

**Online Appendix** to “Narrow Networks on the Health Insurance Exchanges: What Do They Look Like and How Do They Affect Pricing? A Case Study of Texas”

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This online appendix contains material that was excluded from the article due to space constraints. First, we provide greater detail on the data and methods underlying our measures of insurer network breadth (“discharge share” and “expected utility”). Second, we present a number of figures and tables discussed but not included in the published article.

Our measures of insurer network breadth rely upon two main data sources. First, insurer network data was gathered manually from insurer websites. These data contain the names and locations of all facilities in all insurer networks for silver plans in Texas. Second, we obtained inpatient discharge data from the Texas Department of State Health Services Center for Health Statistics for 2010. We exclude from both of these datasets hospitals (and for the discharge data, admissions to hospitals) that are not general acute care facilities. In addition, we exclude patients living outside of Texas, patients with lengths of stay above 30 days, patients admitted to a hospital through the ER and for other non-elective stays, patients admitted for conditions that can be treated at non-acute care facilities (e.g., ophthalmological and mental disorders), and discharges that were missing key data elements (e.g., age, patient residence, admission diagnosis, name of treating facility, and gender).

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We match hospitals in each of these two datasets to American Hospital Association (AHA) IDs based on name and location, and then merge the datasets using the AHA ID. Hospitals lacking an AHA ID, but present in both the network and discharge datasets are assigned a synthetic ID and included in the analysis. As a test of the accuracy of our process, we calculate the share of beds in a ratings area (according to the AHA) that is accounted for by hospitals appearing in at least one network for that ratings area. We find that ratings area 26 has a relatively low “share captured” (64%), and this is among the reasons we exclude ratings area 26 from our estimation sample. The other semi-outlier is ratings area 1, with a share captured of 75%. Across the remaining areas (2-25), the lowest share captured was 92%, and the average was 99%.

As we note in the paper, the discharge share is calculated as the ratio of patient discharges in hospitals belonging to a network over the total number of discharges to patients residing in the ratings area.

We construct our measure of the expected utility that a consumer will obtain from choosing a given network following the approach laid out in the existing literature (Capps et al., 2002; Ho, 2006, 2009). The first step is to estimate a discrete choice model for hospitals allowing for differences across individuals. We do this using the flexible semiparametric estimator described in Carlson, et al. (2012). This approach involves first partitioning patients into mutually exhaustive bins based around their demographic characteristics and conditions.<sup>2</sup> Then we use the

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<sup>2</sup> Our categorizing variables are as follows. Our initial categorizing variable is patients’ zip code of residence. This should capture a large degree of variation in income and other potentially informative factors. In addition, we use three age groups: under 18; 18-64; and 65 and over. For conditions, we use the combination of seven disease categories based off of the HCFA’s Major Diagnosis Categories: respiratory; circulatory; digestive; orthopedic; endocrine and kidney; reproductive and obstetric; and all others. We further subdivide things by degree of condition

empirical probabilities that observationally equivalent individuals within these bins go to different hospitals to form predicted choice probabilities for the relevant set of hospitals for each bin. These predicted probabilities are merged back to the patient-level data so that we have a predicted probability for each relevant hospital for each patient in our sample.<sup>3</sup>

In order to turn these predicted probabilities into estimates of expected utility, we use the formula presented in Berry (1994), which recovers consumers' expected utility for each hospital as the difference between the logged probability of visiting that hospital and the logged probability of visiting a reference facility. In our application, the expected utility of each hospital is measured relative to that of a large provider utilized by many consumers state wide: Medical City Dallas Hospital.<sup>4</sup> In those cohorts where this choice was never utilized, we impose that it nonetheless had a very small chance of being chosen so that the normalization utility is well-defined.

To form estimates of the ex-ante desirability of insurer networks, we follow broadly the same approach as Ho (2006, 2009), aggregating over consumers within ratings areas. A key part of this aggregation process relates to consumers' ex ante expectations of suffering different conditions. Like Ho, we assume that conditional on hospitalization, consumers' ex ante expectations for the MDC and severity weight reflect the empirical distribution for their age-cohort across the state.

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acuity as proxied by the weight attributed to their diagnosis-related group (DRG). We use three such groups: low (weight under 1); medium (weight between 1 and 2); and high (weight above 2).

<sup>3</sup> In an effort to avoid the problems posed by sparse bins, we implement a modest extension of the approach described in Carlson et al. This involves iteratively dropping categorizing variables, and forming new estimated choice probabilities. The choice probability from the richest model will be kept if calculated for a bin of at least a certain threshold size (in our case 20). If not, the choice probability will be taken from the second richest model, provided that it was calculated for a bin of at least the threshold size. This process was repeated until all observations had choice probabilities.

<sup>4</sup> The choice of facility was largely arbitrary. A general hospital appearing in many choice sets was chosen.

Unlike Ho, we assume that consumers' ex ante expectations for the probability of being hospitalized are given by the empirical distribution of hospitalizations within age-zip-code combinations.

Online Appendix Table 1: Network Discharge Shares by Insurer and Ratings Area

Ratings Area	Population	Share of Total Population	Insurer															
			Blue Cross			Aetna	Cigna	Ambetter	CHC	CommunityFirst	FirstCare	Humana	ScottWhite	Sendero				
			discharge share, PPO	discharge share, HMO	PPO/HMO premium ratio	discharge share, PPO	discharge share, PPO	discharge share, HMO										
Dallas (8)	6,754,588	25.5%	100	41	1.27	31	99											
Houston (10)	6,340,014	24.0%	99	39	1.29	27	90											
San Antonio (19)	2,277,550	8.6%	100	91	1.24	32												
Austin (3)	1,883,051	7.1%	100	56	1.27	54	95											
El Paso (9)	827,718	3.1%	100	97	1.29													
McAllen-Edinburg-Mission (15)	815,996	3.1%	100	97	1.27													
Corpus Christi (7)	442,600	1.7%	100	95	1.22													
Killeen-Temple-Ft Hood (11)	423,257	1.6%	100	6	1.35	5												
Brownsville-Harlingen (5)	417,276	1.6%	100	93	1.33													
Beaumont-Port Arthur (4)	390,732	1.5%	91	84	1.28	38												
Lubbock (14)	295,315	1.1%	100	10	1.28													
Laredo (12)	262,495	1.0%	100	82	1.25													
Amarillo (2)	256,094	1.0%	73	71	1.28													
Waco (24)	241,481	0.9%	100	64	1.28	64												
College Station - Bryan (6)	236,819	0.9%	100	32	1.24													
Longview (13)	216,530	0.8%	100	85	1.28													
Tyler (22)	216,080	0.8%	100	39	1.31													
Abilene (1)	167,501	0.6%	100	92	1.28													
Midland (16)	151,468	0.6%	100	62	1.32													
Wichita Falls (25)	151,201	0.6%	100	25	1.21													
Odessa (17)	149,378	0.6%	100	54	1.28													
Sherman-Denison (20)	122,353	0.5%	100	37	1.28													
Victoria (23)	119,299	0.5%	100	84	1.23													
San Angelo (18)	116,566	0.4%	99	38	1.28													
Texarkana (21)	93,487	0.4%	100	95	1.28													

Notes: Excludes ratings area 26. Ratings area numbers are in () next to ratings area names.

**Online Appendix Table 2: Summary Statistics for Network Structure Analysis**

	mean	SD
In Network	0.57	0.49
Critical Access Hospital	0.11	0.32
ln(Hospital Price)	9.14	0.65
Case Mix Index	1.64	0.32
For Profit	0.53	0.50
ln(number of beds)	4.75	1.23
Medical School	0.04	0.19
RA System	0.53	0.50
non-RA System	0.19	0.40

Notes: N=1,145. The unit of observation is the hospital-network-ratings area. Network-ratings area pairs are restricted to those that remain after imposing the following restrictions on plans: exclude metal colors other than silver, ratings area 26, multi-state plans, one observation with an Exclusive Provider Network (EPO), and the sole plans offered by Sendero and Community First that remain after applying these restrictions. Hospitals are restricted to General Acute Care Hospitals participating in at least one network in the relevant ratings area and successfully matched to a complete record in the AHA survey. ln(Hospital Prices) and CMI are derived from HCRIS data, and are missing for Critical Access Hospitals and a small number of other facilities with data problems. If either value is missing, the facility is coded as a Critical Access Hospital, and both are set to the sample mean. Medical School is one if a hospital is the main teaching affiliate of a medical school, based searches of medical school web sites. RA system is one if a hospital is in a system which has another member in the same ratings area. non-RA system is one if a hospital is in a system which has another member in the same state, but not the same ratings area.

**Online Appendix Table 3: Predicting Inclusion in Insurer Networks**

	(1)	(2)	(3)
<i>Hospital Characteristics</i>			
Critical Assess Hospitals	0.0745 [0.0516]	0.0902 [0.0452]**	0.0842 [0.0484]*
ln(Hospital Price)	-0.00954 [0.0298]	-0.0192 [0.0260]	-0.00361 [0.0273]
Case Mix Index	-0.177 [0.0591]***	-0.147 [0.0517]***	-0.147 [0.0531]***
For Profit	-0.00250 [0.0348]	0.0368 [0.0308]	0.0395 [0.0328]
ln(number of beds)	0.0303 [0.0151]**	0.0379 [0.0132]***	0.0310 [0.0137]**
Medical School	0.0772 [0.0857]	0.107 [0.0750]	0.121 [0.0775]
RA System	-0.00555 [0.0404]	0.0357 [0.0357]	0.0556 [0.0382]
non-RA System	0.0386 [0.0482]	0.0390 [0.0424]	0.00327 [0.0475]
Insurer fixed effects	N	Y	Y
Ratings Area fixed effects	N	N	Y
R-sq	0.023	0.260	0.287
Observations	1,045	1,045	1,045

Notes: The unit of observation is the network x ratings area x hospital. Networks are restricted to those that remain after imposing the following sample restrictions: exclude metal colors other than Silver, ratings area 26, multi-state plans, one observation with an Exclusive Provider Network (EPO), and the sole plans offered by Sendero and Community First remaining after the other restrictions are applied. Hospitals are restricted to General Acute Care Hospitals. ln(Hospital Prices) and CMI are missing for Critical Access Hospitals and a small number of other facilities with data problems. If either is missing, the facility is coded as a Critical Access Hospital and both variables are assigned the sample means. Standard errors are unclustered and displayed in [ ].

\* p<0.10, \*\* p<0.05, \*\*\* p<.01

**Online Appendix Table 4: Summary Statistics for Hedonic Analysis**

	mean	SD
ln(premium)	5.46	0.15
Share of Discharges	0.60	0.35
Consumer Surplus from Network	3.31	1.26
deductible is 0	0.08	0.28
ln(deductible)	7.40	2.28
ln(max OOP)	8.74	0.04
HMO	0.66	0.47

Notes: N=251. Premiums are monthly rates for a single 27-year-old. Sample excludes metal colors other than Silver, ratings area 26, multi-state plans, one observation with an Exclusive Provider Network (EPO), and the sole plans offered by Sendero and Community First remaining after the other restrictions are applied. Two insurers, Community Health Choice and Molina Marketplace have zero deductibles: ln(deductible) is coded as zero in these cases.

**Online Appendix Table 5: Relationship between Network Expected Utility and Plan Premiums**

Sample	Non-BCBS			
	All plans (1)	plans (2)	BCBS plans (3)	BCBS plans (4)
Consumer Surplus from Network	0.0621 <i>[0.022]***</i>	-0.011 <i>[0.012]</i>	0.178 <i>[0.016]***</i>	0.00815 <i>[0.005]</i>
deductible is 0	-0.402 <i>[0.154]**</i>	-0.389 <i>[0.295]</i>		
ln(deductible   >0)	-0.0659 <i>[0.020]***</i>	-0.064 <i>[0.038]*</i>	-0.0444 <i>[0.000]***</i>	-0.0444 <i>[0.000]***</i>
ln(max OOP)	-0.289 <i>[0.091]***</i>	-0.278 <i>[0.122]**</i>		
HMO				-0.235 <i>[0.006]***</i>
Insurer fixed effects	Y	Y	N/A	N/A
R-sq	0.671	0.822	0.808	0.997
Observations	251	151	100	100

Notes: Sample excludes metal colors other than Silver, ratings area 26, multi-state plans, one observation with an Exclusive Provider Network (EPO), and the sole plans offered by Sendero and Community First remaining after the other restrictions. Two insurers, Community Health Choice and Molina Marketplace have zero deductibles: ln(deductible) is coded as zero in this cases. All specifications include ratings area fixed effects. Observations are weighted using the county population divided by the number of plans offered in the county, summed over the counties within the ratings area in which the plan is offered. Standard errors are clustered by ratings area x insurer network. Standard errors are listed in []. \* p<0.10, \*\* p<0.05, \*\*\* p<.01

Online Appendix Figure 1: Measures of Network Breadth and Expected Utility

