How do insurance firms respond to financial risk sharing regulations? Evidence from the Affordable Care Act

Abstract: Many insurance markets have reinstated premium stabilization programs to ensure financial protection from market volatility. In this paper, we focus on one such regulation – risk corridors- in the context of the Health Insurance Marketplaces established under the Affordable Care Act. We develop a model to show how the program provided incentives for some insurers to lower their premiums. The Risk Corridors program was defunded unexpectedly for coverage year 2016, before its legislated end in 2016. Consistent with the model, we find that making a risk corridors claim before the program ended is associated with higher premium growth after the program's demise. The model and empirical evidence are consistent with the view that the end of the risk corridors program contributed to premium growth in the Marketplaces.

Keywords: Health care financing, health insurance, Affordable Care Act, Risk Corridors, Health Insurance Marketplaces

1. Introduction

Risk stabilization in insurance markets is a central regulatory consideration. Several key goals of risk stabilization programs are to ensure financial protection of consumers from market volatility, encourage participation of insurers in the marketplace, manage the risk pool and address concerns such as adverse selection by consumers and risk selection by insurers. Such goals become even more pronounced for newly established insurance marketplaces where insurers have limited information on the risk pool and consumers face heightened uncertainty on volatility of the products and prices. However, risk stabilization through regulation creates incentives as firms share profits. It is important to understand how firms respond to such financial risk sharing regulations and the impact of their response on pricing and market participation.

In this paper, we study one type of a risk stabilization regulation – risk corridor (RC) program - in the context of the Health Insurance Marketplaces established in 2014 as part of the Affordable Care Act (ACA). The RC program subsidized insurers whose medical costs exceed a target, equal to 80 percent of revenue, and taxed insurers with costs below the target. We ask, whether the RC program that intended to share risk among insurers actually improved risk sharing, or instead it incentivized some insurers to reduce premiums. We first build a model to study incentives created by the RC program on the pricing decisions of health insurers. Next, we examine the implications of the model using data from the Health Insurance Marketplaces established by the ACA. For coverage year 2016 there was an unexpected "de-funding" of the program, and it formally ended for coverage year 2017. We examine how insurers responded to de-funding and program ending, asking whether their response is consistent with the predictions or our model.

Our model shows that it can be optimal for some insurers to set premiums low enough to receive a RC payment. For insurers claiming an RC payment (because their medical costs exceed a target), the RC program acts as an implicit subsidy, effectively reducing marginal costs by as much as 40 percent at the RC parameters established by the ACA. Intuitively, if a claiming insurer reduces its premium, its revenue and costs both rise, leaving true profit roughly unchanged. Its RC payment rises, however, because costs have increased faster than the RC target amount, which is equal to only 80 percent of revenue. Thus the RC program encourages insurers to reduce premiums, acting as an implicit subsidy. The equilibrium effects of this subsidy could be large, as insurers may react to their rivals' low premiums with low premiums of their own. Defunding or ending the RC program removes this subsidy, raising premiums, reducing profitability and potentially discouraging participation.

We test the model by examining how premiums and participation changed following the unexpected defunding and then end of the RC program. The model implies that insurers should react heterogeneously to the end of the RC program: insurers who claimed RC payments in 2015 should differentially increase their premiums after defunding. We test this implication with two primary data sources. The first source is insurers' financial filings, which record RC claims (RC owed amounts to insurers) or RC contributions (RC payments from insurers to the program) in 2014 and 2015. The second source is an insurer-plan level dataset recording the prices and characteristics of all plans in the Marketplaces in 2015-2017, from which we infer insurer prices and participation decisions. In 2015, 74 percent of insurers had RC claims, and the average claim amount was $53 per member month, or 12 percent of medical claims incurred. Consistent with our model, we find that that insurers who made RC claims in 2015 had 7 percent higher premium increases over the next two years than did non-claiming insurers, even after adjusting for the higher medical claim costs and lower baseline premiums of claiming insurers. However, insurers who made RC claims were no more likely to exit the Marketplace.

As our approach compares insurers to making RC claims to other insurers, it inherently involves comparing high and low cost insurers, and so it is possible that the differential premium growth we observe reflects these pre-existing differences, rather than the causal effect of the end of the RC program. While we cannot rule out all confounding factors, several pieces of evidence suggest that the end of the RC program itself contributed to the faster premium growth that we document. We show in placebo test that RC claiming insurers in 2014 had no differential premium growth in 2015, before the program was defunded. This facts help rule out mean reversion as an alternative explanation. We present evidence against several other alternative explanations, such as the end of the ACA's reinsurance program, insurer mistakes, and the "invest-then-harvest" hypothesis that firms priced low to gain market share while the RC program was in effect, and then raised prices to take advantage of consumer inertia.

Our model suggests that in general Risk Corridors programs may have unintended consequences for premiums, and the defunding and end of the program may have contributed to rising premiums in 2017. On average, premiums rose by about 28 percent between 2015 and 2017 for insurers in our data. Interpreting our estimates in a causal way and ignoring potential equilibrium effects, our estimates imply that had the program not ended, premiums would have risen only by about 22 percent, or about a fifth less.

2. Related Literature

The establishment of the Health Insurance Marketplaces in 2014 was one of the signature changes of the Affordable Care. Prior to them, obtaining health insurance in the individual market (i.e., not through an employer) was a difficult process, involving costly consumer search, frequent rejections, and high premiums (see, e.g., Abraham and Karaca-Mandic (2011), Abraham et al. (2013) and Karaca-Mandic et al. (2015)). The Marketplaces created a centralized platform for insurance purchase. Accompanying regulations required guaranteed issue and prevented medical underwriting, permitting insurers to charge different prices only on the basis of location, age, and tobacco use. As there was considerable uncertainty about who would sign up for coverage, the ACA included temporary provisions to share risk between insurers and the government. We focus on the risk corridors program.

Initially the Marketplaces appeared to work well, attracting many enrollees and insurers. In 2015, 11.6 million people signed up for insurance coverage in the Health Insurance Marketplaces, and the average Marketplace had 4.9 insurers offering coverage.[1] In 2016, however, premiums rose by 9 percent and insurer participation fell to 4.2 insurers. In 2017, premiums rose a further 25 percent, and participation fell to 2.9 insurers per market. Rapid premium increases and declining insurer participation provoked considerable concern among policymakers. Mark Dayton, governor of Minnesota, publicly noted that the "Affordable Care Act is no longer affordable,"[2] and the Senate majority leader cited both premium increase and insurer exits to justify legislative action.[3]

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[1]On coverage, see https://aspe.hhs.gov/system/files/pdf/83656/ib_2015mar_enrollment.pdf. Statistics on insurer participation and premiums are derived from our data, described below. See http://www.kff.org/health-reform/issue-brief/2017-premium-changes-and-insurer-participation-in-the-affordable-care-acts-health-insurance-marketplaces/

[2] http://minnesota.cbslocal.com/2016/10/12/gov-dayton-affordable-care-act/

[3] "Obamacare Is Hurtling Towards Collapse." https://www.mcconnell.senate.gov/public/index.cfm/pressreleases?ID=2C1887CF-E46C-4F95-B162-2EFBE378D6BF

These premium and participation trends coincided with important regulatory changes in the Health Insurance Marketplaces related to the RC program. The RC program was scheduled to expire at the end of 2016, as was the reinsurance program. However, the ACA did not appropriate funding for the RC program, which in fact was defunded for coverage year 2016 by the Consolidated and Further Continuing Appropriations Act (Cromnibus),[4] effectively ending the RC program a year early. Cromnibus was championed by Senator Marco Rubio, who boasted that he “Killed Obamacare” by cutting pivotal funding for insurers,[5] a claim which pundits echoed.[6]

Our results are related to the literature on reinsurance, i.e. insurance for insurers, of which the RC program is an example. Geruso and McGuire (2016) and Layton et al. (2016) study the tradeoffs in the design of reinsurance programs, arguing that programs that share risk between insures and the government result in weaker cost-control incentives for insurers. Our focus on the empirical consequences of the RC program for premium and participation complements these papers, which do not consider pricing incentives, nor estimate insurer responses. Our finding that insurers respond to the incentives embedded in the RC program is consistent with a broader literature on the strategic response of insurers to supply-side subsidies. For example Brown et al. (2014) show evidence that when reimbursement for diabetes care is higher, insurers enroll more diabetics in the presence of risk adjustment (cream skimming). Similarly Geruso and Layton, (2015) find that risk adjustment creates incentives for insurers to report more diagnoses per patient (upcoding). Geruso, Layton, and Prinz (2016) show that insurers tailor their plan design

[4] We provide more details about the timing of Cromnibus in Section 2 below.
[5] http://www.msnbc.com/rachel-maddow-show/rubios-curious-boast-he-killed-obamacare
[6] See, for example, “How Marco Rubio Is Quietly Killing Obamacare,” https://www.washingtonpost.com/opinions/how-marco-rubio-is-quietly-killing-obamacare/2015/12/14/c706849a-a275-11e5-b53d-972e2751f433_story.html?utm_term=.e3ac21baff81

to attract enrollees whose costs are below their risk adjustment payment. Additionally, Carey (2017) shows that risk adjustment payments influence which prescriptions drugs are covered by health plans and how much they cost to patients.

Our findings also contribute to the recent literature on pricing and participation on the Health Insurance Marketplaces. This literature has documented that more insurer competition leads to lower premiums (Dickstein et al. 2015; Dafny, Gruber, and Ody, 2015; Zhu, et al. 2017) and that insurer participation is positively related to market size (Dickstein. et al. 2015; Abraham et al. 2017). Medicaid expansion also induces lower premiums, mainly by drawing relatively high-cost enrollees out of the Marketplace's risk pool (Sen and DeLeire 2018). An additional set of papers documents adverse selection in the Marketplaces (Panhans 2019, Saltzman 2019, Tebaldi, 2020). These results are helpful for understanding the level of premiums, but they give few insights about why premiums have risen. Garthwaite and Graves (2017) argue that falling insurer participation reflects a natural shake out as insurers learned whether they could profitably operate on the Health Insurance Marketplaces. Our findings suggest that the end of the RC program may have been an important contributing factor.

3. Background

3.1 Risk Corridors and the Premium Stabilization Programs

The RC program was meant to provide insurance against having higher than expected claims costs, financed with payments from insurers with lower than expected claims costs.[7] It was therefore a profit-sharing program between the government and insurers. Essentially, the RC program allows insurers' markups of premium revenue over medical claims to fall within a

[7] Our description of the RC program, as well as reinsurance and risk adjustment, draws heavily on Cox et al. (2017).

narrow range around a target. Insurers with a markup in this range neither make a payment nor receive one, so we call them "neutral." If markups are too high, then insurers must make a payment into the RC program; we call such insurers "contributing." If markups are too low, then insurers receive a payment from the RC program; we call such insurers "claiming."

The target for medical claims costs is equal to 80 percent of premium revenue. If the insurer's claims fall between 97 and 103 percent of the target, the insurer neither makes nor receives a payment (so it is neutral). If the insurer's medical claims fall between 103 and 108 percent of the target, insurer receives a payment equal to 50 percent of the excess over 103 percent. If the insurer's medical claims exceed 108 percent of the target, then insurer receives a payment equal to 2.5 percent of the target (i.e. 50 percent of 108-103), plus 80 percent of the excess over 108 percent. The situation is reversed for insurers with low expenses: they pay in 50 percent on the margin if medical claims are between 92 and 97 percent of the target, and 80 percent on the margin if claims are below 92 percent of the target. Figure 1, panel A illustrates the RC payments as a function of claims, both relative to the target amount. As we emphasize in the model below, the dollar amount for the target is tied to premiums, so an insurer who sets a lower premium (holding fixed its claims) gets a higher RC payment.

The RC program was one of three "premium stabilization programs" created by the ACA. The others are reinsurance and risk adjustment. Reinsurance and the RC program were both legislated to be in effect for 2014-2016; risk adjustment was permanent. Risk adjustment redistributes revenue among Marketplace insurers, from insurers that enroll few people with expensive diagnoses to insurers that enroll relatively many people with expensive diagnoses. Risk adjustment is not a net subsidy. The reinsurance program, however, is a subsidy for

Marketplace insurers: it pays fraction of any individual's medical costs that exceed an attachment point ($45,000 in 2014 and 2015, and $90,000 in 2016).

3.2 Defunding the risk corridors program

As legislated in the Affordable Care Act, the RC program need not be budget neutral; if all insurers experience high medical claims relative to premiums, then the program would call for large net payouts, financed from general revenue. However, the program was made budget neutral by the Consolidated and Further Continuing Appropriations Act (Cromnibus) of December, 2014. Cromnibus required that the Centers for Medicare and Medicaid Services only use payments from contributing insurers to pay claiming insurers. Although the Department of Health and Human Services (HHS) was authorized to look for additional sources of funds, Section 227 of the Cromnibus specifically prohibited HHS from borrowing from other accounts. In October 2015, CMS announced that in the first year of the RC program, insurers submitted claims for $2.87 billion in losses, against gains that totaled only $362 million (Department of Health and Human Services 2015; Jost 2015). The shortfall for 2014 meant that health insurers were to be paid only 12.6% on the dollar for their RC claims.[8] Because 2014 claims have seniority over subsequent years, 2015 and 2016 losses were likely to be paid even less. Cromnibus essentially defunded the RC program.

Although Cromnibus passed in 2014, we assume that the earliest it could affect insurers' pricing and participation decisions was for coverage year of 2016. This is because participation, pricing, and enrollment decisions in the Marketplaces are made several months before the start of the coverage year. The process begins in May-June before the coverage year, when participating

[8] See https://www.cms.gov/CCIIO/Programs-and-Initiatives/Premium-Stabilization-Programs/Downloads/RiskCorridorsPaymentProrationRatefor2014.pdf

insurers must submit plan information, including premiums, for certification. After all plans are finalized and certified in late October, data is locked down and insurers cannot change their premiums or plan offerings. Then open enrollment begins, typically running from mid-November through mid-January of the coverage year (Centers for Medicare and Medicaid Services, 2014). Thus, by the time Cromnibus was passed, insurers had already committed to their 2015 participation and pricing decisions.

It is possible that insurers anticipated Cromnibus' defunding of the RC program, and priced accordingly, but several considerations make this unlikely. First, insurer anecdotes indicate that they were counting on receiving RC payments. For example, the CEO of Health Republic of Oregon, said in 2015, "We were stable, had a growing membership and could have been successful if we had received those payments. We relied on the payments in pricing our plans."[9] Second, it would have been difficult for insurers to know, even after Cromnibus, exactly how little the RC program would pay out, because the exact payment amount depends on the realized revenues and losses of all insurers. Third, the Department of Health and Human Services (HHS), which oversees the RC program, continued to indicate as late as February 2015 (two months post-Cromnibus) that it expected all RC claims to be paid in 2016. Even if contributions fell short of claims, the regulations indicated that "HHS will use other sources of funding for the risk corridors payments, subject to the availability of appropriations."[10] These appropriations ultimately did not become available, of course. In fact, such assurances may have persuaded some insurers that the RC payments would eventually come through. The shortfall of the RC

[9] See "Marco Rubio Quietly undermines Affordable Care Act," https://www.nytimes.com/2015/12/10/us/politics/marco-rubio-obamacare-affordable-care-act.html, Robert Pear, December 9, 2015, last accessed 7/11/2017.

[10] See "Patient Protection and Affordable Care Act; HHS Notice of Benefit and Payment Parameters for 2016," 80 FR 10749, 10749-10877.

program became the clear October 1, 2015 through a CMS letter stating that 2014 RC payments would be prorated at 12.6 percent.[11] At that point, it was too late to adjust premiums for 2016. Therefore, while we expect the effect of RC defunding on premiums and participation to occur the earliest for the 2016 coverage year, for some insurers, it may not be until the 2017 coverage year. Dozens of insurers, including a class action with over 116 insurers sued the government over the unpaid RC claims. After a long litigation process, on April 27, the Supreme Court voted 8-1 that the government was obligated to make the RC payments owed to insurers in 2014, 2015 and 2016 (Keith, 2020).

3.3 The Minimum Medical Loss Ratio Requirement

The RC program interacted with another ACA regulation: the minimum medical loss ratio (MLR) requirement, which requires that insurers' qualified medical expenses equal at least 80 percent of their premium revenue in the individual market. If expenses fall below this target, then insurers must rebate the difference to their enrollees. The MLR appears to be a reasonable target for regulating insurers' profits (Karaca-Mandic, Abraham, Simon, 2015). The MLR's 80 percent target roughly coincides with the 80 percent target for the RC program.[12] For the purposes of MLR calculations, RC contributions count as cost (i.e. RC contributions are paid before MLR rebates). As a result, although the RC program subsidizes insurer losses, it does not penalize insurer gains, because the required RC contribution for a high-margin insurer would go to the MLR program in the absence of the RC program.

[11] https://www.cms.gov/CCIIO/Programs-and-Initiatives/Premium-Stabilization-Programs/Downloads/RiskCorridorsPaymentProrationRatefor2014.pdf

[12] An important distinction to make is that MLR is defined at the state-year level for the entire individual market business of an insurer, including both the Marketplace and the off-Marketplace segments. On the other hand, RC is defined for an insurer-year, only for the Marketplace segment. The MLR target and the RC target can diverge if off-Marketplace business is an important part of an insurer's individual market operations. However, for insurers in our analysis sample, Marketplace premiums represent 89 percent of all premium review in 2015, and Marketplace costs represent 98 percent of all costs.

4. Model

We develop a model of the RC program to understand its implications for firm-level pricing and participation decisions, as well as market-level premiums.

4.1 Firm-level pricing decisions

We begin by considering the premium response of a single insurer to the incentives created by the RC program. We model insurers as price setters here because the ACA's guaranteed issue provision bars insurers from setting quantity—they must sell insurance to everyone who demands it. We focus on price setting rather than cost reduction because we believe that insurers can much more easily control their prices than their costs. We assume that insurer i sets premiums to maximize profit, equal to revenue less total variable costs and fixed costs, plus a RC transfer:

$$\pi_i = p_i q_i(p_i, p_{-i}) - VC_i(p_i, p_{-i}) - F_i + RC_i,$$

where q_i is demand, VC_i is variable cost, and F_i is the fixed cost. In general, π_i depends on the premiums of all the competitors of i, p_{-i}, but for notational simplicity we omit this dependence in this subsection, and we drop the i subscript. We write variable cost as the product of demand $q(p)$ and an average cost curve $AC(p)$.[13] Average cost may depend on price because of adverse selection, which implies that as the price rises, relatively healthy people are less likely to buy coverage, resulting in higher average costs of the insured.[14] The risk adjustment program may offset adverse selection; the extent or presence of adverse selection does not affect our results.

We model the RC transfer to firm i as a piecewise linear function of variable costs $VC = cq$, with kink points determined by the cost target, which is equal to revenue $R = pq$, scaled by a

[13] We think of marginal costs here as reflecting both actual claims costs and associated variable costs, such as utilization review and disease management. These associated costs also count as costs for the RC program.
[14] Einav, Finkelstein, and Cullen (2010) model adverse selection in this way.

factor T. In the individual insurance market, $T = 0.8$. There are five line-segments, with four kink points, $k_1, \ldots, k_4$, and four non-zero slopes $m_1, \ldots, m_4$. These kink points are 0.92, 0.97, 1.03, and 1.08 and the slopes are 0.8, 0.5, 0.5, and 0.8, as shown in Figure 1.

We write the RC payment function as

$$RC(VC, R) = \begin{cases} m_1(VC - k_1TR) + m_2(k_1 - k_2)TR, & VC \leq k_1TR \\ m_2(VC - k_2TR), & k_1TR < VC \leq k_2TR \\ 0, & k_2TR < VC \leq k_3TR \\ m_3(VC - k_3TR), & k_3TR < VC \leq k_4TR \\ m_4(VC - k_4TR) + m_3(k_4 - k_3)TR, & k_4TR < VC \end{cases}$$

At the program parameters, this works out to

$$RC(VC, R) = \begin{cases} 0.8VC - 0.5688R, & VC \leq 0.736R \\ 0.5VC - 0.388R, & 0.736R < VC \leq 0.776R \\ 0, & 0.776R < VC \leq 0.824R \\ 0.5VC - .412R, & 0.824R < VC \leq 0.864R \\ 0.8VC - 0.6712R, & 0.864R < VC, \end{cases}$$

The RC payment is affected by prices in two ways, through both revenue and costs. As long as demand responds to prices, the program creates complex pricing incentives, as Panel A of Figure 1 illustrates. With inelastic demand, the RC function is simply piecewise linear in p. With elastic demand, however, the function is highly nonlinear, and can give rise to surprising pricing incentives.

We begin by providing some intuition on how the RC program skews pricing incentives, particularly for claiming insurers. Inspection of the RC equation reveals that claiming insurers would increase their profits if they could raise costs and revenue by one dollar each. Doing so raises RC payments by about \$0.13, and otherwise leaves profits unchanged. It may seem surprising that raising both revenue and costs can increase RC payments, since on the margin each \$1 of cost above the target only raises payments by \$0.8. The reason this strategy is profitable is that the target rises slower than revenue. Increasing revenue and cost by \$1 raises the target by only \$0.8, and so the RC payment by roughly \$0.16 (=0.2*0.8). (The exact increase in RC payment is \$0.13 because the RC program only covers 80 percent of costs that exceed 108 percent of the target). These calculations suggest that, on the margin, claiming insurers might prefer small or even negative mark ups. Thus, we expect that the RC program distorts downward the pricing decisions of claiming firms.

We show this more formally by considering the first order condition for an insurer that is on the last line segment, meaning that its costs are more than 8% above its target, or put differently that its premium is low relative to its target. The first order condition for such an insurer is

$$p = \frac{(1-m_4)}{1-T(m_4k_4 - m_3(k_4-k_3))}\left[AC(p) - \frac{AC'(p)}{\eta}\right] + \frac{1}{\eta} = s\left[AC(p) - \frac{AC'(p)}{\eta}\right] + \frac{1}{\eta}, \qquad (1)$$

where $\eta \equiv -\frac{\partial q}{\partial p}/q$ is the firm's semi-elasticity of demand, and $s \equiv \frac{(1-m_4)}{1-T(m_4k_4-m_3(k_4-k_3))}$. In the absence of the risk corridor program, the first order condition is

$$p = AC(p) - \frac{AC'(p)}{\eta} + \frac{1}{\eta}.$$

Equation (1) is equivalent to the usual first order condition for a profit-maximizing firm, except for two factors. First, adverse selection means that when the firm raises its price, its average cost may rise as well, making it want a lower price, all else equal; the $AC'(p)$ term captures this effect. Second, the firm acts as if it faces cost curve of $sAC(p)$ rather than $AC(p)$. At the program parameters, $s \approx 0.61$, so the RC program induces insurers with large claims to price as if they faced a 39 percent marginal cost subsidy. For insurers locating on the second-to-last budget segment, the first order condition implies a subsidy of 15 percent of marginal cost.[15]

[15] For such insurers, the first order condition is $p = \frac{1}{\eta} + s'AC - \frac{s'AC'}{\eta}$, where $s' = \frac{1-m_3}{1-m_3k_3T} = 0.85$.

Figure 1, panel B illustrates the pricing distortion created by the RC program. We show variable profit as a function of premium, for an insurer with constant average costs normalized to 1 and an iso-elastic demand curve with an elasticity of $\epsilon = -4$.[16] With this demand curve, the insurer optimally charges a premium of $(1 + 1/\epsilon)^{-1}$ percent of cost. In the absence of the RC program, the optimal premium is 133 percent of cost. With the RC program, if the insurer did not re-optimize, it would end up making a payment into the RC program equal to roughly half of its profit. With re-optimization, however, the insurer can do better by charging a much lower premium and making a large RC claim. With the RC program, the insurer acts as though it faces a cost of 0.61, and so it charges a markup of 33 percent above that, or a premium of 81 percent of its true cost (i.e. 1.33*0.61). The RC's implicit subsidy is so large that it can be optimal for a firm to price below cost.

4.2 Reinsurance, Risk Adjustment, and Cost-Sharing Reductions

Our model easily accommodates reinsurance and risk adjustment, and our results are essentially unchanged once we incorporate them.[17] These programs both essentially involve changing the average cost function. Reinsurance can be modelled as a reduction in average costs equal to the expected reinsurance payment per enrollee. Cost-sharing reductions (CSR) are additional discounts that reduce the enrollees' copayments, coinsurance or deductible if they meet income eligibility criteria. As such, risk adjustment and cost-sharing reductions affect pricing decisions by changing the average cost function (but not revenue). We can therefore account for these programs by defining an effective average cost, $\widetilde{AC}(p)$ as

[16] This may seem like a very elastic demand curve, but Abraham et al. (2017) estimate that the average Marketplace plan in 2015 had an elasticity of -4.6 with respect to the unsubsidized premium (i.e. gross of the premium tax credit), which is the relevant elasticity from the insurer's perspective.

[17] Here we abstract from the influence of risk adjustment on benefit design, which Geruso, Prinz, and Layton (2017) study.

$$\widetilde{AC}(p) = AC(p) + Reinsurance(p) + RiskAdjustment(p)$$

where $Reinsurance(p)$, and $RiskAdjustment(p)$ are the expected per-enrollee reinsurance, and Risk Adjustment, payment when the premium is p. Risk Corridor payments are calculated on costs net of reinsurance, risk adjustment, and CSRs, so the first order condition for optimal pricing under the RC program becomes

$$p = s\left[\widetilde{AC}(p) - \frac{\widetilde{AC}'(p)}{\eta}\right] + \frac{1}{\eta}.$$

Allowing for reinsurance or cost sharing reductions does not change the conclusion that the RC program causes insurers to price as though they face an average cost curve scaled by s.

4.3 Insurer participation decisions

Given participation decisions, the RC program distorts premiums downward. The RC program may also affect insurer participation in the Marketplace. To see this, let π_i^* be firm i's maximal profit, assuming it decided to participate. Insurer i participates if $\pi_i^* > F_i$. The RC program affects participation by changing maximal profit. It is straightforward to see that the RC program must increase profit. At any premium, profit is weakly higher under the RC program (given MLR regulations), so the maximal profit must also be higher under RC program. Thus, our model implies at least a small effect of the program on participation.

However this effect need not be large. In particular, even firms making large risk corridor claims may experience small changes in profit and therefore small changes in participation probabilities. Figure 1 gives the intuition. Under the RC program, the firm charges a low premium and receives a large risk corridor payment. Absent the RC program, the firm would charge a much higher premium, undoing most of the loss from the end of the RC program. Thus, even though insurers suffered large losses from the surprise defunding of the RC program, there is no guarantee that insurers will have low profit going forward.

5. Data

5.1 MLR filing data

The MLR filing data are derived from reports that insurers submit annually to the Center for Medicare and Medicaid Services to document their compliance with the minimum MLR requirements. Since 2014, insurers also report information on their Marketplace business, including any RC claims or contributions. The MLR filing data are publicly available.[18] The unit of observation is an insurer-state, since MLR filings, insurance regulation, and premium rate review occur at the state level. (We will often refer to observations as "insurers" for simplicity, noting that an insurer is actually an insurer-state, such as "Aetna in Indiana.")

We use the 2014 and 2015 MLR filing data to define our independent variables and our analysis sample. Our key independent variables are premiums earned, medical claims incurred (net of risk adjustment payments made or received, and cost sharing reduction (CSR) subsidies received), member-months of enrollment, reinsurance payments (through the premium stabilization program), and, most importantly, RC claims. We define insurers as claiming if they have positive RC claims, contributing if they have negative RC claims, and neutral if they have zero RC claims.

We define the analysis sample as insurers in the MLR data that met several sample selection criteria. First, we only consider insurers who reported positive Marketplace enrollment, Marketplace premiums, and Marketplace medical claims in their 2015 MLR filings. We focus on Marketplace participation because only Marketplace plans are eligible for RC payments, and we

[18] See https://www.cms.gov/CCIIO/Resources/Data-Resources/mlr.html

define the sample based on 2015 variables because future values of RC claims are affected by its defunding. Next, we follow a two-step procedure suggested by Karaca-Mandic et al. (2015) to identify and exclude erroneous observations from the raw data. First, we flag observations with extreme values, defined as insurers with claims cost incurred and premiums revenue both in the top or bottom percentile; or with, either RC net payment per member per month (PMPM)[19] or ratio of claims to premiums fell into the top or bottom percentile. Second, we exclude the six flagged observations in 2015 with fewer than 1,000 member-years of enrollment. We excluded these insurers because the MLR regulations do not apply to insurers with fewer than 1,000 member-years, and we are concerned about small insurers having implausibly large ratios of claims to premiums (and hence large RC payments per member). This leads to a sample of 339 insurer-states participating in 2015. We excluded two insurers whom we could not match to the HIX data (described below), for a final sample of 337 insurers participating in 2015, of whom 282 continued to participate in 2016, and 204 in 2017.

5.2 HIX Compare Data

The HIX dataset, compiled by the Robert Wood Johnson Foundation, contain information on the premiums and characteristics of Marketplace plans offered in 2014-2017.[20] We observe each plan's metal level (measuring plan's generosity, with bronze being the least generous and platinum being the most), plan type (PPO, HMO, EPO, POS, or other), and premium. The ACA

[19] For claiming insurers, this amount is the payment per member-month that they expected to receive from the RC program, while for contributing insurers, this is the payment per member-month that they contributed to the RC program.

[20] We obtained the 2014 and 2017 data from http://www.rwjf.org/en/library/research/2017/04/hix-compare-2014-2017-datasets.html. The 2015 and 2016 data were incomplete so we obtained an updated from Vericred, the data vendor. We expect that these data will be publicly available soon. We found that the 2014 and 2015 data sets are incomplete; some insurers with Marketplace enrollment in the MLR data do not appear in the latest data release. (There were two such insurers in 2014, and 15 in 2015). By combining these two releases, we ended up with a nearly complete set of all Marketplace offerings in 2015-2017 and silver offerings in 2014. We believe we have all or nearly all offerings because of the very high match rate between the MLR and HIX data: 337 of the 339 Marketplace insurers in the MLR in 2015 are also in the HIX data, and 283 of the 286 in 2014.

allows insurers to charge different premiums in different geographic rating areas, which are typically aggregations of counties; we observe each plan's premium in each area where it is offered. We exclude 23 plans with monthly premiums over $10,000, which we believe are erroneous. In 2015-2017, we observe all plans in all rating areas. In 2014, however, we only observe silver plans for the states that did not use healthcare.gov (for the healthcare.gov states, we observe all plans). We observe the Health Insurance Oversights System (HIOS) identifier of the insurer offering each plan, except for a handful of 2014 plans in state-based marketplaces, where we impute it based on the reported insurer's name.

We use the HIX dataset to define our insurer-year level outcomes. Our first outcome is an insurer-year level premium index, obtained by aggregating premiums across plans and rating areas, and adjusting for plan characteristics. Although we observe premiums at the plan level, we aggregate premiums to the insurer-state level because RC claiming varies across insurer-states, not plans. To aggregate, we estimate the following hedonic regression for the log premium of plan i offered by insurer-state observation j in rating area a and year:

$$\log p_{ijat} = \mu_{metal} + \tau_{type} + \gamma_{at} + \theta_{jt} + \varepsilon_{ijat}.$$

This regression projects log premiums onto fixed effects for metal level, plan type, rating area-year, and insurer-state-year.[21] We take the insurer-state-year fixed effect $\hat{\theta}_{jt}$ to be the premium index of insurer-state j in year t. It measures how high j's premiums are in a given year, adjusting for the generosity (i.e. metal level) and type of plans j offered, as well as characteristics of the market where j offered plans in year t. We normalize the premium index to zero in 2015 for each insurer-state.

[21] The dependent variable in these regressions is the premium a 27-year-old would pay. The premium for any other age is equal to this premium times an age factor, so the log price index we estimate is valid for all ages.

Our second outcome is simply Marketplace participation, coded as one if an insurer-state offers at least one plan in any rating area in the HIX data in a given state and year.[22] We define participation as an indicator variable equal to one if an insurer-state offers at least one Marketplace plan in a given year. By construction, participation is equal to one in 2015 in our analysis sample.

5.3 Summary statistics

Table 1 presents summary statistics for the insurer-year dataset, separately for claiming, neutral, and RC contributing insurers in 2015. Of the 337 Marketplace insurers in 2015, 74 percent (N=248) were claiming, and 9 percent (N=31) were contributing; the remaining 17 percent (N=58) were neutral. Among claiming insurers, RC claims were large: $53 per member month, or about 12 percent of average medical claims costs. Claiming insurers did not have especially low premium revenue, but they did have high claims costs and high reinsurance payments,[23] Consistent with these high costs, claiming insurers had high reinsurance payments. Claiming insurers were more likely to have participated in the 2012 market: they had more covered lives, and a larger share of them covered at least 1000 lives. Unadjusted rates of participation fell substantially for claiming insurers; only 80 percent participated in 2016, and 54 percent in 2017. For claiming, contributing, and neutral insurers, premium indexes increased on average in 2016 and 2017, but the increase was especially large for claiming insurers.

6. Empirical approach and results

[22] We use the HIX data rather than the MLR filing data to define participation because the MLR data are only available through 2015.
[23] This might seem inconsistent with our model, which implies that claiming insurers have low premiums but not necessarily high costs. The claims and premiums in Table 1, however, are not adjusted for differences across insurers in the generosity of plans they offer, and indeed claiming insurers also offer relatively generous plans.

6.1 Approach

The model implies that the RC program reduced premiums for claiming insurers relative to their non-claiming competitors. Empirically, we examine whether claiming insurers had larger premium increases after the 2016 RC defunding and 2017 program end. We take advantage of the fact that RC defunding and ending affect 2016 and 2017 decisions, but not earlier ones, and that they have differentially implications for firms who would make claims under the program, not neutral or contributing firms. We therefore compare the change in outcomes from 2015 to 2016 or from 2015 to 2017, for RC claiming insurers, relative to non-claiming insurers, both and contributing ones. It might seem strange to include RC contributing insurers in the "control" group, since their premium decisions seem affected by the RC program. However, as we noted in Section 2.3, for RC contributing insurers, the minimum MLR requirements supersede the RC program, and the RC program has no additional effect on premiums or profits. Our approach allows for controlling for simultaneous trends such as changes in the reinsurance program or late Medicaid expansions, as well as any other shock at the state-year level that is common to all insurers.

Specifically, we estimate the following model for premium growth:

$$p_{jt} - p_{jt_0} = \alpha\, 1\{RC\ Claim_j > 0\} + X_j\theta + \mu_s + \epsilon_{jt}. \qquad (2)$$

Our dependent variable is the difference in the premium index (in logs) of insurer j (recall that insurer j represents an insurer-state pair) between year t and a base year t_0 (2015 in our main specifications, 2014 in placebo tests). We estimate separate models for the 2015-2016 premium changes, the 2015-2017 premium change, and (as a placebo test) the 2014-2015 premium change. The key coefficient of interest is α, the coefficient on an indicator for whether insurer j

has any RC claims in the base year. α measures the differential premium increase for such insurers, relative to non-claiming insurers, after adjusting for our controls.

There are of course many reasons beyond the RC program itself that claiming and non-non-claiming insurers might have differential premium growth. Our controls are designed to account for as many of these reasons as possible. In particular, we control linearly for bas year medical claims expenses (net of risk adjustment and CSR payments), premium revenue, and enrollment (measured as member months). These controls address the concerns that mean reversion in premiums or higher base year costs explain differential premium growth. These controls are potentially important because RC claiming is a function of base year premium revenue and claims costs. (It is possible to control for these variables because RC claiming is a nonlinear function of them.) We also control for insurer characteristics (nonprofit status and membership in a large insurer group such as Anthem) and state fixed effects, μ_s. These fixed effects account for statewide trends such as late Medicaid expansion or differential support for the Marketplaces.

We also conduct placebo tests based on the premise that RC claims in 2014 should not be correlated with premium or participation decision in 2015, because insurers made their 2015 pricing and participation decisions without knowledge that the RC program was defunded. It is possible, however, that mean reversion in premiums and claims, or other failures of parallel trends, yield differential trends among claiming insurers. In that case we would expect to see an "effect" of the RC program defunding even in 2015.

Our empirical approach relates premium changes to prior year RC status, and therefore implicitly assumes substantial persistence in RC claiming. We think of RC claims in 2015 as a proxy for "would have made an RC claim in 2016 or 2017, had the RC program not been defunded or ended." This interpretation is valid only if there is indeed a high correlation between past and current RC claims. Appendix Table A1 documents this persistence, showing high autocorrelation between 2014 and 2015 in both an indicator for making an RC claim, and the amount claimed.

We perform a similar analysis to look at insurer participation. We estimate the association of the RC program with Marketplace participation with regressions of the following form:

$$\Pr(Participate_j\ ) = L\big(\alpha 1\{RC\ Claim_j > 0\} + X_j\theta + \ \mu_{s)}\big), \tag{5}$$

where L is the logit function and our outcome is Marketplace participation in 2016 or 2017. We control for the same variables used in the premium analysis: premiums per member month, claims per member month, member months of enrollment for insurer j, all in 2015, as well as not-for-profit status, membership in a large insurer alliance, and state fixed effects.[24] Note that we look at the level of participation rather than the change in premiums, because our sample consists of insurers who participated in the base year. Thus in a sense we are looking at changes in participation, and our participation decision can be understood as not exiting.We ask whether participation is more likely to change in 2016 (and in 2017) among insurers with larger RC claims in 2015, relative to other insurers in the same state and adjusting for insurers' financial position.

6.2 Results

We present the estimates for premiums in Table 2. In column (1) we show results from our baseline specifications; we discuss the remaining columns as robustness checks. In Panel A

[24] In some states the 2016 and 2017 participation rate was 100 percent, so their fixed effects are not identified, and we must omit them. In robustness tests below, we estimate linear probability models with state fixed effects, in which case we can include all states.

we look at the 2015-2016 price change. Consistent with the model, we estimate that RC claiming insurers have higher premium growth in 2016 (relative to their 2015 premiums), but the effect is not statistically significant. In Panel B, we repeat the same estimation for the premium difference from 2015 to 2017. We estimate a coefficient of 0.07 on RC_j, meaning that insurers who made a RC claim in 2015 increased their prices by 7 percent more than other insurers in the same state in 2017, after adjusting for differences in medical claims, premium revenue, enrollment, and insurer characteristics. The larger effect in 2017 than in 2016 is consistent with the possibility that insurers placed a positive probability on eventually receiving their RC claims. To give a sense of the magnitude, note that in our sample, premium growth averaged about 28 log points between 2015 and 2016, and about three-quarters of insurers made RC claims. Interpreting our estimates in a causal way, these claiming insurers would have had 7 log point lower premium growth had the RC program not ended, and overall premiums would have grown by about 20 percent less than it actually did.

Table 3 shows the estimates for Marketplace participation. Our baseline estimates are in column (1), presented as adjusted log odds ratios. We find no statistically significant relationship between RC claims and 2016 participation or 2017 participation. These specifications therefore show little participation effects of the RC program. We conclude that rather than exit the marketplace entirely, insurers reacted to the end of the RC program by raising premiums. This conclusion may be surprising, as several insurers cited RC defunding to explain their decision to exit the Marketplaces.[25] We find no differential participation between claiming and non-claiming insurers because non-claiming insurers were also fairly likely to exit the Marketplaces, and (especially) because we adjust for the precarious financial position of claiming insurers.

[25] See, e.g,. https://www.modernhealthcare.com/article/20151012/NEWS/151019994/kentucky-co-op-blames-inadequate-risk-corridor-funding-for-closure.

6.3 Robustness checks

We show robustness of our premium estimates in columns (2)-(6) of Table 2. A key concern with our estimates is that, by construction, insurers with large RC claims in 2015 had high costs relative to premiums. Our main specifications address this concern by controlling linearly for 2015 medical claims and premium revenue, as well as total enrollment. However, there need not be a linear relationship between premium growth and prior medical claims, revenue, or enrollment. In column (2) of the table, we add controls for all second-order terms: quadratics for medical claims, premium revenue, and enrollment, plus all two-way interactions. Because RC claiming is a nonlinear function of these variables, controlling for them ends up raising our standard errors. The estimated coefficients are a bit smaller and the 2017 coefficient is now marginally significant (p=0.07). In column (3), we add richer controls for the insurer, in particular we add a set of dummy variables indicating Blue status, and indicating membership in each of the five largest insurer alliances (Aetna, Cigna, Humana, United HealthCare, and Wellpoint). These additional controls change the estimated coefficients only slightly. In column (4), we control for 2015 reinsurance claims PMPM (discussed in more detail in Section 7.3 below), and in column (5) we control for all variables considered. The coefficients are quite similar to the baseline estimates. In column (6), we exclude from the sample RC contributors, insurers who paid into the RC program in 2015. Thus in this column we are identified by comparing claiming insurers to neutral insurers, whose claims are between 77 and 83 percent of premium revenue, and who therefore more closely resemble claiming insurers. We continue to find similar effects of the defunding and end of the RC program, although the 2017 standard error rises and the point estimate is only marginally significant (p=0.07), reflecting our lower power. Overall we conclude that our premium estimates are not highly sensitive to the exact set of controls used or the comparison group.

We perform an analogous set of checks for participation in columns (2)-(6) of Table 3. We go through the same robustness tests as in the premium specifications, controlling nonlinearly for the financial variables, adding richer insurer controls, controlling for reinsurance, or excluding contributors. In none of the specifications do we find a significant association between RC claiming and insurer participation. In the final column, we estimate a linear probability model, and we continue not to find a significantly negative association (for 2016 we find a marginally positive association). Thus the non-association between participation and RC claiming is robust to alternative controls and specifications.

7. Alternative explanations

We have found robust evidence that insurers making RC claims in 2015 had larger premium growth in 2016 and especially 2017 than did non-claiming insurers. This differential growth is consistent with the predictions our model. Here we consider, and rule out, several alternative explanations.

7.1 Mean reversion

A simple explanation for the observed differential premium growth is mean reversion. Claiming insurers have low premium revenue (relative to costs) and non-claiming insurers have higher revenue. Our baseline specifications adjust for mean reversion by controlling for baseline premium revenue and costs, but it is possible these controls are inadequate. To test this possibility, we re-estimate our models for premium growth and participation, but instead we take 2015 as the outcome year and 2014 as the base year. We do not expect to find any differential growth (or participation) in 2015 because the RC program was not defunded until after coverage year 2015 decisions were set. But if mean reversion explains our results, we should still see differential changes for RC claiming insurers. We show this placebo test in Table 4. For both outcomes, we estimate small and insignificant coefficients on RC claiming. Differential trends by claiming status do not appear to explain the results.

7.2 "Invest-then-harvest" pricing strategies

An alternative explanation is that these premium increases represent an "invest-then-harvest" or "penetration pricing" strategy whereby insurers initially price low, to achieve high market share, and then raise premiums, exploiting substantial inertia in health insurance enrollment (e.g., Handel, 2013). Ericson (2014) shows that insurers pursued such a strategy during the rollout of Medicare Part D. As low-premium insurers receive RC payments, this strategy generates a correlation between RC claims and future premium growth.

To investigate this possibility, we test for invest-then-harvest pricing, following the test of Ericson (2014). The idea is that under invest-then-harvest strategies is that in a given year, older plans should have higher premiums than newer plans, all else equal, because a greater share of their demand consists of inert enrollees who have already made their enrollment decisions. To test this prediction, we estimate the following regression:

$$\ln p_{ijast} = \beta_1 \left(age_{ijast} = 2 \right) + \beta_2 \left(age_{ijast} = 3 \right) + Fixed\ Effects + \epsilon_{it}, \qquad (6)$$

where $\ln p_{ijast}$ is the premium of plan i offered by insurer j in area a, state s, and year t, and age_{ijast} measures the age of the plan in a given rating area, i.e. the number of years it has been continuously offered in that rating area, as of t. We include fixed effects year-by-area, year-by-metal level, and year-by-insurer fixed effects.[26] (Note that, although we have four years of data,

[26] These regression contains a large vector of fixed effects, so we estimate them using the *reghdfe* command, described in Correia (2016).

we cannot identify an age fixed effect because it is collinear with a 2017 dummy.) The invest-then-harvest strategy implies that $0 < \beta_1 < \beta_2$. We estimate equation (6) treating each plan in a given rating area as a different insurance plan, since insurers can charge different premiums for the same plan in different rating areas.[27] We report these estimates in Table 5. Across all specifications, the plan age effects are economically small—never larger than 0.01—and statistically insignificant. We conclude that penetration pricing is not an important explanation for the patterns we have documented.[28]

7.3 The end of reinsurance program

The reinsurance program ended at the beginning of 2017, at the same time the RC program ended. This is only a problem for our analysis to the extent that reinsurance differentially affected RC claiming insurers, however. RC claiming insurers had high reinsurance payments in 2015, as Table 1 shows, so perhaps they raised their premiums in 2017 because of the end of reinsurance. To investigate the importance of reinsurance, we add 2015 reinsurance payments per member per month as an additional control. The estimates are in Table 6 (as well as column 4 of Tables 2 and 3).

We find that the estimated coefficient on RC claiming becomes larger when we control for reinsurance, as the comparison of columns (1) and (2) in Table 6 show. This is surprising because we also find that reinsurance payments in 2015 are positively associated with price growth in 2017. In columns (3)-(5) of the table, we show that conditional on our controls,

[27] Note that, although we have four years of data, we cannot identify an age fixed effect because it is collinear with a 2017 dummy

[28] Note that this finding in no way invalidates the results in Ericson (2014). The Health Insurance Marketplaces differ in important ways from Medicare Part D. In particular, there is considerable churn in the Marketplaces, as people may lack employer-sponsored insurance in one year and then obtain it the next, whereas there is essentially no churn in eligibility for Medicare.

reinsurance payments are negatively correlated with RC payments. This explains why our results are robust to controlling for reinsurance, despite the clear unconditional correlation between reinsurance and RC claiming, and the conditional association between reinsurance payments in 2015 and subsequent price growth.

7.4 Mispricing and insurer learning

A potential alternative explanation for our results is insurer learning. In 2014 insurers faced considerable uncertainty about the costliness of Marketplace enrollees, and some insurers may have set premiums too low. Such insurers would have made RC claims early on, and then raised their premiums, even independent of any true effect of the RC program.

Although insurer learning likely contributes to the overall price dynamics during this period, several factors suggest that insurer learning do not explain all the results here. First, we observe no response in 2015 to 2014 RC claiming, although learning would imply faster premium growth in 2015 for 2014 claiming insurers. Second, we control for premiums and claims, so we control for premium changes that are linearly related to premiums and claims. Third, if learning or mispricing is a problem, then it is likely a problem for neutral as well as claiming insurers, as neutral insurers have thin margins as well. Yet we see in Table 1 that neutral insurers have premium changes like contributing insurers, not like claiming insurers. Fourth, we proxy for the importance of learning by looking at insurer experience with the individual market. We define experienced insurers as ones with at least 1,000 covered lives in the 2012 individual market. Such insurers were more likely to make RC claims, as Table 1 shows. If learning were important, we would expect a smaller differential premium growth for experienced insurers than for inexperienced insurers. But in Table 7 we show that the association between RC claiming and future premium growth is strongest for experienced insurers. . Under the hypothesis that these insurers understood the market best, this is suggestive evidence that learning does not explain the observed association between RC claiming and premium growth. We view this evidence as suggestive, because experience in 2012 may be an unreliable guide to 2014, after community rating and guaranteed issue came into effect, and because the estimates in Table 7 are somewhat noisy. Nonetheless the available evidence suggests that, although learning is important in influencing premium and participation dynamics during this period, it likely does not explain our key findings.

8. Conclusions

In 2016 and 2017, premiums in the Health Insurance Marketplaces rose rapidly, while insurer participation fell. At the same time, the RC program was defunded and then ended. Collectively, insurers in 2015 expected to receive billions of dollars from this program. We have shown theoretically that the RC program encourages claiming insurers to reduce their premiums, so the end of the program could have caused premiums to rise. Empirically, we find that insurers making RC claims in 2015 had larger premium increases by 2017, adjusting for observable characteristics as well as differences across states. We found no evidence, however, that insurers making RC claims were particularly likely to exit the market. It is possible nonetheless that the RC program encouraged participation of insurers not in the market in 2015. One motivation for the program was to protect insurers from aggregate uncertainty in 2014 about the likely composition of enrollees. Our design, which looks at behavior after this uncertainty is resolved, cannot detect this effect. Our results suggest that government-insurer risk sharing programs can have meaningful unintended consequences for premiums.

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TABLES

Table 1: Insurer-state level summary statistics

Insurer type:	Claiming		Contributing		Neutral	
	Mean	SD	Mean	SD	Mean	SD
2015 variables:						
Risk corridor claims PMPM	52.5	54.8	-9.8	9.6	0	-
Premium revenue PMPM	362.65	83.43	372.66	59.93	368.79	65.69
Medical claims costs PMPM	433.03	140.98	280.31	67.15	317.5	83.13
Member months (1000s)	495.4	1,060.60	247.4	422.5	479.0	1,051.10
Reinsurance claims PMPM	58.0	39.8	28.9	18.7	35.9	20.3
2012 Individual market						
Covered lives (1000s)	13.9	43.2	3.9	18.9	4.6	8.6
% Covering > 1000 lives	42	50	19	40	40	40
Participation, by year						
2015	1.00	-	1.00	-	1.00	-
2016	0.80	0.40	0.94	0.25	0.93	0.26
2017	0.54	0.50	0.74	0.44	0.79	0.41
Premium index, by year						
2015	0	-	0	-	0	-
2016	0.10	0.11	0.04	0.08	0.04	0.14
2017	0.32	0.19	0.15	0.14	0.16	0.15
Number insurers	248		31		58	

Notes: Sample consist of insurer-states participating in the Health Insurance Marketplace in 2015 and meeting the sample restrictions described in the text. Claiming insurers have positive RC claims, contributing insurers have negative RC claims, and neutral insurers have zero RC claims. Premium revenue, medical claims costs, member months, and RC are derived from insurer's annual MLR filings. "PMPM" means "per member per month." Participation is a dummy variable indicating whether the insurer offers any Marketplace plans, and price index is an index of the log price of plans offered by the insurer, adjusting for plan and market characteristics in a given year, with 2015 normalized to zero. Price index is missing for insurers who exit the Marketplaces.

Table 2: Risk Corridors claiming and premium growth

Specification:	Baseline	Nonlinear controls	Richer insurer controls	Control for reinsurance	All controls	Exclude contributors
	(1)	(2)	(3)	(4)	(5)	(6)
	A. Outcome = Change in log premium index, 2015 to 2016					
$1\{Claim > 0\}$	0.027	0.016	0.033	0.025	0.022	0.025
	(0.021)	(0.022)	(0.023)	(0.021)	(0.024)	(0.026)
# Insurer-states	282	282	282	282	282	253
	B. Outcome = Change in log premium index, 2015 to 2017					
$1\{Claim > 0\}$	0.072	0.057	0.072	0.086	0.064	0.068
	(0.032)	(0.032)	(0.031)	(0.032)	(0.030)	(0.038)
# Insurer-states	204	204	204	204	204	181

Notes: Table shows the coefficient from a regression of insurer price index on an indicator for "made RC claim." Additional controls always include medical claims per member month, premium revenue per member month, member months, nonprofit status, and membership in an insurer alliance and state fixed effects. In column (2) we add controls for all quadratic terms and interactions among claims per member month, premium per member month, member months, each interacted with year dummies. In column (3) we add controls a set of dummies indicating Blue status, and membership in each of the five largest insurer alliances, all interacted with year dummies. In column (4) we add controls for 2015 reinsurance claims PMPM. In column (5), we add all the controls tried in columns (2), (4), and (4). In column (5), we repeat the base specification but exclude insurers who made positive RC contributions. Robust standard errors in parentheses.

Table 3: RC claiming and Marketplace participation

Specification:	Baseline	Nonlinear controls	Richer Insurer controls	Reinsurance Controls	All Controls	Exclude Contributors	Linear probability model
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	A: Outcome = 2016 Marketplace participation						
$1\{RC\ claim > 0\}$	0.90	0.20	1.54	1.03	1.71	1.67	0.10
	(0.95)	(1.19)	(0.94)	(1.00)	(1.24)	(0.99)	(0.05)
Sample size	242	242	180	242	180	206	337
	B: Outcome = 2017 Marketplace participation						
$1\{RC\ claim > 0\}$	-0.75	-0.31	-0.36	-0.62	0.00	-0.89	-0.11
	(0.52)	(0.56)	(0.67)	(0.53)	(0.73)	(0.68)	(0.07)
Sample size	311	311	298	311	298	247	337

Notes: Table shows the estimated coefficient from a regression of Marketplace participation in the indicated year on an indicator for positive RC claims. Additional controls always include premium revenue per member month, claims expenses per member month, and member months in 2015, as well as dummy variables for nonprofit status and membership in an insurer alliance, and state fixed effects. Because we include state fixed effects, the sample excludes states with 100 percent participation in the indicated year. In column (2), we also control for all quadratic terms and interactions among premium revenue per member month, claims expenses per member month, and member months. In column (3) we add controls a set of dummies indicating Blue status, and membership in each of the five largest insurer alliances. (United and Wellpoint had no exits in 2016, so these insurer groups are dropped.) In column (4) we add controls for reinsurance claims per member per month. In columns (5) we add the nonlinear controls, richer insurance controls, and reinsurance controls. In column (6) we use the base controls but exclude contributing insurers. Columns (1)-(6) are estimated with logistic regression and the reported coefficient is an adjusted log odds ratio. In column (7) we estimate a linear probability model. Robust standard errors in parentheses.

Table 4: 2015 outcomes and 2014 RC claiming (placebo test)

Outcome:	$p_{2015} - p_{2014}$	2015 Marketplace participation
	(1)	(2)
1{RC claims >0}	-0.012	0.25
	(0.041)	(1.08)
Specification	OLS	Logit
Sample size	255	102

Notes: Table shows no differential premium growth or continued participation in 2015 among 2014 RC claimants. This is a placebo test because the RC program was not defunded until after insurers had committed to their 2015 coverage year premiums and participation. The specification is the "baseline" specification of Tables 2 and 3. See notes to those tables for more details.

Table 5: Older plans do not have higher premiums

$y = \log Premium$	(1)	(2)	(3)	(4)	(5)
$1\{Age = 2\}$	-0.011	-0.010	-0.002	0.000	0.001
	(0.013)	(0.013)	(0.008)	(0.007)	(0.005)
$1\{Age = 3\}$	-0.009	-0.007	0.006	0.007	0.009
	(0.014)	(0.016)	(0.010)	(0.008)	(0.007)
Fixed effects for					
Plan-area	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes			
Metal-year		Yes	Yes	Yes	Yes
State-year			Yes		
Area-year				Yes	Yes
Insurer-year					Yes
# Observations	58,479	58,479	58,479	58,460	58,452
# Insurer-states	311	311	311	311	309

Notes: Table shows coefficients on indicators for plan age = 2 and age = 3, obtained from a regression of log premium on age indicators, as well as the indicated fixed effects. The unit of observation is an insurance plan in a given rating area and year. The sample is limited to observations belonging to non-singleton cells. Robust standard errors, clustered on insurer, in parentheses.

Table 6: The end of reinsurance does not explain the observed association between RC claiming and premium growth

Specification	Baseline	+Reinsurance	No controls	Control for claims, premiums, enrollment	All controls
	$Y = \ln p_{2017} - \ln p_{2015}$		$Y = 2015\ Reinsurance\ payments\ PMPM$		
	(1)	(2)	(3)	(4)	(5)
$1\{RC\ CLaim > 0\}$	0.072	0.086	0.191	-0.069	-0.103
	(0.032)	(0.032)	(0.040)	(0.029)	(0.034)
Reinsurance PMPM		0.129			
		(0.054)			
Observations	204	204	204	204	204

Notes: Table shows that controlling for reinsurance payments raises the coefficient on RC claiming, because reinsurance is conditionally correlated with price increases, but conditionally negatively correlated with claiming. Columns (1) and (2) show the results of regressing the change in log premiums between 2015 and 2017 on RC claiming dummy, reinsurance per member per month (in $100s), and the baseline controls (medical claims PMPM, premium revenue PMPM, member months PMPM, a nonprofit indicator, and an indicator for membership in a large insurer alliance. In columns (3)-(5) the dependent variable is reinsurance payments per member per month. There are no additional controls in column (3), controls only for claims, premiums, and enrollment in column (4), and the full set of controls in column (5). Robust standard errors in parentheses.

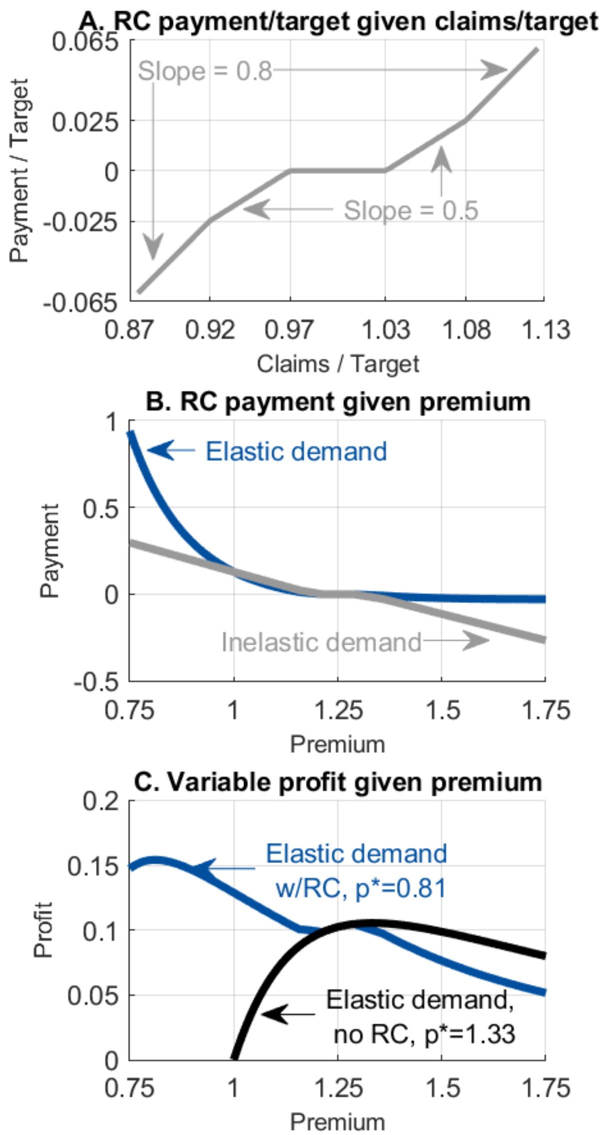
Table 7: Heterogeneity by prior individual market experience

Outcome	$p_{2016} - p_{2015}$			$p_{2017} - p_{2015}$		
Sample	All	Prior experience	No prior experience	All	Prior experience	No prior experience
	(1)	(2)	(3)	(4)	(5)	(6)
1{RC Claim >0}	0.027	0.075	0.004	0.072	0.092	0.063
	(0.021)	(0.036)	(0.032)	(0.032)	(0.048)	(0.051)
# Observations	282	108	74	204	84	120

Notes: Table show the coefficient on an indicator for 2015 RC claims. Additional controls, not shown, include (medical claims PMPM, premium revenue PMPM, member months PMPM, a nonprofit indicator, an indicator for membership in a large insurer alliance, and state fixed effects. Columns (1) and (4) use the full sample, columns (2) and (5) are limited to experienced insurers, and columns (3) and (6) are limited to inexperienced insurers. Insurers with prior experience are ones with at least 1,000 covered lives in the 2012 individual insurance market. Robust standard errors in parentheses.

FIGURES

Figure 1: Risk corridor payments and profit



Notes: Panel A shows the risk corridor payment as a function of medical claims, both scaled by the target amount, which is equal to 80 percent of premium revenue. Panel B shows the risk corridor payment as a function of premium, for an insurer facing the demand curve $q = p^{\epsilon}$, with $\epsilon = -4$ ("elastic demand") or $\epsilon = 0$ ("inelastic demand"), assuming marginal cost $c = 1$. Panel C shows variable profit for an insurer with elastic demand, under the risk corridor program ("w/RC") or not ("No RC").

Appendix tables

Appendix Table A1: Autocorrelation in risk corridor exposure, 2014 to 2015

Outcome	1{RC Claims >0}	RC Claims PMPM
	(1)	(2)
Coefficient on lag of outcome	0.248	0.58
	(0.058)	(0.12)
Constant	0.571	20.12
	(0.048)	(3.31)
Observations	249	249

Notes: Table shows the estimated autocorrelation coefficient obtained from a regression of the indicated variable in 2015 on its 2014 lag. Aggregate RC claims is the average risk corridor claim per member month, among insurers offering coverage in the rating area. The sample consists of insurers participating in both 2014 and 2015.