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ABSTRACT

Impacts of Shifting Responsibility for High-Cost Individuals on Health Insurance Exchange Plan Premiums and Cost-Sharing Provisions

States with Section 1332 Waivers to operate high-risk pools (HRPs) or reinsurance programs can receive federal pass through funds equal to reductions in federal expenditures generated by the Waiver. Shifting financial responsibility for high-cost individuals out of the Health Insurance Exchange (HIX) markets is expected to reduce federal expenditures for Advanced Premium Tax Credits, by reducing HIX plan premiums. Simulation models predict that a new HRP or reinsurance program would trigger premium reductions ranging from 7% to 23%. These models assume that insurers do not adjust plan cost-sharing requirements or plan generosity. However, federal requirements specifying the Medical Loss Ratio and plan Actuarial Values give insurers incentives to make multidimensional adjustments. We use plan level fixed effects to generate difference-in-difference estimates of insurer responses to closures of state-operated HRPs during 2014-2016. Silver plan premiums increased 7.7%, deductibles increased 41%, and Maximum-Out-Of-Pocket (MOOPs) expenditures increased 24% following closure of a state HRP.

JEL Classification: I11, I13, I18

Keywords: high risk pools, insurance premium, health insurance exchanges, cost-sharing

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Impacts of shifting responsibility for high-cost individuals on Health Insurance Exchange plan premiums and cost-sharing provisions

1. Introduction

Concerns about Health Insurance Exchange (HIX) market stability have generated renewed interest in strategies for shifting financial responsibility for unusually high-cost individuals out of the HIX markets. The impact of this shift on HIX plan premiums could be substantial. The 2016 Medical Expenditure Panel Survey (MEPS) data indicates that 2% of people under age 65 accounted for 36% of the total dollars spent by privately insured non-elderly individuals (MEPS 2016). Removing the most-expensive 2% of non-elderly individuals from the 2016 data reduces average healthcare expenditures by 35%, from $3486 to $2250. This shift would not necessarily reduce total expenditures, but it could potentially increase HIX participation by reducing health plan premiums and cost-sharing requirements. It could also enhance market stability, as states adjust to the repeal of the individual health insurance mandate, beginning in 2019[1].

States may apply for waivers authorized under Section 1332 of the Affordable Care Act (ACA), to shift this risk from HIX insurers to high-risk pools (HRPs) or reinsurance programs (RPs) (DHHS 2017). States with approved Section 1332 waivers to operate one of these risk-shifting mechanisms (RSMs) would receive pass-through funds equal to RSM-generated reductions in federal expenditures for Advanced Premium Tax Credits (APTC). By the end of 2017, the Centers for Medicare and Medicaid Services (CMS) had approved waivers permitting three states (Alaska, Minnesota, and Oregon) to establish RSMs. By mid-2018, the governors of four additional states signed laws requiring the state to apply for a waiver to create an RSM (Indiana, Maryland, New Jersey, and Wisconsin), and a similar law was passed in Colorado and sent to the Governor. Bills had been filed in six additional states, to initiate the process (NCSL 2018, SHADAC 2018, KFF 2017).

Traditional HRPs provided health insurance directly to high-risk individuals following ex-ante identification of those individuals. Reinsurance Programs (RPs) accomplish the same goal by reimbursing private-market insurers for expenditures incurred on behalf of high-cost

[1] New Jersey, for example, plans to implement a state individual mandate and use revenue from the anticipated fines to help fund a reinsurance program. https://www.politico.com/states/new-jersey/story/2018/05/30/new-jersey-becomes-second-state-to-adopt-individual-health-insurance-mandate-442183 Access on June 1st, 2018

individuals following ex-post identification of those individuals. The distinction between the two types of RSMs is increasingly blurred as analysts consider hybrids such as "invisible HRPs" that would utilize ex-ante identification of high-risk individuals, but continue to deliver insurance services through the HIX plan.

Actuarial analyses included in the three approved waiver applications predict premium reductions ranging from 7% to 23% of current levels in those states, and a Milliman report predicts potential premium reductions ranging from 19% to 31% of current premium levels[2] (Alaska 2016, Minnesota 2017, Oregon 2017, Ely, Murawski and Thompson 2017). These predictions are based on simulation exercises that develop actuarial analyses of the impacts of the change in RSM status on expected insurer expenditures, and then use these results to predict changes in plan premiums under the assumption that insurers do not adjust plan cost-sharing (CS) requirements or levels of plan generosity.

Conceptually, however, insurer responses to a change in RSM status could be multidimensional: insurers could adjust premiums, cost-sharing provisions, and/or plan coverage details such as the extent of the provider network, coverage for out-of-network care, numbers of covered therapy visits or breadth of the prescription drug formulary. The composition of insurer responses may be shaped by competitive strategies and by federal requirements. Constraints imposed by the federal Medical Loss Ratio (MLR) requirement and Actuarial Value (AV) requirements give insurers incentives to adjust cost-sharing provisions and plan coverage details, while the constraint imposed by the federally-specified ceiling for plan Maximum-Out-of-Pocket (MOOP) expenditures may limit the extent to which insurers are able to adjust some cost-sharing provisions.

The composition of insurer responses to a change in RSM status is important from two perspectives. For states with approved 1332 Waivers, federal pass-through payments will be inversely related to the extent to which insurers substitute increased plan generosity for reductions in premiums. In addition, the composition of insurer responses to changes in RSM status will affect individuals who purchase insurance through the HIX market. The federal APTC

[2] The actuarial reports detail some changes in total household out-of-pocket expenditures, but explain that these changes stem from changes in the income profiles of HIX plan buyers as premium reductions induce higher-income buyers to enter the market.

and Cost-Sharing Reduction (CSR) programs largely insulate individuals with income below 250% of federal poverty level (FPL) from changes in premiums and CS requirements, if they purchase competitively-priced Silver plans. However, individuals with higher incomes are not eligible for CSR; hence, 40% of HIX buyers were not eligible for federal CSR in 2016[3]. Further, individuals with incomes above 400% of FPL are not eligible for any assistance, and the federal subsidies do not protect any buyers from changes in plan generosity[4].

We provide empirical estimates of actual insurer responses to closures of state-operated HRPs, to complement the estimates based on simulation models. We leverage the fact that 10 states with pre-2014 HRPs closed the HRPs prior to the start of the first HIX plan year (1/1/2014), 14 states closed HRPs during the years 2014-2016, and 11 states continued to operate HRPs at the end of 2017. We leverage the closures that occurred after 1/1/2014 to estimate the impacts of closing an HRP on premiums, deductibles and MOOPs for plans offered in each metal category.

We construct a plan-level panel dataset using the HIX Compare data on the 50 states plus Washington D.C. In our baseline analysis, we exclude states that expanded Medicaid after 1/1/2014 to reduce the potential of contamination from concurrent expansion of Medicaid eligibility. We use Difference-in-Difference (DD) regressions that control for individual, market, and regulatory variables, and we employ Fixed Effects (FE) at four levels of granularity: State, Rating-Area, Insurer-by-Rating-Area, and Plan. Our plan-level FE estimates suggest that closure of a state HRP leads to a significant increase in premiums, ranging from a 2% increase for Platinum plans to a 9% increase for Catastrophic plans. For Silver plans, which accounted for 71% of plans selected in 2016, HRP closures led to a 7.7% premium increase.

These estimates fall at the lower end of the range indicated by the actuarial simulation models. This is not surprising for two reasons. First, the actuarial models assume that insurers will respond to changes in RSM status by simply adjusting plan premiums; however, we show that insurers also adjust plan CS requirements and we provide suggestive evidence of adjustments to plan generosity. Second, the actuarial models are based on the assumption that

[3] https://www.cbpp.org/blog/interactive-map-cost-sharing-subsidies-at-risk-under-house-gop-health-bill. Accessed on May 28, 2018

[4] Predicting impacts of a new RSM on CS requirements is not important for the actuarial analyses submitted with Section 1332 Waiver applications. These applications must indicate whether the new RSM will adversely impact households. To the extent that new RSMs trigger reductions in CS requirements, the impact on households would be beneficial.

new RSMs will focus on individuals with high health risk or high healthcare expenditures; however eligibility for the traditional state HRPs varied widely (NASCHIP 2011). Depending on the state, groups eligible for pre-2014 state HRP coverage included:

- "Medically-eligible" individuals with high-cost conditions,
- "Medicare-eligible" individuals who qualified for Medicare before age 65 due to disabilities and were seeking supplemental coverage,
- "HIPAA-eligible" individuals with previous group coverage, and
- "Health Coverage Tax Credit (HCTC)-eligible" individuals who became unemployed due to trade-related events.

Thus, the average medical risk for individuals covered through these early state HRPs was lower than the expected medical risk for individuals likely to be covered under the new RSMs created under Section 1332 waivers. Estimation of the HIX premium impacts of closing these early state HRPs therefore provides a lower-bound estimate of the expected impacts of opening new state HRPs that focus on shifting risk out of the HIX markets.

In addition to the premium increases, we estimate a 40.6% increase in Silver plan deductibles, and a 24.4% increase in Silver plan MOOPs. However, the impacts of HRP closures on deductibles and MOOPs for plans offered in other metal categories are smaller, and they are not consistently positive and significant.

The remainder of this paper is organized as follows. In Section II, we provide a conceptual framework for considering the impacts of three federal requirements on plan premiums and cost-sharing provisions. We describe the data, variable definitions and descriptive statistics in Section III. In Section IV, we outline the analytical strategy and provide an indirect test of the parallel trends hypothesis. We present the results in Section V, and the potential limitations and conclusions in Section VI.

2. Conceptual Framework

Insurers' responses to changes in RSM status are constrained by the MLR and AV requirements, and the maximum allowed level of MOOP. For individual plans, the MLR requirement mandates that plan expenditures for medical claims (*Med_Claims*) and quality improvement activities (*QI*) must account for at least 80% of premium revenue. Given that the

AV represents the portion of covered claims that must be paid by the insurer, the MLR requirement implies:

$$\text{MLR} = (AV * Med\_Claims(Generosity, Health\_Status) + QI)/(Premium\_Rev) \geq 0.8$$

where:

- $Med\_Claims(Generosity, Health\_Status)$, which represents covered medical claims, is an increasing function of the generosity of the insurance plan ($Generosity$), and a decreasing function of the average health status of the insured population ($Health\_Status$),
- $Generosity$ encompasses plan coverage details such as the extent of the provider network, coverage for out-of-network care, numbers of covered therapy visits or breadth of the prescription drug formulary,
- QI represents insurer expenditures for quality improvement activities, and
- $Premium\_Rev$ represents revenue from premiums paid to the insurer, which is equal to the plan premium multiplied by the number of insured individuals.

A state's decision to close an RSM would increase the probability that an insurance plan would bear financial responsibility for one or more high-cost individuals, thereby increasing the expected value of expenditures incurred by the plan. If the MLR requirement was initially binding, the increase in expected expenditures would boost the plan's MLR above 0.80. Insurers could restore the MLR to the initial level by either increasing the plan premium or reducing plan generosity.

The Actuarial Value (AV) requirements specify the portion of covered expenditures that must be paid by the insurer. The AV must be at least 90% for Platinum plans, 80% for Gold plans, 70% for Silver plans, and 60% for Bronze plans payments (DHHS 2013). The AV for Catastrophic plans[5] is approximately 57% (Claxton *et al*., 2013). Covered expenditures that are not paid by the plan must be paid by the insured individuals, as specified by the plan's CS provisions; hence the sum of the percentage of claims paid by the plan (*AV*) and the percentage paid by individuals (denoted here as $\overline{S}$) must be equal to 100.

The percentage of covered claims paid by individuals varies across the set of individuals covered under any given plan:

[5] Catastrophic plans can only be purchased by individuals who are younger than age 30 or demonstrate a hardship.

- For individuals with medical claim expenditures below the plan deductible (denoted here as type-1 individuals), CS payments are equal to 100% of medical claims expenditures.
- Individuals with claims above the plan deductible pay the deductible plus a portion of covered claims above that level up to the plan's MOOP. For these individuals, the ratio of CS payments to medical claims expenditures decreases as claims expenditures increase. For individuals with expenditures slightly higher than the plan deductible (denoted here as type-2 individuals), CS payments, as a percentage of covered expenditures, will be greater than (100-AV).
- CS, as a percentage of covered expenditures, could fall below (100-AV) for individuals with high covered expenditures (denoted here as type-3 individuals), because the plan MOOP caps the level of CS payments.

In this simplified example, the plan cost-sharing percentage ($\overline{S}$) is the weighted average of the cost-sharing ratios for the three categories of individuals:

$$\overline{S} = (100 - \overline{AV}) = \sum w_i S_i$$

where,

- $\overline{AV}$ is the actual plan AV
- w_i = the proportion of all individuals with type *i*, and
- S_i = the percentage of covered medical claims incurred by individuals of type *i* that are covered by cost-sharing payments made by those individuals.

By definition, $S_1 = 100$, S_2 > (100-AV), and S_3 < (100-AV) for individuals with high covered expenditures. Closure of an RSM would increase the proportion of insured individuals with unusually high medical claims expenditures; hence, this would automatically reduce the value of $\overline{S}$, and increase $\overline{AV}$. To maintain $\overline{AV}$ at the level specified for the plan's metal category, the insurer could either increase the plan's CS requirements or reduce the plan's generosity.

For plans that maintain constant levels of plan generosity, the MLR and AV requirements imply that changes in RSM status will generate predictable adjustments in premiums and CS requirements. Incentives to substitute changes in plan generosity for the implied changes in premiums or CS requirements for plans are likely to vary across metal categories for two reasons.

First, insurers may not be able to increase the plan MOOP, if the level already approaches the federally-specified maximum legal MOOP. The expected inverse relationship between plan MOOP and plan AV suggests that this constraint is more likely to be binding for Bronze plans than for plans with higher AV levels.

Second, individuals who purchase HIX Silver plans are less likely to be affected by changes in CS requirements than individuals who purchase plans offered in other metal categories. Low-income individuals who buy Silver plans are eligible for CSR, but this program is not available to buyers of non-Silver plans. We hypothesize that HRP closure will trigger significant increases in deductibles and MOOPs for Silver plans, but the impacts on CS provisions for other types of plans will be less pronounced.

3. Data, Variables and Descriptive Statistics

3.1 Data

The primary source of data for this study is HIX Compare (RWJF 2017), which provides plan-level information on plans offered in HIX markets during the years 2014-2017. The HIX Compare dataset includes the years each plan was offered, the plan metal-level, the insurer, state and Rating Area, premiums (by age, smoking status and family size), cost-sharing provisions such as Deductible and MOOP, and whether the plan offers any coverage for out-of-network care. We use the data for plans offered in the individual markets in all states plus Washington D.C.[6] We do not consider the Small Business Health Options Program (SHOP) plans offered to small businesses.

Each plan is offered within a specific Rating-Area. Each Rating-Area defines a geographic market area in which residents select from the set of plans offered in that area. The average population per Rating-Area ranges from 110,629 in South Carolina (which defined 46 Rating-Areas) to 9,032,000 in New Jersey (which defined a single Rating-Area to cover the entire state) (CMS 2017).

A plan identification number (plan ID) is assigned to each plan offered by an insurer within a specific Rating-Area. If an insurer offers plans with identical characteristics in two different Rating-Areas, two different plan IDs are assigned to those plans. An insurer can use the same plan ID for plans offered in a Rating-Area in two consecutive years, if there are no "*substantive*"

[6] Data used in this paper was downloaded from the Robert Wood Johnson Foundation website on 08/16/2017.

changes in the details defining the plan. Under 45 CFR 144.103, the plans offered in the two consecutive years may share a common plan ID if:

(i) Any changes in the cost-sharing requirements were made to maintain the initial AV after unanticipated changes in the cost or utilization of medical care;

(ii) The plan covers most of the same service area and maintains most of the same provider network;

(iii) Additional modifications were made solely to comply with changes in federal or state requirements.

Despite these constraints, year-to-year changes occur within plans that use the same plan ID in consecutive years. This is consistent with the fact that changes in CS provisions may be required after changes in RSM status, to maintain compliance with AV and MLR requirements.

This plan-level dataset is an unbalanced panel, with substantial rates of plan entry and exit. For example, the number of Silver plans offered in states with complete data was 4393 in 2014. This number increased dramatically over the next two years to 9617, and then declined to 4631 plans offered in 2017 (see Panel A of Table 1). We also observe considerable turnover among the plans offered in each year: only 32% of plans offered in 2014 were still offered in 2017 (see Panel B of Table 1). Finally, the numbers of choices offered to the residents of specific Rating-Areas fluctuated dramatically (see Panel C of Table 1). In 2014, the number of Silver plans offered to 50-year-old non-smokers was at least 20 in only 32% of Rating-Areas. Individuals selecting HIX plans enjoyed a wider array of choices in 2015 and 2016: insurers in three-fourths of Rating-Areas offered at least 20 Silver plans during these years. In 2017, however, the proportion of Rating-Areas with at least 20 Silver plans dropped back to 32%.

Table 1: Silver Plans Offered in the 35 States with Data Available Each Year During 2014-2017

Panel A: Numbers of Silver plans offered by year

	Year			
	2014	**2015**	**2016**	**2017**
Numbers of plans	4,393	8,603	9,617	4,631

Panel B: Proportion of Silver plans offered in each base year that were also offered in preceding and subsequent years

	Year			
Base year	**2014**	**2015**	**2016**	**2017**
2014	**1.00**	0.83	0.60	0.32
2015	0.39	**1.00**	0.65	0.28
2016	0.34	0.79	**1.00**	0.43
2017	0.36	0.66	0.84	**1.00**

Panel C: Percent of Silver plans offered to 50-year-old non-smokers selecting plans to cover one adult

	Percent of Rating Areas with	
Year	**at least 10 plans offered**	**at least 20 plans offered**
2014	65%	32%
2015	97%	88%
2016	97%	75%
2017	72%	32%

Source: Author's computation from HIX Compare data (2014-2017)

3.2 Variables and Descriptive Statistics

Outcome variables: plan premiums, deductibles, and MOOPs

Monthly plan premiums, deductibles and MOOP levels are stated in 2014 dollars, after discounting by the Medical Care component of the Consumer Price Index[7]. Average monthly premiums for individual plans offered to 50-year-old non-smokers range from $319 for Catastrophic plans to $648 for Platinum plans (see Panel A1 of Table 2).

[7] https://fred.stlouisfed.org/series/CPIMEDSL

Table 2: Descriptive Statistics for Plan-Level Variables					
	Actuarial Value Category				
	Catastrophic	Bronze	Silver	Gold	Platinum
Panel A: Baseline Sample					
Panel A1: Plan-year observations					
Outcomes variables					
PREMIUM_AGE50	$318.86	$408.95	$478.77	$554.55	$648.10
	(70.01)	(95.21)	(97.13)	(113.69)	(140.31)
PREMIUM_AGE27	$190.45	$248.38	$289.32	$345.93	$395.25
	(41.40)	(67.98)	(71.16)	(97.72)	(95.67)
DEDUCTIBLE	$6448.26	$5349.99	$2422.45	$1353.69	$754.10
	(71.79)	(1048.12)	(1611.28)	(670.52)	(288.58)
MOOP	$6449.27	$6241.18	$4298.10	$4343.79	$1837.95
	(66.04)	(246.07)	(2034.74)	(1443.33)	(770.62)
Plan-level control variables					
NETWORK-ONLY	0.50	0.47	0.53	0.55	0.54
	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)
HMO	0.36	0.32	0.32	0.37	0.29
	(0.48)	(0.47)	(0.47)	(0.48)	(0.45)
PPO	0.38	0.43	0.37	0.35	0.37
	(0.49)	(0.50)	(0.48)	(0.48)	(0.48)
Obs.	6,040	32,372	35,493	18,008	3,455
Percent of all plans	0.06	0.34	0.37	0.19	0.04
Panel A2: Rating-Area-year observations					
NISSUERS	3.13	5.20	4.68	4.34	2.61
	(1.79)	(2.76)	(2.59)	(2.48)	(1.91)
Obs.	1,816	1,891	1,891	1,888	1,176
Panel B: Restricted Sample: 20 least expensive plans in each Rating-Area					
PREMIUM_AGE50	$303.07	$373.76	$446.27	$517.24	$642.99
	(61.78)	(75.50)	(79.47)	(98.70)	(143.81)
PREMIUM_AGE27	$178.51	$220.53	$262.83	$305.85	$377.70
	(36.37)	(43.31)	(45.98)	(56.48)	(83.57)
Obs.	2,068	8,029	8,309	5,882	1,761
Source: HIX Compare data (2014-2017). Standard derivation in parentheses.					

The average Silver plan premium offered to 50-year-old non-smokers was $479. For comparison, the average Silver plan premium offered to 27-year-old non-smokers was $289. When we restrict the sample to include only the 20 least-expensive plans in each Rating-Area, the average premium offered to 50-year-old non-smokers drops to $446 (see Panel B of Table 2).

Plan deductibles measure an important dimension of CS requirements for individuals with low or moderate claims expenditures, and plan MOOPs measure an important dimension of CS requirements for individuals with relatively high claims expenditures. The average deductible ranges from $6448 for Catastrophic plans to $754 for Platinum plans. Similarly, the average MOOP ranges from $6449 for Catastrophic plans to $1838 for Platinum plans. Among Silver plans, the average deductible was $2422, and the average MOOP was $4298 (see Panel A1 of Table 2).

The legal maximum MOOP levels specified by CMS were $6350 in 2014, $6600 in 2015, $6850 in 2016, and $7150 in 2017. For plans included in the baseline dataset, average MOOPs for Catastrophic and Bronze plans were within 5% of the legal maximum each year from 2014-2017, while average MOOPs for Silver, Gold and Platinum plans were less than 72% of the legal limit in each year.

Key explanatory variable: NO_HRP

The key explanatory variable is the binary variable, *NO_HRP*, which is set equal to one if the state does not operate an HRP in a given year, and zero if it does. HRP closures typically occurred in phases, as states closed the pools to new enrollees, and then transitioned pool enrollees into other types of coverage including the HIX markets. We code HRPs as operating until enrollment was terminated for all categories of enrollees (see Table 3)[8]. Thus, the final closure only impacted a subset of the individuals enrolled in the pool prior to initiation of the closure process. This definition of HRP closure is conservative, in the sense that it minimizes the probability that we will observe a statistically significant impact of this variable on plan premiums and CS requirements.

[8] We code Alaska as operating an HRP continuously during the years 2014-2017, because it closed its HRP in 2016 and replaced it with a reinsurance program designed to accomplish the same objective.

Table 3: High Risk Pool Operation and Medicaid Expansion by State					
	Medicaid Expansion Status				
	Did not Expand Medicaid	**Implemented Medicaid Expansion**			
		before 1/1/2014	during 2014	during 2015	during 2016
Did not operate HRP prior to 2014	GA[f], ME, VA	AZ, DC[b,e], DE, HI[e], MA[c,e], NV[e], NJ, NY[d,e], OH, RI[e], VT[b,e]	MI	PA	
Operated HRP prior to 2014					
Closed the HRP					
before 1/1/2014	AR[a], KS, MO, NC, NE, UT	KY[e], OR[e]			LA, MT
during 2014	AL, FL, TX, WI	CO[e], MD[e], MN[e], WV	NH[g,h]	IN[f,g]	
during 2015	SD, WY				
during 2016	MS, OK				
Continue to operate the HRP	ID, IA[a], SC, TN	CA[e], CT[e], IL, ND, NM, WA[e]		AK	
[a] Use Medicaid expansion funding to support HIX premiums for individuals with incomes up to 138% of FPL Medicaid expansion					
[b] Eligibility threshold for non-parent adults was >= 138% FPL prior to ACA.					
[c] Implemented extensive reforms prior to ACA					
[d] Mandates pure statewide community rating					
[e] HIX Compare does not include 2014 data for these states.					
[f] HIX Compare does not include 2015 data for these states.					
[g] Excluded from baseline sample because the state expanded Medicaid eligibility during 2014-2017.					
[h] New Hampshire 1115 waiver to use Medicaid expansion funds to support HIX premiums started 1/1/2016.					
Sources: National Association of State Comprehensive Health Insurance Plans (NASCHIP) (2016) and Kaiser Family Foundation (KFF) (2018)					

Of the 14 states that closed their HRPs during 2014-2016, 10 closures occurred during 2014, two occurred during 2015, and two occurred during 2016 (NASCHIP 2016). States that closed HRPs after 1/1/2014 and before 12/31/2014 are coded as operating an HRP during 2014, and not-operating an HRP during subsequent years. This coding convention is based on the fact that insurers were required to submit information about the 2014 plans by June 2013. In states that had announced plans to close the HRP during 2014, insurers setting 2014 premiums faced

uncertainty about the actual closure date, as closures were delayed past the announced dates in several states. A comparable coding strategy is used for states that closed HRPs during 2015 or 2016. For the purpose of estimating impacts of HRP closures on premiums, this coding convention is a conservative strategy that minimizes the probability of finding a significant impact of closures that occurred during 2014, 2015 or 2016.

Independent variables to control for relevant factors

Plan premiums and CS requirements may be impacted by plan characteristics, competitive and regulatory variables that evolve over time, and baseline characteristics of states that remain relatively stable over time. We measure two plan characteristics. First, the variable *NETWORK-ONLY* indicates whether the plan covered any care delivered by out-of-network providers. Among Silver plans, 53% are network-only plans that do not cover any out-of-network care. Second, we define binary variables (*HMO* and *PPO*) to indicate whether each plan is structured as a Health Maintenance Organization (HMO) or Preferred Provider Organization (PPO). These two organization-types account for at least two-thirds of plans in each year. The remaining three organization types (Point of Service (POS), Exclusive Provider Organization (EPO), and OTHER) serve as the omitted category. Among Silver plans offered during 2014-2017, 32% are HMO plans and 37% are PPO plans (See Panel A1 of Table 2).

We utilize the number of insurers offering plans in each Rating-Area, during each year, to control for the degree of competition in the HIX market in each area. Several studies find a negative correlation between the number of insurers offering plans in the HIX market and the average premiums for those plans (Bennett, Smith and Norris 2015, Blumberg, Holahan and Wengle 2016, Dickstein *et al*., 2015). The average number of insurers offering Silver plans in a Rating-Area was 4.7 in our sample (see Panel A2 of Table 2).

Two types of regulatory changes implemented during the 2014-2016 observation period could have impacted plan premiums. First, expansion of Medicaid eligibility could affect plan premiums by altering the risk profile of individuals buying coverage in the HIX markets (Antonisse *et al*., 2018). Ellis, Esson and Frederick (2017) for example, conclude that Medicaid Expansion led to an 11% decrease in the average plan premium.

As detailed in Table 3, 23 states expanded Medicaid eligibility by 1/1/2014 (KFF 2018). Most states that expanded Medicaid eligibility implemented this policy by enrolling the newly-

eligible individuals in the managed care plans or Fee-For-Service (FFS) systems that were already in-place for Medicaid beneficiaries. However, two states (Iowa and Arkansas) used Section 1115 Waivers to implement the expansion by providing premium subsidies to enable the newly-eligible individuals to purchase insurance on the exchanges. In these states, Medicaid funds are deployed to help individuals with incomes between 100% of the FPL and 138% of the FPL to obtain insurance through HIX plans, rather than through traditional Medicaid FFS or Medicaid managed care organizations. We code these two states as non-expansion states, because the Medicaid expansion strategy implemented in these states did not alter the risk profiles of HIX buyers.

Second, some states implemented additional regulatory changes during 2015-2017 that could have affected premiums. We use data from the National Conference of state Legislatures (NCSL) to define variables to indicate whether each state made one of these changes during 2015-2017 (NCSL 2017). The variable *NEW_MANDATE* indicates whether each state adopted new coverage mandates (other than coverage for autism services for children or methods of delivery such as telehealth or pharmacist consultations). In addition, the variable *PERIOD* indicates whether each state lengthened the open-enrollment period, *CAP* indicates whether each state imposed a cap (or reduced an existing cap) on premiums, *NETWORK_ADEQUACY* indicates whether each state tightened network adequacy standards, and *ESSENTIAL* indicates whether each state modified the list of essential benefits. Each of these variables is coded as one if the state made a regulatory change in a given year, and zero otherwise (See Appendix Table 1 for details).

Baseline state, regulatory and market characteristics

Baseline regulatory and market characteristics of individual states could also affect premiums for plans offered in these states. We define variables to control for these pre-2014 characteristics in the OLS regressions. Since these variables remain constant during the 2014-2017 observation period, they are not included in the FE regressions.

We use data on average 2013 premiums for employer-sponsored group insurance from the Medical Expenditure Panel Survey (MEPS)[9] to capture interstate variations in the cost of delivering healthcare and health insurance in the large group market, that accounts for the

[9] https://meps.ahrq.gov/mepsweb/data_stats/download_data_files.jsp

majority of the private-sector health insurance market (*ln(2013_MEPS)*). We do not include data for subsequent years, because these premium changes are potentially endogenous. Instead, we assume that state and year indicator variables capture relevant changes. The average monthly premium for employer-sponsored group insurance was $483 in calendar year 2013.

We also include the proportion of individuals with income below 138% of the FPL (*%POP_INCOME<138FPL)* to control for impacts of variations in levels of uncompensated care on hospital rates demonstrated by Buettgens *et al.* (2011).

Finally, we use state-level information from Kowalski (2014) to indicate whether residents of each state may continue to enroll in non-grandfathered plans that do not meet the ACA minimum standards (*NONGRANDFATHER*), and whether the state mandated community rating (*COMMUNITY_RATING*) or guaranteed issue (*GUARANTEED_ISSUE*) prior to 2014. We also use information on the number of coverage mandates in each state prior to 2014 (*MANDATE*) from Bunce and Wieske (2009).

4. Sample Definitions and Constant Trend Analysis

4.1 Sample Definitions

Our baseline sample includes all plans offered in the 50 states plus Washington, D.C., with four exceptions.

- First, the HIX Compare dataset (RWJF 2017) does not provide information about individual plans offered during 2014 for 15 states, and it does not provide this information during 2015 for two states. This data includes 139,194 plan-year observations for plans offered to 50-year-old non-smokers.
- Second, we exclude plans with monthly premiums less than $100 or greater than $1000, which excludes approximately 1.5% of plans for 50-year-old non-smokers and 1.1% of plans offered to 27-year-old non-smokers. This exclusion is based on the assumption that plan characteristics for plans with unusually high (or low) premiums must have been qualitatively different from the characteristics of the majority of plans, if all plans are priced to meet the MLR requirement. For the baseline sample of plans offered to 50-year-old non-smokers, 2,114 plans are dropped; hence the resulting sample size is 137,080. Approximately two-thirds of the dropped plans offered monthly premiums greater than $1000, while one-third offered premiums below $100.

- Third, we exclude states that implemented Medicaid expansion after 12/31/2013. This exclusion allows us to focus on the impacts of HRP closure without contamination from concurrent changes in risk profiles stemming from the expansion of Medicaid eligibility. This exclusion reduces the number of states included in our primary dataset to 44, and it reduces the number of plans to 122,404. It also reduces the number of states that closed HRPs during 2014 to eight.
- Finally, we exclude plan-years with missing data on premiums, CS requirements or plan characteristics. This reduces the sample to 95,368 plans.

After excluding states that implemented Medicaid expansion during 2014-2016, the baseline sample includes eight states that closed HRPs during 2014. Complete HIX Compare data (RWJF 2017) is available for five of these states (Alabama, Florida, Texas, Wisconsin, and West Virginia). Complete data is also available for the two states that closed HRPs during 2015 (South Dakota and Wyoming), and two that closed HRPs during 2016 (Mississippi and Oklahoma) (See Table 3).

Bronze plans account for 31% of the plans included in the sample, Silver plans account for 32% of these plans, Gold plans account for 23% of the sample plans, and Platinum and Catastrophic plans account for the remaining 15% of plans in the baseline sample. However, Silver plans accounted for the majority of plans purchased. In 2016, for example, 71% of all plans purchased in federal-platform states were Silver plans, 21% were Bronze, and the remaining 8% were Gold, Platinum and Catastrophic plans (CMS 2016).

4.2 Parallel Trends

State decisions to close HRPs during 2014-2016 support difference-in-difference (DD) estimation of the impacts of HRP closures on premiums. However, the validity of this DD analysis hinges on the assumption that premium trends in states that closed HRPs would have paralleled the trends in states that did not change their HRP status in the absence of any HRP closure (parallel trends assumption). This assumption cannot be tested directly. Instead, we test the congruence of pre-2014 market trends in states that did and did-not make these policy changes. The HIX markets did not exist prior to 2014; hence we use MEPS group-insurance premiums for the years 2011-2016 (survey years 2012-2017) to measure trends in healthcare utilization and costs, with MEPS expenditures converted to constant 2014 dollars.

The sample used for the parallel trend regressions includes all states except the seven states that implemented Medicaid expansions during 2014, 2015 or 2016. Using the Baseline comparison group, we reject the null hypothesis that the pre-2014 trends differed significantly between states that closed an HRP during the years 2014-2016 and the states that did not (the p-value of joint significance of the relevant indicator variables is 0.39, as shown in first column of Table 4).

Table 4: Test for Parallel Trend in Healthcare Utilization and Costs: Pre-2014

	OLS Regression Coefficients Dependent variable is MEPS premium (constant 2014 dollars)		
	Comparison States		
	Baseline Comparison Group	**Restricted Comparison Groups**	
	• "never" operated an HRP[a] • "always" operated an HRP[b] • operated HRP pre-2014 and closed it by 1/1/2014	"never" operated an HRP[a]	"always" operated an HRP[b]
Close_HRP[c] * Year 2012	-80.78 (-1.17)	-66.68 (-0.83)	-31.75 (-0.33)
Close_HRP * Year 2013	-21.83 (-0.24)	-49.80 (-0.49)	-5.08 (-0.05)
Close_HRP * Year 2014	8.47 (0.14)	33.39 (0.44)	-11.85 (-0.16)
Close_HRP * Year 2015	-99.58 (-1.08)	-71.55 (-0.62)	-115.63 (-1.02)
Close_HRP * Year 2016	-117.22 (-1.53)	-112.21 (-1.33)	-127.70 (-1.27)
Tests for joint significance of pre-2014 interaction terms			
P-value:	0.39	0.70	0.93
Obs.	264	156	132
Number of states[d]	44	26	22

[a]No HRP pre-2014 or post-2014

[b]Operated HRP pre-2014 and did not close it

[c]Close HRP: The treatment group include states that closed HRP during 2014-2016

[d] Number of states includes Washington DC.

Sample includes state-level average MEPS group insurance premiums for data years 2011-2016 (survey years 2012-2017)

AK, IN, LA, MI, MT, NH and PA omitted from the sample due to Medicaid expansion during 2014-2016.

T-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1

The full set of comparison states, with no change in HRP status during 2014-2016, includes three types of states: those that did not operate an HRP prior to 1/1/2014 (denoted as states that

"never" operated an HRP), those that operated an HRP during earlier years and closed it by 1/1/2014, and those that operated an HRP continuously throughout the observation time-period (denoted as states that "always" operated an HRP). While this set of comparison states offers the maximum sample size for analysis, it includes substantial heterogeneity with respect to HRP status. To assess whether the results are sensitive to this heterogeneity, we define two additional sets of comparison states that reduce this heterogeneity. The first set includes states that "never" operated an HRP, and the second set includes states that "always" operated an HRP. We continue to reject the null hypothesis that the pre-2014 trends differ significantly between states with- and with-out changes in HRP status when we use these streamlined sets of comparison states, with p-values equal to 0.70 for the first set and 0.93 for the second set of states (see columns 2 and 3 of Table 4).

5. Results

We begin by using plan-level fixed effects (Plan-FE) to estimate the impacts of HRP closures on premiums, deductibles and MOOPs for plans offered in all metal categories. In the second step, we report additional results using State-level, Rating-Area-level and Insurer-by-Rating-Area-level fixed effects. These regressions provide estimates of the impacts of HRP closures on premiums and CS requirements averaged over the full sets of plans offered within a state, after entry and exit of plans. Finally, we report several robustness checks, and we test whether the Plan-FE estimates are stable over time.

5.1 Impacts of HRP Closures on Premiums, Deductibles and MOOPs: Within-Plan Variation

We report Plan-FE estimates of the impacts of HRP closures on premiums, deductibles and MOOPs for plans offered in each metal category in Table 5[10]. The dependent variables in these regressions are the natural logs of the variables *PREMIUM* (Panels A and B), *DEDUCTIBLE* (Panel C), and *MOOP* (Panel D). The independent variables include year indicator variables, the number of insurers offering plans in the Rating-Area in each year, and changes in state regulations.

[10] Full regression results for the premium regressions are available in Appendix Table 2.

Table 5: Plan-level FE Estimates of Impacts of HRP Closure					
	Catastrophic	Bronze	Silver	Gold	Platinum
Panel A: Dependent variable is *ln(PREMIUM[a])* for 50-year-old non-smoker					
NO_HRP	0.093***	0.083***	0.077***	0.045***	0.021**
	(0.011)	(0.005)	(0.004)	(0.007)	(0.010)
Average premium increase[a]	$29.62	$33.90	$36.96	$24.90	$13.74
Panel B: Dependent variable is *ln(PREMIUM[a])* for 27-year-old non-smoker					
NO_HRP	0.093***	0.078***	0.078***	0.034***	0.036***
	(0.011)	(0.005)	(0.004)	(0.007)	(0.010)
Average premium increase[a]	$17.71	$19.32	$22.68	$11.90	$14.23
Panel C: Dependent variable is *ln(DEDUCTIBLE)* for 50-year-old non-smoker					
NO_HRP	0.000	-0.024***	0.406***	-0.008	-0.045**
	(0.001)	(0.003)	(0.046)	(0.010)	(0.023)
Panel D: Dependent variable is *ln(MOOP)* for 50-year-old non-smoker					
NO_HRP	-0.001	0.005***	0.244***	0.022***	-0.078***
	(0.001)	(0.001)	(0.035)	(0.006)	(0.012)
Obs.	6,040	32,372	35,493	18,008	3,455

[a]Change in premiums for plans offered to non-smoker buyer insurance for a single adult, age 50 (Panel A) or age 27 (Panel B).
Sample excludes states that implemented Medicaid expansion during the period 2014-2016.
Other independent variables included in the FE regression equations are: *YEAR2015, YEAR2016, YEAR2017, NISSUERS , NEW_MANDATE, PERIOD, CAP, NETWORK, ESSENTIAL*
Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

HRP closure triggers significant increases in insurance premiums offered in each AV category. For 50-year-old non-smokers, premiums for Bronze and Silver plans increase by approximately 8% (see Panel A of Table 5). Multiplying the percentage increases by the average premium for Bronze and Silver plans, these estimates imply a $33.90 increase in the average monthly premium for Bronze plans and a $36.96 increase in the average monthly premium for Silver plans.

The magnitudes of the percentage increases in premiums are similar for 27-year-old non-smokers (see Panel B of Table 5). HRP closure generates a smaller $22.68 increase in average monthly premiums for Silver plans offered to 27-year-old non-smoking adults, however, because the premiums for plans offered to the younger adults are lower than the premiums for plans offered to 50-year-old non-smokers.

HRP closures also generate large and significant increases in deductibles and MOOPs for Silver plans with consistent plan-IDs. The Plan-FE estimates indicate that HRP closure led to a 41% increase in Deductibles, and a 24% increase in MOOPs.

However, the impacts on CS requirements for plans in other AV categories are small and either insignificant or negative. These results are consistent with expectations. While insurers were able to increase MOOPs for many Silver plans, the MOOP constraint specified by CMS limited insurer' ability to increase MOOPs for Bronze plans: the average MOOP exceeded 90% of the maximum legal MOOP for 96% of Bronze plans. The MOOP constraint also limited insurer' ability to raise deductibles for many Bronze plans: deductibles exceeded 90% the maximum legal MOOP for nearly half (47%) of the Bronze plans. Insurers offering Catastrophic plans faced similar constraints. These constraints were less likely to be binding for insurers offering Gold and Platinum plans; however, these plans may occupy a different market niche, given that the central role of the second-lowest-priced Silver plans in the computation of the APTC and the fact that CSR payments are only available to individuals who purchase Silver plans.

5.2 Impacts of HRP Closures on Premiums, Deductibles and MOOPs: Within-Plan Variation and Across-Plan Variation

Table 6 provides estimates of the impacts of HRP closure on average premiums, deductibles and MOOPS for the sets of Silver plans available to consumers within a state or rating area, when these sets of plans are affected by plan entry and exit. The OLS results (column 1) indicate that closing an HRP is significantly associated with an increase in premiums, but the results for the cost-sharing variables are mixed (see Panel A of Table 6).

Table 6: Estimated Impacts of HRP Closure on Silver plans					
	OLS	**Fixed Effects**			
		State	**Rating Area**	**Insurer-by-Rating-Area**	**Plan**
Panel A: Baseline comparison group					
Panel A1: Dependent variable is ln(PREMIUM)[a]					
NO_HRP	0.050***	0.017***	0.011**	0.072***	0.077***
	(0.003)	(0.005)	(0.004)	(0.004)	(0.004)
Panel A2: Dependent variable is ln(DEDUCTIBLE)[a]					
NO_HRP	0.012	0.062*	0.060*	0.221***	0.406***
	(0.015)	(0.034)	(0.034)	(0.036)	(0.046)
Panel A3: Dependent variable is ln(MOOP)[a]					
NO_HRP	-0.075***	0.073***	0.076***	0.181***	0.244***
	(0.011)	(0.025)	(0.025)	(0.026)	(0.035)
Obs.	35,493	35,493	35,493	35,493	35,493
Panel B: Comparison group is states that "always" operated an HRP					
Panel B1: Dependent variable is ln(PREMIUM)[a]					
NO_HRP	0.053***	0.025***	0.009	0.071***	0.087***
	(0.004)	(0.006)	(0.006)	(0.006)	(0.005)
Panel B2: Dependent variable is ln(DEDUCTIBLE)[a]					
NO_HRP	0.083***	0.003	0.013	0.153***	0.342***
	(0.022)	(0.041)	(0.042)	(0.045)	(0.055)
Panel B3: Dependent variable is ln(MOOP)[a]					
NO_HRP	-0.015	0.087***	0.111***	0.246***	0.238***
	(0.015)	(0.030)	(0.031)	(0.032)	(0.042)
Obs.	23,395	23,395	23,395	23,395	23,395
Panel C: Comparison group is states that "never" operates an HRP					
Panel C1: Dependent variable is ln(PREMIUM)[a]					
NO_HRP	0.049***	0.042***	0.045***	0.113***	0.107***
	(0.007)	(0.007)	(0.007)	(0.006)	(0.007)
Panel C2: Dependent variable is ln(DEDUCTIBLE) [a]					
NO_HRP	-0.107***	0.038	0.038	0.164***	0.304***
	(0.039)	(0.046)	(0.046)	(0.049)	(0.071)
Panel C3: Dependent variable is ln(MOOP)[a]					
NO_HRP	-0.019	0.038	0.039	0.099***	0.199***
	(0.028)	(0.034)	(0.034)	(0.036)	(0.055)
Obs.	22,654	22,654	22,654	22,654	22,654

[a]Premiums for 50-year-old non-smoker buyer insurance for a single adult.
Sample excludes 7 states that implemented Medicaid expansion during 2014-2016.
Additional independent variables included in the FE regression equations are: *YEAR2015, YEAR2016, YEAR2017, NISSUERS , NEW_MANDATE, PERIOD, CAP, NETWORK, ESSENTIAL*
In addition, the OLS regression equation includes: *Ln(2013_MEPS), %POP_INCOME<138FPL, MCAID_EXPANSION , MANDATE, NONGRANDFATHER, COMMUNITY_RATING, GUARANTEED_ISSUE*
Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

However, the FE results indicate that HRP closures generate significant increases in all three dependent variables. The *PREMIUM*, *DEDUCTIBLE* and *MOOP* coefficients reported for the State-FE, Rating-Area-FE and Insurer-by-Rating-Area-FE regressions are positive and statistically significant, but the magnitudes are smaller in the State-FE and Rating-Area-FE regressions than in the Plan-FE regressions (Panel A of Table 6).

In Panels B and C of Table 6, we report results based on the alternate definitions of the comparison group. We report the results of OLS and FE regressions when the comparison group consists of states that "always" operated HRPs in Panel B, and we report results generated when the comparison group consists of states that "never" operated HRPs in Panel C. The results reported in Panel A of Table 6 are robust with respect to the composition of the set of comparison states, especially when we use Insurer-by-Rating-Area or Plan FE.

Comparison of the Plan-FE results with the results based on less-granular FE results provides indirect evidence on changes in plan generosity. Regulatory restrictions limit the degree to which insurers can adjust the generosity of a given plan; however, insurers can adjust the generosity of the set of plans offered within a geographic area by withdrawing relatively generous plans and offering new plans with less generous features. The fact that the Plan-FE coefficients are larger than the State-FE and Rating-Area-FE coefficients is consistent with the hypothesis that insurers reduced the generosity of the sets of plans offered within each State and Rating-Area.

5.3 Indirect Evidence of Impacts on Plan Generosity

We construct two more samples, to explore additional indirect evidence that insurers may have responded to HRP closures by reducing plan generosity. We begin by constructing a balanced panel for all four years of the 2014-2017 observation period. This sample does not include any plans that entered or exited the market during the years 2015-2017. Using this balanced panel, the impacts of HRP closure are positive and significant at all four levels of FE granularity, and the magnitudes of the impacts of HRP closure are similar at all levels of FE granularity (see Panel A of Table 7). Comparison of these results with those presented in Table 6 suggests that plan entry and exit accounts for the differences between the magnitudes of the coefficients estimated using State-level or Rating-Area-level FE and those estimated using Plan-level FE. One possible explanation for the impact of plan entry and exit, on the magnitude of the

impact of HRP closure, focuses on the use of entry and exit as a mechanism for adjusting plan generosity.

Table 7: Indirect Evidence of Impact of *HRP* closure on Plan Generosity on Silver Plans					
	OLS	**Fixed Effects**			
		State	**Rating Area**	**Insurer-by-Rating-Area**	**Plan**
Panel A: Restricted Sample of plans offered each year during 2014-2017					
Panel A1: Dependent variable is ln(PREMIUM)[a]					
NO_HRP	0.091***	0.092***	0.089***	0.090***	0.078***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Panel A2: Dependent variable is ln(DEDUCTIBLE)[a]					
NO_HRP	0.625***	0.362***	0.338***	0.332***	0.323***
	(0.056)	(0.088)	(0.093)	(0.094)	(0.092)
Panel A3: Dependent variable is ln(MOOP)[a]					
NO_HRP	-0.109***	0.158**	0.160**	0.157**	0.176**
	(0.037)	(0.06)	(0.070)	(0.070)	(0.070)
Obs.	2,880	2,880	2,880	2,880	2,880
Panel B: Restricted Sample of the 20 least-costly plans in each Rating-Area					
Panel B1: Dependent variable is ln(PREMIUM)[a]					
NO_HRP	0.057***	0.091***	0.088***	0.078***	0.080***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.004)
Panel B2: Dependent variable is ln(DEDUCTIBLE)[a]					
NO_HRP	0.519***	0.625***	0.615***	0.690***	0.469***
	(0.034)	(0.049)	(0.051)	(0.052)	(0.053)
Panel B3: Dependent variable is ln(MOOP)[a]					
NO_HRP	0.063***	0.308***	0.313***	0.366***	0.270***
	(0.021)	(0.036)	(0.037)	(0.038)	(0.041)
Obs.	8,309	8,309	8,309	8,309	8,309

[a]Plans offered to 50-year-old non-smoker buyer insurance for a single adult.
Sample excludes 7 states that implemented Medicaid expansion during 2014-2016.
Additional independent variables included in the FE regression equations are: *YEAR2015, YEAR2016, YEAR2017, NISSUERS , NEW_MANDATE, PERIOD, CAP, NETWORK, ESSENTIAL*
In addition, the OLS regression equation also includes: *Ln(2013_MEPS), %POP_INCOME<138FPL, MCAID_EXPANSION , MANDATE, NONGRANDFATHER, COMMUNITY_RATING, GUARANTEED_ISSUE*
Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

In Panel B of Table 7, we report results for a restricted sample that focuses on the 20 least-expensive Silver plans offered in each Rating-Area. This sample excludes plans with premiums that are unusually high relative to other plans offered in the same Rating-Area. The results exhibit the same pattern as the results reported in Panel A of this table. Closing an HRP generates significant increases in premiums, deductibles and MOOPs, and the magnitudes of the

estimated impacts are similar across the four levels of FE granularity. To the extent that plan entry and exit signals adjustments in plan generosity, these results indicate that this does not typically occur among the 20 most-competitively-priced plans in a Rating-Area. Instead, the generosity adjustments appear to be concentrated among plans with relatively high premiums. This result is consistent with the evidence reported by Bennett, Smith and Norris (2015), indicating that plans offered at the high end of the market are qualitatively different from plans with lower premiums.

5.4 Robustness Checks

We test whether the results are sensitive to variations in the criteria for including states in the sample. We estimated the impacts of HRP closures on premiums when:

(i) the sample is restricted to states for which data is available in all four of the 2014-2017 years (Panel A of Table 8),

(ii) the sample is restricted to exclude unusual states[11] (Panel B of Table 8), and

(iii) the sample is expanded to include states that expanded Medicaid after 1/1/2014 (Panel C of Table 8).

We conclude that the estimated impacts are not sensitive to these variations, although we report anomalous results for the Rating-Area-FE regressions in Panels B and C.

[11]We drop six states from the baseline sample with unusual characteristics. New York mandated pure community rating prior to implementation of the HIX markets. Massachusetts implemented early comprehensive reforms in its state health insurance market. Washington DC and Vermont had high-income thresholds for Medicaid eligibility prior to passage of the ACA. Iowa and Arkansas implemented Medicaid expansion by using expansion funds to provide premium support for Medicaid-eligible adults in the HIX markets.

Table 8: Robustness Checks: Different Criteria for Including States in the Sample					
	Dependent variable is *ln(PREMIUM)*[a] for Silver plans				
	OLS	**Fixed Effects**			
		State	**Rating Area**	**Insurer-by-Rating-Area**	**Plan**
Panel A: Sample excludes states with missing data					
NO_HRP	0.051***	0.016***	0.009**	0.071***	0.074***
	(0.004)	(0.005)	(0.004)	(0.004)	(0.004)
Obs.	27,244	27,244	27,244	27,244	27,244
Panel B: Sample excludes unusual states NY, MA, DC, VT, IA, AR[b]					
NO_HRP	0.054***	0.015***	0.007	0.065***	0.071***
	(0.003)	(0.005)	(0.004)	(0.004)	(0.004)
Obs.	32,655	32,655	32,655	32,655	32,655
Panel C: Sample includes states that expanded Medicaid after 1/1/2014					
NO_HRP	0.031***	0.008*	0.002	0.064***	0.076***
	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)
Obs.	40,351	40,351	40,351	40,351	40,351

[a] Premiums for 50-year-old non-smoker buyer insurance for a single adult.

[b] Sample excludes 7 states that implemented Medicaid expansion during 2014-2016, and NY (pure community rating), MA (early comprehensive state health insurance market reforms), DC (high income threshold for Medicaid eligibility), VT (high income threshold for Medicaid eligibility), IA and AR (waiver to implement Medicaid expansion via HIX voucher system).

Additional independent variables included in the FE regression equations are: *YEAR2015, YEAR2016, YEAR2017, NISSUERS , NEW_MANDATE, PERIOD, CAP, NETWORK, ESSENTIAL*

In addition, the OLS regression equation also includes: *Ln(2013_MEPS), %POP_INCOME<138FPL, MCAID_EXPANSION , MANDATE, NONGRANDFATHER, COMMUNITY_RATING, GUARANTEED_ISSUE*

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

5.5 Stability of Results over Time

Finally, we explore whether insurer' responses to HRP closures changed over time. Several factors could potentially spark such changes. Increasing HIX market experience could have allowed insurers to fine-tune their responses to HRP closures, state regulatory environments could have evolved in ways that are not captured by our independent variables, or insurer responses could have been impacted by termination of the two temporary federal risk management programs (Risk Corridors and the Reinsurance Pool) at the end of 2016. We use two strategies to explore this question. We provide separate estimates for the impacts of HRP closures that occurred during 2014, 2015 and 2016. In addition, we estimate impacts of the 2014 HRP closures by year, to explore the question of whether these impacts that dissipated (or grew) over time.

In Table 9, we report disaggregated estimates of the impacts of HRP closures that occurred during 2014 (Panel A1), 2015 (Panel A2), or 2016 (Panel A3), using states that "always" operated HRPs as the comparison group. HRP closures that occurred during 2014 and 2015 generated significant positive impacts on premiums, deductibles and MOOPs. HRP closures that occurred during 2016 also generated significant positive impacts on premiums, but the impacts on Deductibles and MOOPs are insignificant. This pattern is repeated when we utilize the alternate comparison group composed of states that "never" operated HRPs (Panel B of Table 9). The insignificant impacts generated by the 2016 closures could potentially reflect a change in insurer strategy, or they could reflect idiosyncratic characteristics of the two states that closed HRPs in that year or "noise" generated by closure of the temporary federal Risk Corridors and Reinsurance programs at the end of 2016.

Table 9: Disaggregated Impacts of HRP Closure: Silver Plans, Plan-Level FE

	Dependent variable[a]		
	ln(PREMIUM)	***ln(DEDUCTIBLE)***	***ln(MOOP)***
Panel A: Comparison group is states that "always" operated an HRP			
Panel A1: Treatment group is states that closed HRP during 2014 (n=22,345)			
NO_HRP	0.082***	0.482***	0.314***
	(0.005)	(0.062)	(0.046)
Panel A2: Treatment group is states that closed HRP during 2015 (n=9,371)			
NO_HRP	0.057***	0.257*	0.201*
	(0.019)	(0.135)	(0.117)
Panel A3: Treatment group is states that closed HRP during 2016 (n=9,551)			
NO_HRP	0.084***	-0.272	-0.162
	(0.019)	(0.216)	(0.163)
Panel B: Comparison group is states that "never" operated an HRP			
Panel B1: Treatment group is states that closed HRP during 2014 (n=21,604)			
NO_HRP	0.093***	0.539***	0.313***
	(0.009)	(0.093)	(0.071)
Panel B2: Treatment group is states that closed HRP during 2015 (n=8,630)			
NO_HRP	0.154***	0.240*	0.184
	(0.017)	(0.138)	(0.129)
Panel B3: Treatment group is states that closed HRP during 2016 (n=8,810)			
NO_HRP	0.198***	-0.319	-0.209
	(0.020)	(0.212)	(0.163)

[a]Plans offered to 50-year-old non-smoker buyer insurance for a single adult.
Sample excludes 7 states that implemented Medicaid expansion during 2014-2016.
Additional independent variables included in the FE regression equations: *YEAR2015, YEAR2016, YEAR2017, NISSUERS , NEW_MANDATE, PERIOD, CAP, NETWORK, ESSENTIAL*
Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Finally, we test whether the impacts of HRP closures were transitory, or whether they persisted for several years. We focus on the closures that occurred in 2014, because most HRP closures happened in 2014 and we have three years of post-closure data for these states. We report year-by-year impacts of 2014 closures observed in 2015, 2016 and 2017. We report results using the states that "always" operated HRPs as the comparison group in Panel A of Table 10, and we report results using the states that "never" operated an HRP as the comparison group in Panel B of Table 10. The estimated impacts of HRP closures that occurred during 2014 are stable across the years 2015, 2016 and 2017, and this result is not sensitive to the composition of the comparison group.

Table 10: Impact of 2014 HRP Closure by Year: Plan-FE Estimates for Silver Plans

	Dependent Variables[a]		
	ln(PREMIUM)	***ln(DEDUCTIBLE)***	***ln(MOOP)***
Panel A: Comparison group is states that "always" operated a state HRP			
Impact during			
2015	0.090***	0.423***	0.286***
	(0.005)	(0.063)	(0.048)
2016	0.067***	0.571***	0.355***
	(0.006)	(0.070)	(0.051)
2017	0.082***	0.672***	0.428***
	(0.009)	(0.091)	(0.064)
Obs.	22,345	22,345	22,345
Panel B: Comparison group is states that "never" operated an HRP			
Impact during			
2015	0.098***	0.480***	0.305***
	(0.009)	(0.096)	(0.074)
2016	0.069***	0.605***	0.318***
	(0.011)	(0.098)	(0.076)
2017	0.228***	0.707***	0.374***
	(0.013)	(0.112)	(0.086)
Obs.	21,604	21,604	21,604

[a] Plans offered to 50-year-old non-smoker buyer insurance for a single adult.
Sample excludes 7 states that implemented Medicaid expansion during 2014-2016.
Additional independent variables included in the FE regression equations are: *YEAR2015, YEAR2016, YEAR2017, NISSUERS , NEW_MANDATE, PERIOD, CAP, NETWORK, ESSENTIAL*
Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

6. Discussion and Conclusion

A small number of unusually high-cost individuals account for a substantial proportion of population healthcare expenditures. Therefore, policies that determine whether financial

responsibility for costs incurred by the high-cost individuals will be located within the HIX markets, or shifted out of those markets, can substantially impact HIX plan premiums, cost-sharing requirements and generosity. States can shift this responsibility out of the HIX markets by continuing to operate pre-2014 HRPs or by opening new HRPs or reinsurance programs, and they can receive federal funds through Section 1332 waivers. States may give increasing attention to this policy option, as they face substantial premium increases for the 2019 plan year and concerns about HIX market stability (CBO, 2018).

We use variation generated by closures of state HRPs that occurred during the 2014, 2015 and 2016 plan years to generate DD estimates of the impacts of HRP closures on plan premiums, deductibles and MOOPs. HRP closures triggered significant premium increases for plans offered in all metal categories, with the magnitudes of the increases ranging from 2.1% for Platinum plans to 9.3% for Catastrophic plans. Premiums for Silver plans offered to 50-year-old non-smokers increased by 7.7% (or about $36.96 per month). This empirical estimate of the impact of HRP closure on Silver plan premiums is at the low end of the range of estimates generated by actuarial simulation models. This relationship is consistent with our use of a conservative definition for "HRP closure" that minimizes the likelihood that we would observe a significant impact on premiums, and the broad eligibility criteria for coverage under some of the pre-2014 state HRPs. Therefore, the empirical estimates of the premium impacts of HRP closures reported in this paper are congruent with the simulation-based estimates of new RSMs included in state applications for Section 1332 Waivers.

We also report significant increases in Silver plan deductibles and MOOPs following HRP closure. While the Secretary of Health and Human Services invited states to apply for Section 1332 Waivers as a strategy to stabilize HIX markets (DHHS, 2017), the potential impact of RSMs on household cost-sharing expenditures is an important additional benefit. If insurer responses to implementation of new RSMs are symmetric to the responses to RSM closures, new RSMs could substantially reduce the cost of utilizing healthcare for individuals with incomes above 250% of the FPL.

These results complement the actuarial predictions generated by simulation models. The simulation models account for idiosyncratic characteristics of state RSM designs, regulatory frameworks and competitive environments. These issues are important. For example, Minnesota and Oregon plan to use ex-post identification of high-cost individuals, while Alaska

plans to use the ex-ante strategy typically described as an 'invisible' HRP. Insurer responses to changes in RSM status could be sensitive to specific details associated with ex-ante vs. ex-post identification of high risk individuals, or details defining specifics mechanisms for shifting the financial risk. The simulation models do not, however, encompass the strategic component of insurer responses to changes in RSM strategy, when insurers select the mix of adjustments to plan premiums, cost-sharing requirements and generosity levels.

In contrast, the empirical results reported in this paper provide evidence on insurer responses to HRP closures that occurred in nine states during 2014-2016. These decisions were made in the context of specific state and federal regulatory requirements. While the empirical results provide estimates of the combination of premium and cost-sharing adjustments implemented by insurers, the available data imposes three limitations:

- The new RSMs created and operated under Section 1332 waivers are likely to differ from the state HRPs created prior to implementation of the HIX markets.
- Relevant state and federal regulations are continuously evolving. For example, the analysis presented in this paper relies on data from years in which insurance companies received federal Cost-Sharing Reduction payments. Impacts of termination of those payments on insurer strategies are not reflected in the estimates presented in this paper.
- The HIX Compare dataset (RWJF 2017) provides detailed information about plans offered in each Rating-Area during each year; however it does not provide information about plan market shares. Therefore, we estimate the impact of HRP-closures on average premiums for plans offered in the closure states, but we do not estimate average impacts on buyers.

Compliance with Ethical Standards:

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