Network size does not explain premium variation: A case study of the Texas Health Insurance Marketplace

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Abstract

We replicate the 2015 *American Economic Review* paper by Leemore Dafny, Igal Hendel, and Nathan Wilson, "Narrow networks on the Health Insurance Exchanges: What do they look like and how do they affect pricing? A case study of Texas." We find similar results: network size and valuation are not tightly linked to plan premium pricing. Looking across all silver plans, the aggregate price effect is primarily driven by the pricing strategy of BCBS, which offers an HMO product (narrower networks) at lower prices across the board than their PPO product (broader networks). We extend the original analyses to include bronze and gold level plans, and again find that neither network breadth nor consumer valuation of network explain observed premium variation. Additionally, we explore issues of model dependence and insurer participation by rating area and plan offering.

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1 Introduction

In "Narrow networks on the Health Insurance Exchanges: What do they look like and how do they affect pricing? A case study of Texas," Dafny et al. (2015) describe the breadth of the health insurance networks offered on the Texas health insurance Marketplace. They focus on the "silver" tier of plans, and construct two measures of network breadth and value: discharge shares and consumer surplus. In their overall sample, they find the relationship between network breadth and premium level is driven primarily by the BCBS plan pricing strategy: BCBS HMOs feature narrower networks and lower premiums, and BCBS PPOs feature broad networks and higher premiums. Network breadth and premiums are not associated with each other in non-BCBS plans. Dafny et al. also examine factors related to hospital inclusion in networks, and find that while insurers have different strategies regarding network size, there is a general preference for larger hospitals, but that commercial prices are not related to network inclusion.

Our paper replicates the Dafny et al. results for the silver plan data, and extends their approach to include bronze and gold plans, as well. Bronze plans are priced at 60% actuarial

value, and gold plans are priced at 80% actuarial value. While there are fewer bronze and gold plans offered than silver, the data contain sufficient insurer $\times$ plan $\times$ rating area combinations to apply the same estimation strategy for the bronze and gold tiers. The results in both tiers mirror those of the silver tier: the aggregate price effect is due to the pricing strategy of BCBS, and that neither network breadth no consumer valuation explains observed premium variation. We also explore model dependence with respect to the inclusion of fixed effects and pooling across plan tiers, and find the results are robust to these specifications. Finally, we examine insurer participation by rating area and level of plan offerings.

2 Network breadth and value

Dafny et al. primarily draw upon data from the Texas health insurance Marketplace in 2014. For their network breadth and valuation analyses, they look only at silver plans, because all insurers participating in the marketplace must offer at least one silver plan, so all insurer-network combinations are represented in this actuarial tier. The dataset include eleven insurers who offer at least one plan in at least one rating area. Blue Cross Blue Shield (BCBS) of Texas participates in all rating areas, and offers both an HMO and a PPO product in each rating area. The HMO product is characterized by being a more restricted network with lower premiums, and the PPO product a broader network and generally higher premiums.

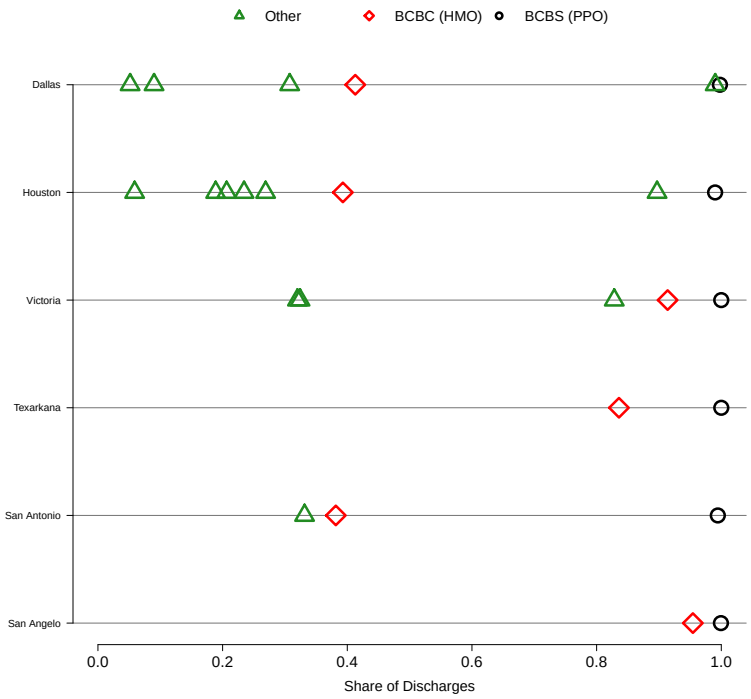
2.1 Discharge shares

Discharge shares are calculated by the original authors as the ratio of patient discharges in hospitals belonging to a network and the total number of discharges to patients in the rating area. The insurer network data comes primarily from the original author's collection from insurer websites, and the discharge data come from the Texas Department of State Health Services Center for Health Statistics. Figure 1 shows variation in network breadth by discharge shares for the there largest and smallest rating areas (by population). The BCBS PPO discharge share is always near 1 in each of the areas, and the BCBS HMO discharge share is always lower than the BCBS PPO share. Figure 2 illustrates BCBS silver plans have near complete separation by network breadth and premium level (the high premium and low premium cutoff in the plot is based on mean premium overall). In comparison, among the non-BCBS plans, there is substantial overlap in the network breadth of high and low premium plans.

2.2 Consumer Surplus

Dafny et al. estimate consumer surplus (expected utility) associated with an insurance network by estimating a discrete choice model of hospital demand, and aggregating across

Figure 1: Breadth of networks offered in largest and smallest Texas rating areas

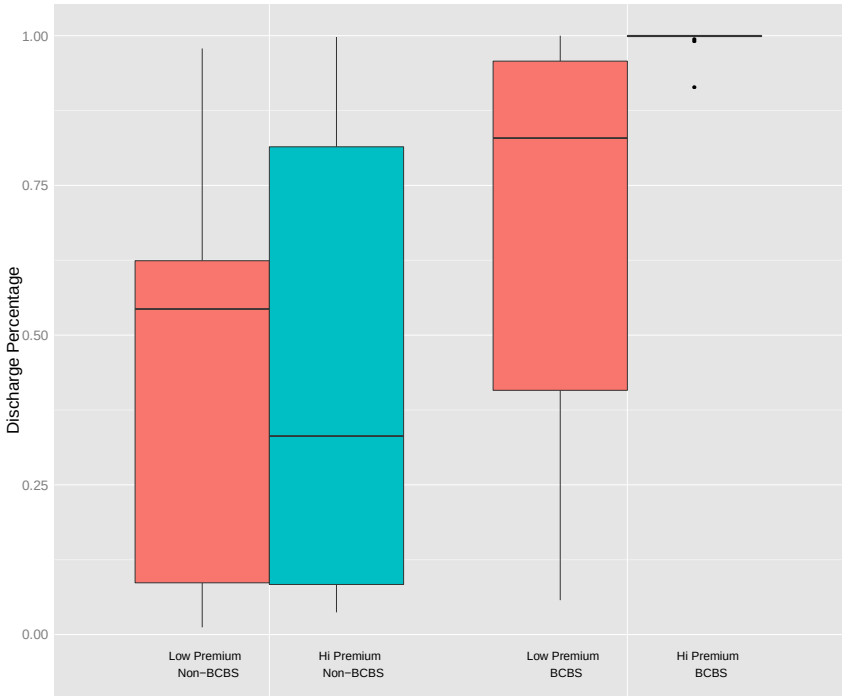


the predicted utilities of admissions for each patient-location-diagnosis-network combination using 2010 data on patient locations and statewide probabilities of admissions. Figure 3 demonstrates there is greater variability in discharge share and consumer surplus by non-BCBS plans compared to BCBS HMO and BCBS PPO plans.

2.3 Silver tier

Following Dafny et al., we regress log premiums on discharge share and several non-network related plan features, including a deductible indicator, the log of a non-zero deductible, log of maximum out of picket expenditures, rating area fixed effects, and insurer fixed effects (Appendix Table 1). The standard errors are clustered at the rating area by insurer network level, and the observations are weighted by population. When including all plans, we find a one unit increase in the share of discharges is associated with about a 30% increase in premiums. After restricting the analysis to non-BCBS plans the relationship between share of discharges and plan premiums becomes negative and not statistically significant. In contrast, isolate the sample to BCBS PPO plans shows that for a one unit increase in

Figure 2: Discharge ratio by plan type and premium level



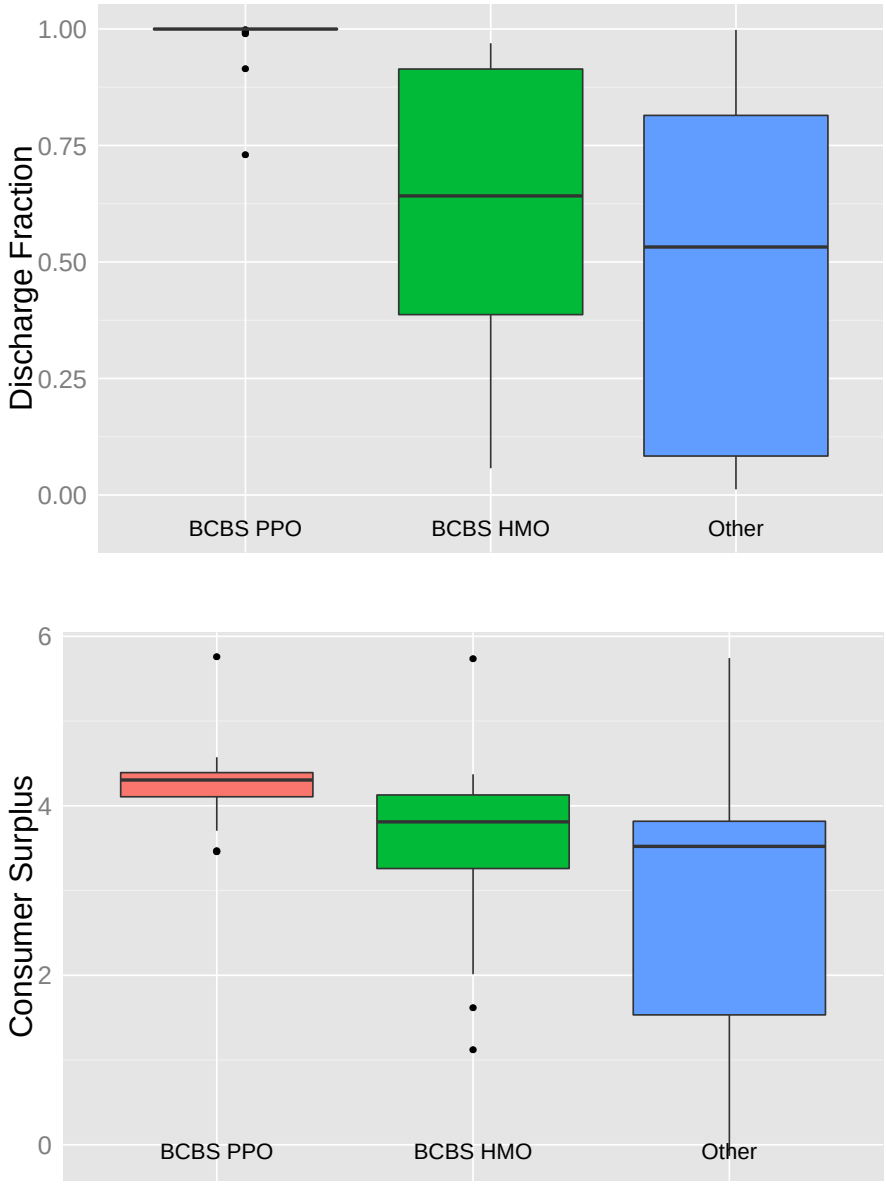
the share of discharges plan premiums increase by about 52%. Figure **??** demonstrates the influence BCBS plans have over the aggregate relationship between network breadth and premium levels.

We also examine the relationship between consumer surplus from network breadth and log premiums (Appendix Table 2). The pattern of results is very similar to that of discharge shares and log premiums, although the magnitudes are reduced. Looking at all plans, a one unit increase in consumer surplus is associated with an approximately 6% increase in premiums. When restricted to non-BCBS plans the relationship again becomes negative and non-significant, and restricting to BCBS PPOs shows a one unit increase in consumer surplus is associated with a 19% increase in premiums.

2.4 Bronze tier

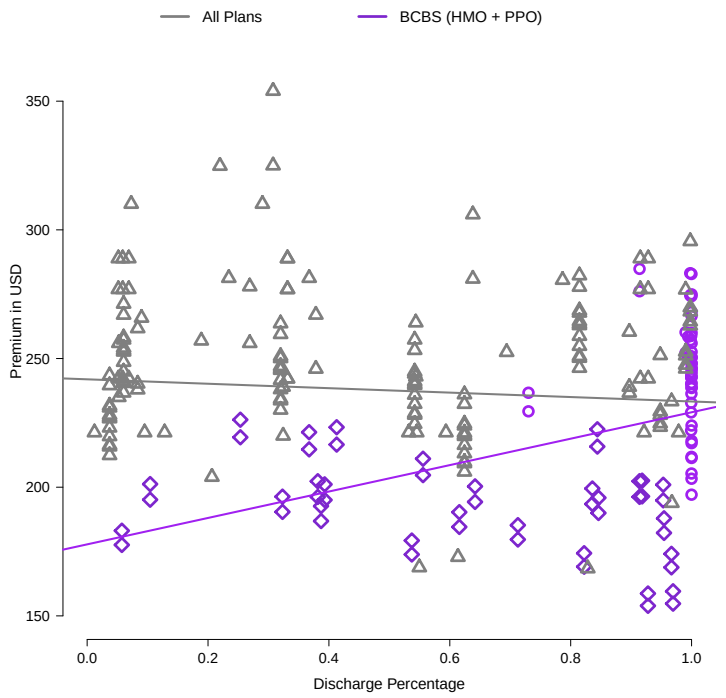
Dafny et al. focus their analyses and discussion on silver tier plans (70% actuarial value), which are both the most commonly offered plans and the benchmark in terms of setting

Figure 3: Explanatory variable span by plan type



premium subsidies. We first extend their analyses to examine bronze level plans, which are a 60% actuarial value. It is possible that in order to keep their premiums lower, these plans

Figure 4: BCBS influence on overall premium discharge correlation: Silver plans



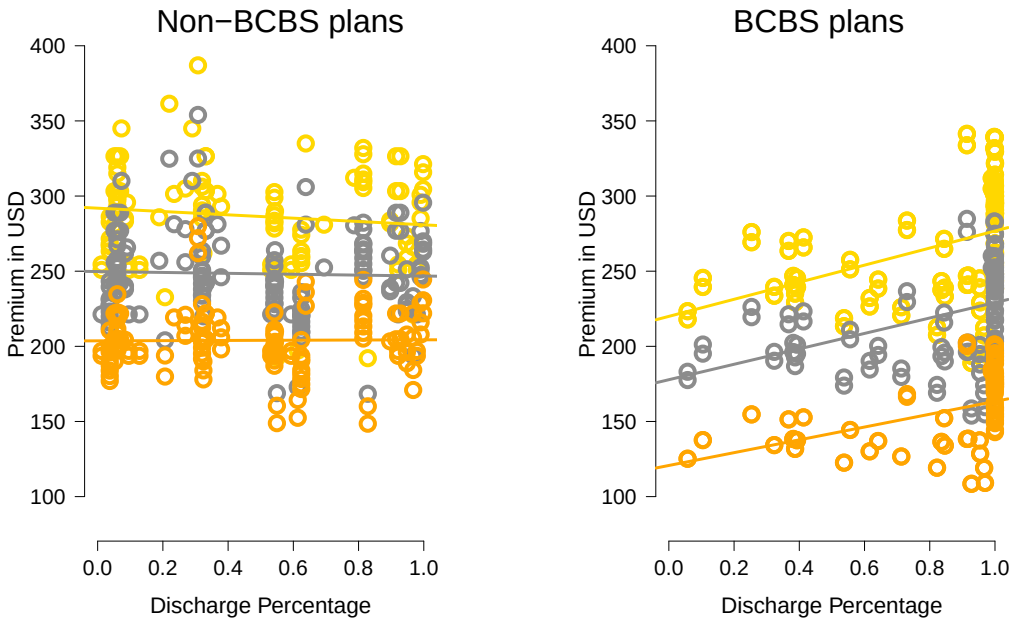
restrict their networks to be even narrower than the silver plans. As in the analysis of the silver plans, we find the difference in the BCBS PPO and HMO network breadth and pricing to be driving the overall relationship between network size and premium level (Appendix Table 3). The results examining consumer surplus and premiums follow a similar pattern (Appendix Table 4). This provides additional support for the original author's results that network breadth is not tightly linked with plan premiums in the Texas health insurance exchange.

2.5 Gold tier

We also analyze gold plans (90% actuarial value) to determine if the same patterns between the explanatory variables and premiums hold for the higher tier plans. Again, the pricing strategy of the BCBS plans appears to be driving the overall relationship between network breadth and network value and plan premiums (Appendix Tables 5 and 6). Figure 5

compares the distribution of discharge shares for non-BCBS plans in the left panel, and for BCBS plans in the right panel. The distribution of plans by discharge share and premium is very similar across all three tiers, differentiated primarily by premium level. This graphically shows that plans are not restricting the networks of their lower premium plans in order to constrain premiums.

Figure 5: BCBS influence across all plan tiers



2.6 Model dependence

In the original paper, Dafny et al. disaggregate the silver plan sample from all plans into non-BCBS, BCBS PPO, and BCBS HMO subgroups, which provides them with their main conclusion. However, they do not explore the extent to which their results may be dependent on other model specification choices. All of their models rely on plan fixed effects to control for statewide insurer strategies and characteristics, based on the logic that some insurers might deliberately price relatively lower to gain marketshare in the early years of the Marketplace. We remove insurer fixed effects and estimate the relationship between

network breadth and logged premiums for all plans and for non-BCBS plans, and find that while removing insurer fixed effects makes the estimates noisier, it does not qualitatively change the nature of the results (Table 7).

Although in their original paper, Dafny et al. do not attempt to estimate any causal effects of being a BCBS plan on logged premiums, we think useful next steps would begin to explore potential causal relationships among different aspects of benefit design in the context of the Marketplaces. We test the counterfactual of switching the insurer indicators for non-BCBS plans and BCBS plans, and use these new plan indicators to predict new values for logged premiums. Using the `WhatIf()` package, we examine if any of these potential counterfactuals would be inside the convex hull; none of them are. This makes sense given that we keep all of the other explanatory variable values the same and only modify the plan indicators.

Finally, we test the effects of pooling plans from the gold, silver, and bronze tiers together into a single sample. We first fit a single linear model of fraction and the usual controls and fixed effects, plus indicators for silver and gold, on logged premiums. Examining the residual plots, we find no evidence of unequal variance that would indicate a preference for fitting separate models for each tier. Thus we fit the four main specifications for network breadth and consumer surplus on a pooled sample (Appendix Tables 8 and 9). We gain power, although not much new insight: the relationship between the primary explanatory variables of network breadth and consumer surplus and premiums remains essentially unchanged. As expected, plan tier is an important predictor of premium level. The other plan features, such as a zero deductible, become more important for non-BCBS plans; switching from a deductible to no deductible is associated with about a 32% decrease in average premium, holding discharge shares and plan tier constant. Given the results are qualitatively similar, running separate regressions for each of the plan tiers may be a somewhat preferred to a pooled sample, for ease of interpretation and presentation of results.

3 Insurer participation by rating area and plan offering

The Texas Marketplace began operating in 2014, and is thus useful for characterizing early behavior of insurers. The ACA includes several market stabilization policies, including reinsurance, risk corridors, and risk adjustment, to ensure that insurers participate in the Marketplaces during the "growing pains" phase. After making the choice of whether or not to participate in the Marketplace in the first instance, insurers then face decisions about which local markets to enter and how many plans to offer. Dafny et al. restrict their analyses to the silver tier on the basis of the requirement that all insurers participating in a Marketplace must offer a silver plan. We seek to characterize insurer decision making

on the intensive margin; that is, conditional on participation in the Texas Marketplace, an insurer may target only a small number of rating areas, they may target only one tier of plan, or both (e.g., only large urban areas and silver plans).

Examining insurer offerings by rating areas and plan tier shows out of eleven insurers, only BCBS participates in all rating areas. Of the eleven participating plans, ten offer gold, silver, and bronze plans in all areas in which they participate; Molina Marketplace offers only gold and silver level plans.[1] Comparing rating areas by population size and by number of insurers shows insurers do not appear to make participation decisions solely on the basis of population size (Figure 6). For example, on the basis of population size, Waco and College Station appear to have a disproportionate number of insurers. It is possible these markets become more attractive because they are feature large universities (Baylor and Texas A&M), or it may be that some insurers already operate plans in these areas and the entry costs are relatively low; additional work is needed to understand plan strategy around rating area participation choice. Figure 6 also shows that most rating areas only have one or two insurers participating (recall that BCBS participates in all Texas ratings areas).

4 Hospital inclusion in networks

To look at which hospitals are included in plan networks, Dafny et al. created a dataset where the hospital-insurer-network rating area is the unit of observation. The sample is restricted to hospitals from the main dataset that match to the American Hospital Association (AHA) survey data. Hospital prices and case mix index come from Healthcare Cost Report data. We were unable to obtain these data because of privacy issues, so for purposes of replication we pursued a simulation based approach of these analyses based on the summary statistics provided by Dafny et al. However, the goal of their analysis was to predict whether or not a hospital was in a given network. We realized that we would have to simulate which hospital observations were in a given network, and therefore we would simply be modeling the relationship (and noise) we had simulated. Therefore we decided not to pursue the hospital inclusion in network portion of the original paper.

5 Discussion

The replication analysis and extensions we present in this paper show there is little relationship between network breadth and consumer surplus and observed premium variation

[1]The Texas Marketplace also includes catastrophic and platinum level plans. Catastrophic plans are only available to consumers under the age of 30 who have a hardship exemption from the health insurance mandate; four insurers offer catastrophic plans in Texas. Only one insurer in Texas, Humana, offers platinum plans.

Figure 6: Rating areas by population vs number of insurers

Ranked by population size	Ranked by total number of insurers	Number of Insurers
Dallas	Houston	7
Houston	Austin	6
San Antonio	Waco	6
Austin	Dallas	5
El Paso	Killeen-Temple-Ft Hood	5
McAllen-Edinburg-Mission	Beaumont-Port Arthur	5
Corpus Christi	San Antonio	4
Killeen-Temple-Ft Hood	College Station - Bryan	4
Brownsville-Harlingen	El Paso	3
Beaumont-Port Arthur	Brownsville-Harlingen	3
Lubbock	McAllen-Edinburg-Mission	2
Laredo	Corpus Christi	2
Amarillo	Lubbock	2
Waco	Laredo	2
College Station - Bryan	Amarillo	2
Longview	Abilene	2
Tyler	Midland	2
Abilene	Odessa	2
Midland	Sherman-Denison	2
Wichita Falls	San Angelo	2
Odessa	Longview	1
Sherman-Denison	Tyler	1
Victoria	Wichita Falls	1
San Angelo	Victoria	1
Texarkana	Texarkana	1

on the Texas Marketplace in 2014. Examining bronze, silver, and gold tiers reveals a consistent pattern whereby the pricing strategy of BCBS HMO vs PPO plans drives the relationship between network characteristics and premium variation across all plans. We find these conclusions to be robust to issues of model dependence. Additionally, we show most insurers narrow their participation in the market by rating area rather than by plan type.

Our paper is limited by the format of the data and availability of the data. For example, the underlying data for calculating consumer surplus is not available because it contains person-level diagnoses, so we use the author's calculations of consumer surplus. Additionally, this restricts our ability to recreate their results on hospital inclusion in networks, which is an area they note is active in their future research. Another limitation is the case

study nature of our analyses. Although the data are restricted to the state of Texas, it is the largest federally facilitated marketplace: over 733,00 individuals were enrolled at the end of 2014, and over 1.3 million were enrolled by the end of the 2016 open enrollment period.[2]. Thus Texas is interesting both as a representative case of other federally facilitated Marketplaces, and as an observation itself, because it covers so many lives.

As the Marketplace matures and stabilizes, additional work should focus on insurer strategy regarding expansion (or contraction) across geographic areas and plan types within a Marketplace, and how these are related to plan pricing. It will also be important to monitor insurer entry and exit from the Marketplaces. Continued work on network measurement and analysis will be needed to adequately assess the performance of the ACA health insurance Marketplaces.

6 Appendix

Tables 1 and 2 replicate regression output tables from Dafny et al. (2015). Subsequent tables present results cited in above text; we retain them in the appendix to appeal to traditional economics audiences.

[2]CMS press release: https://www.cms.gov/Newsroom/MediaReleaseDatabase/Fact-sheets/2016-Fact-sheets-items/2016-02-04.html

Table 1: Relationship between Network Breadth and Plan Premiums: Silver plans

	All plans	Non-BCBS plans	BCBS plans	
	(1)	(2)	(3)	(4)
Discharge ratio	0.268^{***}	-0.036	0.421^{***}	0.026^{*}
	(0.050)	(0.046)	(0.013)	(0.014)
Deductible is 0	-0.401^{***}	-0.388		
	(0.154)	(0.295)		
ln(deductible $\mid >0$)	-0.066^{***}	-0.064^{*}	-0.044^{***}	-0.044^{***}
	(0.020)	(0.038)	(0.0001)	(0.0001)
ln(maximum out-of-pocket expense)	-0.291^{***}	-0.278^{**}		
	(0.087)	(0.123)		
HMO				-0.231^{***}
				(0.006)
Insurer fixed effects	Yes	Yes	N/A	N/A
Observations	251	151	100	100
R^2	0.734	0.822	0.851	0.997

*p<0.1; **p<0.05; ***p<0.01
Significance

Table 2: Relationship between Consumer Surplus and Plan Premiums: Silver plans

	All plans	Non-BCBS plans	BCBS plans	
	(1)	(2)	(3)	(4)
Consumer Surplus from Network	0.062^{***}	-0.011	0.178^{***}	0.008
	(0.022)	(0.012)	(0.016)	(0.005)
Deductible is 0	-0.402^{***}	-0.389		
	(0.154)	(0.295)		
ln(deductible$\mid >0$)	-0.066^{***}	-0.064^{*}	-0.044^{***}	-0.044^{***}
	(0.020)	(0.038)	(0.0001)	(0.0001)
ln(maximum OOP)	-0.289^{***}	-0.278^{**}		
	(0.091)	(0.122)		
HMO				-0.235^{***}
				(0.006)
Insurer fixed effects	Yes	Yes	N/A	N/A
Observations	251	151	100	100
R^2	0.671	0.822	0.808	0.997

*p<0.1; **p<0.05; ***p<0.01
Significance

Table 3: Relationship between Network Breadth and Plan Premiums: Bronze plans

	All plans	Non-BCBS plans	BCBS plans	
	(1)	(2)	(3)	(4)
Discharge ratio	0.320^{***}	-0.057	0.478^{***}	0.024^{*}
	(0.058)	(0.063)	(0.014)	(0.014)
ln(deductible| >0)	-0.214^{***}	-0.201^{***}	-0.031^{***}	-0.031^{***}
	(0.059)	(0.069)	(0.010)	(0.010)
ln(maximum out-of-pocket expense)	-0.795^{***}	2.842		
	(0.276)	(2.286)		
HMO				-0.265^{***}
				(0.006)
Insurer fixed effects	Yes	Yes	N/A	N/A
Observations	230	130	100	100
R^2	0.844	0.834	0.842	0.997

*p<0.1; **p<0.05; ***p<0.01
Significance

Table 4: Relationship between Consumer Surplus and Plan Premiums: Bronze plans

	All plans	Non-BCBS plans	BCBS plans	
	(1)	(2)	(3)	(4)
Consumer Surplus from Network	0.071^{**}	-0.027	0.204^{***}	0.007
	(0.029)	(0.018)	(0.018)	(0.005)
ln(deductible| >0)	-0.213^{***}	-0.199^{***}	-0.031^{***}	-0.031^{***}
	(0.060)	(0.068)	(0.010)	(0.010)
ln(maximum out-of-pocket expense)	-0.792^{***}	2.887		
	(0.281)	(2.251)		
HMO				-0.269^{***}
				(0.006)
Insurer fixed effects	Yes	Yes	N/A	N/A
Observations	230	130	100	100
R^2	0.787	0.840	0.798	0.997

*p<0.1; **p<0.05; ***p<0.01
Significance

Table 5: Relationship between Network Breadth and Plan Premiums: Gold plans

	All plans	Non-BCBS plans	BCBS plans	
	(1)	(2)	(3)	(4)
Discharge ratio	0.208^{***}	-0.041	0.394^{***}	0.027^{*}
	(0.072)	(0.043)	(0.012)	(0.015)
ln(deductible| >0)	-0.007^{**}	-0.005^{**}	-0.031^{***}	-0.031^{***}
	(0.003)	(0.002)	(0.001)	(0.001)
ln(maximum out-of-pocket expense)	-0.074^{***}	-0.073^{***}		
	(0.022)	(0.020)		
HMO				-0.214^{***}
				(0.007)
Insurer fixed effects	Yes	Yes	N/A	N/A
Observations	201	101	100	100
R^2	0.616	0.854	0.864	0.997

*p<0.1; **p<0.05; ***p<0.01
Significance

Table 6: Relationship between Consumer Surplus and Plan Premiums: Gold plans

	All plans	Non-BCBS plans	BCBS plans	
	(1)	(2)	(3)	(4)
Consumer Surplus from Network	0.044	−0.009	0.167***	0.009
	(0.028)	(0.010)	(0.015)	(0.006)
ln(deductible| >0)	−0.007**	−0.005**	−0.031***	−0.031***
	(0.003)	(0.002)	(0.001)	(0.001)
ln(maximum out-of-pocket expense)	−0.072***	−0.072***		
	(0.026)	(0.020)		
HMO				−0.218***
				(0.006)
Insurer fixed effects	Yes	Yes	N/A	N/A
Observations	201	101	100	100
R^2	0.548	0.854	0.823	0.996

*p<0.1; **p<0.05; ***p<0.01
Significance

Table 7: Relationship between Network Breadth and Plan Premiums: No fixed effects

	All plans	Non-BCBS plans
	(1)	(2)
Discharge ratio	−0.020	−0.171**
	(0.083)	(0.085)
Deductible is 0	−0.274	−0.111
	(0.311)	(0.376)
ln(deductible| >0)	−0.047	−0.021
	(0.042)	(0.049)
ln(maximum out-of-pocket expense)	0.093	−0.026
	(0.244)	(0.169)
Insurer fixed effects	No	No
Observations	251	151
R^2	0.333	0.471
Note: Silver plans only	*p<0.1; **p<0.05; ***p<0.01 Significance	

Table 8: Relationship between Network Breadth and Plan Premiums: All plan tiers

	All plans	Non-BCBS plans	BCBS plans	
	(1)	(2)	(3)	(4)
Discharge ratio	0.281***	−0.044	0.432***	0.026**
	(0.049)	(0.045)	(0.011)	(0.013)
Deductible is 0	−0.123	−0.388***		
	(0.081)	(0.074)		
ln(deductible| >0)	−0.019*	−0.058***	−0.036***	−0.036***
	(0.010)	(0.010)	(0.0001)	(0.0001)
ln(maximum out-of-pocket expense)	−0.117***	−0.037**		
	(0.026)	(0.015)		
HMO				−0.237***
				(0.006)
Silver	0.240***	0.141***	0.339***	0.339***
	(0.020)	(0.015)	(0.005)	(0.005)
Gold	0.349	0.233***	0.509***	0.509***
	(0.023)	(0.015)	(0.008)	(0.008)
Insurer fixed effects	Yes	Yes	N/A	N/A
Observations	682	382	300	300
R^2	0.844	0.892	0.953	0.998

Note: Bronze is reference level *p<0.1; **p<0.05; ***p<0.01 Significance

Table 9: Relationship between Consumer Surplus and Plan Premiums: All plan tiers

	All plans	Non-BCBS plans	BCBS plans	
	(1)	(2)	(3)	(4)
Consumer Surplus from Network	0.065^{***}	-0.014	0.183^{***}	0.008
	(0.022)	(0.012)	(0.015)	(0.005)
Deductible is 0	-0.122	-0.388^{***}		
	(0.081)	(0.074)		
ln(deductible$\mid >0$)	-0.019^{*}	-0.058^{***}	-0.036^{***}	-0.036^{***}
	(0.010)	(0.010)	(0.0001)	(0.0001)
ln(maximum out-of-pocket expense)	-0.117^{***}	-0.037^{**}		
	(0.027)	(0.015)		
HMO				-0.241^{***}
				(0.006)
Silver	0.240^{***}	0.141^{***}	0.339^{***}	0.339^{***}
	(0.020)	(0.015)	(0.005)	(0.005)
Gold	0.349	0.233^{***}	0.509^{***}	0.509^{***}
	(0.023)	(0.015)	(0.008)	(0.008)
Insurer fixed effects	Yes	Yes	N/A	N/A
Observations	682	382	300	300
R^2	0.813	0.892	0.939	0.997

*p<0.1; **p<0.05; ***p<0.01
Significance