Online Appendix: Non-Price Competition and Risk Selection Through Hospital Networks

Appendix 1 Current risk adjustment system

Appendix Table 1: Base capitated transfer for the Contributory System during 2011

Department/city	Transfer
National (pesos)	505,627.2
Multiplier a_m	
Amazonas	× 1.10
Arauca, Arauca	× 1.10
Yopal, Casanare	× 1.10
Florencia, Caquetá	× 1.10
Chocó	× 1.10
Riohacha, Guajira	× 1.10
Guainía	× 1.10
Guaviare	× 1.10
Villavicencio, Meta	× 1.10
Putumayo	× 1.10
San Andrés y Providencia	× 1.10
Sucre, Sincelejo	× 1.10
Vaupés	× 1.10
Vichada	× 1.10
Soacha, Cundinamarca	× 1.06
Bello, Antioquia	× 1.06
Itaguí, Antioquia	× 1.06
Envigado, Antioquia	× 1.06
Sabaneta, Antioquia	× 1.06
Soledad, Antioquia	× 1.06
Bogotá	× 1.06
Medellín, Antioquia	× 1.06
Barranquilla, Atlántico	× 1.06

Appendix Table 2: Risk Adjustment Factors in the Contributory System during 2011

Age group	Sex	Multiplier
<1	—	3.0000
1-4	—	0.9633
5-14	—	0.3365
15-18	M	0.3207
15-18	F	0.5068
19-44	M	0.5707
19-44	F	1.0588
45-49	—	1.0473
50-54	—	1.3358
55-59	—	1.6329
60-64	—	2.1015
65-69	—	2.6141
70-74	—	3.1369
>74	—	3.9419

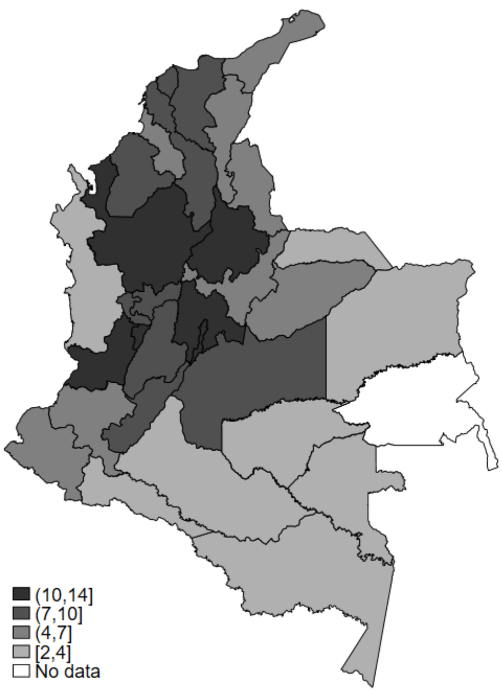
Appendix 2 Service categories

Service code	Description
01	Procedures in skull, brain, and cerebral meninges
03	Procedures in spinal cord and structures of spine
04	Procedures in peripheral and skull nerves
05	Procedures in nerves or sympathetic ganglia
06	Procedures in thyroid and parathyroid gland
08	Procedures in eyelids and lacrimal apparatus
10	Procedures in conjunctive, cornea, iris, retina, orbit
18	Procedures in ear
21	Procedures in nose and paranasal sinuses
23	Procedures in teeth, tongue, salivary glands
27	Procedures and interventions in mouth and face
28	Procedures in tonsils and adenoids
29	Procedures in pharynx, larynx, trachea
32	Procedures in lung and bronchus
34	Procedures in thoracic wall, pleura, mediastinum, diaphragm
35	Procedures in heart valves
36	Procedures in cardiac vessels
37	Procedures in heart and pericardium
38	Procedures in blood vessels
40	Procedures in lymphatic system
41	Procedures bone marrow and spleen
42	Procedures in esophagus
43	Procedures in stomach
45	Procedures in intestines
47	Procedures in appendix
48	Procedures in rectum, rectosigmoid, perirectal tissue
50	Procedures in liver
51	Procedures in gallbladder and biliary tract
52	Procedures in pancreas
53	Procedures in abdominal wall
55	Procedures in kidney
56	Procedures in ureter
57	Procedures in bladder
58	Procedures in urethra and urinary tract
60	Procedures in prostate, seminal vesicles, scrotum, testicles, penis
65	Procedures in ovaries, fallopian tubes, cervix, uterus
70	Procedures in vagina and cul-de-sac
72	Procedures and interventions in vaginal delivery
76	Procedures in bones and facial joints
79	Reduction of fracture and dislocation
80	Procedures in joint structures
81	Repair procedures and plasties in joint structures
82	Procedures in tendons, muscles, and hand fascia
83	Procedures in muscle, tendon, fascia, bursa except hand
85	Procedures in breast
86	Diagnostic procedures in skin and subcutaneous cellular tissue
87	Radiology and non-radiology imaging
89	Consultation, anatomic measures, physiology, manual tests, and pathology
90	Laboratory
91	Blood bank and transfusion medicine
92	Nuclear medicine and radiotherapy
93	Procedures and interventions in functional development and rehabilitation
94	Procedures related to mental health
95	Non-surgical procedures and interventions related to eye and ear
97	Substitution and extraction of therapeutic devices
98	Non-surgical extraction of kidney stones
99	Prophylactic and therapeutic procedures
S1	Inpatient services

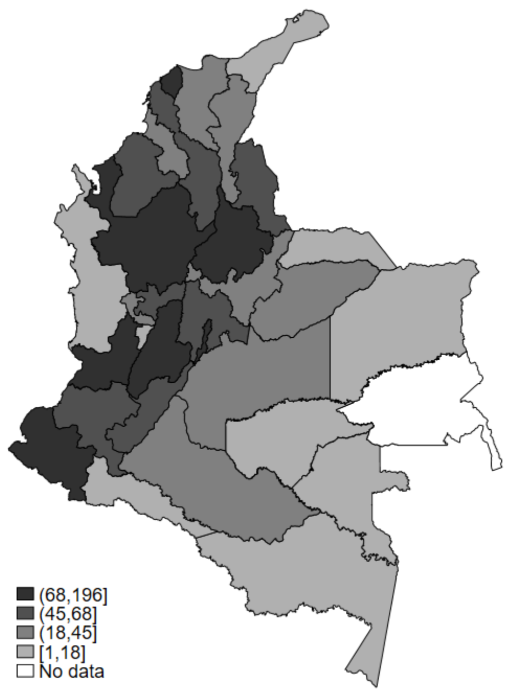
Appendix 3 Description of the Colombian health care market

Appendix Table 3: National market shares in 2011

Insurer	Market share
EPS013	21.4
EPS016	15.2
EPS037	11.1
EPS002	9.3
EPS017	7.2
EPS010	7.1
EPS005	4.5
EPS018	4.4
EPS003	4.0
EPS008	3.7
EPS023	3.1
EPS009	1.8
EPS001	1.6
EPS012	1.6

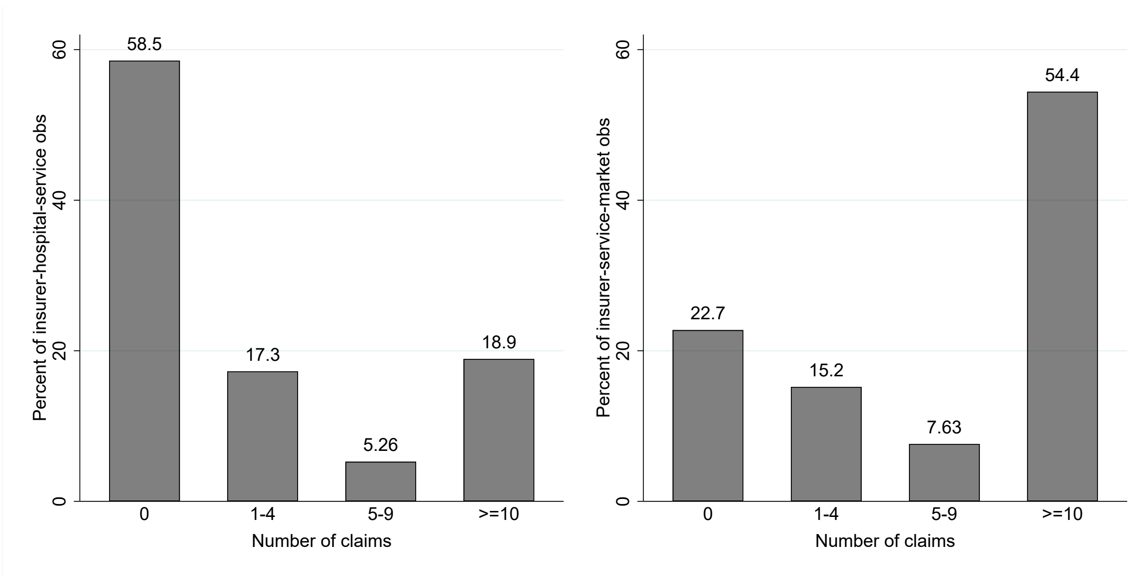


(a) Insurers per market



(b) Hospitals per market

Appendix Figure 1: Number of insurers and hospitals per market



Appendix Figure 2: Distribution of number of claims

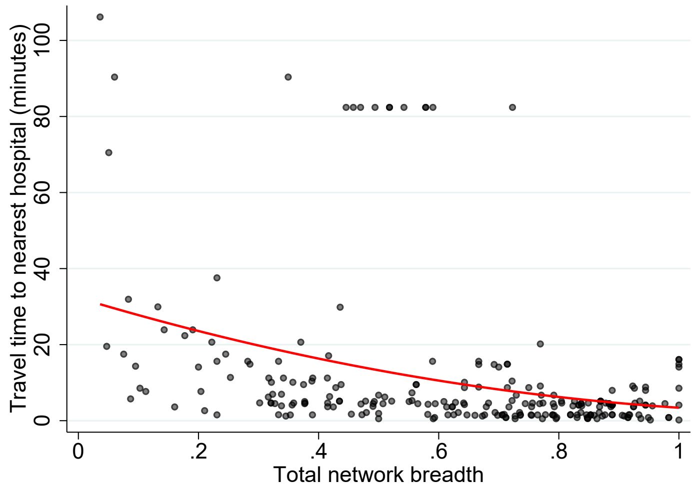
Note: This figure shows the distribution of number of claims by hospital-insurer-service in the left panel and by insurer-service in the right panel.

Appendix Table 4: Service coverage per insurer at several hospitals

	Cardiology			Dialysis			General adult admission		
Insurer	Valle del Lili	Santa Fe	Pablo Tobón	Valle del Lili	Santa Fe	Pablo Tobón	Valle del Lili	Santa Fe	Pablo Tobón
EPS001	1	0	0	0	0	0	1	0	0
EPS002	0	0	0	1	0	1	0	0	1
EPS003	0	0	0	0	0	0	0	0	0
EPS005	0	1	0	0	1	0	1	1	0
EPS008	1	1	0	1	0	0	1	1	0
EPS009	0	0	1	0	0	0	0	0	0
EPS010	1	1	0	1	0	0	0	1	0
EPS012	1	1	0	0	0	0	1	1	0
EPS013	0	0	0	0	0	0	0	0	0
EPS016	0	0	0	0	0	0	1	1	1
EPS017	0	0	0	0	1	0	0	1	0
EPS018	1	1	1	0	0	0	1	0	1
EPS023	0	0	0	0	0	0	0	0	0
EPS037	1	1	1	1	0	0	1	1	1

Note: Table presents service coverage per insurer at three hospitals in the country. Data comes from the National Health Superintendency.

Appendix 4 Variation in provider quality within service



Appendix Figure 3: Correlation between total network breadth and travel time

Note: This figure shows a scatter plot of network breadth over all services and travel time from the municipality centroid to the nearest in-network hospital in minutes. The red line represents a quadratic fit.

Appendix Table 5: Correlation between network breadth and measures of hospital quality

	Star hospital	Patient satisfaction	Inverse mortality
Network breadth	0.15***	0.002	0.16***
	(0.01)	(0.003)	(0.01)
R^2	0.67	0.43	0.43
N	13,572	10,195	9,949

Note: This table shows results of a linear regression of star hospital coverage indicator, patient satisfaction, and inverse inpatient mortality rate after 48 hours on service-level network breadth. Patient satisfaction levels and mortality rates per hospital are obtained from the National Health Superintendency's 2011 hospital quality measures (https://docs.supersalud.gov.co/PortalWeb/SupervisionInstitucional/IndicadoresCalidadEPS/Indicadores-Calidad-IPS-consolidado-2011.xlsx). All regressions include insurer, market, and service fixed effects. Robust standard errors in parenthesis. ***p<0.01, **p<0.05, *p<0.1.

Appendix 5 Additional results for selection incentives

Appendix Table 6: Insurer choice among switchers with changes in health status

	Insurer choice
(1) Women in childbearing ages	
$H_{jm}^{2010} - H_{j'm}^{2011}$ Delivery	-2.77***
	(0.12)
N	14,958
(2) Additional diagnosis of renal disease	
$H_{jm}^{2010} - H_{j'm}^{2011}$ Dialysis	-1.51*
	(0.84)
N	40
(3) Additional diagnosis of cancer	
$H_{jm}^{2010} - H_{j'm}^{2011}$ Therapy	-3.23***
	(0.37)
N	1,658
(4) Additional diagnosis of arthritis	
$H_{jm}^{2010} - H_{j'm}^{2011}$ Bones and joints	-1.82***
	(0.65)
N	533
(5) Newly diagnosed	
$H_{jm}^{2010} - H_{j'm}^{2011}$ Hospital admissions	-1.94***
	(0.21)
N	5,787

Note: Table presents results of a conditional logit estimated by maximum likelihood on the sample of switchers. Panel (1) uses the subsample of women in childbearing ages during 2010. The main explanatory variable is the difference in network breadth for delivery services between the incumbent insurer j and all other insurers j'. Panel (2) uses the subsample of patients who develop renal disease in 2011 and the difference in network breadth for dialysis between the incumbent insurer and all other insurers. Panel (3) uses the subsample of patients who develop cancer in 2011 and the difference in network breadth for chemotherapy between the incumbent insurer and all other insurers. Panel (4) uses the subsample of patients who develop arthritis and the difference in network breadth for procedures in bones and joints between the incumbent insurer and all other insurers. Panel (5) uses the subsample of patients who were healthy in 2010 and develop a disease in 2011. The main explanatory variable is the difference in network breadth for hospital admissions between the incumbent insurer and all other insurers. Robust standard errors in parenthesis. ***p<0.01, **p<0.05, *p<0.1.

Appendix Table 7: Insurer choice among switchers diagnosed in 2010

	Insurer choice
(1) Renal disease	
$H_{jm}^{2010} - H_{j'm}^{2011}$ Dialysis	-2.91***
	(1.00)
N	92
(2) Cancer	
$H_{jm}^{2010} - H_{j'm}^{2011}$ Therapy	-2.77***
	(0.40)
N	1,988
(3) Arthritis	
$H_{jm}^{2010} - H_{j'm}^{2011}$ Bones and joints	-0.93
	(0.58)
N	462
(4) Any disease	
$H_{jm}^{2010} - H_{j'm}^{2011}$ Hospital admissions	-1.72***
	(0.16)
N	9,512

Note: Table presents results of a conditional logit estimated by maximum likelihood on the sample of switchers. Panel (1) uses the subsample of patients diagnosed with renal disease in 2010. The main explanatory variable is the difference in network breadth for dialysis between the incumbent insurer j and all other insurers j'. Panel (2) uses the subsample of patients diagnosed with cancer in 2010 and the difference in network breadth for chemotherapy between the incumbent insurer and all other insurers. Panel (3) uses the subsample of patients diagnosed with arthritis in 2010 and the difference in network breadth for prcedures in bones and joints between the incumbent insurer and all other insurers. Panel (4) uses the subsample of patients with any disease in 2010 and the difference in network breadth for hospital admissions between the incumbent insurer and all other insurers. Robust standard errors in parenthesis. ***p<0.01, **p<0.05, *p<0.1.

Appendix 6 Correlation between network breadth and health care costs

I estimate the following equation using data from 2011:

$$\log(y_{ijkm} + 1) = \beta_0 + \beta_1 H_{jkm} + \mathbf{d}_i \beta_2 + \eta_k + \delta_j + \gamma_m + \varepsilon_{ijm}$$

where y_{ijkm} is individual i's annual health care cost in service k, H_{jkm} is insurer j's network breadth in market m for service k, $\mathbf{d}_i$ is a vector of consumer demographics and diagnoses, and η_k, δ_j, and γ_m are service, insurer, and market fixed effects, respectively. Results are reported in appendix table 8.

Appendix Table 8: Network breadth, utilization, and costs

	log(total service cost + 1)		
	(1) Stayers	(2) New	(3) Full
H_{jmk}	0.06***	0.02***	-0.01***
	0.003	0.001	0.003
N	14,487,530	14,496,056	14,831,006
R^2	0.44	0.21	0.34

Note: OLS regression of the logarithm of health care cost per service on insurer network breath during 2011. All models include demographic controls, and market and service fixed effects. Models are estimated on a random sample of 250,000 individuals from the sample of stayers with continuous enrollment in column (1), from the sample of new enrollee with continuous enrollment in column (2), and from the full sample without constraining enrollment to be continuous in column (3). Robust standard errors in parenthesis. ***p<0.01, **p<0.05, *p<0.1.

Appendix 7 Correlation between network breadth and market share

I estimate the correlation between consumer choice and network breadth during 2011 using the following linear regression at the insurer-market level:

$$s^k_{jm} = \beta_0 + \beta_1 H^k_{jm} + \gamma_m + \varepsilon^k_{jm}$$

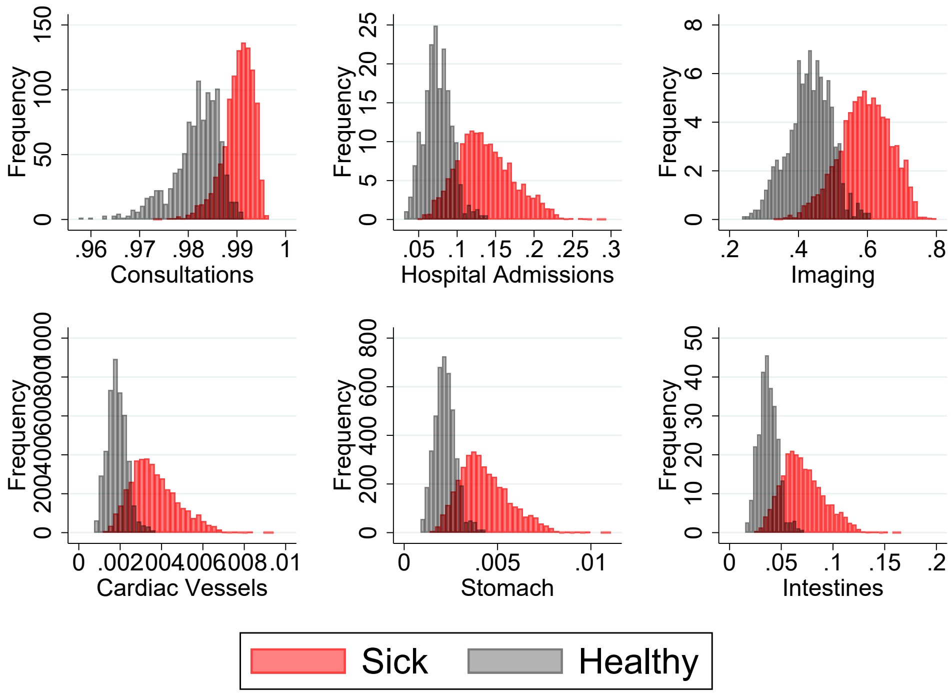
Here s^k_{jm} is insurer j's market share in the number of patients with any disease, no diseases, renal disease, cancer, arthritis, pregnancy, or cardiovascular disease. H^k_{jm} is either average network breadth across all services, or network breadth for dialysis, chemotherapy and radiotherapy, procedures in bones and facial joints, delivery, and procedures in heart, respectively. Results are reported in appendix table 9.

Appendix Table 9: Correlation between market share and service-level network breadth

Market share in	(1) Stayers	(2) New	(3) Full
(1) Any disease			
H_{jm} Average	0.56***	0.55***	0.58***
	(0.03)	(0.03)	(0.04)
(2) Healthy			
H_{jm} Average	0.58***	0.57***	0.58***
	(0.04)	(0.03)	(0.04)
(3) Renal disease			
H_{jm} Dialysis	0.37***	0.41***	0.39***
	(0.04)	(0.05)	(0.04)
(4) Cancer			
H_{jm} Therapy	0.44***	0.43***	0.45***
	(0.03)	(0.05)	(0.04)
(5) Arthritis			
H_{jm} Procedures in bones	0.41***	0.37***	0.41***
	(0.04)	(0.03)	(0.04)
(6) Childbirth			
H_{jm} Delivery	0.50***	0.48***	0.50***
	(0.04)	(0.04)	(0.04)
(7) Cardiovascular			
H_{jm} Procedures in heart	0.46***	0.46***	0.45***
	(0.04)	(0.04)	(0.04)
N	424	424	424

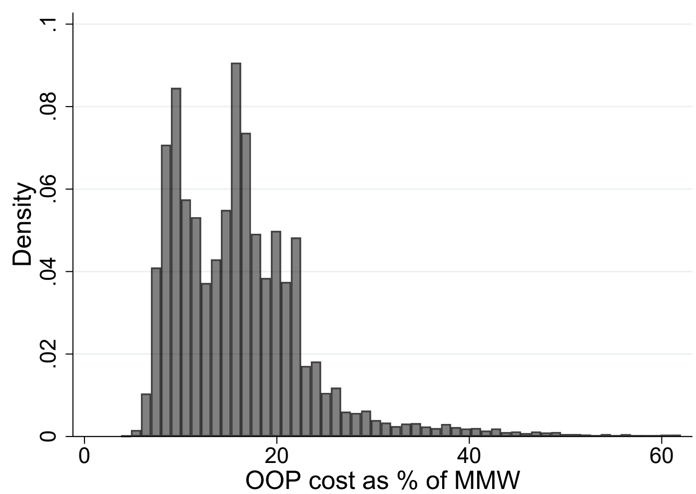
Note: OLS regressions of insurer market share in the number of patients with any disease, no diseases, renal disease, cancer, arthritis, childbirth, and cardiovascular disease, on service-level network breadth during 2011. Column (1) uses the sample of stayers from those who are continuously enrolled, column (2) uses new enrollees from those who are continuously enrolled, and column (3) uses the full sample without constraining enrollment to be continuous. All models include market fixed effects. Robust standard errors in parenthesis. ***p<0.01, **p<0.05, *p<0.1.

Appendix 8 Description of variables in demand model



Appendix Figure 4: Distribution of service claim probability

Note: This figure shows the distribution of the probability of making a claim in 6 service categories separately for sick and healthy individuals. The 6 services are consultations, hospital admissions, imaging, and procedures in cardiac vessels, stomach, and intestines.



Appendix Figure 5: Distribution of out-of-pocket costs as percentage of monthly minimum wage

Note: This figure presents the distribution of out-of-pocket costs conditional on observed insurer choices as percentage of the monthly minimum wage (MMW) in 2011. The average out-of-pocket cost equals 17% of the MMW. Of the total variation in out-of-pocket costs, 33% comes from consumer types and 3% from insurers.

Appendix 9 Additional demand results

9.1 Correlation between out-of-pocket costs and average costs per enrollee

Appendix Table 10: Pass-through of average costs to out-of-pocket costs

	Out-of-pocket cost		
	(1)	(2)	(3)
	< 2 x MMW	[2,5] x MMW	> 5 x MMW
$AC_{\theta jm}$	0.083***	0.143***	0.209***
	(0.0004)	(0.0002)	(0.003)
Constant	0.036***	0.061***	0.182***
	(0.0002)	(0.0001)	(0.002)
N	162,464	334,961	2,575
R^2	0.19	0.63	0.68

Note: This table presents results of an OLS regression of out-of-pocket costs on observed average cost per enrollee conditional on observed insurer choices. Column (1) uses the sample of low-income individuals earning less than 2 times the monthly minimum wage (MMW), column (2) uses the sample of middle-income individuals earning between 2 and 5 times the MMW, and column (3) uses the sample of high-income individuals earning more than 5 times the MMW. Robust standard errors in parenthesis. ***p<0.01, **p<0.05, *p<0.1.

9.2 First stage control function

Appendix Table 11: Control function for out-of-pocket costs

	OOP spending	
	Coefficient	Std. Error
$\sum_k q_{\theta km} A_k$	3.66***	0.01
Demographics		
Male	0.01***	0.00
Age<1	(ref)	(ref)
Age 1-4	-0.03***	0.00
Age 5-14	-0.03***	0.00
Age 15-18	-0.03***	0.00
Age 19-44	-0.04***	0.00
Age 45-49	-0.03***	0.00
Age 50-54	-0.03***	0.00
Age 55-59	-0.03***	0.00
Age 60-64	-0.03***	0.00
Age 65-69	-0.02***	0.00
Age 70-74	-0.02***	0.00
Age>=75	-0.04***	0.00
Diagnoses		
Cancer	0.02***	0.00
Cardio	0.03***	0.00
Diabetes	0.04***	0.00
Renal	0.25***	0.01
Other	0.04***	0.00
>=2 diagnoses	0.15***	0.00
Healthy	(ref)	(ref)
Location		
Normal	0.00***	0.00
Special	0.00***	0.00
Urban	(ref)	(ref)
N	5,800,610	
R^2	0.20	

Note: First stage regression of average out-of-pocket costs on service reference prices. Includes insurer fixed effects. Robust standard errors in parenthesis. ***p<0.01, **p<0.05, *p<0.1.

9.3 In-sample demand model fit

Appendix Table 12: National market shares

Insurer	Observed	Predicted
EPS001	2.06	2.09
EPS002	7.46	7.51
EPS003	4.19	4.25
EPS005	4.33	4.16
EPS008	3.88	3.84
EPS009	2.11	2.11
EPS010	6.38	6.37
EPS012	1.19	1.21
EPS013	16.10	16.09
EPS016	19.78	19.92
EPS017	6.41	6.46
EPS018	4.16	4.05
EPS023	2.38	2.36
EPS037	19.59	19.59

Note: This table presents the observed and predicted national market share per insurer in the sample of new enrollees.

Appendix Table 13: Market shares in four largest markets

	05		08		11		76	
Insurer	Obs	Pred	Obs	Pred	Obs	Pred	Obs	Pred
EPS001	0.86	0.91	2.58	3.95	4.33	4.33	1.41	1.16
EPS002	4.47	3.56	14.86	21.98	9.55	9.44	2.78	2.88
EPS003	3.27	3.45	1.25	2.62	9.26	5.98	0.81	2.65
EPS005	1.08	1.57	2.68	5.10	9.94	5.77	1.91	2.15
EPS008	0.00	0.98			14.24	11.89	0.00	1.32
EPS009	8.48	9.97			0.02	0.83	0.01	0.58
EPS010	24.20	9.48	8.52	12.82	3.30	9.22	4.68	5.25
EPS012					0.01	0.91	8.74	6.94
EPS013	10.86	18.63	13.30	11.98	7.84	7.40	5.78	9.92
EPS016	28.74	25.51	36.05	12.52	4.01	7.64	31.48	29.86
EPS017	0.04	0.49	2.76	5.09	16.05	15.43	0.07	0.86
EPS018	0.04	0.45			0.12	3.12	22.51	18.07
EPS023	1.81	2.67	0.00	0.58	6.68	4.50	1.55	1.89
EPS037	16.14	22.34	18.01	23.37	14.67	13.55	18.28	16.47

Note: This table presents the observed market share and predicted market share from the insurer demand model in the four largest markets and in the sample of new enrollees.

9.4 Robustness checks

Appendix Table 14: Insurer demand with star hospital indicator

Variable		Coefficient	Std. Error
Network		1.38***	0.04
OOP spending	(million COP)	-9.77***	0.58
Star hospital		5.57***	0.38
Interactions			
Network	Male	0.27***	0.01
	Age	-0.01***	0.00
	Cancer	-0.26***	0.02
	Cardiovascular	-0.30***	0.02
	Diabetes	-0.47***	0.05
	Renal	-0.50***	0.09
	Other	-0.48***	0.02
	>=2 diseases	-0.61***	0.02
	Healthy	(ref)	(ref)
	Normal munic.	0.23***	0.01
	Special munic.	0.74***	0.04
	Urban munic.	(ref)	(ref)
	Low income	0.69***	0.04
	Medium income	0.50***	0.04
	High income	(ref)	(ref)
OOP spending	Male	1.54***	0.25
	Age	-0.03***	0.01
	Cancer	4.58***	0.51
	Cardiovascular	4.20***	0.48
	Diabetes	2.71**	1.08
	Renal	4.27***	0.70
	Other	3.84***	0.51
	>=2 diseases	3.56***	0.47
	Healthy	(ref)	(ref)
	Normal munic.	6.27***	0.47
	Special munic.	1.36	1.84
	Urban munic.	(ref)	(ref)
Star hospital	Male	0.25***	0.04
	Age	-0.01***	0.00
	Cancer	-0.34***	0.07
	Cardiovascular	0.05	0.07
	Diabetes	0.89***	0.30
	Renal	-0.23	0.28
	Other	-0.13	0.09
	>=2 diseases	0.30***	0.10
	Healthy	(ref)	(ref)
	Normal munic.	5.54***	0.44
	Special munic.	-0.86***	1.94
	Urban munic.	(ref)	(ref)
	Low income	-2.37***	0.38
	Medium income	-2.93***	0.38
	High income	(ref)	(ref)
N		5,800,610	
N enrollees		500,000	
Pseudo-R^2		0.18	

Note: This table presents results of the insurer choice model including a measure of star hospital coverage equal to $\sum_k q_{\theta km} Star_{jkm}$, where $Star_{jkm}$ is an indicator for insurer j covering a star hospital in market m for service k. Includes insurer fixed effects. Robust standard errors reported. ***p<0.01, **p<0.05, *p<0.1.

Appendix Table 15: Insurer demand in markets with no star hospitals

Variable		Coefficient	Std. Error
Network		1.13***	0.03
OOP spending		-1.91***	0.11
Interactions			
Network	Demographics		
	Male	0.25***	0.01
	Age	-0.01***	0.00
	Diagnoses		
	Cancer	-0.05**	0.02
	Cardiovascular	-0.13***	0.01
	Diabetes	-0.21***	0.03
	Renal	-0.42***	0.07
	Other	-0.26***	0.02
	>=2 diseases	-0.25***	0.01
	Healthy	(ref)	(ref)
	Location		
	Normal	—	—
	Special	—	—
	Urban	(ref)	(ref)
	Income		
	Low	0.47***	0.02
	Medium	0.34***	0.02
	High	(ref)	(ref)
OOP spending	Demographics		
	Male	0.03	0.06
	Age	0.00***	0.00
	Diagnoses		
	Cancer	1.64***	0.16
	Cardiovascular	2.09***	0.10
	Diabetes	1.41***	0.28
	Renal	2.24***	0.13
	Other	2.04***	0.11
	>=2 diseases	1.98***	0.11
	Healthy	(ref)	(ref)
	Location		
	Normal	—	—
	Special	—	—
N		4,391,032	
N enrollees		500,000	
Pseudo-R^2		0.20	

Note: This table presents results of the insurer choice model estimated in the sample of markets without star hospitals or where there is no significant variation in hospital quality. Excluded markets are 05, 08, 11, and 76. Robust standard errors reported. ***p<0.01, **p<0.05, *p<0.1.

Appendix Table 16: Insurer demand with additional insurer quality measures

Variable			Coefficient	Std. Error
Network			2.03***	0.03
OOP spending	(million COP)		-7.00***	0.56
Likert quality			0.001***	0.00
Wait time			-0.002***	0.00
Interactions				
Network	Demographics			
	Male		0.30***	0.01
	Age		-0.01***	0.00
	Diagnoses			
	Cancer		-0.36***	0.02
	Cardiovascular		-0.34***	0.01
	Diabetes		-0.44***	0.04
	Renal		-0.62***	0.08
	Other		-0.55***	0.02
	>=2 diseases		-0.64***	0.02
	Healthy		(ref)	(ref)
	Location			
	Normal		-0.02**	0.01
	Special		0.55***	0.03
	Urban		(ref)	(ref)
	Income			
	Low		0.50***	0.03
	Medium		0.31***	0.03
	High		(ref)	(ref)
OOP spending	Demographics			
	Male		1.46***	0.23
	Age		-0.03***	0.01
	Diagnoses			
	Cancer		2.38***	0.50
	Cardiovascular		2.03***	0.46
	Diabetes		1.16	0.88
	Renal		2.27***	0.61
	Other		2.07***	0.48
	>=2 diseases		1.83***	0.45
	Healthy		(ref)	(ref)
	Location			
	Normal		5.18***	0.45
	Special		-2.83	2.11
	Urban		(ref)	(ref)
N			5,800,610	
N enrollees			500,000	
Pseudo-R^2			0.17	

Note: This table presents results of the insurer choice model with additional quality measures obtained from enrollment surveys conducted by the Colombian Ministry of Health during 2013 to 2016. These measures include average quality from a likert scale and average waiting time for an appointment with the primary care doctor or specialist. Both variables are measured at the insurer-market level. I interact each of them with the probability of making claims for a service $q_{\theta km}$, then summing across services. The model includes insurer fixed effects. Robust standard errors reported. ***p<0.01, **p<0.05, *p<0.1.

Appendix Table 17: Insurer demand with alternative network measures

Variable		Largest hospitals Coef.	Largest hospitals SE	All providers Coef.	All providers SE
Network		2.03***	0.06	2.39***	0.05
OOP spending	(million COP)	-10.79***	0.61	-4.03***	0.46
Interactions					
Network	Demographics				
	Male	0.31***	0.01	0.14***	0.01
	Age	-0.01***	0.00	0.00***	0.00
	Diagnoses				
	Cancer	-0.28***	0.03	-0.72***	0.02
	Cardiovascular	-0.38***	0.02	-0.51***	0.02
	Diabetes	-0.44***	0.05	-0.64***	0.06
	Renal	-0.65***	0.10	-0.59***	0.11
	Other	-0.56***	0.02	-0.70***	0.03
	>=2 diseases	-0.67***	0.02	-0.90***	0.02
	Healthy	(ref)	(ref)	(ref)	(ref)
	Location				
	Normal	-0.06***	0.01	-0.39***	0.01
	Special	0.75***	0.05	-0.74***	0.02
	Urban	(ref)	(ref)	(ref)	(ref)
	Income				
	Low	0.39***	0.06	0.45***	0.05
	Medium	0.27***	0.06	0.11**	0.05
	High	(ref)	(ref)	(ref)	(ref)
OOP spending	Demographics				
	Male	2.00***	0.25	0.50***	0.17
	Age	-0.04***	0.01	-0.02***	0.00
	Diagnoses				
	Cancer	5.24***	0.52	-0.87**	0.34
	Cardiovascular	5.49***	0.48	-0.94***	0.33
	Diabetes	4.20***	1.05	-1.85***	0.62
	Renal	5.94***	0.60	-0.35	0.43
	Other	5.23***	0.51	-1.59***	0.35
	>=2 diseases	4.71***	0.47	-0.94***	0.33
	Healthy	(ref)	(ref)	(ref)	(ref)
	Location				
	Normal	6.09***	0.48	5.68***	0.37
	Special	4.91***	1.24	5.61***	0.46
	Urban	(ref)	(ref)	(ref)	(ref)
N		5,800,610		5,800,610	
N enrollees		500,000		500,000	
Pseudo-R^2		0.17		0.12	

Note: This table presents results of the insurer choice model under alternative specifications of network breadth. Column (1) reports coefficients and standard errors of a model where network breadth is constructed from a sample of the largest hospitals in each market. Large hospitals are defined as having number of beds above the 70th percentile of the distribution of beds in each market. There are 314 hospitals under this definition. Column (2) presents coefficients and standard errors of a model where network breadth is constructed from the sample of all institutional providers of which there are 16,609. All models include insurer fixed effects. Robust standard errors reported. ***p<0.01, **p<0.05, *p<0.1.

Appendix 10 Note on primitives of average cost function

Suppose there is a second stage in the demand model where consumers choose a hospital to receive service k. The cost of consumer i enrolled to insurer j can be written as:

$$c_{ij}(G_j) = \sum_k q_{\theta k} \sum_{h \in G_{jk}} p_{jhk} s_{ihk}(G_{jk})$$

where G_{jk} is the set of hospitals in the network of insurer j for service k, $G_j = \{G_{jk}\}_{k=1}^{\#K}$, p_{jhk} is the negotiated price for service k between insurer j and hospital h, s_{ihk} is the probability that consumer i chooses hospital h for service k, and $q_{\theta k}$ is the probability that consumer i of type θ makes a claim for service k.

With this specification of individual costs, the insurer profit function is:

$$\pi_j = \sum_i (R_{ij} - c_{ij}(G_j)) s_{ij}(G)$$

where s_{ij} is the probability that consumer i enrolls with insurer j and $G = \{G_j\}_{j=1}^{\#\mathcal{J}}$. We can rewrite the previous equation as:

$$\pi_j = (R_j - AC_j(G_j))D_j$$

where $R_j = \sum_i R_{ij}$, $D_j = \sum_i s_{ij}$, and

$$AC_j(H_j) = \frac{1}{D_j} \sum_i c_{ij}(G_j) s_{ij}(G)$$

Suppose s_{ihk} and s_{ij} are obtained from discrete choice models with preference shocks that independent of each other and distributed T1EV. For exposition, assume there are two hospitals and two insurers. Then, the insurer's average cost is:

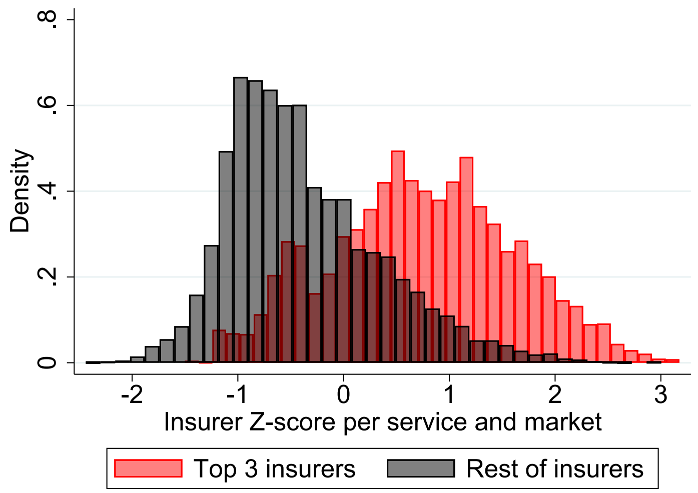
$$AC_j(G_j) = \sum_i \left(\sum_k q_{\theta k} \underbrace{\sum_{h \in G_{jk}} p_{jhk} \frac{\exp(\delta_{ihk})}{1 + \exp(\delta_{ihk})} \frac{1}{D_j}}_{A_m} \right) \frac{\exp(\eta_i(G))}{1 + \exp(\eta_i(G))}$$

where $\eta_i(H_j)$ is the average utility of choosing insurer j and δ_{ihk} is the average utility of choosing hospital h for service k. Take one consumer and apply logs to the equation above, which yields:

$$\log(AC_{ij}(G_j)) = \log\left(\sum_k q_{\theta k} A_k\right) + \underbrace{\eta_i(G)}_{\sum_k q_{\theta k} H_{jk}} - \underbrace{\log(1 + \exp(\eta_i(G)))}_{\sum_k \sum_{l \neq k} q_{\theta k} q_{\theta l} H_{jk} H_{jl}}$$

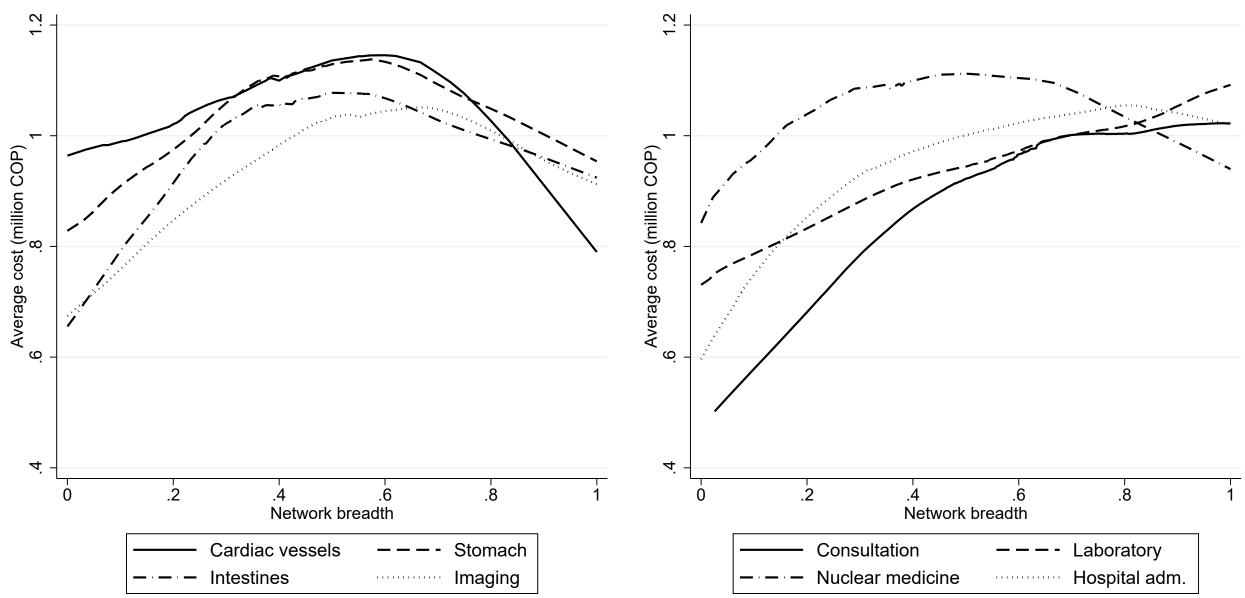
The second term to the right of the equation above is the average utility for the network, which increases average costs and thus is approximated by $\sum_k q_{\theta k} H_{jk}$. The third term is a function of networks that reduces average costs, which I approximate using a measure of scope economies. My average cost function can then be derived from a more involved model of hospital choice under certain conditions.

Appendix 11 Additional average cost results



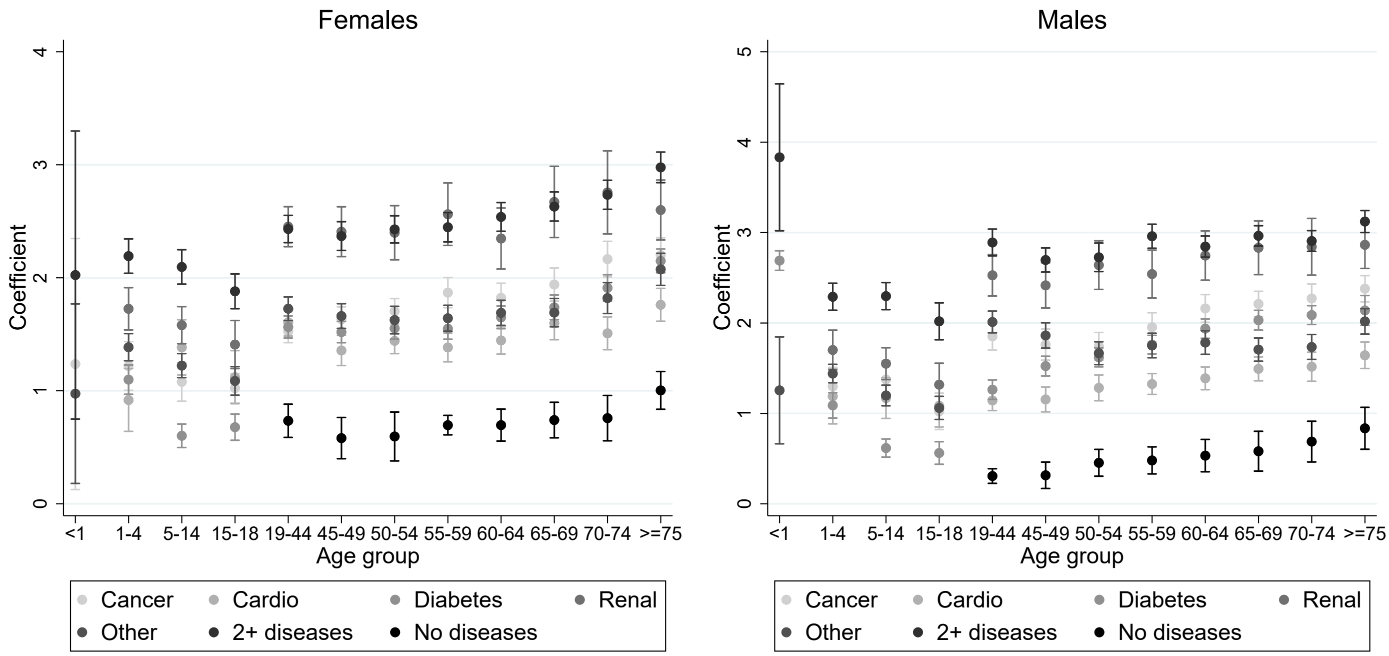
Appendix Figure 6: Standardized network breadth per service and market

Note: Figure shows the distribution of network breadth standardized within service and market, separately for the top 3 insurers (EPS013, EPS016, and EPS037) and the rest of insurers. Standardized values of network breadth are obtained by subtracting the service-market level mean and dividing by the service-market level standard deviation. The top 3 insurers have consistently broad networks across services, while the rest tend to have narrow networks across services.



Appendix Figure 7: Average cost function per service

Note: This figure shows the predicted average cost conditional on observed levels of network breadth separately for 8 service categories: procedures in cardiac vessels, stomach, intestines, and imaging, consultations, laboratory, nuclear medicine, and hospital admissions.



Appendix Figure 8: Consumer type fixed effects

Note: This figure shows the point estimate and 95% confidence interval of the consumer type fixed effects in the average cost function. The left panel shows the fixed effects for females separately by disease category and age group. The right panel shows the fixed effects for males separately by disease category and age group.

Appendix Table 18: Patient-level estimates of average cost

	log(total cost + 1)	
Variable	Coefficient	Std. Error
Network	0.39***	0.01
Scope economies	-9.53***	0.31
Avg. ref. price	-6.65***	0.19
Insurer		
EPS001	-0.57***	0.01
EPS002	0.51***	0.01
EPS003	0.45***	0.01
EPS005	1.98***	0.01
EPS008	1.86***	0.01
EPS009	0.51***	0.01
EPS010	0.77***	0.01
EPS012	1.02***	0.01
EPS013	1.00***	0.01
EPS016	0.12***	0.01
EPS017	1.19***	0.01
EPS018	1.06***	0.01
EPS023	1.19***	0.01
EPS037	(ref)	(ref)
N	8,655,617	
R^2	0.25	

Note: OLS regression of logarithm of patient-level total healthcare cost (plus 1) on network breadth, economies of scope, and service reference price. Consumer type is defined as combinations of sex, age, and diagnosis. Includes insurer, market, and consumer type fixed effects. Robust standard errors reported.

Appendix Table 19: Average cost in markets without star hospitals

Variable	Coefficient	Std. Error
Network	0.26***	0.04
Scope economies	-4.78***	0.91
Avg. ref. price	-0.63***	0.21
Insurer		
EPS001	-0.12***	0.05
EPS002	-0.50***	0.03
EPS003	-0.20***	0.03
EPS005	0.02	0.02
EPS008	0.05	0.13
EPS009	0.13***	0.08
EPS010	-0.23***	0.04
EPS012	-0.35***	0.07
EPS013	-0.02	0.02
EPS016	-0.18***	0.02
EPS017	-0.34***	0.04
EPS018	-0.20***	0.05
EPS023	-0.39***	0.08
EPS037	(ref)	(ref)
N	21,217	
R^2	0.39	

Note: OLS regression of logarithm of average cost per consumer type on markets without star hospitals (excluding markets 05, 08, 11, 76). Includes insurer, market, and consumer type fixed effects. Robust standard errors reported.

Appendix Table 20: Predicted change in females' average cost by type of carrier and diagnosis

	F, 19-44, Healthy		F, 19-44, Cancer	
Service	Narrow	Broad	Narrow	Broad
Cardiac vessels	455	1,588	787	6,784
Stomach	457	1,592	799	6,802
Intestines	659	1,784	1,638	7,559
Imaging	3,399	4,071	9,841	14,105
Consultations	8,236	6,893	17,764	18,175
Laboratory	5,413	5,847	14,711	17,086
Nuclear medicine	1,296	2,724	3,189	8,816
Hospital admissions	1,755	3,035	4,949	9,967

Note: This table shows the average change in the average cost of a healthy female aged 19-44 and a female aged 19-44 with cancer following a 10% increase in network breadth for the service in the row, separately for broad and narrow network carriers. Broad network carriers are defined as insurers with average network breadth across all other services above 70% and narrow network carriers as the complement. Units are in Colombian pesos.

Appendix 12 Dropout and transition probabilities

To estimate the marginal cost of network formation in the third step of my model, I first need to compute the probability that consumer type θ drops out of the contributory system and the probability that consumer type θ in period t transitions into θ' in period $t+1$. Because sex and age are deterministic, transitions across θ are equivalent to transitions across diagnoses. Both of these probabilities weight future per-enrollee profits in the insurer's total profit function.

I use the data from *all* enrollees to the contributory system in 2010 and 2011, regardless of their enrollment spell length, to compute dropout probabilities. For each consumer type θ, I calculate the probability that she drops out of the system non-parametrically as the number of individuals of type θ observed only in 2010 but not 2011, divided by the total number of type θ individuals in 2010. Appendix table 21 presents the mean and standard deviation of the dropout probability overall, and conditional on health status, sex, and age. Healthy individuals are on average 10 percentage points more likely to dropout of the system compared to sick patients, and consumers aged less than 44 are on average 3.8 percentage points more likely to dropout compared to individuals aged 45 or older. The table also shows that males are more likely to dropout of the contributory system relative to females, with the difference in means equal to 3.6 percentage points.

I use a non-parametric approach to compute transition probabilities as well, using data from continuously enrolled new *and* current enrollees in 2010 and 2011. The probability that type θ transitions into θ' equals the number of type θ in 2010 that end up with diagnosis l' in 2011, divided by the number of type θ individuals in 2010. Appendix table 22 presents the mean and standard deviation in parenthesis of transition probabilities from having cancer, cardiovascular disease, diabetes, renal disease, other diseases, 2 or more diseases, and no diseases in period t to having each of these 7 diagnoses in period $t+1$. Because my list of diagnoses is mutually exclusive, the table shows that the probability of transitioning from a particular diagnosis in t to a single different diagnosis in $t+1$ is zero, but the probability for the transition into the same diagnosis or to an added diagnosis (≥ 2 diseases) in $t+1$ is non-zero. For patients without diseases in period t, remaining healthy in period $t+1$ has the higher likelihood, followed by receiving a diagnosis for cardiovascular disease and other diseases like long-term pulmonary disease. The fact that the diagnosis list is mutually exclusive simplifies the computation of future profits and future marginal variable profits per enrollee that are needed to recover the marginal cost of network formation. I move to the estimation of this marginal cost next.

Appendix Table 21: Summary statistics of dropout probability

	Mean	SD
Overall	0.111	0.114
Sick	0.094	0.110
Healthy	0.201	0.092
Age>44	0.094	0.100
Age<=44	0.135	0.129
Male	0.129	0.124
Female	0.093	0.101

Appendix Table 22: Summary statistics of transition probabilities across diagnoses

Diagnosis t/t+1	Cancer	Cardio	Diabetes	Renal	Other	$\geq$2 disea.	No disea.
Cancer	0.789	0.000	0.000	0.000	0.000	0.211	0.000
	(0.136)	(0.000)	(0.000)	(0.000)	(0.000)	(0.136)	(0.000)
Cardio	0.000	0.774	0.000	0.000	0.000	0.226	0.000
	(0.000)	(0.148)	(0.000)	(0.000)	(0.000)	(0.148)	(0.000)
Diabetes	0.000	0.000	0.654	0.000	0.000	0.346	0.000
	(0.000)	(0.000)	(0.209)	(0.000)	(0.000)	(0.209)	(0.000)
Renal	0.000	0.000	0.000	0.643	0.000	0.357	0.000
	(0.000)	(0.000)	(0.000)	(0.167)	(0.000)	(0.167)	(0.000)
Other	0.000	0.000	0.000	0.000	0.711	0.289	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.171)	(0.171)	(0.000)
>=2 diseases	0.000	0.000	0.000	0.000	0.000	1.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
No diseases	0.034	0.087	0.007	0.004	0.044	0.054	0.770
	(0.038)	(0.086)	(0.015)	(0.016)	(0.028)	(0.084)	(0.148)

Note: This table shows the mean and standard deviation in parenthesis of transition probabilities from cancer, cardiovascular disease, diabetes, renal disease, other diseases, 2 or more diseases, and no diseases in period t to each of these 7 diagnoses in period $t+1$. Summary statistics are calculated across sex-age combinations in each cell.

Appendix 13 Additional results for network formation costs

Appendix Table 23: Summary statistics of marginal variable profits per insurer

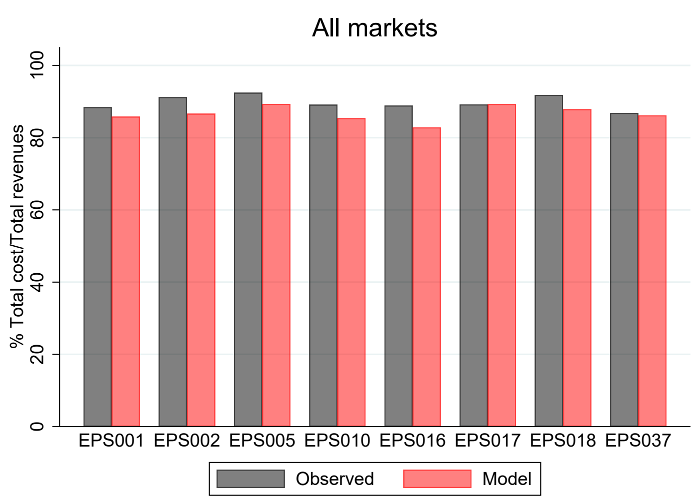
Insurer	MVP
EPS001	272 (1,143)
EPS002	829 (3,095)
EPS003	400 (1,551)
EPS005	222 (864)
EPS010	894 (3,067)
EPS013	717 (2,331)
EPS016	1,276 (4,166)
EPS017	619 (3,339)
EPS018	571 (2,224)
EPS037	1,103 (3,533)

Note: Mean and standard deviation in parenthesis of marginal variable profits in the left-hand side of equation (5). Measured in millions of Colombian pesos per service per market.

Appendix Table 24: First stage regression of network breadth

H_{jkm}	Coefficient	Std. Error
H_{jkm}^{t-1}	0.76***	0.01
$\overline{q}_{female,k,m}$	33.93***	8.45
$\overline{q}_{healthy,k,m}$	14.30***	4.21
$\overline{q}_{age\ 19-44,k,m}$	-55.33***	13.63
$H_{jkm}^{t-1} \times \overline{q}_{age\ 19-44,k,m}$	0.16***	0.05
Insurer FEs		
EPS001	-0.02***	0.01
EPS002	0.02*	0.01
EPS003	-0.03***	0.01
EPS005	0.02*	0.01
EPS010	-0.01	0.01
EPS013	0.00	0.01
EPS016	0.14***	0.01
EPS017	0.00	0.01
EPS018	-0.01	0.01
EPS037	(ref)	(ref)
Market FEs		
Market 05	1.14***	0.25
Market 08	1.14***	0.25
Market 76	1.14***	0.25
Market 11	1.12***	0.24
N	2,262	
F-stat	774.45	

Note: This table presents the first stage of the GMM estimation of equation (7). H_{jkm}^{t-1} is the network breadth in 2010. $\overline{q}_{i,k,m}$ is the average probability that a consumer with characteristic i makes a claim for service k in market m. The specification includes insurer, market, and service fixed effects. Robust standard errors and first-stage F-statistic reported. ***p<0.01, **p<0.05, *p<0.1.



Appendix Figure 9: Out-of-sample model fit

Note: This figure shows a comparison of the model's predicted ratio of total costs (total average costs plus network formation costs) to total revenues per insurer against the ratio obtained from insurers' public income statements. Public income statements are obtained from `https://docs.supersalud.gov.co/PortalWeb/SupervisionRiesgos/EstadisticasEPSRegimenContributivo/RC%20Estados%20financieros%20Dic%202011-CT2011.pdf`

Appendix Table 25: Network formation costs in markets without star hospitals

$\log(MVP_{jmk})$	Coefficient	Std. Error
Network	1.19***	0.08
Insurer FEs		
EPS001	-1.62***	0.04
EPS002	-0.42***	0.03
EPS003	-1.10***	0.03
EPS005	-1.86***	0.02
EPS010	-1.30***	0.04
EPS013	-0.14***	0.03
EPS016	-0.22***	0.03
EPS017	-0.66***	0.03
EPS037	(ref)	(ref)
Market FEs		
Market 15	4.86***	0.07
Market 52	4.15***	0.07
Market 54	4.49***	0.06
Market 68	5.16***	0.07
First stage F-stat	89.9	
N	1,450	
R^2	0.98	

Note: This table presents a 2-step GMM estimation of equation (7) on the subsample of markets without star hospitals, where there are at most 10% of corner solutions in network breadth, these are markets 15, 52, 54, 68. Robust standard errors and first-stage F-statistic for the endogenous variable, network breadth, are reported. ***p<0.01, **p<0.05, *p<0.1.

Appendix 14 Concavity of the profit function

The second partial derivative of the short-run insurer profit function with respect to network breadth for service m, all else equal, is:

$$\frac{\partial^2 \Pi_{jm}}{\partial H_{jkm}^2} = \sum_i \left((R_{\theta m} - (1-r_i)AC_{\theta jm}) \frac{\partial^2 s_{ijm}}{\partial H_{jkm}^2} - 2(1-r_i) \frac{\partial s_{ijm}}{\partial H_{jkm}} \frac{\partial AC_{\theta jm}}{\partial H_{jkm}} - (1-r_i) s_{ijm} \frac{\partial^2 AC_{\theta jm}}{\partial H_{jkm}^2} \right) - 2\omega$$

Given the functional form for demand and average costs and the estimated parameters, we have that

$$\frac{\partial AC_{\theta jm}}{\partial H_{jkm}} > 0$$

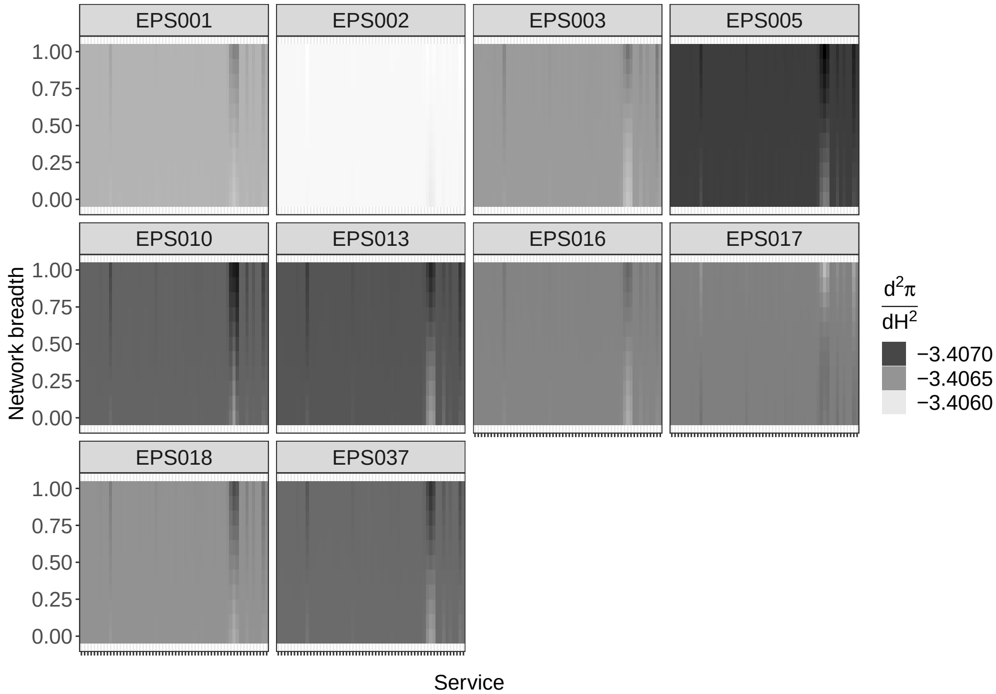
$$\frac{\partial s_{ijm}}{\partial H_{jkm}} > 0$$

$$\frac{\partial^2 AC_{\theta jm}}{\partial H_{jkm}^2} = \left(\frac{\partial AC_{\theta jm}}{\partial H_{jkm}} \right)^2 \frac{1}{AC_{\theta jm}} > 0$$

$$\frac{\partial^2 s_{ijm}}{\partial H_{jkm}^2} = s_{ijm}(1-s_{ijm}) \left(\underbrace{\alpha_i \mu_y \frac{\partial^2 AC_{\theta jm}}{\partial H_{jkm}^2}}_{A<0} + \underbrace{(1-2s_{ijm}) \left(\beta_i q_{\theta km} + \alpha_i \mu_y \frac{\partial AC_{\theta jm}}{\partial H_{jkm}} \right)^2}_{B>0} \right)$$

If $s_{ijm} > 1/2$ then $\frac{\partial^2 s_{ijm}}{\partial H_{jkm}^2} < 0, \;\; \forall H_{jkm} \in [0,1]$, and the second partial derivative is negative given that $\sum_i \Big(R_{\theta m} - (1-r_i)AC_{\theta jm} \Big) > 0$. If $s_{ijm} < 1/2$ then $\frac{\partial^2 s_{ijm}}{\partial H_{jkm}^2} < 0, \;\; \forall H_{jkm} \in [0,1]$ if and only if $-A > B$.

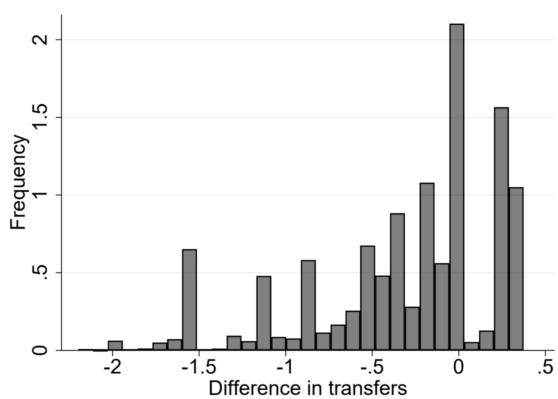
To check whether the second partial derivative is negative at all values of network breadth and resulting choice probabilities and average costs, I conduct a partial equilibrium exercise where each insurer is allowed to deviate and set $H_{jkm} = \{0, 0.1, 0.2, 0.3, ..., 1\}$ for each service k, while holding its rivals' network breadth choices fixed at observed levels. I compute this exercise in the market of Bogotá where my counterfactual simulations are conducted. Appendix figure 10 presents the results. Each panel corresponds to the deviating insurer and displays the value of the second partial derivative for each service in the horizontal axis and for each value of network breadth in the vertical axis. Results show that the second partial derivative of the short-run profit function is negative for all insurers and services, suggesting a potentially concave profit function and well-behaved best-response function.



Appendix Figure 10: Second partial derivative of short-run profit function

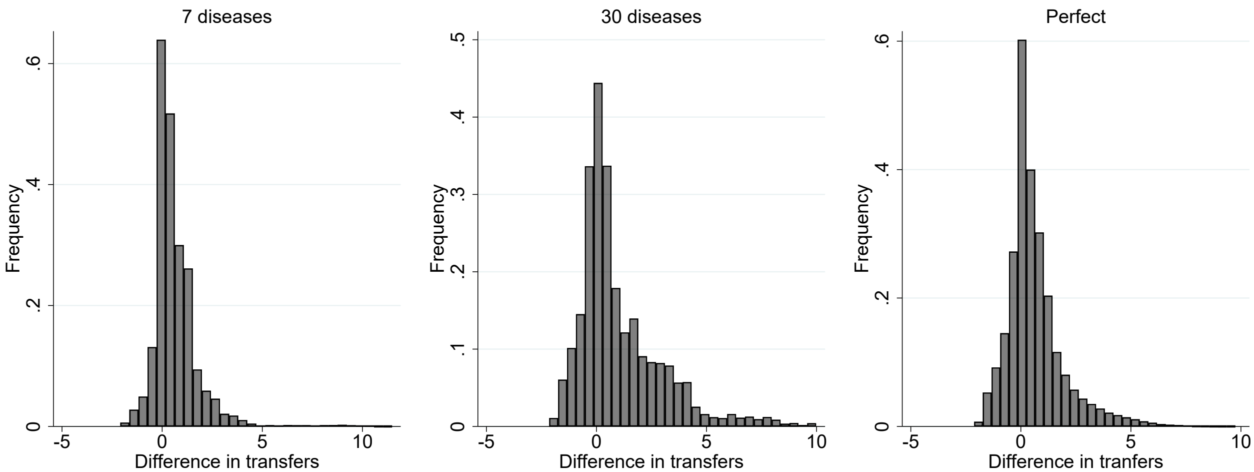
Note: This figure presents the value of the second partial derivative of the insurers' short-run profit function for every service. The second partial derivative is calculated in a partial equilibrium sense. Each insurer is allowed to deviate and set network breadth for service m equal to values between 0 and 1. Other services of this insurer and rivals' choices are fixed at observed levels.

Appendix 15 Additional counterfactual results



Appendix Figure 11: Distribution of counterfactual minus observed transfer under no risk adjustment

Note: This figure shows the distribution of the difference between the observed risk-adjusted transfer and the counterfactual under no risk adjustment across consumer types.

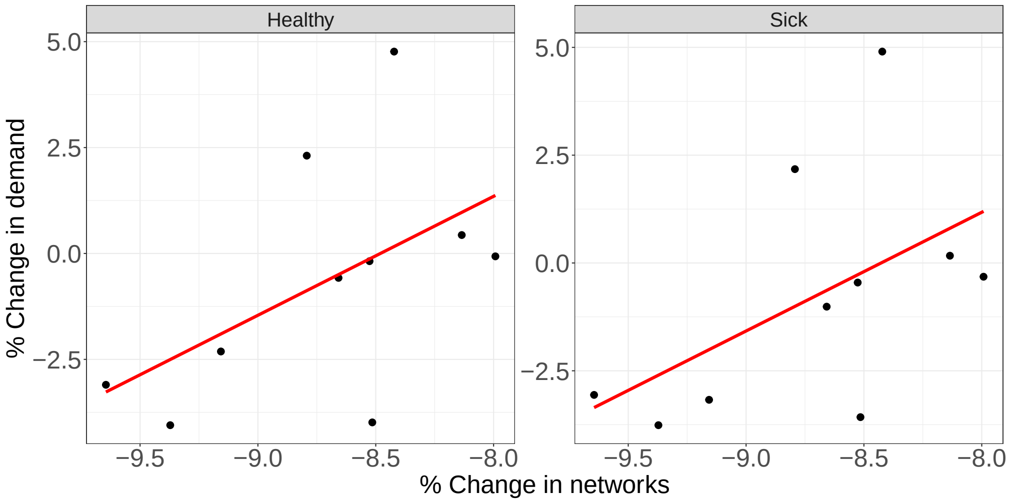


Appendix Figure 12: Distribution of counterfactual minus observed transfer under improved risk adjustment

Note: This figure shows the distribution of the difference between the observed risk-adjusted transfer and the counterfactual transfer under a improved risk adjustment formula across consumer types. In the left panel, the counterfactual transfer compensates insurers for the list of 7 diseases included in the model in addition to sex, age group, and municipality. In the middle panel, the counterfactual transfer compensates insurers for a list of 30 exhaustive and mutually exclusive disease categories (presented in appendix table 26), in addition to sex, age group, and municipality. The right panel corresponds to "perfect" risk adjustment, where the transfer equals the individual's average cost.

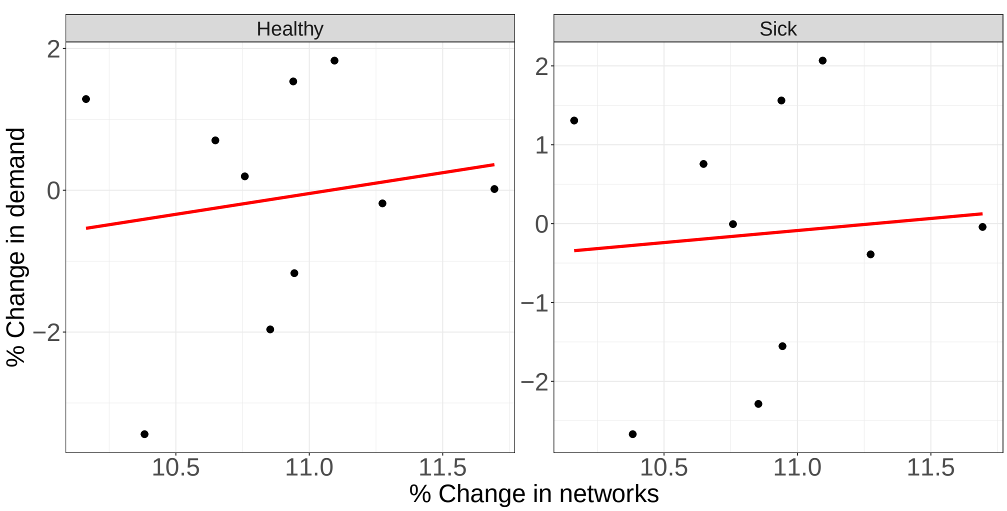
Appendix Table 26: Disease categories

Arthritis
Arthrosis
Asthma
Autoimmune disease
Breast cancer
Cancer in digestive organs
Cancer in female genitalia
Cancer in male genitalia
Cancer therapy
Invasive cervical cancer
Local cervical cancer
Diabetes
Epilepsy
Genetic anomalies
HIV-AIDS
Hypertension
Cancer in respiratory organs
Lymphatic cancer
Melanoma or skin cancer
Other types of cancer
Other types of cardiovascular disease
Long-term pulmonary disease
Renal disease
Chronic kidney disease
End-stage renal disease
Long-term renal disease
Transplant
Tuberculosis
More than 2 diseases
No diseases



Appendix Figure 13: Correlation between network changes and changes in demand under no risk adjustment

Note: This figure shows the correlation between changes in network breadth and changes in demand at the insurer level in the counterfactual of no risk adjustment relative to the observed scenario. Every black dot is an insurer and the red line corresponds to a linear fit. The left panel focuses on changes in demand from healthy individuals and the right panel focuses on changes in demand from sick individuals.



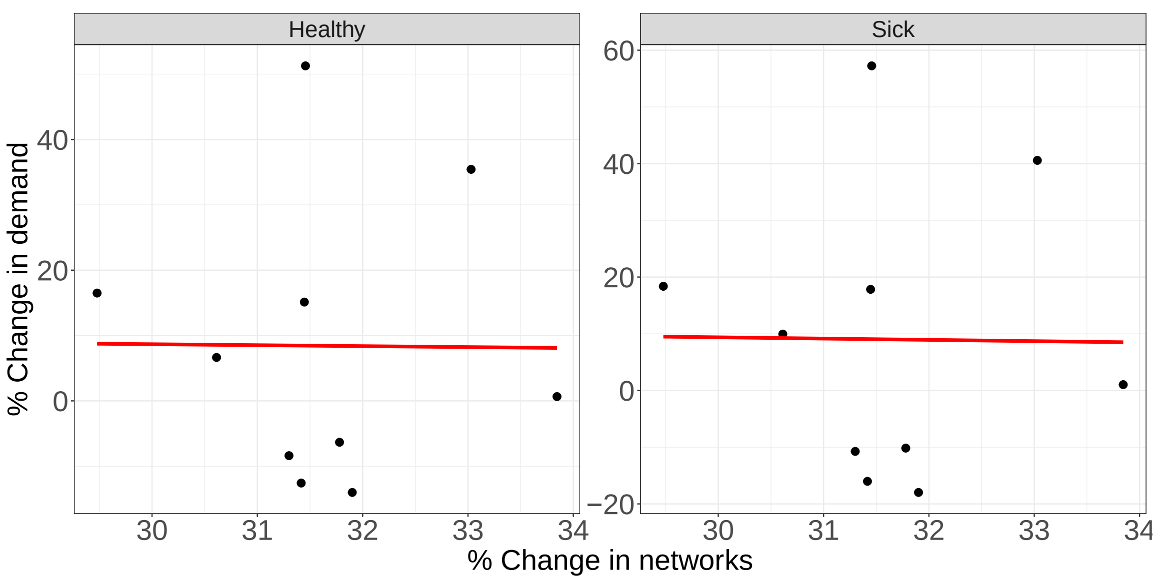
Appendix Figure 14: Correlation between network changes and changes in demand under improved adjustment

Note: This figure shows the correlation between changes in network breadth and changes in demand at the insurer level in the counterfactual of improved risk adjustment with compensations for 30 disease categories relative to the observed scenario. Every black dot is an insurer and the red line corresponds to a linear fit. The left panel focuses on changes in demand from healthy individuals and the right panel focuses on changes in demand from sick individuals.

Appendix Table 27: Comparison of counterfactual results in markets without star hospitals

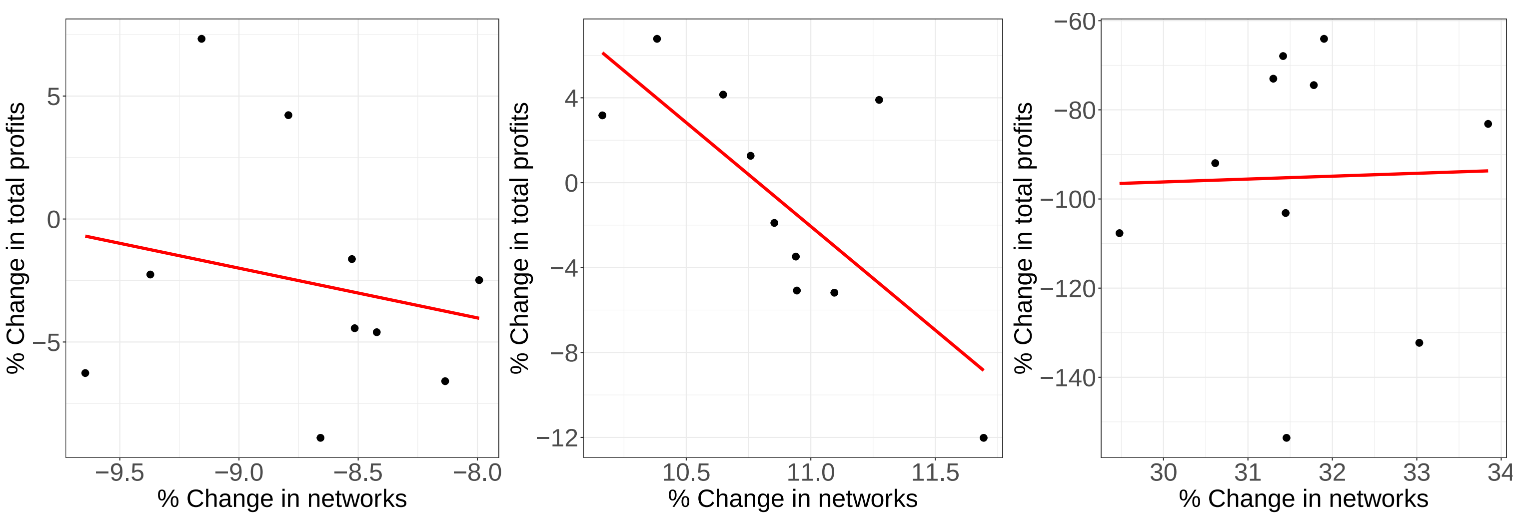
	No RA			Improved RA - 7 diseases		
Parameter estimation:	Main sample		No stars	Main sample		No stars
Counterfactual data:	Main sample Market 11	No stars Market 15	No stars Market 15	Main sample Market 11	No stars Market 15	No stars Market 15
	(1)	(2)	(3)	(4)	(5)	(6)
Avg. network breadth	-6.7	-1.8	-3.9	4.6	0.0	3.9
Total avg. cost	-0.7	-0.9	-2.3	1.0	-0.1	1.3
Avg. cost per enrollee	-0.9	-1.1	-1.7	1.1	0.0	1.0
Consumer welfare (healthy)	-2.1	-3.0	-5.9	2.8	-0.1	3.3
Consumer welfare (sick)	-3.3	-3.0	-5.8	3.4	-0.1	3.1

Note: This table shows the main counterfactual results and robustness checks in markets without star hospitals. Main counterfactual results are simulated in market 11 with parameters estimated in the full sample. Column (1) reports main counterfactual results for no risk adjustment and column (4) for improved risk adjustment with ex-ante compensations for 7 diseases. Column (2) uses parameter estimates in the full sample to simulate the no-risk-adjustment counterfactual in market 15 without star hospitals. Column (5) uses parameter estimates in the full sample to simulate the improved-risk-adjustment counterfactual in market 15 without star hospitals. Column (3) uses parameter estimates in the sample of markets without star hospitals to simulate the no-risk-adjustment counterfactual in market 15 without star hospitals. Column (6) uses parameter estimates in the sample of markets without star hospitals to simulate the improved-risk-adjustment counterfactual in market 15 without star hospitals. Comparisons of columns (2)-(3) and columns (5)-(6) show that my simulations provide a lower bound of the true effect of eliminating risk adjustment and improving risk adjustment on network breadth.



Appendix Figure 15: Correlation between network changes and changes in demand under premium deregulation

Note: This figure shows the correlation between changes in network breadth and changes in demand at the insurer level in the counterfactual of premium setting relative to the observed scenario. Every black dot is an insurer and the red line corresponds to a linear fit. The left panel focuses on changes in demand from healthy individuals and the right panel focuses on changes in demand from sick individuals.



(a) No risk adjustment (b) Improved risk adjustment (c) Premium deregulation

Appendix Figure 16: Correlation between profit and network changes in counterfactual

Note: This figure shows the correlation between changes in network breadth and changes in total profits at the insurer level in the counterfactual of no risk adjustment in panel (a), improved risk adjustment with 30 disease categories in panel (b), and premium setting in panel (c), all relative to the observed scenario. Every black dot is an insurer and the red line corresponds to a linear fit.