Understanding ACA Exchanges Market Stability under Adverse Selection

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Précis: ACA exchanges exhibit substantial adverse selection, but insurers have stabilized the market by attracting large enrollment volume to relatively low-generosity plans with assistance of subsidies.

Takeaway points:

Adverse selection is omnipresent when insurers cannot fully price insurance products based on risks. It threatens market stability if high-risk enrollees incur claims higher than the actuarially fairly priced premium and lack sufficient low-risk individuals to allow the insurers to break even. We estimated the extent to which adverse selection was present in the individual health insurance marketplaces (exchanges) and explored factors responsible for the low degree of adverse effect despite the presence of a high level of risk selection.

- Lack of detailed cost data and a proper comparison market limits previous research from quantifying the degree of adverse selection and attribute it to market (in)stability, which is important for insurers' participation decisions and policy interventions.
- We use a novel data set to compare medical spending among exchange enrollees to medical spending among commercially insured, small-group enrollees who had actuarially similar products from a large national issuer.
- The exchanges exhibit a higher tendency of high-risk individuals to enroll in richer products than that in the small-group market—adverse selection along the intensive margin.
- The much lower spending by exchange enrollees in less-rich products, who account for about 90% of total enrollment, offsets the destabilizing effect of adverse selection.

Abstract

Adverse selection continues to be a concern in the individual health insurance market in the United States. We estimated the extent to which adverse selection was present in the individual market by comparing medical spending among individual-market enrollees to medical spending among small-group enrollees insured with actuarially similar products from a large national issuer, 2014 through 2017. We found that individual-market enrollees only incurred higher spending than their small-group counterparts in the richest products (Gold and Platinum), which corresponded to less than 10% of person-years of individual market enrollment. Thus, the large majority of the individual market, which is covered by Bronze and Silver products, was not adversely affected by risk selection. Spending and enrollment patterns in cost-sharing reduction (CSR) subsidized Silver products – which tended to have lower average spending than actuarially comparable small-group products – suggest that CSR subsidies also played an important role in the stability of the individual market.

Introduction

Concerns about the stability of the individual health insurance market continue to be a fixture of discussion about health insurance policy in the United States. Questions on stability largely arise from concerns about adverse selection, whereby the lowest-cost potential enrollees – typically young and healthy individuals – are the most likely to forgo insurance or underinsure, raising average costs and hence premiums to potentially unsustainable levels. [1] In its 7th year of operation, the Affordable Care Act (ACA) individual health insurance marketplaces (the exchanges) have shown an increasingly robust trend in market stability and sustainability. [2, 3] However, understanding how adverse selection presents in this market and its role in market stability still helps inform policies aimed at ensuring health insurance market stability. We quantify the adverse selection presented in the exchanges and discuss the possible reasons why it does not threaten market stability.

Prior to the enactment of the ACA, the individual health insurance market was mostly risk-rated at the enrollee level. Transforming to community rating under the ACA regulation gave rise to adverse selection in the exchanges. Yet literature lacks comparable data to assess the magnitude of selection on the exchanges. Ideally, a researcher should first benchmark care utilization of on-exchange products in the absence of adverse selection, and then compare care utilization affected by adverse selection with the benchmarks. In practice, the choice of benchmark plan is challenging. A pre- and post-ACA comparison of the individual market is confounded by other ACA policy changes such as Medicaid expansion. Cross-sectional comparison such as with the large group market lacks a common support of plan characteristics—plans in the large group market are typically much more generous than the exchange plans. The commercial small group (SG) insurance market, where employers with 1 to

50 full-time employees shop for policies, is the most suitable benchmark for the exchanges, as its products are subject to many of the same regulations as exchange products, and plan generosity is in the same range as exchange plans. Most importantly, individual SG enrollees can only choose from a small menu pre-selected by their employers; hence their plan choices are minimally affected, if at all, by individual-level adverse selection. We thus use their care utilization to benchmark for the exchange plans of equivalent coverage generosities.

Adverse selection in the exchange threatens market stability if high-risk enrollees incur claims higher than the actuarially fairly priced premium and lack a sufficient number of low-risk individuals to balance out the risk pool. Comparing health plan costs for both low-risk and high-risk enrollees in the exchanges to the SG market provides a better understanding of the relationship between adverse selection and market stability. Moreover, premium subsidies (a.k.a., the advanced premium tax credit applied to premium payments when individuals and families with income up to 400% of the federal poverty level enroll on the exchanges) and cost-sharing (CSR) reduction subsidies (extra consumer cost-sharing for very low income households who enroll in exchange Silver plans, see **Appendix 1**) are designed to attract low-risk and low-willingness-to-pay individuals to the exchanges. Examining their roles in mitigating adverse selection and its impact is the prime goal of this study. Using novel benefit design data and claims data, we identify the loci for adverse selection on the exchanges and assess whether and how the receipt of subsidies affects adverse selection severity. Our results shed light on concerns about individual-market stability and contribute to future discussion on exchange policy design.

Methods

Data:

The study population consists of persons with any enrollment in ACA-compliant individual market Marketplace plan(s) issued by a large commercial carrier between 01/01/2014 and 12/31/2017, and any enrollment in SG plan(s) issued by the same carrier during the same time frame. Enrollees were excluded if they were older than age 65 or showed incomplete demographic information. Small group enrollments that start exactly on 01/01/2014 or end on 12/31/2017 are also excluded to preclude potential utilization data censoring.

We observe coverage effective and termination dates, enrollee's ZIP code, birth date, sex, and eligibility for CSR subsidy for each enrollee. Plan characteristics include the actuarial value (AV), the state where the plan was issued, and the market segment (exchange or SG). Enrollment and plan characteristics data were merged with medical claims by service dates.

Analysis:

We compared exchange enrollees to SG enrollees who were in actuarially similar products during 2014 - 2107; for example, we compared the average costs of exchange Bronze enrollees to SG Bronze-equivalent enrollees whose plans are in 60±3% AV. This comparison allows us to isolate and measure adverse selection unique to the exchange, which we quantify as the regression-adjusted average *additional* spending per member (i.e., enrollee) per year (PMPY) among individual enrollees compared to SG enrollees in metal-equivalent plans using the least-generous plan as a reference. Our difference-in-difference specification regresses total medical cost PMPY on enrollees' age, sex, dummies of state and rating area, dummies of metal tiers and segments, and full interactions between metal tier and segment indicators.

We also leverage the detailed claims data to construct a novel hierarchical condition category (HHS-HCC) style risk index for each enrollment to control for different levels of health status between enrollees in the two market segments. The original HHS-HCC risk score

"employs the hierarchical condition category grouping logic used in the Medicare risk adjustment program [on the non-elderly] population," and accounts for insurers' financial responsibility that differs by metal tier; adverse selection reflected in enrollment duration; and additional utilization due to CSR benefits. Because our risk index only aims to capture the differences in expected medical risks, we modify the algorithm by assigning scores only based on enrollees' age, gender, and procedure and diagnosis codes (**Appendix 2**).

To assess the relationship between CSR eligibility and adverse selection, we first compared CSR beneficiaries to SG enrollees in plans with the closest actuarial value: Silver 73% CSR enrollees are compared to SG Silver enrollees, and Silver 87% and 94% CSR enrollees were compared to SG Platinum enrollees. We then compared all Silver CSR enrollees to non-CSR Silver enrollees based on the rationale that CSR benefit levels are exogenously set by policymakers.

Results

Table 1 Panel A describes the exchange enrollees and the SG enrollees in our sample. The study population consisted of 3,413,140 enrollments by exchange enrollees and 1,629,531 by SG enrollees. A higher share of exchange enrollees was female (54% vs. 49%), and exchange enrollees were older on average (41.4 vs. 34.6 years). The average duration of enrollment (per enrollee) was short in both segments, at eight months in the exchange and 7.4 months in the SG market.

Figure 1 compares enrollment distribution in the two segments by metal tier, pooling all four plan years. Small group enrollees tended to have richer insurance than exchange enrollees; for example, only 13% of SG enrollment were in a Bronze plan, while 31% of exchange enrollment were in Bronze. Among exchange enrollees, 7% were enrolled in Gold or Platinum

plans, and an additional 39% were enrolled in the Silver 87% or 94% CSR plans, which have actuarial values in the Gold/Platinum range, for a total of 46% of exchange enrollees in richer products. In comparison, 57% of SG enrollees were in Gold or Platinum plans. The contrast in enrollment distribution highlights the importance of investigating the degree of adverse selection by metal tier. If the positive correlation between enrollee medical risk and plan generosity is stronger in the exchanges than the SG market, the exchanges would wind up with more high-medical-risk individuals enrolled in richer products, *and* more low-medical-risk individuals enrolled in less-generous products. If the least-rich products attract disproportionate enrollment in the exchanges, the low-medical-risk individuals enrolled there could balance insurers' risk pool. Then there would be fewer reasons for concern that adverse selection threatens the exchange stability.

Table 1 Panel B summarizes care utilization of exchange and SG enrollees. Care utilization increases in coverage generosity in both market segments. Exchange enrollees of Bronze and Silver plans had a substantially higher share with $0 utilization. Conditioning on using any care, Bronze and Silver exchange enrollees had lower PMPY costs compared to SG counterparts, but Gold and Platinum exchange enrollees had higher PMPY costs. Risk index exhibits the same pattern (**Panel C**), where exchange enrollees in non-Bronze metal tiers had higher medical risks compared to SG enrollees. Overall, exchange enrollees were *healthier* and generated *lower* PMPY costs. **Panel B** and **C** together highlight the methodological importance of including the risk index as a control. First, results can be biased in either direction if health status difference is not adjusted for. Second, because we use spending as outcome variable, the similar patterns between care utilization and risk index ease the concern that results are driven by factors unrelated to medical risks.

Despite their higher costs, the smaller market shares by Gold and Platinum exchange plans suggest moderate effects on the overall insurers' costs. **Table 2** compares the distribution of PMPY medical expenditure of the two segments by quantile. The top one percent exchange spenders accounted for 45% of total medical expenditures with an annual mean of $218,128. For the SG enrollees, the top one percent spenders accounted for slightly more. Compared to SG enrollees, the top 10 percent exchange spenders consisted disproportionally by Platinum plans (22% of all Platinum enrollees), Gold plans (17%), Silver 94% (13%), and Silver 84% (12%).

Figure 2 shows our regression analysis results. The vertical axis represents the regression-adjusted costs of all medical claims PMPY, and the horizontal axis represents the plan generosity summarized by metal tier or equivalent. The red and blue symbols denote the mean annual care utilization with 95% confidence intervals by the exchange and SG enrollees, respectively. Exchange enrollees incurred higher utilization than SG enrollees only in richer products: Gold exchange enrollees averaged $1,522 PMPY higher utilization than Gold SG enrollees, and Platinum exchange enrollees averaged $6,600 PMPY higher utilization than Platinum SG enrollees. However, in other metal tiers, the exchange enrollees had lower mean utilization than their SG counterparts: $246 PMPY lower for Silver and $1,745 lower for Bronze. The observation that PMPY costs increase along plan generosity reveals adverse selection in both markets, and the greater increment in the exchange suggests a higher degree of selection compared to the SG market.

Regardless of whether the Silver CSR enrollees are compared to SG enrollees in actuarially equivalent products (i.e., 73% Silver to SG Silver, 87% Silver to SG Platinum, and 94% Silver to SG Platinum) or to SG Silver enrollees, they tended to have lower PMPY cost than SG counterparts. When comparing Silver CSR enrollees to SG enrollees in the nearest-actuarial-

value products (**Figure 2a**), they averaged *lower* spending PMPY than SG enrollees in comparable products, by $920 for 73% AV, $1,735 for 87% AV, and $1,589 for 94% AV. When comparing all Silver CSR enrollees to SG Silver enrollees (**Figure 2b**), 73% AV enrollees had $953 lower PMPY costs, 87% AV enrollees had $494 lower costs, and 94% AV enrollees had $345 lower costs than SG Silver enrollees.

Discussion:

Adverse selection is often associated with a negative impact on market stability. While such a relationship is convenient in the context of a single product market or focusing on the extensive margin selection – high-risk individuals are more likely to enroll in *any* insurance plan, it is less obvious when a market such as the ACA exchange where multiple products differentiate by quality (coverage generosity) and selection also works across products. In this paper, we first show that the degree of intensive adverse selection – the tendency of high-risk individuals to enroll in richer products – in the exchanges is higher than that in the SG market: the medical spending increment for a given increase in coverage is significantly larger in the exchanges. However, as we further demonstrate, the lower spending by low-generosity exchange plans can offset the possible destabilizing effect of high-risk individuals' disproportionate enrollment in richer products.

When evaluating the effect of intensive adverse selection, emphasis has been placed on the strength of the association between risks and product generosity. Our findings suggest that the number of low-risk enrollees the least-generous product can attract, and how low their average medical risks get, also play a critical role. We conceptualize this notion in **Figure 3**, where the degree of intensive adverse selection is captured by the slope of the risk curve against plan generosity, and average medical risk of the least-generous plan is captured by the intercept.

While the exchanges exhibit a steeper slope (red line) relative to the stable SG market (blue line), a higher intercept of the exchanges (**Figure 3a**) would raise more concerns regarding the market stability. In contrast, a lower intercept (**Figure 3b**) would not, and even less so if the least-generous product(s) attract a disproportionally large share of total enrollment. Our finding suggests that the exchanges resemble the latter case. Enrollees accounting for the large majority of enrollment – over 90% of person-years of enrollment in this insurer's exchange plans during the period 2014-17 – had similar or lower PMPY costs as enrollees in comparable SG products. This shows that the distinct features of the exchanges that appeared to be fertile ground for adverse selection have not destabilized the markets. Furthermore, Silver CSR enrollees tended to have lower costs, whether comparing them to SG enrollees in plans with comparable AVs or simply with enrollees in Silver plans, thus easing concerns about the severity of adverse selection into the Silver CSR plans.

We hypothesize that several factors are responsible for the low degree of destabilizing effect despite high level of adverse selection, relative to the SG market. First, the availability of premium subsidies made insurance affordable for low- and moderate-income individuals, likely attracting enrollment into the exchange plans among both individuals who needed and did not need high levels of care. [4] Premium subsidies are benchmarked to the second lowest cost Silver plan (SLCSP), making Bronze and Silver plan premiums most affordable. Second, the penalties before 2019 for not carrying insurance, operative throughout our data period, likely induced some entry by relatively healthy people into the Bronze, Silver, and Silver-CSR products. [5] Conceptually, those two factors combined likely steepen the slope of the individual market risk curve (red line) in **Figure 3a** and shift it downward, resulting in a more stable state as in **Figure 3b.** Finally, because eligible enrollees automatically receive CSRs upon enrollment in a Silver

plan, enrollment in an actuarially rich Silver CSR plan was not driven solely by an expectation about one's likelihood of high consumption of health care.

A much smaller, but not trivial, portion of the exchange market appears to be impacted by risk selection: enrollees in Gold and Platinum products have much higher PMPY costs than their SG counterparts enrolled in actuarially similar products, as predicted by actuaries and health economists. [6] This is likely driven by enrollment among higher income enrollees (who don't qualify for CSRs) who anticipate high levels of health care utilization, but it may also reflect the lack of plan choice for many SG employees leading to both higher and lower utilizers enrolling in the single Gold plan offered by their employers.

Limitations:

First, due to data limitations, we could not examine and control for potential firm-level adverse selection in the SG market, which could bias our results in either direction. As the decision-making unit of plan menus in the SG market, an employer can purchase a plan commensurate with what they know to be the health risks of their employees and dependents, using information unavailable to the issuer. Consequently, we interpret the results as intensive adverse selection in the individual market *beyond* what could be experienced in other markets. Second, we did not observe offerings by other issuers, thus we do not know the precise choice set of individual-market enrollees. However, because the commercial insurer was one of the largest participants in all states where it offered exchange products, its offerings are likely to reflect the range of products available to exchange enrollees in the given state.

Conclusion:

The majority of the individual market for health insurance in 2014-17 appeared stable, at least compared to the SG market, from the perspective of one large national carrier. Despite a high

level of intensive adverse selection in the exchanges, Bronze, Silver, and Silver CSR variant enrollees all had lower spending than SG enrollees in comparable products, suggesting a key role that subsidies play in stabilizing the exchange market.

While we observe adverse effects in the Gold and Platinum plans during the years of this study, that finding is worth further research in future years. When the federal government ceased reimbursements to issuers for the CSRs starting in 2018, issuers raised Silver premiums to account for the costs of providing the required CSRs to eligible enrollees. As a result, premium subsidies also rose, making Gold and Platinum plans more affordable and potentially encouraging enrollment among a more diverse (with respect to utilization) mix of enrollees. The continued stability of the exchange market may also depend on issuers' ability to structure their offerings to maintain the low costs of low-generosity plans.

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Table 1: Demographic Summary of the Sample Population

	Small group market		Exchange individual market	
Panel A: Demographics summary				
Female, pct	49.35%		54.12%	
Age group, pct				
0-18	21.81%		9.99%	
19-25	10.47%		8.82%	
25-34	16.24%		16.01%	
35-44	16.62%		15.56%	
45-54	18.44%		21.23%	
55-64	16.42%		28.40%	
Age, mean (sd)	34.64 (17.74)		41.36 (16.6)	
Months of enrollment, mean (sd)	7.37 (4.42)		8.03 (3.98)	
Regional distribution, pct				
Northeast	16.25%		13.30%	
Midwest	22.18%		20.91%	
South	19.93%		28.59%	
West	41.63%		37.19%	
Prevalence				
Asthma	2.28%		1.93%	
Cardiovascular disease	0.20%		0.42%	
Depression	0.60%		0.83%	
Diabetes	3.05%		4.82%	
Panel B: Care utilization summary				
	Share with $0 utilization	Mean PMPY ($) allowed amount	Share with $0 utilization	Mean PMPY ($) allowed amount
Bronze	38%	4,548	49%	2,568
Silver	32%	5,033	30%	5,340
Silver 73%			32%	4,928
Silver 87%			31%	5,565
Silver 94%			31%	5,567
Gold	29%	5,685	22%	8,651
Platinum	24%	5,901	20%	14,579
Overall	31%	5,349	36%	4,854
Panel C: Risk index summary				

	Mean risk score index	Mean log (risk score index)	Mean risk score index	Mean log (risk score index)
Bronze	1.44	-1.46	1.24	-1.32
Silver	1.61	-1.41	2.27	-1.13
Silver 73%			2.38	-1.00
Silver 87%			2.73	-0.88
Silver 94%			2.79	-0.87
Gold	1.74	-1.4	4.00	-0.95
Platinum	1.82	-1.39	5.07	-0.58
Overall	1.66	-1.46	2.29	-1.06
Total N. of person-enrollment	1,629,531		3,413,140	
Total N. of unique enrollees	926,383		2,198,075	

Note: PMPY is abbreviation for per-member-per-year. In this table, each health plan enrollee counts as one observation, regardless of his/her duration of enrollment. The presence of disease was identified by the presence of a diagnosis code in medical claims over the enrollee's entire enrollment period, with no adjustment made for the duration of enrollment.

Table 2: Distribution of total medical spending by magnitude of spending and mean spending, grouped by market segment and proportional contribution by metal tier

Panel A: Small group market										
Spending quantile	Contribution to total med. spending	Avg. PMPY($)		Contribution of each metal tier to the quantile category						
				Bronze	Silver	Silver 73%	Silver 84%	Silver 94%	Gold	Platinum
Top 1 pct[a]	47%	254,004		1%	1%	-	-	-	1%	1%
Top 1-5 pct[b]	26%	34,122		3%	4%	-	-	-	4%	5%
Top 5-10 pct	10%	10,745		4%	5%	-	-	-	5%	6%
Top 10-50 pct	16%	2,130		35%	39%	-	-	-	41%	47%
Bottom 50 pct	1%	108		57%	51%	-	-	-	48%	41%
Panel B: Exchange individual market										
Spending quantile	Contribution to total med. spending	Avg. PMPY($)		Contribution of each metal tier to the quantile category						
				Bronze	Silver	Silver 73%	Silver 84%	Silver 94%	Gold	Platinum
Top 1 pct	45%	218,128		1%	1%	1%	1.13%	1.07%	1.96%	4.11%
Top 1-5 pct	29%	34,895		2%	4%	4%	5%	5%	7%	9%
Top 5-10 pct	11%	10,618		2%	5%	5%	6%	7%	8%	9%
Top 10-50 pct	15%	1,794		30%	45%	44%	43%	43%	51%	49%
Bottom 50 pct	1%	56		65%	44%	46%	45%	44%	33%	29%

Note: PMPY is abbreviation for per-member-per-year. In this table, each health plan enrollee counts as one observation, regardless of his/her duration of enrollment.

[a]This row should be read as the following: the 1st percentile of SG spenders contribute to 47% of the total medical spending by all SG products, with an average PMPY medical spending of $254,004. The metal tier distribution of the 1st percentile SG spenders is proportional to the enrollment, as all SG metal tiers have their 1st percentile spenders in this quantile category.

[b]This row should be read as the following: the 1st to 5th percentile of SG spenders contribute to 26% of the total medical spending by all SG products, with an average PMPY medical spending of $34,122. The metal tier distribution of the 1st percentile SG spenders is NOT proportional to the enrollment. 3% of Bronze SG enrollment (i.e., 1st to 4th within-Bronze quantile), 4% of Silver SG enrollment, 4% of Gold SG enrollment, and 5% of Platinum SG enrollment make up this quantile category.

Figure 1: Enrollment share by metal tier or equivalent, small group versus exchange

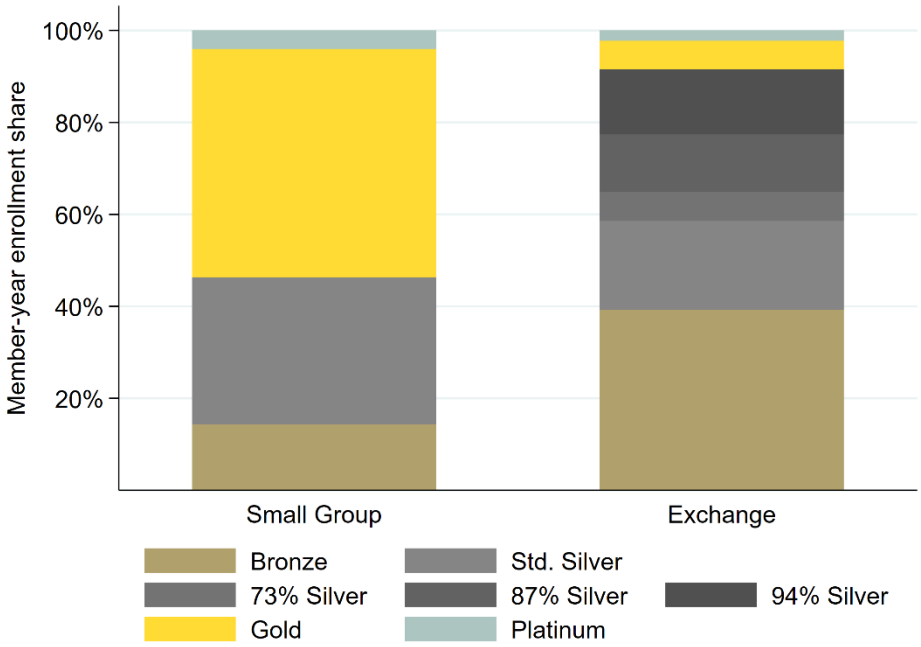


Figure 2a: Comparing exchange enrollees with small group enrollees of equivalent metal tiers, considering Silver CSR enrollees comparable to their nearest-AV small group counterparts

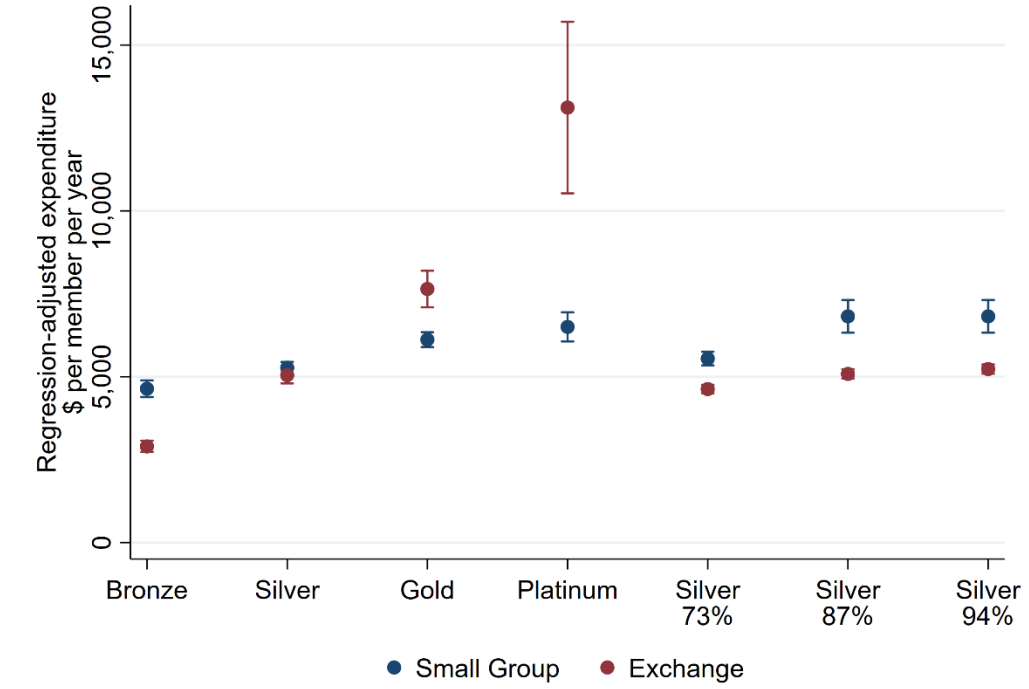


Figure 2b: Comparing exchange enrollees with small group enrollees of equivalent metal tiers, considering Silver CSR enrollees comparable to small group Silver counterparts

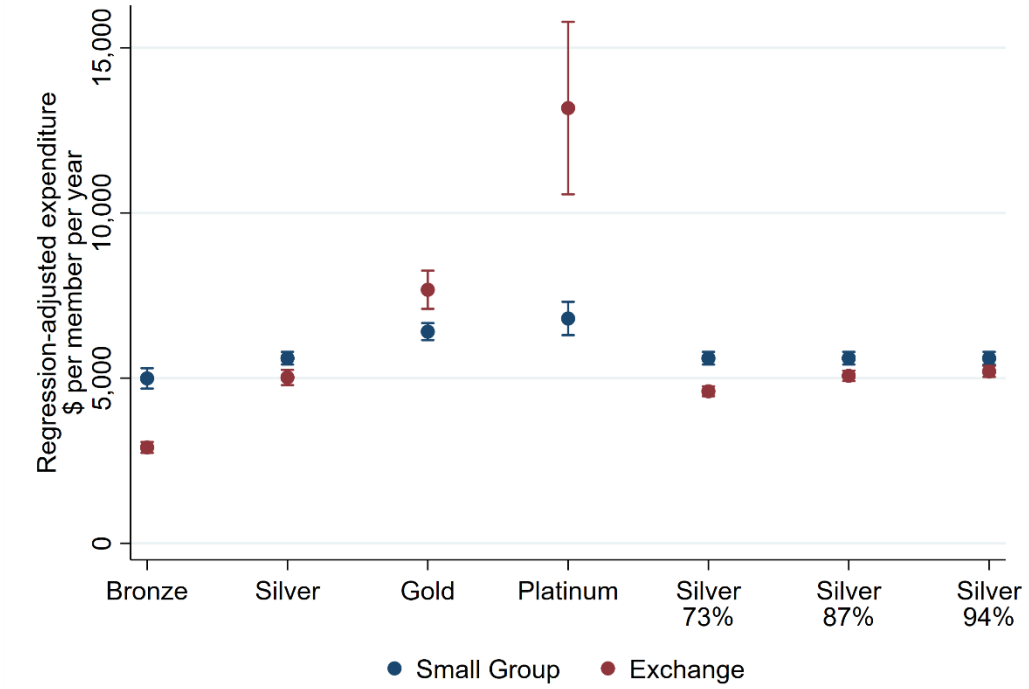
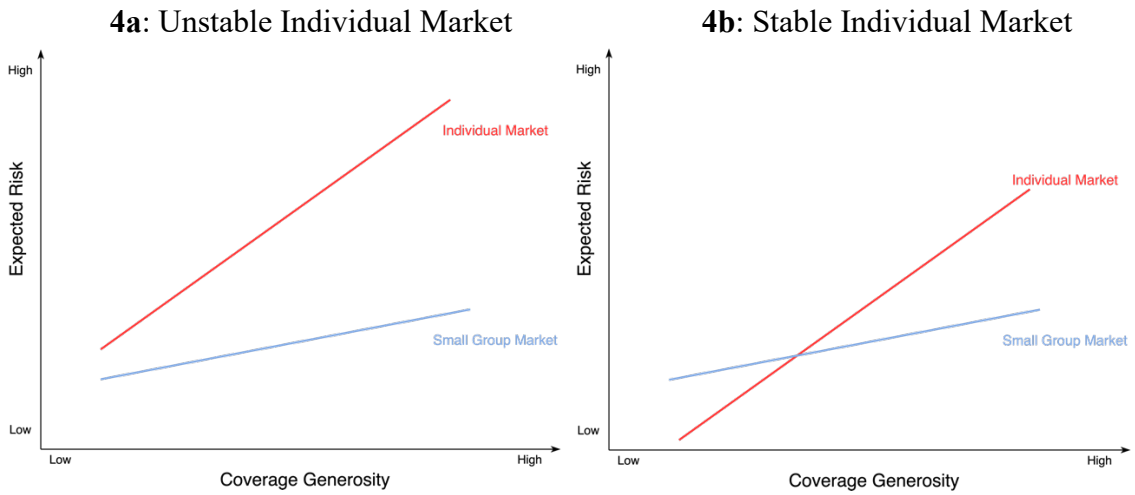


Figure 3: Risk selected into the least generous plan matters in evaluating the impact of adverse selection on market stability



Appendix

I. Actuarial Values for Cost-Sharing Reduction Silver Plan Variations

Household income	Silver plan variant AV	Closest metal tier equivalence based on AV
100-150% federal poverty level (FPL)	94% AV	Platinum
150-200% FPL	87% AV	Platinum
200-250% FPL	73% AV	Silver

Note: The AV is the average portion of incurred costs paid by the insurer (as opposed to the enrollees).

II. HHS-HCC Risk score construction

We apply HHS-HCC risk adjustment to claims of exchange enrollees and small group enrollees in 14 states where the commercial insurer participated in the exchanges in 2014-17. For each person-year enrollment, we compute two risk scores based on the HHS-HCC risk adjustment methodology. We compare the two HHS-HCC based risk scores, summarize them by enrollment segment and metal tier, and add each of them to the current difference-in-difference regression as a control variable and compare the results.

HHS-HCC Risk Adjustment and Risk Score

The Affordable Care Act authorizes the Department of Health and Human Services (HHS) to utilize criteria and methods similar to those utilized under Medicare Parts C or D to implement risk adjustment. The purpose of risk adjustment is to lessen or eliminate the influence of risk selection on the premiums that plans charge. The HHS risk adjustment methodology is based on the premise that premiums should reflect the differences in plan benefits, quality, and efficiency, and not the health status of the enrolled population. The HHS risk adjustment methodology includes the risk adjustment model and the payment transfer formula.

The HHS risk adjustment model uses an individual's demographic data and diagnoses to determine a risk score, which is a relative measure of how costly that individual is anticipated to be to the plan (i.e. a relative measure of the individual's actuarial risk to the plan). Risk adjustment modeling determines the base actuarial risk based on predicted costs for a plan's enrollees.

Calculation of the HHS-HCC risk adjustment proceeds in the following steps:

1. Generate bins for age-gender.
2. Filter diagnosis based on a CPT/HCPCS code.
3. Crosswalk ICD-10 CM diagnosis codes to generate CCs.

4. Apply hierarchy to generate HCCs.

5. Generate groups, severity measurement and interaction indicators for adult, child, and infant populations. Each population has its own set of risk variables and corresponding risk multipliers.

6. For an enrollee in a given metal level plan, the total predicted plan liability is the sum of the incremental predicted plan liability (multipliers) from the relevant metal level model. For adults and children, this is the sum of the age-gender, HCC, and disease interaction multipliers. For infants, this is the sum of the maturity/disease-severity category and additive sex multipliers, if male. Separating models by metal tiers is intended to capture the insurer's cost-sharing that vary by metal tiers.

The methodology and a DIY instruction on risk score calculation are available on the CMS website[1]. We translate the DIY program to Stata.

Application of the HHS-HCC to CA claims Data

We apply the HHS-HCC risk adjustment model to the claims data. The 2014-2017 HHS-HCC risk adjustment includes in the adult model a baseline factor of enrollment duration. The enrollment duration factor is additive to the HCC and demographic factors. In recognition that individuals enrolled for a shorter period of time tend to incur higher medical consumption (adverse selection in enrollment duration), shorter enrollment duration corresponds to a greater multiplier. The enrollment duration component is in the same spirit as we use annualized medical consumption as the outcome variable. We thus leave the enrollment duration component in the risk adjustment as it is.

The HHS-HCC risk adjustment also adjusts for induced demand due to cost-sharing reduction (CSR). Because CSR plans have higher actuarial value, enrollees of CSR plans

[1] The risk score algorithm accessible at https://www.cms.gov/CCIIO/Resources/Regulations-and-Guidance/Downloads/Updated-CY2018-DIY-instructions.pdf

presumably utilize more care due to their lower cost-sharing. Because the adjustment for CSR is based on moral hazard, not the explicit or hidden health risk, we exclude the CSR adjustment part in the risk score calculation.

Recall that the HHS-HCC score accounts for the insurer's cost-sharing that differ by metal tiers. That is, for any given HCC or demographic factor, the corresponding risk multiplier is higher for a person enrolled in a Platinum plan than that for a person enrolled in a Silver plan. This, however, defeats the purpose of calculating the risk score. Our goal of adding a risk score as a control variable is to absorb the effects of health status on medical consumption, assuming those effects do not vary plan choice. In other words, the ideal risk score should ignore the plan's liability. As a result, we calculate a second risk score, a "baseline" risk score such that, regardless of an enrollee's actual metal tier, we apply a Bronze plan's HCC and demographic multipliers to that enrollee's diagnosis. By forcing every HCC and demographic factor to have the same risk multiplier across all metal tiers, the "baseline" risk score ignores plan's liability and only captures enrollees' health risk. The "baseline" risk score is highly correlated with the HHS-HCC risk score (correlation = 0.99). "Baseline" risk score is the risk score index used in analysis.

III. Bibliography

[1] S. Dorn, "Health Affairs Blog," July 2018. [Online]. Available: https://www.healthaffairs.org/do/10.1377/hblog20180727.541089/full/.

[2] R. Fehr, C. Cox and L. Levitt, "Data Note: Changes in Enrollment in the Individual Health Insurance Market through Early 2019," Kaiser Family Foundation, 21 August 2019. [Online]. Available: https://www.kff.org/private-insurance/issue-brief/data-note-changes-in-enrollment-in-the-individual-health-insurance-market-through-early-2019/. [Accessed July 2021].

[3] R. Fehr, D. McDermott and C. Cox, "Individual Insurance Market Performance in 2019," Kaiser Family Foundation, 13 May 2020. [Online]. Available: https://www.kff.org/private-insurance/issue-brief/individual-insurance-market-performance-in-2019/. [Accessed June 2021].

[4] M. Frean, J. Gruber, and B. D. Sommers, “Premium subsidies, the mandate, and Medicaid expansion: Coverage effects of the Affordable Care Act,” *J Health Econ*, vol. 53, no. Rev. Econ. Stat. 89 3 2007, p. 72 86, May 2017, doi: 10.1016/j.jhealeco.2017.02.004.

[5] E. Saltzman, “Demand for health insurance: Evidence from the California and Washington ACA exchanges.,” *J Health Econ*, vol. 63, no. Inquiry 43 2006, p. 197 222, Jan. 2019, doi: 10.1016/j.jhealeco.2018.11.004.

[6] M. Panhans, “Adverse Selection in ACA Exchange Markets: Evidence from Colorado,” *Am Econ J Appl Econ*, vol. 11, no. 2, pp. 1–36, 2019, doi: 10.1257/app.20170117.