***	-35.88***
4	-74.72***	-48.72**	-95.15***	-52.25	-71.28***	-44.93**	-79.45***	-35.71*

Note: The data are from the Robert-Wood-Johnson Foundation and AHRQ SODH, 2015–2023. There are 6 treatment groups: 2018 reinsurance states include Alaska, Minnesota, and Oregon; 2019 reinsurance states include Maine, Maryland, New Jersey, and Wisconsin. 2020 reinsurance states include Colorado, Delaware, Montana, North Dakota, and Rhode Island. 2021 reinsurance states include Pennsylvania and New Hampshire. 2022 reinsurance state includes Georgia. 2023 reinsurance states include Idaho and Virginia. The rest of the states are in the control group. The rest of the states are in the control group. Counties' competition was determined by whether a county had one or more insurers.

*** p<0.01, ** p<0.05, * p<0.1

Table 2.6 Sensitive Analysis Event Study Coefficient with IW

Event Time	All Plans		Gold		Silver		Bronze	
	Competition	No competition	Competition	No competition	Competition	No competition	Competition	No competition
-8	-8.41	21.90	7.02	74.59	-9.28	9.61	20.08	10.00
-7	-6.24	15.87	19.04	80.51	-7.76	5.29	1.42	10.00
-6	-16.37	14.26	7.24	70.93	-21.99	3.05	14.12	10.00
-5	14.86	-11.01	25.76	18.84	9.18	-16.98	7.64	10.00
-4	11.30	11.24	23.30	59.48	8.69	1.80	4.56	10.00
-3	-2.33	-38.38***	-16.12	-11.81	-1.25	-37.03**	-11.98	10.00
-2	-10.21	-47.22***	10.00	-39.45**	-15.16	-43.13***	-13.98	10.00
0	-63.02***	-69.64***	-71.90***	-72.82***	-65.02***	-68.49***	-38.36***	10.00
1	-69.01***	-67.93***	-76.39***	-67.33***	-70.41***	-64.97***	-40.03***	10.00
2	-68.57***	-72.79***	-83.18***	-84.47***	-68.35***	-69.97***	-50.32***	10.00
3	-66.22***	-88.86***	-88.11***	-89.90***	-63.45***	-91.52***	-62.86***	10.00
4	-62.52***	-86.38***	-61.56***	-76.21***	-64.36***	-89.89***	-70.90***	10.00

Note: The data are from the Robert-Wood-Johnson Foundation and AHRQ SODH, 2015–2023. There are 6 treatment groups: 2018 reinsurance states include Alaska, Minnesota, and Oregon; 2019 reinsurance states include Maine, Maryland, New Jersey, and Wisconsin. 2020 reinsurance states include Colorado, Delaware, Montana, North Dakota, and Rhode Island. 2021 reinsurance states include Pennsylvania and New Hampshire. 2022 reinsurance state includes Georgia. 2023 reinsurance states include Idaho and Virginia. The rest of the states are in the control group. The rest of the states are in the control group. Counties' competition was determined by whether a county had one or more insurers.

*** p<0.01, ** p<0.05, * p<0.1

Chapter 3: The impact of state reinsurance programs on the provision of employer-sponsored health insurance

Introduction

The Affordable Care Act (ACA) was designed to reform the US health care system to be more accessible and affordable. Through the early years of ACA implementation, the United States overall experienced an increase in coverage for the population, yet healthcare costs remained increasing. The ACA brought various new regulations, such as the elimination of pre-existing conditions, which introduced uncertainties in reimbursement costs for insurers (Lueck, 2019). As a result, insurers continuously increased premiums for all sorts of coverage after the ACA. It was not till 2018 that the average benchmark premium increased by 37%, with some variation across states (Gabel et al., 2016; DHHS, 2016; DHHS, 2017; McKillop, 2018). In response, several states adopted the reinsurance program to stabilize the health exchange market (HIX) and address the concerns of rising premiums.

Reinsurance essentially is an insurance for the insurers. It redistributes the insurers' financial risk by collecting fees from the participating firms and using the pool of funds to reimburse these firms when high-cost claims. Such practice was first adopted in the commercial setting (Blazenko, 1986; Zhu et al., 2013). Federal reinsurance came along with all other ACA regulations aiming to stabilize the HIX, specifically premiums, due to the drastic policy changes, including the Individual and Employer Insurance mandate, Medicaid expansion, prohibiting pre-existing conditions, etc. From 2014 to 2015, federal reinsurance operated with numerous contributions from the state, commercial insurers, and self-insured group health plans (Jacobs et al., 2017; Nicholson & Gruwell, 2018; Winkelman et al., 2012). The states started to apply for state reinsurance programs through 1332 waivers after the conclusion of the federal reinsurance program (Nicholson & Gruwell, 2018). The ACA section 1332 waiver, also known as State Innovation Waivers, allows states to pursue innovative strategies for providing residents with

access to high-quality, affordable health insurance while maintaining the basic protections of the ACA (CMS, 2017). Once approved, states can structure and fund their reinsurance programs with autonomy to determine program type, attachment point, coinsurance rate, and reinsurance cap. Most of the states established their program following a claim cost-based approach; the reinsurance program would reimburse the insurer portion of the high-cost claims exceeding the attachment point, similar to deductibles (Oyeka & Wehby, 2023; CMS 2017). Based on emerging evidence investigating reinsurance programs, previous reports, and studies indicated that HIX premiums declined after the implementation of the state reinsurance programs (Oyeka & Wehby, 2023; Fung et al., 2023)

Based on the law of supply and demand, when the price of a substitute good or service decreases (premium of HIX) while the overall demand for health insurance remains the same, the demand curve for goods (ESI) would move towards the left, resulting a lower quantity and high price as a new equilibrium in the ESI market. In response to that, the supply curve of original goods (ESI) would move leftwards to reach a new equilibrium with a lower quantity of ESI being available on the market. In theory, the market can observe the process in two ways. One is that with lower premiums in the HIX, more participating insurance companies will enter the market. Previous studies prior to state reinsurance programs suggested that insurers entering the market are associated with a premium decrease, while insurers leaving the market are associated with a premium increase (Cox et al. 2016; Abraham et al. 2017). In response to whether reinsurance impacts the supply in the market, researchers found in a previous Quasi-Experimental study that although the reinsurance implementation has decreased the premium of plan in the Individual HIX, the policy has no significant impact on insurer participation in the HIX (Oyeka & Wehby, 2023).

The other one is that more people will purchase health insurance plans from the marketplace, and fewer employers will be willing to provide ESI. It is consistent with the Crowding-out theory established by Bruno Frey, suggesting that external intervention via monetary incentives or punishments may undermine and, under different identifiable conditions, strengthen intrinsic motivation (Frey, 1998; Frey & Jegen, 2021). In the context of the US health insurance market, the application of crowding theory can be due to the implementation of a state-subsidized reinsurance program; health plans available in the market would be cheaper, incentivizing some employers to stop providing Employer Sponsor Insurance (ESI) (Chollet, 2004). Previous literature has documented that public reinsurance programs can crowd out private reinsurance programs (Lewis & Murdock, 1996), and general state policy interventions crowd out private insurance plans (Sloan & Conover, 1998). However, empirical evidence on the potential crowding-out effect of state reinsurance programs is limited.

This study aims to examine the extent to which the state reinsurance programs had a crowding-out effect over ESI provided by employers. Given the substantial differences in demographics and socioeconomic conditions, we will also investigate the heterogeneous effect across different states. Lastly, since one of the core ACA components is Employer Shared Responsibility Provisions (Employer Mandate) in providing insurance coverage to their employees, this left a loophole for smaller employers hiring less than 50 full-time employees (IRS, 2024; USOPM, 2024). We will study the differential effect of reinsurance by firm size of employers.

Methods

Data and Sample

In this study, we used the Medical Expenditure Panel Survey Insurance/Employer Component (MEPS IC) from AHRQ for our main analysis. MEPS IC is an annual survey of private employers and State and local governments. The MEPS-IC produces national and state-level estimates of employer-sponsored insurance, including offered plans, costs, employee eligibility, and number of enrollees (AHRQ, 2024). We retrieved part of the MEPS IC data from Section “Private Sector - States” from 2008 to 2020. This section contains state-level data reflecting information on the private sector’s establishment details, ESI information, and employees.

In addition, we used the 2008-2020 National Welfare Data from the University of Kentucky Center for Poverty Research (UKCPR). The data contains information regarding population, employment, unemployment, welfare, poverty, and politics. We were able to merge the National Welfare Data with MEPS IC using state FIPS code and year because both data organized the observation as state-year.

For our analysis, we included all fifty states and DC from year 2008 to 2020. The unit of analysis is state-year, totaling 663 observations. Although both MEPS and National Welfare data support our analysis till the year 2020, we decided not to use observation due to the outbreak of the COVID-19 pandemic. As previous studies and reports have found, the recession due to COVID-19 has made a noticeable impact on employers maintaining employment and, together with their ESI provided to employees (Gangopadhyaya et al., 2020) (Karpman et al., 2020). The decisions on health insurance, including participation, premium, and benefits, for both ESI and HIX plans are made in the year before the open enrollment period. Therefore, it is reasonable to keep the year 2020 in our analysis since its decision was made before November 2019, when the pandemic was not significantly recognized in the USA.

Measures

The dependent variable in this study for the main analysis is the percentage of employers in a state or DC of a specific year providing ESI to their employees. We also included the percentages of employees in a state or DC of a particular year, providing ESI categorized by the size of the establishment, mainly firms with more than 50 employees versus firms with less than 50 employees. These measures are used as dependent variables in our subgroup analysis.

Our primary predictor for the study is the implementation of a state reinsurance program. We also included three state-level covariates: political fraction in state houses, Gross State Production per Capita (GSP per Capita), and a state's unemployment rate in a particular year.

Statistical Analysis

We first provided descriptive analysis reflecting the percentage of employers providing ESI in each state from 2015 to 2020 by three groups: all firms, firms with less than 50 employees, and firms with more than 50 employees. The distinction between firms with over 50 or less than 50 employees captures the potential heterogeneous effect caused by the inclusion criteria of the Employer Insurance Mandate of the ACA. The descriptive analysis was also categorized by 1) the implementation of reinsurance programs and 2) the year in which the state implemented reinsurance.

In our main analysis, we computed an event study Difference-in-Differences (DiD) estimates with variation in treatment timing, which are states implementing reinsurance programs in the year 2018, 2019, and 2020, with states never adopted reinsurance from 2008-2020 as the comparison group. Our dependent variables were the percentage of all employers providing ESI, and the independent variable reinsurance implementation was reflected by relative “event time” to the year of implementation. All observations of states that never implemented reinsurance would

be marked as 0 in all our event time variables. We estimate the following equation using linear regression:

$$ESI_{sy} = \alpha + Reinsurance * \sum_{\substack{t=-12 \\ t \neq -1}}^2 \beta_t I(y - y_i = t) + \lambda_y + \delta_s + \beta_u + \beta_g + \beta_p + \epsilon_{sy}$$

The data was constructed at state(s) by year level(t). Where, ESI_{sy} measures the percentage of employers providing ESI. The independent variable was measured as indicator variable $I(y - y_i = t)$, measuring the relative event time(t) to reinsurance implementation. It was determined by calendar year (y) and policy implementation year (y_i). The omitted category is $t = -1$ the year prior to expansion. All states that had never adopted the reinsurance programs would be marked as 0 in our event time variables.

The parallel assumption can be evaluated by whether the trend between implementation states and non-implementation states was similar prior to the implementation. In other words, it is expected that from event time -12 to -2, the estimated coefficient should be zero with no statistical significance (Callaway & Sant'Anna, 2020; Miller et al., 2021; Athey & Imbens, 2022). We controlled for state-fixed effect (δ_s), calendar year fixed effects (λ_t), unemployment rate (β_u), and GSP per capita (β_g).

We conducted several subgroup analyses. First, we conducted a DiD analysis separately for state groups based on the reinsurance implementation year, using all non-implementation states as controls. It allows us to explore the effect of heterogeneous policy across states. Secondly, we conducted a subgroup analysis based on firm size. Specifically, we further separated the main model and separate year group models into employer firm size subgroups, reflecting firms or employers hiring more than 50 employees versus those hiring less than 50 employees. We estimated heterogeneous policy effects on smaller firms and larger firms among the states that

implemented reinsurance in the same year, as well as across all implementation states. Lastly, all models had wild cluster bootstrap standard errors clustered at the state level and the number of employees of the states as analytical weights (Cameron, 2008; Meiselbach & Abraham, 2023).

Limitation

There are two major limitations we want to acknowledge. First, our data is at the state-year level, which disallows us to control urban-rural differences and across-county differences within a state. However, the reinsurance program is a statewide policy, and the inclusion of state and year-fixed effects is likely to account for potential confounding variables.

The second limitation is that we have a few years of data after the reinsurance implementation. This limitation prevented us from looking into the potential longer-term crowding-out effect of the reinsurance on ESI provision. Further investigation on this issue would be recommended when more data is available for years after the COVID-19 pandemic.

Results

Descriptive Statistics

Table 3.1 is the result of descriptive statistics describing the characteristics of the states, categorized by the year of reinsurance program implementation. When looking at the probability of providing ESI, the difference of firms between implementing and non-implementing state groups supplying ESI is not statistically significant. However, when we separated the observations by firm sizes, the ones with more than 50 employees tended to have a homogenous probability of supplying ESI. In comparison, firms with 50 or fewer employees tended to have different probabilities of providing ESI among different treatment and control groups. Similar to the dependent variables, political characteristics and the proportion of employees working in the larger

versus smaller firms are statistically different across the state groups. The GSP per capita and Unemployment rate are homogeneous across the nation.

Figure 3.1 visualizes the trends of change for the percentage of firms providing ESI, which are different among the states that implemented reinsurance from 2015 to 2020. Specifically, among the three implementation groups, we only saw a decrease in the treatment groups in the first year of implementation for states that had reinsurance in 2019 and 2020 based on the descriptive analysis. These results indicate that the reinsurance policy would affect treatment groups differently, motivating a subgroup analysis.

Main results

Figure 3.2 displays the DiD estimate on the effect of reinsurance programs of 4 different models. The first general model presents the trend for the percentage of firms supplying ESI to their employees according to the relative time to the treatment of our analysis in all treatment groups and regardless of the size of the firms. The trend before the implementation satisfies the parallel assumption before the implementation of the reinsurance program. We observed that the policy decreased the percentage of firms supplying ESI in the first year (event time zero) by 3.19 percentage points ($p = 0.012$). The probability decreased by 0.62 ($p = 0.496$) in the second year and the third year by 1.04 percentage points ($p = 0.544$) after the treatment, but they are all statistically insignificant.

We then investigated whether there was a variation in the treatment effect among different treatment groups. We noticed that the analysis results of all three treatment groups satisfy the parallel assumption. However, we can only observe that reinsurance decreased the percentage of employers providing ESI in the 2019 and 2020 groups, and only states in the 2020 group had a statistically significant impact (-6.11 percentage points, $p = 0.000$). It was similar to our general

model, where policy effects were only observed in the first year after implementation. For states in the 2018 group, the reinsurance program had no policy impact on the percentage of employers providing ESI.

Subgroup analysis

Figure 3.3 visualizes the results of our sensitivity analysis by firm sizes. As we expected and explained in the earlier section, the policy effect on ESI provision reduction is visually observable only for the smaller firms in all treatment states, as well as in the treatment states in 2019 and 2020. Table 3.2 provides detailed results for the second stage of our subgroup analysis, reflecting the differential policy impact of reinsurance programs on firms hiring different numbers of employees. In general, we found that, for firms hiring more than 50 employees, the reinsurance program had no significant impact on ESI offering and state-implemented reinsurance among the treatment groups. For smaller employers hiring less than 50 employees, the results are similar to our main analysis and the first phase of subgroup analysis. We also observed that reinsurance has insignificantly decreased overall smaller firms' percentage of ESI offering by 2.92 percentage points ($p = 0.067$) in 2019 but significantly decreased the percentage for states in the 2020 treatment group by 4.32 percentage points ($p = 0.000$). It is important to note that, for states that implemented reinsurance programs in 2019 and 2020, smaller firms had a relatively large decrease in the percentage of ESI offerings compared to larger firms with opposite trends, although it was not precisely estimated.

Discussion

Our study examined the crowding-out effect of state reinsurance programs under the ACA section 1332 State Innovation Waiver on ESI. Overall, there is a considerable decrease, though not statistically significant, in the percentage of ESI offered among states with reinsurance programs

during the first year of implementation. There are heterogeneous policy effects across states that implemented reinsurance in different years. We found that the policy effect is large and statistically significant for states implementing the programs in 2020. In addition, our results revealed considerable differential impacts of reinsurance on ESI provision between large and small firms. Smaller firms in the 2020 treatment group experienced a large and statistically significant decline, almost 5 percentage points in providing insurance to workers, while for the 2019 and 2020 treatment groups, such a result is still relevant but statistically insignificant.

The results of this study suggest that states aiming to stabilize HIX and restrain premiums through reinsurance programs should consider its impact on ESI provision. This is especially true for states with a higher portion of small employers in their economic system. Although more research should be done to investigate why the decline in the 2020 treatment group states was more significant than other states, one thing is for sure: smaller employers will be impacted more. The differential policy effect among employer firm size can be explained by inclusion criteria of the Employer Mandate under the ACA. Although not all employees are influenced by reinsurance programs, we cannot simply neglect the crowding-out effect. According to Kaiser Family Foundation data, around 158,018,100 enrollees are covered by ESI. This population makes up 48.7% of the US population (KFF, 2024). Among this population, around 36,265,642 work full-time or part-time for a private employer hiring less than 50 full-time employees, that is more than 11 % of the total population, and potentially their family members, whose usual source of health insurance coverage being ESI could be impacted by the decision of the states (AHRQ, 2024). The result of our study somewhat aligns with the previous research of economists and health economists who expressed concerns that public intervention, in general, into the HIX would crowd out private sectors (Frey, 1998; Lewis & Murdock, 1996; Sloan & Conover, 1998; Chollet, 2004).

Fortunately, the ACA prevented the effect from impacting the majority of US employees and their family members. This is not to state whether it is a good or bad thing for people crowding into publicly subsidized individual markets, nor should the US population rely on ESI and private sectors for health insurance coverage. The study presented us with a scenario of a state public policy aiming to release the financial burden for both the insurer and the population, which could have an unintended consequence. From the perspective of smaller firms with less than 50 employees, the reinsurance program has the potential to reduce the cost of running businesses in the first year after implementation by providing substitutive HIX plans with lower prices so that they don't have to contribute to the employer part of the ESI.

Research on State Reinsurance programs shows that the policy continues to be effective in stabilizing the market and regulating marketplace premiums for health insurance (Fung et al., 2023; Oyeka & Wehby, 2023). States that aim to regulate health exchange would find the policy attempting to be effective in protecting unsubsidized health exchange enrollees who are not eligible for advanced premium tax credits to share the burden of cost for health coverage. However, the policymakers in these states should be cautious and considerate regarding the unintended crowding-out over the ESI, particularly in smaller private firms, which are already a primary health coverage source for a significant portion of the employees in their jurisdiction. Such unintended consequences can cause a change in coverage among its population. Potentially, states that seek or have already established reinsurance programs can avoid the unintended crowding-out through supplemental policies like expanding the Employer Mandate to smaller private firms or providing incentives for smaller businesses to enroll small group health exchange to provide insurance coverage for their employees when reinsurance is taking effect.

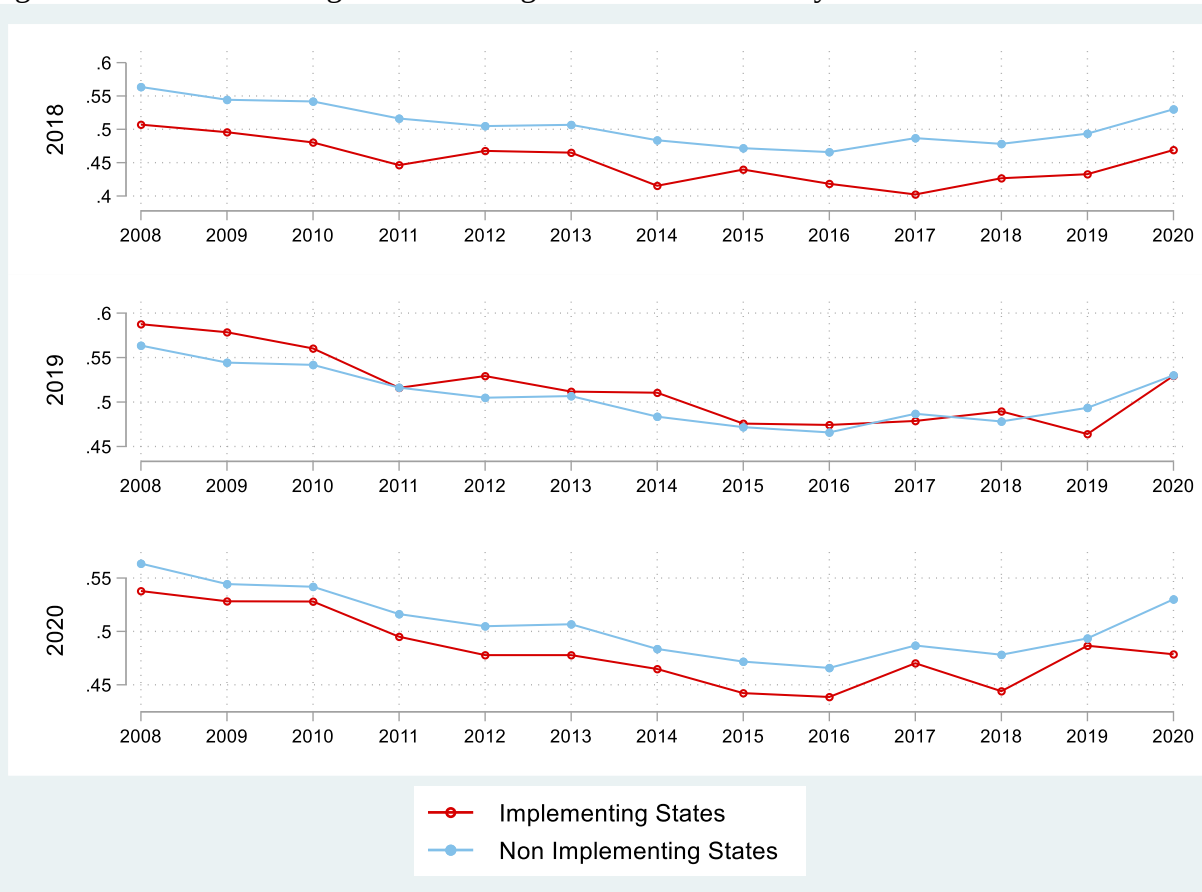
In conclusion, the state reinsurance program under the ACA section 1332 State Innovation Waiver in 2020 was associated with crowding out ESI among small employers hiring less than 50 workers. This result showed that the insight of previous studies regarding public intervention in health exchange crowding out private sector activity is valid. It would be essential for state policymakers to take caution on the unintended consequences into consideration when conducting policy regarding establishing state reinsurance programs. Future studies can continue to examine the causes of differential crowding-out effects among states that are caused by state reinsurance programs and whether the state that implemented the policy after 2020 will experience effects similar to those in 2020.

Table 3.1 Characteristics of States on ESI supply and other employment-related variables, by reinsurance implementation

Factor	State-year by year adopting reinsurance				P-value
	Never	2018	2019	2020	
N	34	3	4	5	
Percent of Firm offering ESI to employee, mean (SD)	0.49 (0.09)	0.40 (0.08)	0.48 (0.06)	0.47 (0.07)	0.65
Insurance offered - Less than 50 employees, mean (SD)	0.31 (0.10)	0.24 (0.10)	0.32 (0.07)	0.33 (0.06)	0.74
Insurance offered - 50 or more employees, mean (SD)	0.97 (0.01)	0.95 (0.02)	0.97 (0.01)	0.97 (0.01)	0.41
Unemployment rate, mean (SD)	4.28 (0.86)	4.80 (1.85)	3.88 (0.63)	3.66 (0.86)	0.48
GDP per capita, mean (SD)	59281.42 (25851.70)	62743.10 (7602.83)	58604.52 (9767.74)	61077.62 (11131.53)	1.00
Fraction of State House that is Democrat, mean (SD)	0.42 (0.18)	0.50 (0.09)	0.56 (0.13)	0.53 (0.23)	0.55
Governor is Democrat					0.39
No	26 (76%)	1 (33%)	4 (100%)	1 (20%)	
Yes	7 (21%)	2 (67%)	0 (0%)	4 (80%)	
Employees working in small firms, mean(SD)	0.27 (0.04)	0.32 (0.04)	0.30 (0.03)	0.33 (0.06)	0.09
Employees working in large firms, mean(SD)	0.73 (0.04)	0.68 (0.04)	0.70 (0.03)	0.67 (0.06)	0.09

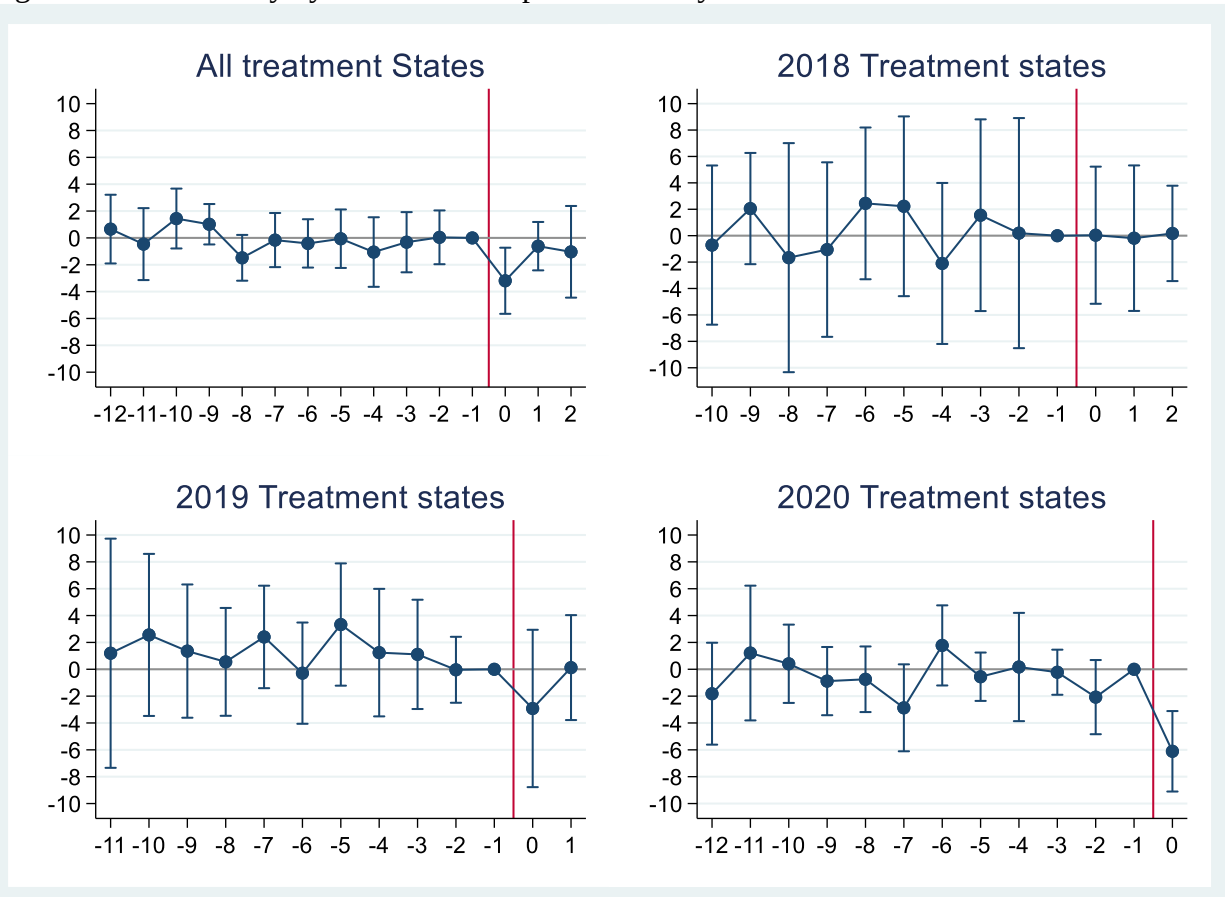
Note: The results of this table are unweighted and shown together with standard deviation in parentheses. The unemployment rate, GSP per capita, State House political component, and Governor party allegiance are from the University of Kentucky Center for Poverty Research National Welfare Data, 2015–2020. All other variables are from state-year estimates based on the AHRQ’s Medical Expenditure Panel Survey – Insurance/Employer Component, 2015–2020.

Figure 3.1 Trends of Change for Percentage of Firms Provide any ESI



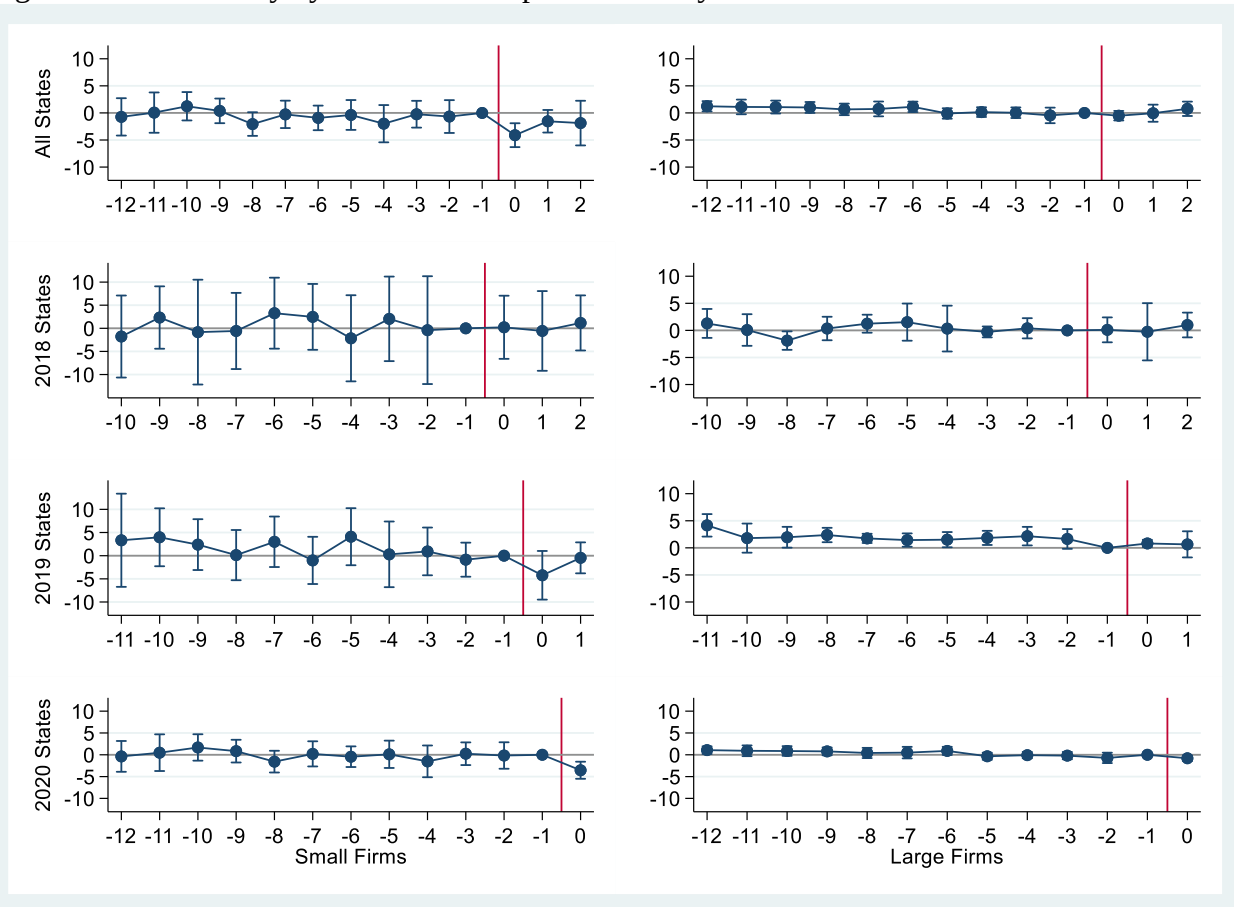
Note: The source of the data is State-year estimates based on the AHRQ's Medical Expenditure Panel Survey – Insurance/Employer Component, 2015–2020. 2018 reinsurance states include Alaska, Minnesota, and Oregon; 2019 reinsurance states include Maine, Maryland, New Jersey, and Wisconsin. 2020 reinsurance states include Colorado, Delaware, Montana, North Dakota, and Rhode Island.

Figure 3.2 Event Study by reinsurance implementation year



Note: The X-axis represents the event times, and the Y-axis represents the percentage point of ESI being provided by employers. Source of the data: State-year estimates based on the AHRQ's Medical Expenditure Panel Survey – Insurance/Employer Component, 2015–2020, and the University of Kentucky Center for Poverty Research National Welfare Data, 2015–2020. 2018 reinsurance states include Alaska, Minnesota, and Oregon; 2019 reinsurance states include Maine, Maryland, New Jersey, and Wisconsin. 2020 reinsurance states include Colorado, Delaware, Montana, North Dakota, and Rhode Island. Regressions were controlled for the following covariates: unemployment rate by state, GSP per capita, State House fraction of Democratic Party, Governor's political allegiance, calendar year fixed effect, and state fixed effect. Standard errors are clustered at the state level.

Figure 3.3 Event Study by reinsurance implementation year and Firm size



Note: The X-axis represents the event times, and the Y-axis represents the percentage point of ESI being provided by employers. Source of the data: State-year estimates based on the AHRQ's Medical Expenditure Panel Survey – Insurance/Employer Component, 2015–2020, and the University of Kentucky Center for Poverty Research National Welfare Data, 2015–2020. 2018 reinsurance states include Alaska, Minnesota, and Oregon; 2019 reinsurance states include Maine, Maryland, New Jersey, and Wisconsin. 2020 reinsurance states include Colorado, Delaware, Montana, North Dakota, and Rhode Island. Regressions were controlled for the following covariates: unemployment rate by state, GSP per capita, State House fraction of Democratic Party, Governor's political allegiance, calendar year fixed effect, and state fixed effect. Standard errors are clustered at the state level.

Table 3.2 Impact of Reinsurance program on Percentage of Employer offering ESI, by treatment year and firm size

Event Time	All Treatment Group			2018 Treatment Group			2019 Treatment Group			2020 Treatment Group		
	Firm size			Firm size			Firm size			Firm size		
	All	Small	Large	All	Small	Large	All	Small	Large	All	Small	Large
-12	0.007	-0.001	0.015***							-0.018	-0.036	0.009
-11	-0.005	-0.002	0.014**				0.012	0.026	0.040***	0.012	0.010	0.004
-10	0.014	0.017	0.013**	-0.007	-0.013	0.016	0.026	0.047	0.022	0.004	0.006	0.003
-9	0.010	0.009	0.012**	0.021	0.027	0.007	0.014	0.031	0.021*	-0.009	-0.007	0.016*
-8	-0.015*	-0.018	0.012**	-0.017	-0.007	-0.012**	0.006	0.009	0.027***	-0.007	-0.008	0.004
-7	-0.002	0.000	0.009	-0.011	-0.002	0.011	0.024	0.038	0.019***	-0.0287*	-0.020	-0.019
-6	-0.004	-0.005	0.014***	0.025	0.033	0.017**	-0.003	-0.003	0.018**	0.018	0.008	0.026***
-5	-0.001	0.000	0.000	0.022	0.028	0.021	0.033	0.051	0.016**	-0.006	-0.0224*	0.014**
-4	-0.011	-0.013	0.002	-0.021	-0.016	0.009	0.012	0.010	0.019***	0.002	0.007	0.002
-3	-0.003	-0.002	0.002	0.016	0.023	0.001	0.011	0.017	0.022**	-0.002	-0.001	0.006
-2	0.000	-0.004	-0.004	0.002	0.000	0.007	0.000	-0.002	0.016*	-0.021	-0.027	-0.021*
0	-0.032**	-0.035***	-0.004	0.000	0.001	0.004	-0.029	-0.033	0.010***	-0.061***	-0.044***	-0.010
1	-0.006	-0.011	-0.001	-0.002	-0.002	0.002	0.001	0.002	0.006			
2	-0.010	-0.015	0.006	0.002	0.012	0.014						

Note: The source of the data is State-year estimates based on the AHRQ's Medical Expenditure Panel Survey – Insurance/Employer Component, 2015–2020, and the University of Kentucky Center for Poverty Research National Welfare Data, 2015–2020. 2018 reinsurance states include Alaska, Minnesota, and Oregon; 2019 reinsurance states include Maine, Maryland, New Jersey, and Wisconsin. 2020 reinsurance states include Colorado, Delaware, Montana, North Dakota, and Rhode Island. Regressions were controlled for the following covariates: unemployment rate by state, GSP per capita, State House fraction of Democratic Party, Governor's political allegiance, calendar year fixed effect, and state fixed effect. Standard errors are clustered at the state level. *** p<0.01, ** p<0.05, * p<0.1

Chapter 4: The impact of state reinsurance programs on the patient's out-of-pocket premium and enrollment in the individual market

Introduction

Cost and coverage of health insurance have been the center of the discussion on health care system reform in the US for decades. Since the implementation of the ACA, millions have been lifted from the uninsured status, including both men and women, and across race and ethnic groups, levels of education, and so on (Blumberg et al., 2016; Garrett & Gangopadhyaya, 2016). The ACA was able to achieve goals, including improving access and reducing financial barriers for the uninsured population, through measures such as Medicaid expansion and the Health Exchange Market (HIX) reform (Glied et al., 2020). However, due to many incidents in the ACA policy process, the healthcare system reform was not universal across the country, especially for HIX and Medicaid expansion. To this day, there are still nearly thirty million Americans being uninsured or uncovered by any form of medical coverage with major inequities (Sommers, 2020).

Aiming to address the loophole in health care reform, the Section 1332 waiver, also known as the State Innovation Waiver, was introduced as a provision under ACA. State governments can use the waiver to propose innovation to expand access to affordable and flexible health coverage while maintaining essential health benefits. State reinsurance programs were a popular option for states to decrease the cost of insurance coverage. Reinsurances are insurances for the insurance companies, providing capacity for the HIX by redistributing risk among insurers, just like health insurance did the same to the patients (Blasenکو, 1986). The state proposed to establish its reinsurance program just like the commercial prototypes and federal reinsurance program that first came together with the ACA. Similar to commercial and federal reinsurance, state reinsurance is also considered a risk management tool, effective in reducing the variability of cash flows and financial leverage simultaneously (Garven & Lamm-Tennant, 2011).

Till 2023, there have been 17 states successfully implementing reinsurance programs. Section 1332 waiver allowed the state to flexibly propose and establish a reinsurance framework as long as it meets the standards of coverage adequacy, budget neutrality, and deficit reduction. Upon approval, states can seek federal pass-through funding, which refers to the amount of federal spending saved in Marketplace subsidies, to finance their state-based reinsurance program. Like the federal reinsurance program from 2014 to 2016, state programs can collect contributions called “assessment fees” from insurance companies participating in the state’s HIX and use the pooled fund to cover the cost of significantly high claims (Barry et al., 2012). Among all the states with reinsurance programs, there are three models for state reinsurance. One is the cost-based design that reimburses insurers a percentage of high-cost claims exceeding the attachment point. The other is a condition-based design that reinsures insurers based on specific health conditions. The last one is a hybrid of condition and cost-based design (CMS, 2021).

First, to explore the impact of state reinsurance programs, RAND launched three observation studies on the state reinsurance programs of Alaska, Minnesota, and Oregon. The report indicated an observed premium reduction in HIXs of these three states (Liu et al., 2022; Rao et al., 2022; Timbie et al., 2022). Later, various previous studies explored the causal inference effect of premium reduction from the state reinsurance program (Fung et al., 2023; Oyeka and Wehby, 2023). In our previous sections, we have discovered similar outcomes of the premium reduction effect. Furthermore, we found large differences, though not statistically significant, in the treatment effect of the policy in counties with versus without the competition of health insurance companies. We also looked at the possibility of the crowding-out effect of the policy on the supply of Employer-Sponsored Insurance (ESI) among the private sections.

However, previous evaluation studies of reinsurance programs are limited to the insurance plan level. Since consumers purchase different metal tier plans, the extent to which the premium reduction of reinsurance could trickle down to the consumer has not yet been studied. As suggested by Lueck in 2019, those who benefit from the premium reduction in HIX are those who pay the full sticker price of their coverage. Such a population would not be eligible for ACA subsidies (Lueck, 2019). Considering the supply and demand relationship, the premium reduction from the reinsurance program works more like a price ceiling in the HIX. Reinsurance provides a risk reduction mechanism for insurers to prevent premiums from increasing. Although similar to a price ceiling, the state reinsurance programs are still market-oriented rather than regulatory or policing-like. It has the potential to increase the quantity of demand along the demand curve. Furthermore, when the price of HIX plans is lowered, there is a potential for individuals to switch from other sources of private insurance coverage to HIX, for example, ESI, if the coverage provided by an employer is not ideal or affordable. It is commonly understood that the uninsurance rate will increase if both public and private insurance premiums increase (Hadley et al., 2006), and the premium reduction will increase participation in health insurance plans (Chernew et al., 1997). Therefore, an empirical question is whether state reinsurance programs have reduced costs and increased participation in HIX.

In this quasi-experimental study, we examined the policy effect of state reinsurance programs on out-of-pocket premiums, the probability of being covered by Employer Sponsor Insurance, and Health Exchange plans for populations that are not eligible for public health coverage among states with differential policy implementation time. We used an event-study method with variation in treatment times. Our study will make new contributions to our

understanding of the trickling-down policy effect of the state reinsurance program under the 1332 State Innovation waiver toward consumers.

Methods

Data and Sample

The primary data we used for analysis in this study is the Medical Expenditure Panel Survey (MEPS), provided by The Agency for Healthcare Research and Quality (AHRQ). The first part was the Full-year consolidated Data files from 2016 to 2019. These publicly available files provide information collected from a nationally representative sample of the civilian population. They contain variables, including indicators of participants getting insurance coverage from employer-sponsored insurance (ESI) or private health exchange (HIX), as well as other demographics, health utilization, and health condition-related information. Similar to Full-year consolidated data files, the person round plan files are publicly available but contain health insurance records for the proportion of the observations in the full-year consolidated data files. We obtained personal insurance-related variables from the data, including monthly out-of-pocket (OOP) premiums, the source of the insurance plan, the metal tier for the insurance plan, and so on. Lastly, we obtained permission from the AHRQ data center to access the restricted data in MEPS. Ideally, we should use the observations' residential state for our analysis. However, the AHRQ did not provide full access to state identifiers. Instead, they created flags indicating the year states participated in the reinsurance programs. We assessed the restricted data through the Amazon Workspace (AWS).

Compared with the number of participants in full-year consolidated files, the participants in person round plan files were only a portion of that. Since the outcomes of our interest came from these two datasets, the total observation number would differ in different parts of our analysis.

In general, we included all participants who were not covered by public insurance, Medicare, and Medicaid in both data sets from 2016 to 2020, with ages ranging from 27 to 64. Furthermore, we excluded those who did not get coverage from HIX to observe the impact on OOP premiums.

Measures

Our outcomes include the OOP premium among participants who purchased plans from the private insurance exchange market, the percentage of participants with ESI, and the percentage of respondents who purchased plans from the private insurance exchange market.

The primary predictor for this study is the implementation of a state reinsurance program. Our analysis also included age, sex, education, income, English proficiency, marital status, health conditions, employment, and time-fixed effect. Because we only have access to “implementation group” variables and census regions, our alternatives for state fixed effect were the interaction term between region and implementation groups. We were able to identify the implementation states. However, all other groups in non-implementation states could not be distinguished and thus treated as the same.

Statistical methods

Our study includes two datasets. We used merged data consisting of full-year consolidated files, person round plan files, and restricted files for the analysis of the OOP premium. We used full-year consolidated files and restricted files in the analysis of the other two outcomes: the percentage of participants with ESI and the percentage of respondents who purchased plans from the private insurance exchange market.

The analytical models applied to both sections are similar, and all controlled for similar covariates. We first provided descriptive analysis reflecting the outcomes of our analysis, together with other demographic and socioeconomic variables by control group and treatment groups. The

treatment groups are categorized based on the year of the state-implemented reinsurance program. We had two treatment groups of observations, those from 2018 implementation states and 2019 implementation states. Observations from all other states are treated as control groups.

For all outcomes, we first applied DiD using linear regression with treatment and post-policy dummy interaction to estimate the overall policy effect (Equation 1). We applied a DiD event study together with the same controlled covariates to leverage the staggered adoption of reinsurance programs across states (Equation 2). We generated event time reflecting the relative difference between the year of the observation and the year of the implementation of the reinsurance program in a state. Event time negative one means the year before the implementation of the reinsurance program. Event time for individuals from states that never adopted reinsurance programs was coded as zero. We estimate the following equation using linear regression:

Equation 1:

$$Outcomes_{iy} = \alpha + \beta_l * (Treatment * Post) + \lambda_y + \delta_{ry} + \beta_c * X_i + \epsilon_{iy}$$

In this analysis, the data was constructed at a personal by-year level. The outcomes from the two sections include OOP premium and Percentage being covered by ESI or Exchange Plans. β_l is the estimated coefficient for the interaction term between an individual in a treatment state (binary) and an individual in a year of treatment (binary). We controlled λ_t and δ_{ry} as the estimated coefficient of the fixed effect (categorical calendar year variable) and the interaction term of geographic region and policy implementation year as the substitute to the inaccessible state variables, we also included other covariates previously mentioned.

Equation 2:

$$Outcomes_{iy} = \alpha + Reinsurance * \sum_{\substack{t=-3 \\ t \neq -1}}^1 \beta_t I(y - y_i = t) + \lambda_y + \delta_{ry} + \beta_c * X_i + \epsilon_{iy}$$

In this event study analysis, the independent variable was measured as indicator variable $I(y - y_i = t)$, measuring the relative event time(t) to reinsurance implementation. It was determined by calendar year (y) and policy implementation year (y_i). The omitted category is $t = -1$ the year prior to expansion. The parallel assumption can be evaluated by whether the trend between implementation states and non-implementation states was similar before the implementation. In other words, it is expected that from event time -3 to -1, the estimated coefficient should be zero with no statistical significance (Callaway & Sant'Anna, 2020; Miller et al., 2021; Athey & Imbens, 2022). We controlled for the interaction term of geographic region and policy implementation year as the substitute to the inaccessible state variables alternatives(δ_i), calendar year fixed effects (λ_t), and other covariates.

We further implemented subgroup analysis using event study analysis to evaluate the policy impact on our outcomes over time-based on different groups of states. The subgroup analysis was done based on the year of implementation of the state reinsurance program.

Limitation

There were several limitations we would like to acknowledge. First, our restricted MEPS data only include indicators for the year in which individuals' residential states implemented their reinsurance programs. AHRQ did not provide state identifiers in the restricted data due to their data confidentiality and disclosure rules. Therefore, we were not able to fully control the state-fixed effect. To address this limitation, we controlled the interaction between region and implementation year fixed effects in the model. In addition, in our analysis of OOP premiums, the sample size was reduced to 78528 after restricting the sample to the population that is not covered by any public insurance plan and household income larger than 400 % FPL so that they did not

qualify for premium tax credits. The small sample size might lead to insufficient power in our statistical analysis.

Result

Descriptive Statistics

Table 4.1 shows the characteristics of participants' demographics in the sample used for OOP premium analysis, including unweighted and weighted statistics. The average monthly OOP premium is higher among those who resided in a state implementing reinsurance in 2018 or 2019 than those living in states without reinsurance programs. After we applied the sample weight, we found that participants from the states in both treatment groups tended to have higher education levels, total annual family income, a lower percentage of the minority population, a lower percentage being married, and a lower probability of having chronic conditions. Similarly, Table 4.2 provides similar information to the sample population used for insurance coverage analysis. Among this sample population, participants from states in treatment groups have a higher percentage of being covered by ESI. Only participants from states in 2018 treatment groups had a higher percentage of being covered by HIX plans. Similar to the OOP analysis population, treatment groups have higher education levels, annual family income levels, and less minority populations.

Figure 4.1 presents the trends of change in monthly OOP premium, percentage of population being covered by ESI, and HIX plans between treatment groups and control group from 2016 to 2019. The OOP premium experienced a reduction from 2016 to 2017 for treatment groups, and the control group experienced an increase. As for the insurance coverage, both the HIX plans and ESI coverage were mostly parallel between treatment and control groups, but in 2019, the

treatment group experienced a slight decrease in ESI coverage and an increase in HIX plan coverage.

Regression results

Table 4.3 shows the DiD estimation of linear regression with treatment and time interaction. Our results show that the implementation of the state reinsurance program is associated with an average of \$81.18 and \$132 decreases in premiums among those living in the states that adopted reinsurance programs in 2018 and 2019, respectively. Although these reductions are not statistically significant at the $\alpha = 0.05$ level, the effect size carries significant public health implications. Moreover, we also found that those living in states with reinsurance programs in 2018 (2019) were 0.5 (0.6) percentage points more likely to be covered by HIX plans and 0.2 (1.8) percentage points less likely to be covered by ESI. However, we need to note that all these results are not statistically significant.

Figure 4.2 visualizes estimated results for event study analysis over OOP, HIX plan coverage, and ESI Coverage. We can observe from the parallel assumption that they were satisfied in all three outcomes before the implementation of reinsurance programs since the 95% confidence intervals include zero in all three outcomes. After the treatment, there were statistically insignificant decreases in monthly OOP premium in the first year ($p = 0.370$) and second year ($p=0.225$) after implementation. Reinsurance is associated with a reduction of around \$100 in OOP premiums. For ESI and HIX plan coverage, we can observe a statistically insignificant decrease in ESI and an increase in HIX plan coverage sustained after the reinsurance implementation. The results are similar to what we have gotten from the DiD Linear regression with treatment and time interaction.

Sensitive Analysis

To test whether the reinsurance programs have the same effect over different states implemented programs in 2018 and 2019, we use event study methods to do subgroup analysis based on different treatment groups. As presented in Figure 4.3, we can see that, in general, parallel assumptions were satisfied in both treatment groups for all outcomes. Statistically speaking, for those who live in states with 2018 reinsurance implementation, the policy did not have much impact on OOP premium HIX plan participation. There was a decrease in ESI in the year after the implementation, but it was statistically not significant. For individuals in states from the 2019 treatment group, we can observe a more considerable decrease in OOP premium of \$170 ($p = 0.052$). This population also experienced a 1.4 percentage point increase in participation in HIX plans ($p = 0.251$) and a statistically significant 3 percentage point decrease in ESI coverage ($p = 0.022$).

Discussion

This study examined the policy effect of the state reinsurance program under the ACA Section 1332 State Innovation Waiver on the OOP premium of the eligible population, as well as the HIX plan and ESI coverage from 2016 to 2019. Generally speaking, there was a non-statistically significant trend of decrease in OOP premium and ESI, together with a non-statistically significant trend of increase in HIX plan coverage. Our event study analysis reflected a similar outcome as DiD linear regression analysis with treatment and time interactions. Further subgroup analysis was done to distinguish the differential treatment effect among sample populations coming from states that implemented state reinsurance. The heterogeneity of policy effect was detected. The population from states with reinsurance implemented in 2018 has not experienced statistically significant policy effects in all three outcomes, while the 2019 treatment group has experienced a statistically significant decrease in ESI coverage. The other two outcomes

are also statistically insignificant but noticeable. In other words, for states that implemented reinsurance in 2019, the policy effects are actually meaningful regarding policy implication. Overall, our results are consistent with the results in the previous chapters.

Although we were not able to control for state-fixed effect due to the limitation of the MEPS-restricted data regulation, we mimicked an alternative using the interaction between a US census region variable and a tagging variable indicating the year of implementing state reinsurance programs for participant's residential states. The results of this study indicated that from the perspective of the consumers and patients, their perceived policy effect aligned with the prediction of theory. For the people who gained health insurance coverage, our analysis estimated a decrease in the OOP premium. Although the estimation was not statistically significant, on average, a \$100 reduction for individual monthly premiums is remarkable and worthy of noting on policy. Similar to what was suggested by Lueck, the patient population covered by HIX plans without any subsidies would benefit the most from the policy (Lueck, 2019). Along with the reduction in OOP premium, we also observed an increase in HIX participation and potential evidence for crowding out effect over ESI for states that implemented reinsurance in 2019. This phenomenon fits out crowed theory and predictions that were previously mentioned by researchers that when public reinsurance might interrupt private participation in the industry (Frey, 1998; Lewis & Murdock, 1996; Sloan & Conover, 1998; Chollet, 2004). Up till 2023, it is estimated that 18.2 million people have individual market coverage, and it was the highest since 2016. Since the studying period of this analysis, we have observed increasing enrollment in HIX (Ortaliza et al., 2023). The growing enrollment indeed reflects the importance and significance of research and understanding of policies like state reinsurance programs that could impact this growing population.

Combined with previous research on how state reinsurance programs were proven to have a causal inference effect in reducing premiums for insurance plans in individual HIX (Fung et al., 2023; Oyeka & Wehby, 2023), we furthered our understanding of how the effect of this policy trickling down to the consumer level. On the consumer level, we observed a reduction in OOP premium that is not statistically significant but politically meaningful. For state governments that are looking for better ways to increase health insurance coverage through the pathway of government intervention in the HIX, policymakers should take reinsurance programs into consideration. While the crowd-out effect might still be a concern for policymakers, the evidence in this study indicated that such an impact would not be as significant.

In conclusion, the state reinsurance program under the ACA section 1332 State Innovation Waiver was associated with a reduction in OOP premium on the consumer side, a statistically insignificant decrease in ESI enrollment, and an increase in the HIX plan. This result showed that the insight of previous studies regarding public intervention in health exchange crowding out private sector activity is valid. This policy would have trickled down policy effects on the consumer side of the HIX. Future studies can further the discovery of the longer-term effect of the OOP premium reduction of the policy and aim to measure how state fixed effect might change the outcome of this causal inference through other sources of data or more restricted MEPS data.

Table 4.1 Characteristics of the study sample for OOP Premium Analysis in 2017, data one

Factors	Control and Treatment State Groups					
	Control States		2018 states		2019 states	
	Unweighted Frequency	Weighted Percentage	Unweighted Frequency	Weighted Percentage	Unweighted Frequency	Weighted Percentage
Monthly OOP premium	N=69,527 283.20 (316.82)	262.11	N=2,930 282.49 (287.02)	340.23	N=6,071 315.43 (336.46)	321.58
Age	39.80 (21.43)	48.14	40.19 (21.91)	52.46	39.97 (21.65)	50.36
Education levels						
No School/Kindergarten	1,745	0.1%	87	0.0%	202	0.0%
Elementary School	7,853	3.3%	318	0.0%	600	0.0%
Some High School	4,998	5.3%	179	4.0%	380	3.6%
Grade 12	14,949	29.5%	523	26.2%	1,275	33.9%
Some College	26,958	49.3%	1,249	54.4%	2,351	49.9%
5+ Years College	9,031	12.5%	408	15.4%	947	12.6%
Income Levels						
<10000	1,552	3.5%	44	3.2%	120	1.9%
<20000	2,516	7.5%	101	8.8%	181	7.1%
<30000	3,990	11.1%	130	11.7%	271	7.9%
<40000	5,003	11.6%	156	8.5%	311	11.1%
<50000	5,095	11.6%	185	6.2%	338	8.1%
<75000	12,957	21.0%	489	24.3%	888	13.4%
<100000	10,797	10.7%	545	16.9%	919	23.8%
<150000	14,461	13.4%	628	11.3%	1,441	18.8%
>150000	13,046	9.7%	649	9.0%	1,591	8.0%
Sex						
Male	33,856	44.7%	1,499	41.4%	2,945	41.3%
Female	35,671	55.3%	1,431	58.6%	3,126	58.7%
Race and Ethnicity						
Hispanic	12,740	16.7%	225	0.7%	714	6.8%
Non-Hispanic White	40,187	61.5%	2,304	91.7%	3,863	77.4%
Non-Hispanic Black	8,900	9.2%	135	0.0%	886	6.7%
Non-Hispanic Asian	5,282	10.6%	155	4.2%	424	6.7%
Non-Hispanic Other	2,418	2.0%	111	3.3%	184	2.5%
Marital Status						
Married	33,364	59.2%	1,441	55.6%	2,859	55.3%
Widowed	2,409	2.4%	96	2.2%	198	5.5%
Divorce	5,911	16.3%	252	15.2%	463	19.2%
Separated	902	2.1%	21	0.0%	57	0.7%
Never Married	15,565	20.0%	609	27.0%	1,501	19.3%

Under age 16	11,375	0.0%	511	0.0%	993	0.0%
English proficiency						
Very well	63,450	84.0%	2,790	98.0%	5,659	91.6%
Well	2,259	7.3%	44	1.3%	148	3.9%
Not well	1,481	6.3%	14	0.6%	90	3.3%
Not at all	486	2.4%	3	0.0%	17	1.2%
Under age 5	1,851	0.0%	79	0.0%	157	0.0%
Has Chronic Diseases						
No	36,019	42.9%	1,590	33.0%	3,237	39.4%
Yes	33,508	57.1%	1,340	67.0%	2,834	60.6%
Employment status						
Employed	38,522	70.5%	1,632	52.7%	3,408	60.5%
Return to Job	145	0.2%	2	1.7%	15	0.2%
Not Employed	19,487	29.3%	785	45.6%	1,655	39.2%

Note: This table contains unweighted frequencies and weighted descriptive percentages. Monthly Out-of-Pocket Premium is from AHRQ Medical Expenditure Panel Survey - Person Round Plan Files, 2016-2019. Demographic and socioeconomic factors are from AHRQ Medical Expenditure Panel Survey - Full Year Consolidated Files, 2016–2019. 2018 reinsurance states include Alaska, Minnesota, and Oregon; 2019 reinsurance states include Maine, Maryland, New Jersey, and Wisconsin. All other states are categorized as control states.

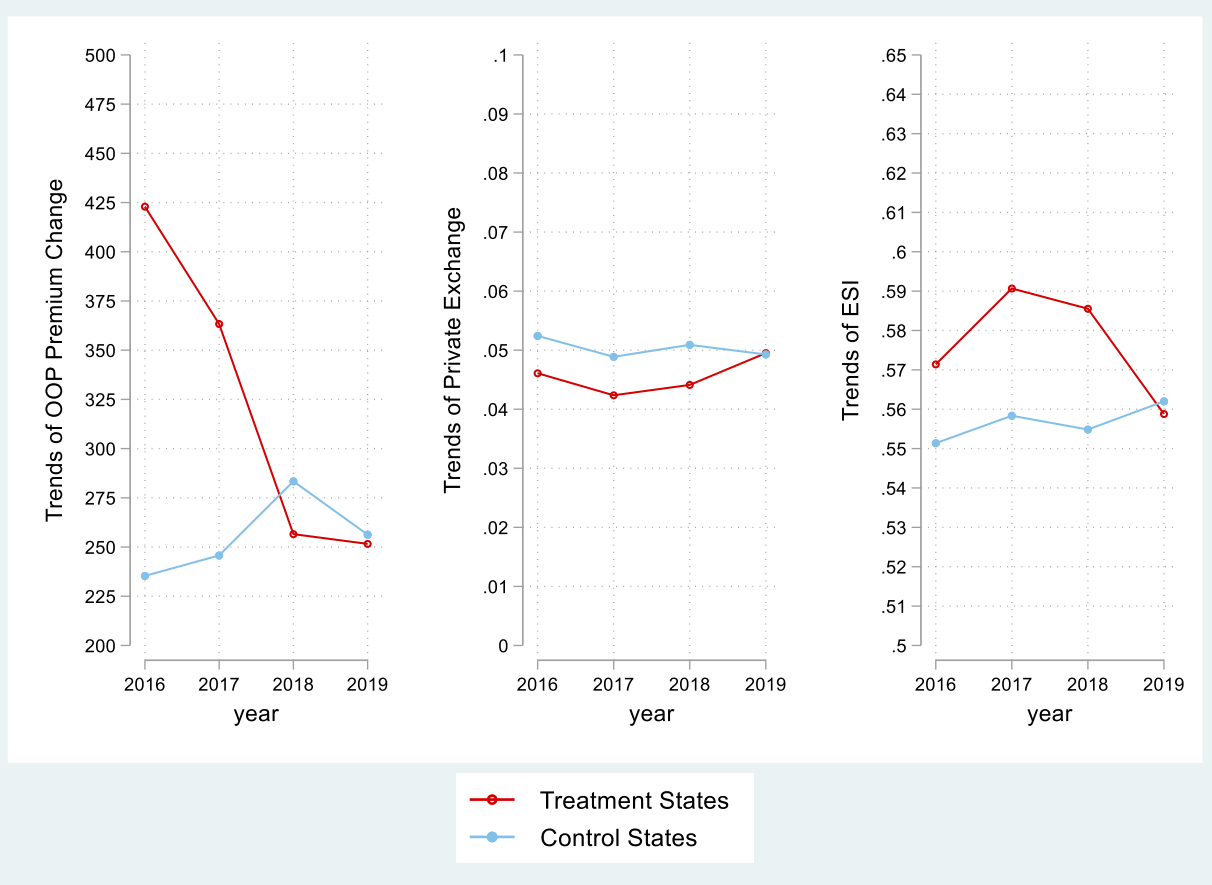
Table 4.2 Characteristics of the population for Insurance Coverage Analysis in 2017, data two

Factors	Control and Treatment State Groups					
	Control States		2018 states		2019 states	
	Unweighted Frequency	Weighted percentage	Unweighted Frequency	Weighted percentage	Unweighted Frequency	Weighted percentage
	N=113,540		N=3,820		N=8,148	
Covered by ESI						
No	88,363	44.3%	2,849	39.8%	6,188	43.4%
Yes	25,177	55.7%	971	60.2%	1,960	56.6%
Cover by private exchange plans						
No	109,566	95.0%	3,711	96.4%	7,845	95.0%
Yes	3,127	5.0%	87	3.6%	253	5.0%
Age	37.85 (23.56)	45.19	39.80 (23.76)	45.12	38.82 (23.57)	46.23
Education levels						
No						
School/Kindergarten	3,933	0.1%	135	0.0%	278	0.1%
Elementary School	18,994	3.1%	486	1.5%	1,134	1.4%
Some High School	12,421	5.2%	325	3.5%	757	3.0%
Grade 12	26,281	24.9%	743	20.1%	1,937	25.0%
Some College	33,000	50.1%	1,421	58.9%	2,532	51.5%
5+ Years College	8,817	16.5%	406	16.0%	859	19.0%
Income Levels						
<10000	10,703	2.5%	220	1.4%	666	2.2%
<20000	12,375	3.7%	347	2.2%	702	2.5%
<30000	12,119	5.9%	324	4.2%	660	4.0%
<40000	10,863	7.3%	265	5.2%	650	4.9%
<50000	9,139	7.5%	298	5.5%	594	6.1%
<75000	18,427	18.8%	648	18.4%	1,218	14.2%
<100000	12,609	15.6%	550	20.0%	976	15.3%
<150000	14,987	20.7%	636	22.7%	1,380	25.5%
>150000	11,831	18.0%	524	20.3%	1,272	25.3%
Sex						
Male	54,140	50.0%	1,872	50.9%	3,933	50.4%
Female	59,400	50.0%	1,948	49.1%	4,215	49.6%
Race and Ethnicity						
Hispanic	32,142	17.2%	426	5.0%	1,669	13.6%
Non-Hispanic White	51,603	62.0%	2,746	83.2%	4,239	65.6%
Non-Hispanic Black	18,669	11.3%	290	4.3%	1,516	12.1%
Non-Hispanic Asian	6,799	6.8%	179	4.4%	467	6.9%

Non-Hispanic Other	4,327	2.7%	179	3.1%	257	1.8%
Marital Status						
Married	41,485	64.5%	1,573	68.6%	3,057	67.1%
Widowed	5,916	1.6%	197	1.1%	378	1.5%
Divorce	10,464	12.0%	384	11.1%	712	10.0%
Separated	2,345	2.2%	29	1.0%	121	1.2%
Never Married	28,207	19.7%	860	18.3%	2,177	20.1%
Under age 16	25,101	0.0%	777	0.0%	1,703	0.0%
English proficiency						
Very well	97,062	91.4%	3,552	97.1%	7,161	92.3%
Well	4,803	3.9%	72	2.0%	282	3.8%
Not well	4,846	3.4%	49	0.8%	279	3.0%
Not at all	2,569	1.3%	19	0.1%	114	0.9%
Under age 5 Has Chronic Diseases	4,260	0.0%	128	0.0%	312	0.0%
No	60,688	47.0%	2,038	51.2%	4,324	46.4%
Yes	52,852	53.0%	1,782	48.8%	3,824	53.6%
Employment status						
Employed	44,875	79.8%	1,689	83.7%	3,507	82.5%
Return to Job	254	0.2%	5	0.2%	17	0.1%
Not Employed	43,312	20.0%	1,349	16.1%	2,921	17.4%

Note: This table contains unweighted frequencies and weighted descriptive percentages. All variables are from AHRQ Medical Expenditure Panel Survey-Full Year Consolidated Files, 2016–2019. 2018 reinsurance states include Alaska, Minnesota, and Oregon; 2019 reinsurance states include Maine, Maryland, New Jersey, and Wisconsin. All other states are categorized as control states.

Figure 4.1 Descriptive General Trends of Weighted Main Outcomes



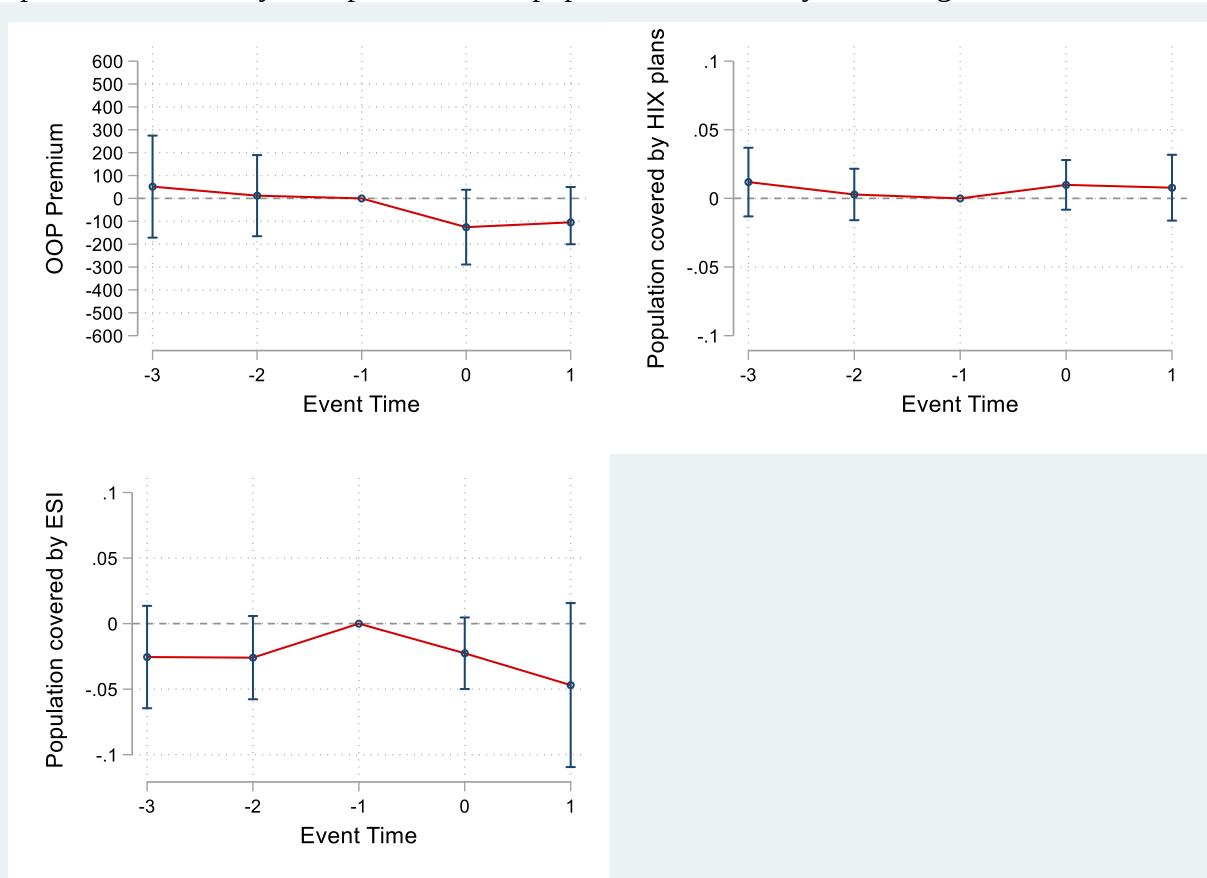
Note: The sources of the data are AHRQ's Medical Expenditure Panel Survey - Person Round Plan Files and Full Year Consolidated Files, 2016-2019. 2018 reinsurance states include Alaska, Minnesota, and Oregon; 2019 reinsurance states include Maine, Maryland, New Jersey, and Wisconsin.

Table 4.3 DiD Estimate of Linear Regression with Interaction

Outcomes	Treatment Group					
	2018			2019		
	Coeff	SE	p-value	Coeff	SE	p-value
OOP Premium	-81.18	145.65	0.578	-132	68.03	0.052
HIX coverage	0.005	0.114	0.64	0.006	0.0157	0.695
ESI coverage	-0.002	0.024	0.941	-0.018	0.0176	0.308

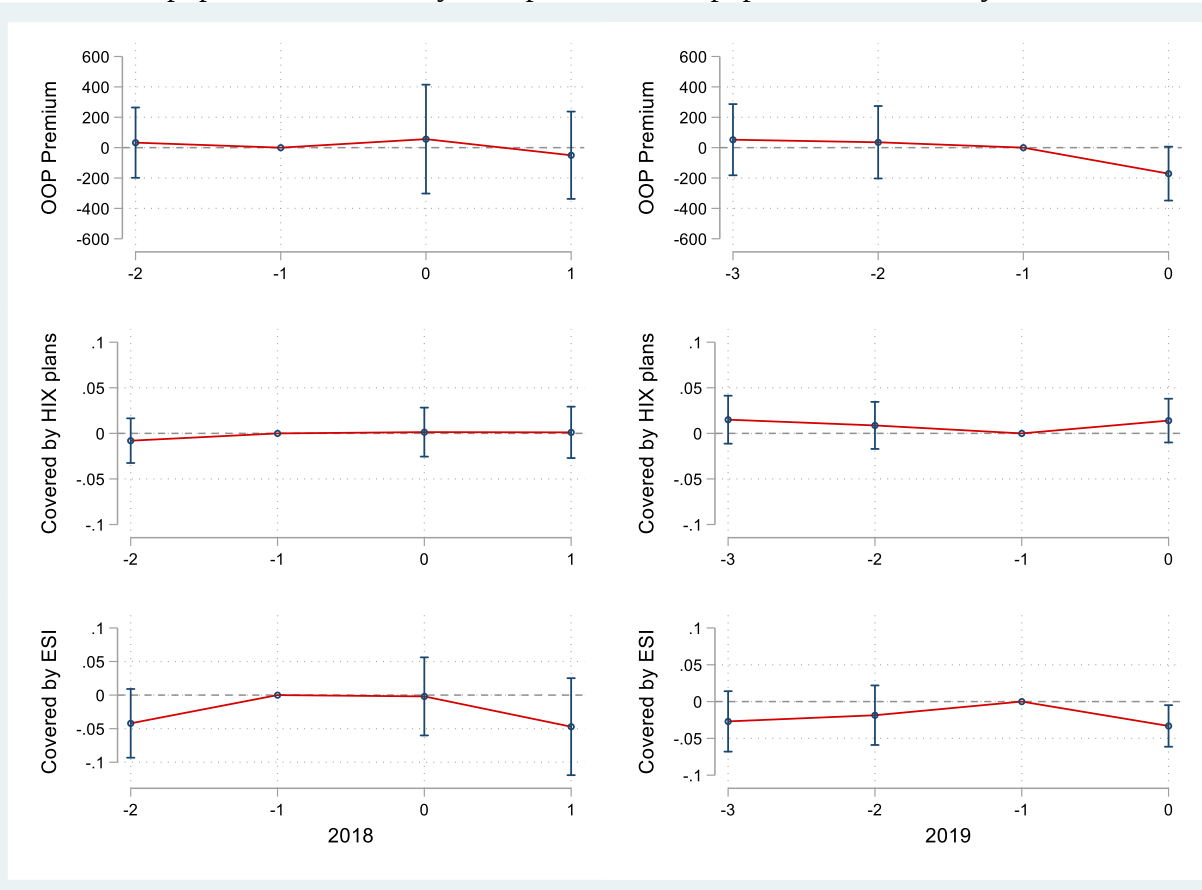
Note: This table shows the estimate coefficient for DiD Linear Regression with Interaction of Reinsurance Implementation with time. The sources of the data are AHRQ's Medical Expenditure Panel Survey - Person Round Plan Files and Full Year Consolidated Files, 2016-2019. 2018 reinsurance states include Alaska, Minnesota, and Oregon; 2019 reinsurance states include Maine, Maryland, New Jersey, and Wisconsin.

Figure 4.2 Event study results for the policy effect of reinsurance program on OOP premium, the population covered by HIX plans, and the population covered by ESI, the general model.



Note: The X-axis represents the event times, and the Y-axis represents the policy effect over the three outcomes of interest. The sources of the data are AHRQ's Medical Expenditure Panel Survey - Person Round Plan Files and Full Year Consolidated Files, 2016-2019. 2018 reinsurance states include Alaska, Minnesota, and Oregon; 2019 reinsurance states include Maine, Maryland, New Jersey, and Wisconsin. Regressions controlled for the following covariates: age, education levels, sex, race-ethnic groups, marital status, household income level, English proficiency, chronic conditions, and employment status.

Figure 4.3 Sensitivity Analysis results for the policy effect of the reinsurance program on OOP premium, the population covered by HIX plans, and the population covered by ESI.



Note: The X-axis represents the event times, and the Y-axis represents the policy effect over the three outcomes of interest. The left column represents the 2018 treatment states, and the right column represents the 2019 treatment groups. The sources of the data are AHRQ's Medical Expenditure Panel Survey - Person Round Plan Files and Full Year Consolidated Files, 2016-2019. 2018 reinsurance states include Alaska, Minnesota, and Oregon; 2019 reinsurance states include Maine, Maryland, New Jersey, and Wisconsin. Regressions controlled for the following covariates: age, education levels, sex, race-ethnic groups, marital status, household income level, English proficiency, chronic conditions, and employment status.

Chapter 5: Conclusion on state reinsurance programs

This dissertation project investigates the policy effects of state reinsurance programs developed under the ACA 1332 Waiver. To fulfill this research goal, we established three study aims: 1) to estimate the heterogeneous policy effect of premium reduction from state reinsurance programs in the Health Insurance Exchange (HIX); 2) to estimate the crowd-out effect on Employer-Sponsored Insurance (ESI) from state reinsurance programs at the supply side; 3) to estimate the policy effect of state reinsurance programs on the demand side, including out-of-pocket premiums, percentage of the population covered by HIX plans and ESI. Reinsurance programs are not unfamiliar to the US health insurance market; commercial reinsurance has been widely practiced (Garven & Lamm-Tennant, 2011; Blazenko, 1986). However, it was not until the full implementation of the ACA in 2014 that the US was first introduced to a publicly subsidized federal reinsurance program designed to stabilize the health insurance market and health plan premiums (Nicholson & Gruwell, 2018; Jacobs et al., 2017; Winkelman et al., 2012). During three years of the federal reinsurance program's practice, state governments recognized its advantages of risk reduction and market stabilization and thus developed state versions of public reinsurance programs to fill the void upon the termination of the federal program in 2017. The project provided quantitative analyses of the causal inference relationship between the programs and their policy effects.

In the analysis, I made the following findings related to the state reinsurance programs. In Aim 1, I discovered that, on the national level, the ACA 1332 waiver for state reinsurance programs was able to decrease the market insurance premium for insurance policies by an average of \$60.54 after implementation. Additionally, the heterogeneous treatment effect by county insurer competition was around \$21.11. The reinsurance programs of the 17 implementation states were able to stabilize the insurance market on average. The effect of market stabilization would be larger

if a county has more than one insurer. We also showed that the effect of reinsurance lasted in the years following implementation, especially for more expensive metal-tier plans. In Aim 2, it was discovered that there was a statistical decrease in ESI being provided by employers in smaller firms with fewer than 50 employees in states that implemented reinsurance in 2020. Lastly, I found no statistically significant estimated policy effects on the demand side regarding out-of-pocket premiums, ESI, and HIX plan coverage, yet the result could potentially be policy-wise impactful. The findings from the project do not all statistically align with our hypothesis. For outcomes including premiums in the market and out-of-pocket premiums, reinsurance programs had a more noticeable policy impact when compared with the effects on ESI and HIX plans on both supply and demand sides.

Based on these findings, several statements can be made. The first one is that for non-implementation states aiming to use market-based approaches to address market stability and high premiums in the HIX, state reinsurance programs are an option proven capable of delivering desirable outcomes. Second, the reinsurance program could be more effective in counties that have more than one health insurance provider. Third, the reinsurance programs can potentially crowd out ESI supply for the working population in the first year after implementation as an unintended consequence; therefore, to prevent such consequences, policy tools like expanding the insurance mandate for employers to firms with fewer than 50 employees should be considered. Lastly, for states looking to decrease the burden of their residents in purchasing health insurance plans, state reinsurance programs can be considered an option if not implemented already, with the possibility that residents of the states might favor HIX plans over ESI.

This study supports several policy recommendations for state decision-makers. First of all, state governments and legislation should consider designing and developing their version of state

reinsurance programs if they have not yet applied or been approved for doing so because there was clear evidence to support the effectiveness of such innovation programs on premium reduction and market stability. Additionally, state governments could utilize the resources from the Federal government that were saved from Marketplace subsidies. What's more, reinsurance as a market-oriented policy tool is less regulative, penalizing, or "policing-like" than other policy tools. Thus, it is more approachable for the insurers in the market. Second, for a state that is considering applying for state reinsurance programs, giving other promoting policies to attract insurers to enter counties with less competition is going to maximize the policy effect of state reinsurance. Lastly, along with the implementation of the state reinsurance program, a state should also consider passing regulations over expanding the Employer Mandate of firms with less than 50 employees providing ESI in the state. Although not required on the federal level, such substitution could be very beneficial in preventing the potential crowd-out effect over ESI among small businesses. It is crucial since the majority of US citizens rely on ESI, and there are a pretty substantial number of people working for smaller businesses with fewer than 50 workers.

In the end, there are several aspects that future studies can explore regarding state reinsurance programs. One is the differential effects of reinsurance on consumers' preferences over different tiers of health insurance plans provided by the same insurer. The second is to further examine the causes of differential crowd-out effects among states caused by state reinsurance programs and whether the states that implemented the policy after 2020 will experience effects similar to those in 2020. Lastly, further the discovery of the longer-term effect of the out-of-pocket premium reduction of the policy and aim to measure how state fixed effect might change the outcome of this causal inference through data sources other than the ones I have been using for this project.

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