For Online Publication

Appendix A Additional Tables and Figures

Table A.1: Summary Statistics of Outcomes and Main Independent Variables, Levels, Internists

	Sample	Mean	SD	p25	Median	p75	Physician-Quarters
Pmt	Pooled	2607	2910	675	1760	3560	529465
	Non-Switchers	2527	2936	621	1642	3423	473720
	Switchers	3281	2585	1445	2749	4438	55745
Patients	Pooled	12	12	4	8	16	529465
	Non-Switchers	11	12	3	8	15	473720
	Switchers	16	12	8	14	22	55745
HCPCS	Pooled	34.6	39.61	9	23	47	529465
	Non-Switchers	33.53	39.92	8	22	45	473720
	Switchers	43.64	35.58	19	36	59	55745
Pmt/Pt	Pooled	245	188	144	204	294	529465
	Non-Switchers	249	194	144	205	300	473720
	Switchers	211	112	148	194	253	55745
Pmt/HCPCS	Pooled	81	38	63	76	92	529465
	Non-Switchers	81	38	63	76	93	473720
	Switchers	80	30	65	76	90	55745
HCPCS/Pt	Pooled	3.08	2.09	1.92	2.64	3.67	529465
	Non-Switchers	3.12	2.16	1.92	2.67	3.71	473720
	Switchers	2.7	1.29	1.9	2.53	3.25	55745
Procedures	Pooled	7	7	2	5	10	494203
	Non-Switchers	7	7	2	5	10	439610
	Switchers	9	7	5	8	12	54593
LOS	Pooled	7.75	6.12	4.84	6.48	9	529465
	Non-Switchers	7.79	6.26	4.8	6.5	9	473720
	Switchers	7.42	4.74	5.02	6.42	8.44	55745
Share(30-Day Readm)	Pooled	.24	.21	.09	.23	.33	529465
	Non-Switchers	.24	.21	.08	.22	.33	473720
	Switchers	.24	.15	.15	.24	.33	55745
Share(30-Day Mort)	Pooled	.1	.15	0	.06	.15	529465
	Non-Switchers	.1	.15	0	.05	.14	473720
	Switchers	.11	.12	0	.09	.15	55745
Share(365-Day Mort)	Pooled	.31	.24	.14	.29	.43	529465
	Non-Switchers	.31	.25	.13	.29	.43	473720
	Switchers	.32	.18	.2	.3	.4	55745
Δ_{size}	Switchers	38.58	214.33	-40.5	14	93.25	55745
Δ_{pmt}	Switchers	-334.64	2535.27	-1503.86	-257.37	923.05	55745

The "pooled" sample refers to the total sample of Switchers and Non-Switchers combined. Observations are at the physician-episode-quarter level.

Table A.2: Summary Statistics of Outcomes and Main Independent Variables, Logs, Internists

	Sample	Mean	SD	p25	Median	p75	Physician-Quarters
Ln(Pmt)	Pooled	7.25	1.3	6.52	7.47	8.18	529465
	Non-Switchers	7.19	1.32	6.43	7.4	8.14	473720
	Switchers	7.73	1.04	7.28	7.92	8.4	55745
Ln(Patients)	Pooled	2.18	.87	1.61	2.2	2.83	529465
	Non-Switchers	2.13	.87	1.39	2.2	2.77	473720
	Switchers	2.64	.69	2.2	2.71	3.14	55745
Ln(HCPCS)	Pooled	3.06	1.08	2.3	3.18	3.87	529465
	Non-Switchers	3.01	1.1	2.2	3.14	3.83	473720
	Switchers	3.48	.86	3	3.61	4.09	55745
Ln(Pmt/Pt)	Pooled	5.27	.77	4.98	5.32	5.69	529465
	Non-Switchers	5.27	.79	4.98	5.33	5.71	473720
	Switchers	5.21	.64	5	5.27	5.54	55745
Ln(Pmt/HCPCS)	Pooled	4.31	.52	4.16	4.34	4.54	529465
	Non-Switchers	4.31	.52	4.16	4.34	4.54	473720
	Switchers	4.32	.47	4.19	4.35	4.51	55745
Ln(HCPCS/Pt)	Pooled	1.32	.4	1.07	1.29	1.54	529465
	Non-Switchers	1.32	.41	1.07	1.3	1.55	473720
	Switchers	1.26	.31	1.06	1.26	1.45	55745
Ln(Procedures)	Pooled	1.71	.85	1.1	1.79	2.3	529465
	Non-Switchers	1.66	.85	1.1	1.61	2.3	473720
	Switchers	2.09	.71	1.61	2.2	2.56	55745
Ln(LOS)	Pooled	2.05	.47	1.76	2.01	2.3	529465
	Non-Switchers	2.05	.47	1.76	2.01	2.3	473720
	Switchers	2.04	.39	1.8	2	2.25	55745
Δ_{size}	Switchers	.51	1.57	-.6	.43	1.53	55745
Δ_{pmt}	Switchers	-.14	.78	-.54	-.08	.28	55745

The "pooled" sample refers to the total sample of Switchers and Non-Switchers combined. Observations are at the physician-episode-quarter level.

Table A.3: Physician Count by Restriction

Restriction	Count
Physicians with a claim that can be linked to a beneficiary's inpatient stay	553721
Physicians with 90% of claims in a given year-quarter associated with one group	552420
Switchers	
Physicians who belong to an origin group for at least four consecutive quarters, and then switch to a destination group where they are subsequently observed for at least five consecutive quarters (including the switch quarter)	72426
Physicians who remain in one hospital throughout their episode	30488
Physicians whose origin and destination groups exist in the four-quarter pre-switch period	19847
Physicians who are in groups with at least one other physician	16187
Physicians in origin and destination groups that treat at least 10 patients per quarter	13883
With a specialty of internal medicine (Internists)	3108
Non-Switchers	
Physicians who are only ever in one group	321963
Physicians who remain in one hospital throughout their episode	237496
Physicians in hospitals with switcher physicians	162433
With a specialty of internal medicine (Internists)	30887

This table reports the number of physicians at each step of the sample construction, after imposing a particular restriction.

Table A.4: Summary Statistics, All Specialties

Measure	(1) All	(2) Switchers	(3) $\Delta_{pmt} < 0$	(4) $\Delta_{pmt} > 0$
A. Baseline treatment intensity				
Δ_{pmt}		-.08	-.63	.53
Origin group reimb. per physician	2049	3327	4281	2279
Destination group reimb. per physician		3015	2399	3690
Pre-switch physician reimb.	2280	3002	3733	2422
Pre-switch physician reimb. v. origin group reimb. per physician	241	-219	-548	143
Pre-switch physician reimb. v. destination group reimb. per physician		93	1335	-1268
B. Patient characteristics				
Mean Age	73	74	74	74
Share(Male)	.44	.46	.46	.45
Share(White)	.82	.84	.85	.83
Share(Black)	.12	.11	.11	.12
Mean Predicted Mortality	.11	.12	.12	.12
C. Physician characteristics				
Share(Male)	.78	.75	.77	.73
Mean Years Experience	26	25	25	25
Share(Internal Medicine)	.18	.23	.24	.22
D. Group characteristics				
Origin Num. Patients	244	207	216	196
Origin Num. Physicians	141	66	63	69
Destination Num. Patients		361	321	404
Destination Num. Physicians		158	144	174
Δ_{size}		1.0	.91	1.1
Total Physician-Episodes	176920	14487	7579	6908

Column (1) represents overall unadjusted averages/shares for the entire study sample. Column (2) reports averages and shares for the switching physicians, as defined in the text. Column (3) reports statistics for physicians whose destination group is less intense than their origin group, while column (4) represents physicians whose destination group is more intense than their origin group. Reimbursement is abbreviated by reimb., and represents intensity of practice. For switchers, reimbursement measures are calculated in the four quarters prior to the switch quarter, and origin and destination reimbursement measures exclude the index physician. For non-switchers, reimbursement measures are calculated across all quarters, and origin group reimbursement does not exclude the index physician. Δ_{pmt} is the difference in log intensity between origin and destination groups. Δ_{size} is the size difference between origin and destination groups, in logs. Years of experience is calculated as 2016 minus the year of graduation from medical school for the sub-sample of physicians who we can match to Physician Compare. Group characteristics are calculated in the four quarters prior to the switch for switchers, and over all quarters for non-switchers. Number of patients in a group is calculated as the average of the distinct number of patients group physicians treated in a hospital in a year-quarter. Number of physicians in a group is calculated as the average of the distinct number of MDs or DOs who treated patients in a hospital in a year-quarter. Total Physician-Episodes reports the total number of distinct physician and switching episodes; each physician can switch multiple times.

Table A.5: Difference-in-Difference, Δ_{pmt}, With Patient Controls

	(1) Ln(Pmt)	(2) Ln(Pmt)	(3) Ln(Pmt)	(4) Ln(Pmt)	(5) Ln(Pmt)	(6) Ln(Pmt)	(7) Ln(Pmt)
Δ_{pmt}*Post Switch	0.285***	0.285***	0.285***	0.285***	0.285***	0.285***	0.285***
	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)
Δ_{pmt}*Qtr=0	0.037	0.037	0.037	0.037	0.037	0.037	0.037
	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)
Mean(Bene Age)		0.001***	0.001***	0.001***	0.001***	0.001***	0.000
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Share(Bene Male)			0.029***	0.029***	0.029***	0.029***	0.027***
			(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Share(Bene White)				-0.006	0.015	-0.003	-0.005
				(0.009)	(0.013)	(0.017)	(0.017)
Share(Bene Black)					0.033*	0.014	0.008
					(0.016)	(0.019)	(0.019)
Share(Bene Hisp.)						-0.051*	-0.056*
						(0.026)	(0.026)
Mean(Pred. Mort)							0.206***
							(0.029)
Constant	7.251***	7.168***	7.148***	7.151***	7.128***	7.147***	7.182***
	(0.001)	(0.022)	(0.023)	(0.023)	(0.026)	(0.027)	(0.027)
Observations	529465	529465	529465	529465	529465	529465	529465
Adjusted R^2	0.6963	0.6963	0.6963	0.6963	0.6964	0.6964	0.6964
Mean	7.250	7.250	7.250	7.250	7.250	7.250	7.250

Standard errors in parentheses

All models include fixed effects for physician-episode and hospital-year-quarter. Standard errors are two-way clustered at the physician and group levels. Omitted category is an indicator for quarters $\in [-10, -1]$.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A.6: Pre v. Post-Switch Regressions, Δ_{pmt}, All Specialties

	(1) Ln(Pmt)		(2) Ln(Pmt/Pt)		(3) Share(30-Day Readm)		(4) Share(30-Day Mort)		(5) Share(365-Day Mort)	
Δ_{pmt}*Post Switch	0.126***	(0.012)	0.093***	(0.008)	0.001	(0.001)	-0.000	(0.001)	-0.000	(0.001)
Δ_{pmt}*Qtr=0	0.010	(0.010)	0.017**	(0.006)	-0.000	(0.002)	0.001	(0.002)	-0.002	(0.002)
Constant	7.084***	(0.000)	5.193***	(0.000)	0.246***	(0.000)	0.093***	(0.000)	0.282***	(0.000)
Observations	2997461		2997461		2997461		2997461		2997461	
Adjusted R^2	0.674		0.746		0.135		0.153		0.244	
Mean	7.082		5.192		0.246		0.093		0.282	

Standard errors in parentheses

All models include fixed effects for physician-episode and hospital-year-quarter. Standard errors are two-way clustered and group levels. Omitted category is an indicator for quarters $\in [-10, -1]$.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A.7: Pre v. Post-Switch Regressions, Δ_{pmt}, Non-Internal Medicine Physicians

	(1) Ln(Pmt)		(2) Ln(Pmt/Pt)		(3) Share(30-Day Readm)		(4) Share(30-Day Mort)		(5) Share(365-Day Mort)	
Δ_{pmt}*Post Switch	0.092***	(0.010)	0.073***	(0.007)	0.001	(0.001)	-0.001	(0.001)	-0.002	(0.001)
Δ_{pmt}*Qtr=0	0.005	(0.010)	0.013	(0.007)	0.001	(0.002)	0.000	(0.002)	-0.003	(0.003)
Constant	7.047***	(0.000)	5.176***	(0.000)	0.246***	(0.000)	0.091***	(0.000)	0.276***	(0.000)
Observations	2450115		2450115		2450115		2450115		2450115	
Adjusted R^2	0.671		0.758		0.140		0.156		0.256	
Mean	7.045		5.175		0.246		0.091		0.276	

Standard errors in parentheses

All models include fixed effects for physician-episode and hospital-year-quarter. Standard errors are two-way clustered at the physician and group levels. Omitted category is an indicator for quarters $\in [-10, -1]$.

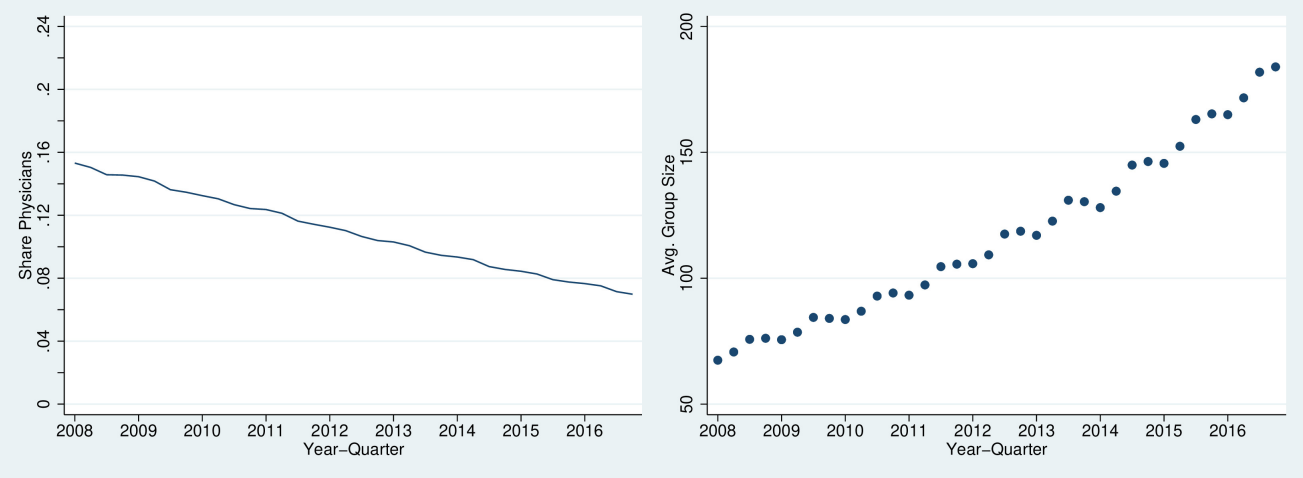
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A.8: Inpatient Evaluation and Management Codes, By Level

Level	CPT Code	Description	Avg. Reimbursement
1	99221	Hospital initial inpatient care, straightforward or low complexity	$97.40
	99231	Subsequent inpatient care, straightforward or low complexity	$40.64
	99234	Admission and discharge same day, straightforward or low complexity	$130.80
2	99222	Hospital initial inpatient care, moderate complexity	$132.44
	99232	Subsequent inpatient care, moderate complexity	$74.24
	99235	Admission and discharge same day, moderate complexity	$166.79
3	99223	Hospital initial inpatient care, high complexity	$194.89
	99233	Subsequent inpatient care, high complexity	$104.69
	99236	Admission and discharge same day, high complexity	$211.83

This table reports the inpatient evaluation and management (E&M) codes used in our analysis of billing intensity. Common inpatient E&M codes were identified from University of Southern California medical group compliance guidelines. Average reimbursement is calculated from the carrier files as the sum of the line NCH payment amount, the line beneficiary part B deductible amount, the line coinsurance amount, and the line beneficiary primary payer paid amount. The resulting total represents the payment due to the provider for that particular HCPCS.

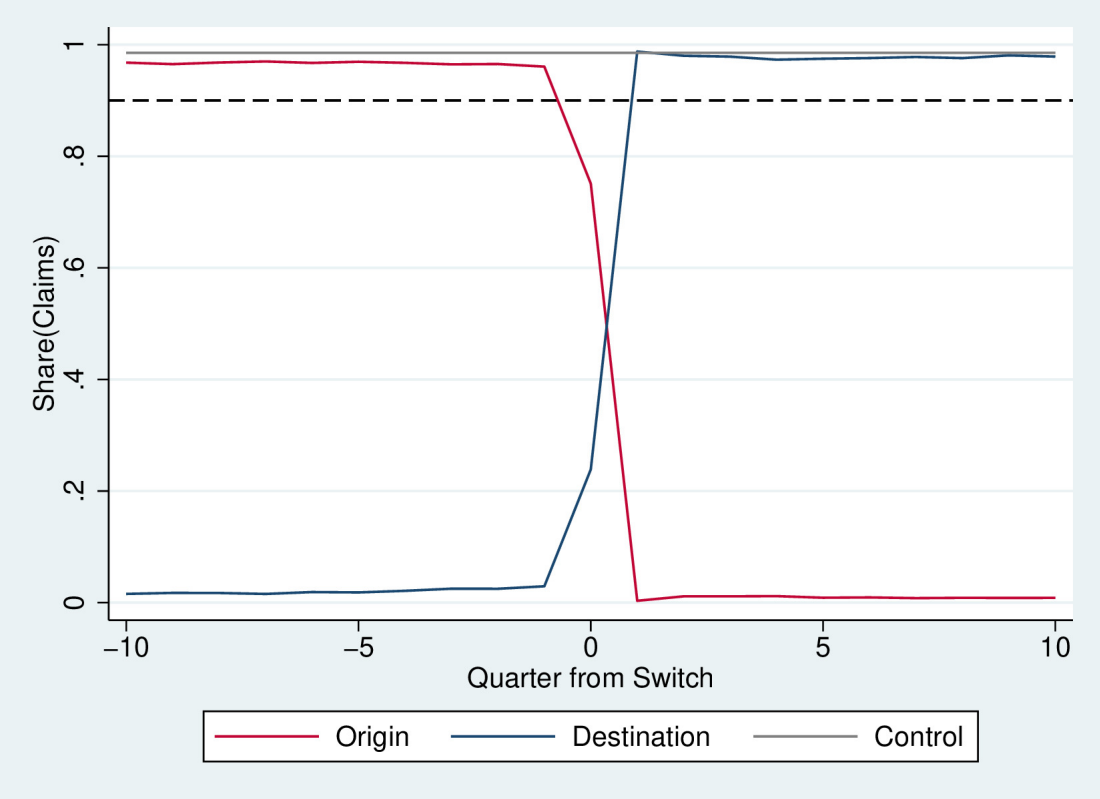
Figure A.1: Group Trends in Hospitals Over Time



(a) Share(Physicians) In Solo Practice (b) Group Size

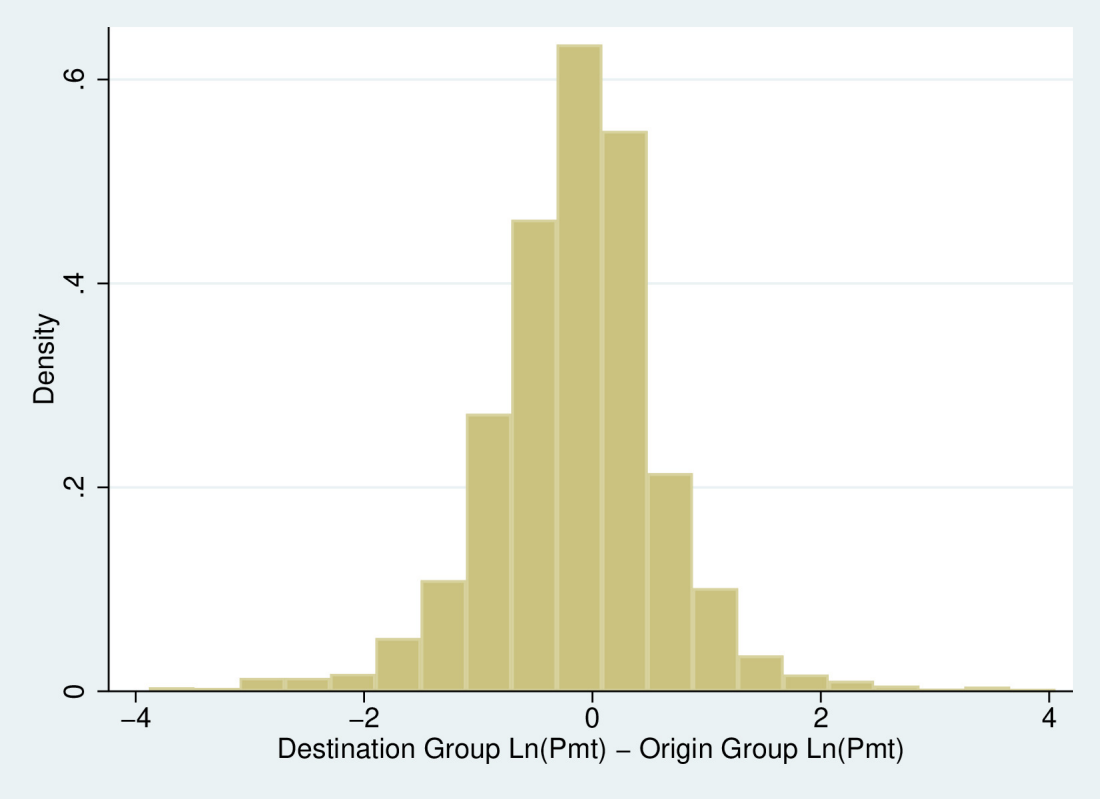
This figure plots trends in group size among physicians practicing in hospitals by year-quarter during our study period (2008-2016). Panel (a) plots average group size over time. Group size is calculated as the number of distinct National Provider Identifiers (NPIs) with an entity type of "1" (i.e. an individual) and a taxonomy type of "Allopathic & Osteopathic Physicians" associated with a particular billing identifier. Panel (b) plots the share of physicians in a group size of 1 (which we characterize as solo practice) over time.

Figure A.2: Share of HCPCS Associated with a Group, Internists



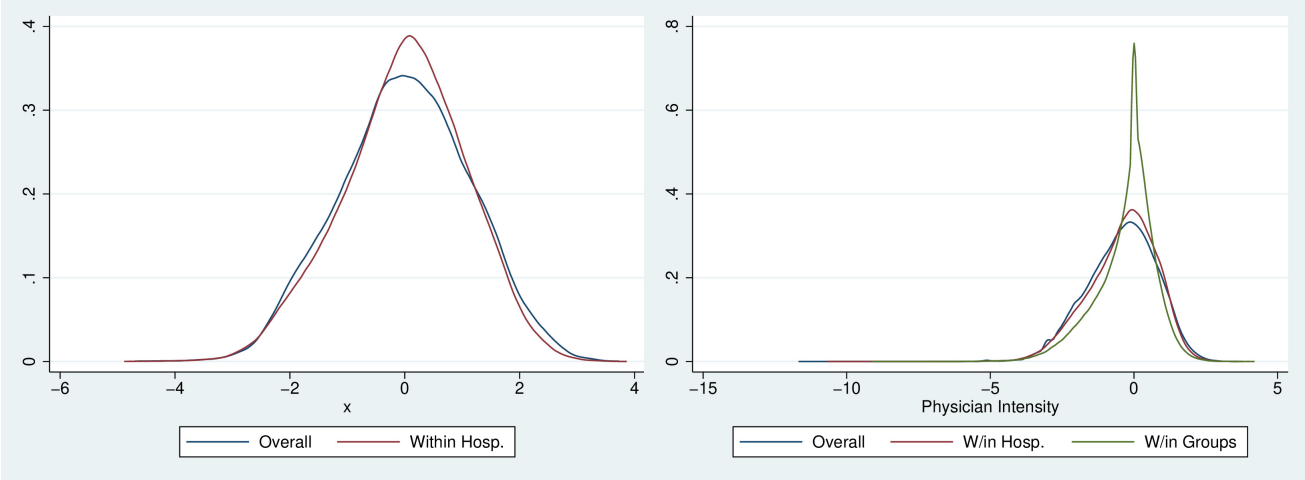
This figure plots the average share of physicians' HCPCS that are associated with a given group in the quarters relative to the switch. The red line plots the share of HCPCS associated with the origin group of the switching physician in a given quarter relative to the switch; the blue line, the share associated with the destination group of the switching physician. The gray line plots the average share of HCPCS associated with the single group that a non-switching physician belongs to over all quarters (by definition, non-switchers don't have quarters relative to a switch). The dotted black line indicates the 0.9 threshold (generally) used to attribute physicians to groups.

Figure A.3: Distribution of Δ_{pmt}, Internists



This figure plots the distribution of (non-demeaned) Δ_{pmt}, the difference in average pre-switch log reimbursement per physician per quarter between the origin and destination groups, for internists. Δ_{pmt} has a mean of -0.14 and a standard deviation of 0.78.

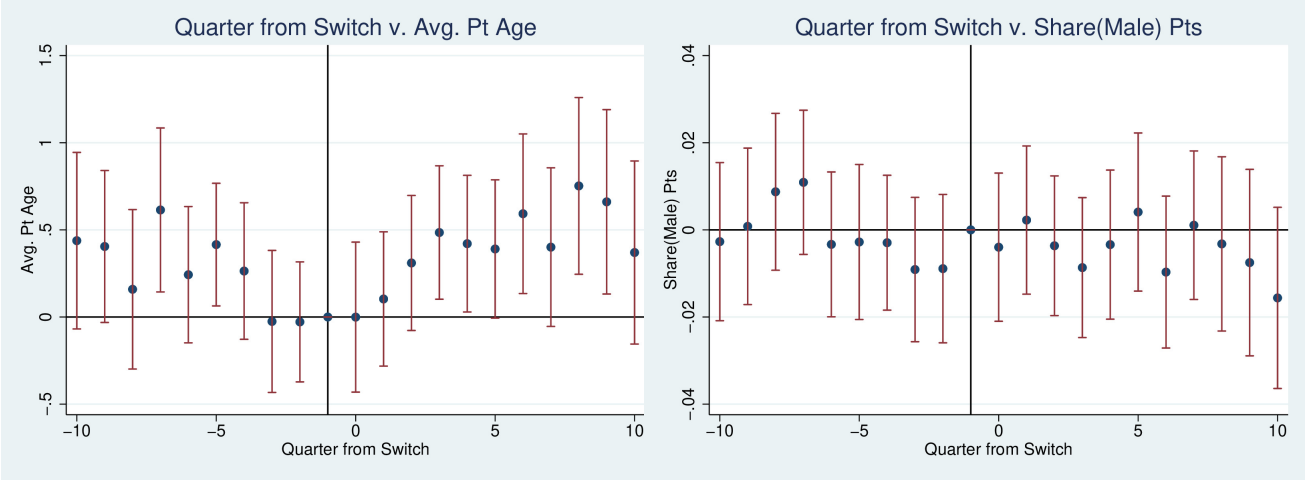
Figure A.4: Distribution of Group and Physician Intensity



(a) Group Intensity, All Specialties (b) Physician Intensity, All Specialties

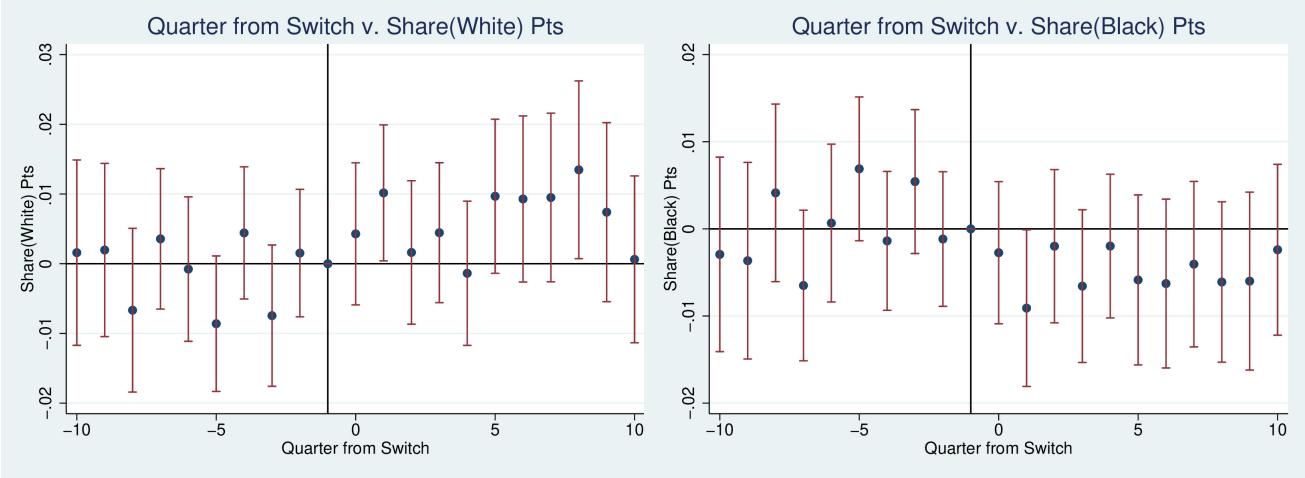
This figure plots variation in physician and group intensity among physicians of all specialties, as measured by average log reimbursement per physician per quarter. Group intensity is calculated as described above, and average physician intensity is calculated across all quarters. Panels (a) and (b) plot the variation in (demeaned) physician and group intensity overall, within hospitals, and within groups (for physicians only), for switchers, non-switchers, and all other out-of-sample physicians associated with in-sample groups. Within-hospital and within-group intensity is demeaned using the hospital- and hospital-group specific averages, respectively. The standard deviation for overall and within-hospital group intensity is 1.14 and 1.08, respectively. The standard deviation for overall, within-hospital, and within-group intensity for physicians is 1.20, 1.18, and 1.02, respectively.

Figure A.5: Test for Balance of Patient Characteristics Across Switch, Internists



(a) Patient Age Across Switch

(b) Patient Sex Across Switch

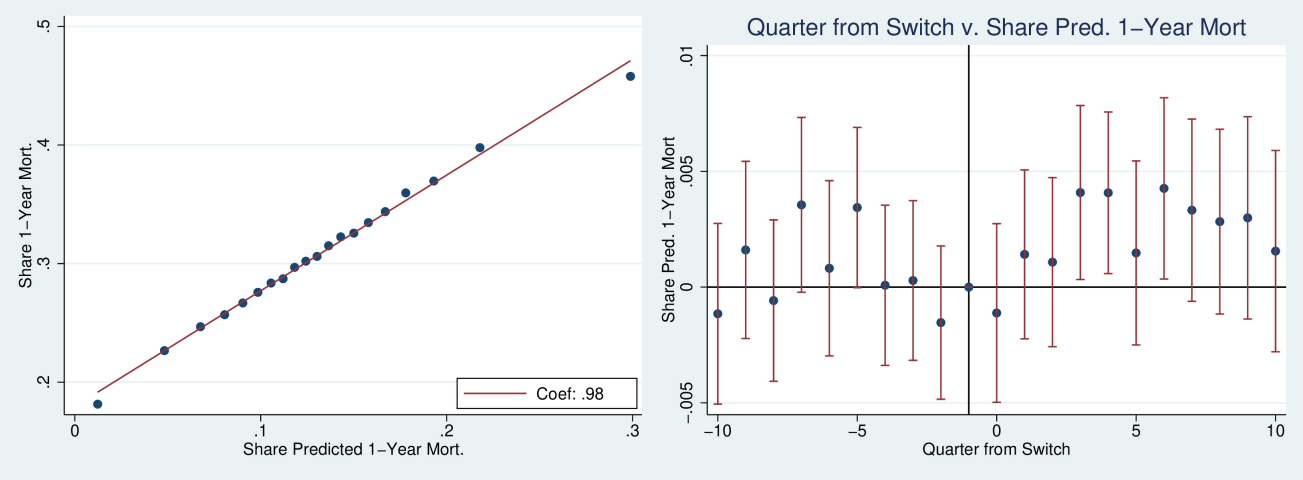


(c) Share of White Patients Across Switch

(d) Share of Black Patients Across Switch

This figure plots changes in patient characteristics across the switch, scaled by Δ_{pmt} (i.e. plots of θ_qs from Equation 6 with patient characteristics as the dependent variables). Included are 95% confidence intervals using standard errors that are two-way clustered at the physician and group level.

Figure A.6: Balance in Patient Mortality, Internists

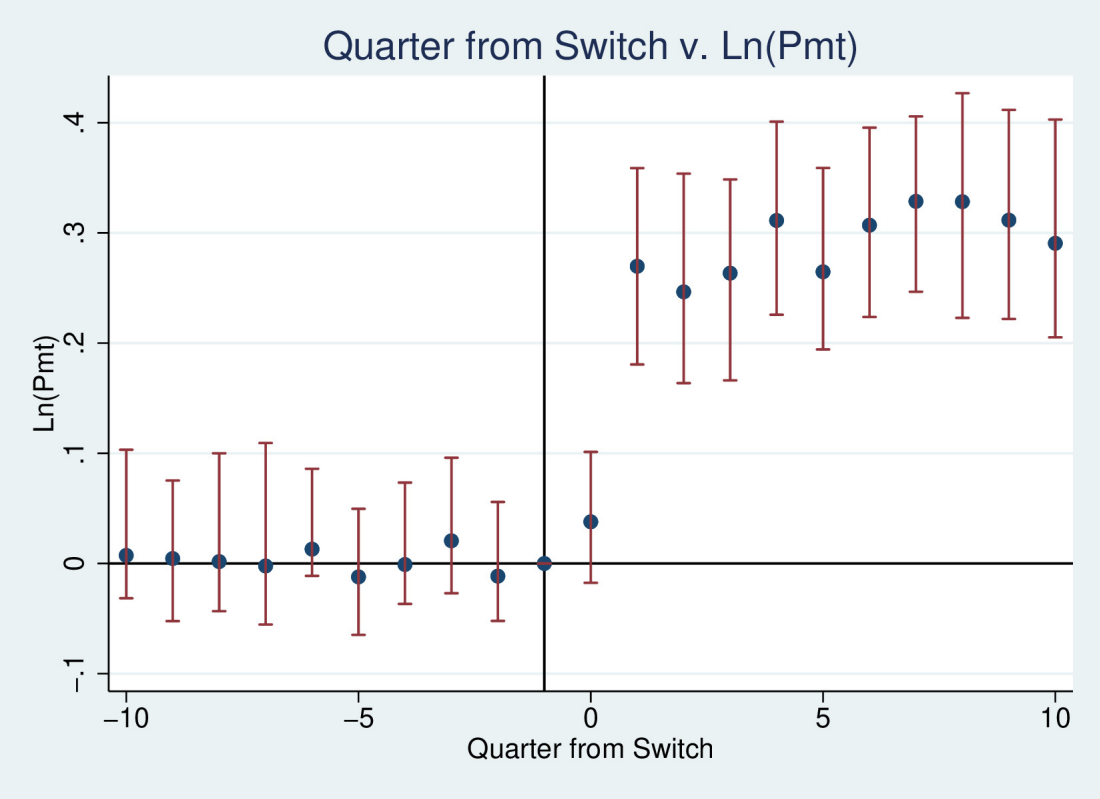


(a) Share(1-Year Mort.) v. Share(Predicted 1-Year Mort.)

(b) Average Patient Predicted 1-Year Mortality Across Switch

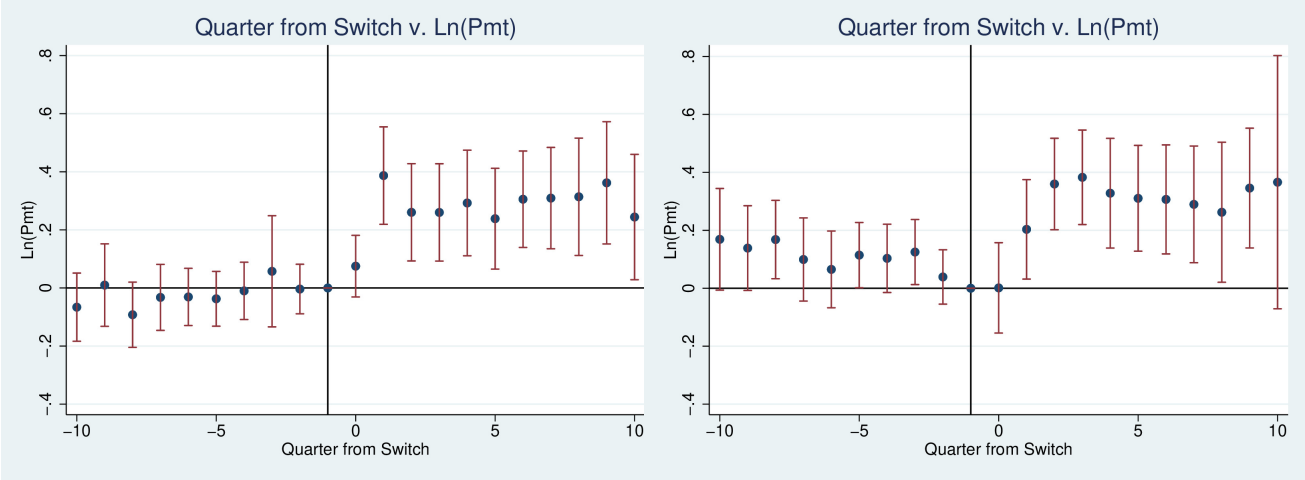
This figure shows balance in predicted patient mortality across the group switch. Panel (a) plots the relationship between the observed share of a physician's patients with 1-year mortality and the share of a physician's patients with predicted 1-year mortality (based on the approach discussed below). We find the vigintiles of the share of predicted mortality, and collapse the observations (at the physician-quarter level) of the observed share and predicted share to their means, plotted here. The coefficient of 0.98 represents the relationship between the share of predicted 1-year mortality and the observed share of 1-year mortality within these Vigintile bins. Panel (b) plots changes in average predicted 1-year mortality of patients across the switch, scaled by Δ_{pmt} (i.e. plots of θ_qs from Equation 6 with predicted mortality as the dependent variable.) Predicted 1-year mortality is calculated in the following steps. First, we estimate the relationship (in a linear model) between an indicator for whether a patient died in 2012 or 2013 and patient age (in vigintiles), sex, race, and comorbidity indicators recorded in 2012, with 2012 being the midpoint of our study period. We exclude all patients treated by physicians in our final study sample from this analysis. Using the coefficients obtained from this regression, we predict 1-year mortality for each patient treated by a physician in our final study sample based on the inputs in the model. Notably, to avoid endogeneity concerns of a new group's influence on diagnostic intensity, we use the comorbidity indicators from the year prior to the physician treating the patient (i.e. the index treatment event). We collapse predicted one-year mortality to the physician-quarter level, and estimate our main event study for this outcome. Included are 95% confidence intervals using standard errors that are two-way clustered at the physician and group level.

Figure A.7: Event Study, Pre v. Post Group Switch, Bootstrapped 95% Confidence Intervals



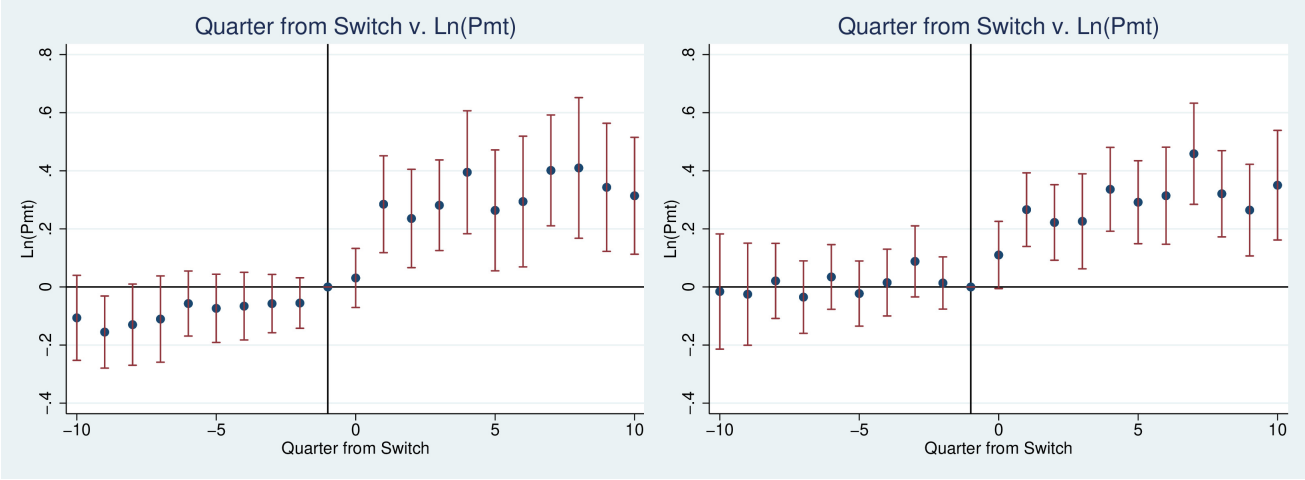
This graph plots the main results with bootstrapped 95% confidence intervals to take into account variability due to the calculation of Δ_{pmt} as a generated regressor. To do this, we first empirically re-sample (with replacement) the data at the claims level for each origin and destination group, iterating 50 times, to generate a set of simulated origin and destination group intensities which we then use to calculate a set of (50) Δ_{pmt}s for each switching physician. Next, we re-sample each simulated dataset (with replacement) at the switching physician-episode level, and re-run Equation 6 50 times to estimate our 95% confidence interval using the coefficients estimated from these 50 iterations. Due to computational limitations, we only show the bootstrapped 95% confidence intervals for our main result to illustrate that this approach does not change the significance of our main findings.

Figure A.8: Event Study, Pre v. Post Group Switch, by Quartile of Origin Group Intensity, Internists



(a) Origin Intensity, 3.75–7.77

(b) Origin Intensity, 7.77–8.08

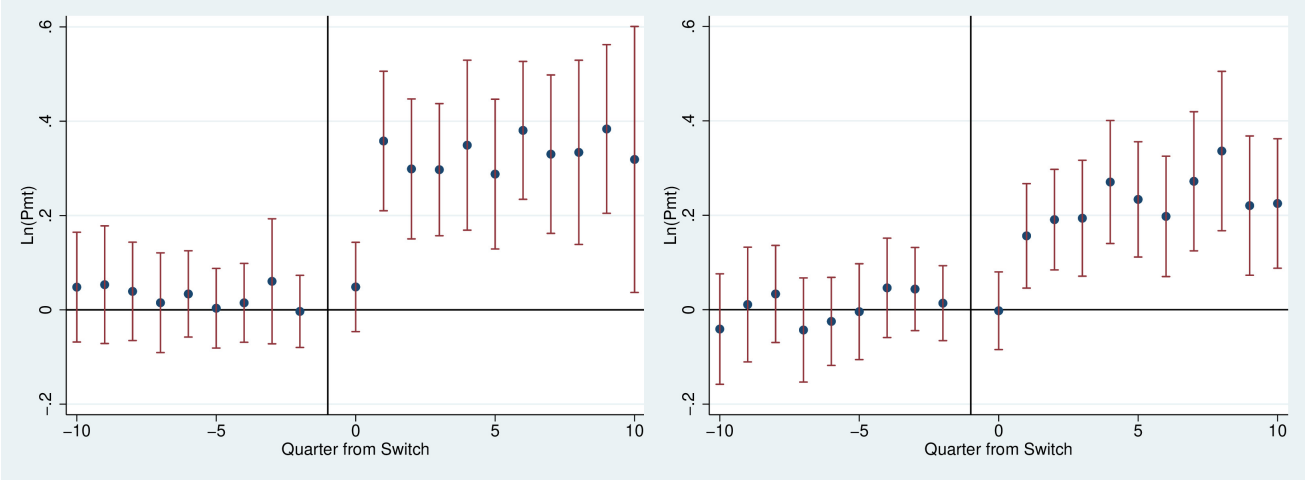


(c) Origin Intensity, 8.08–8.35

(d) Origin Intensity, 8.35–10.26

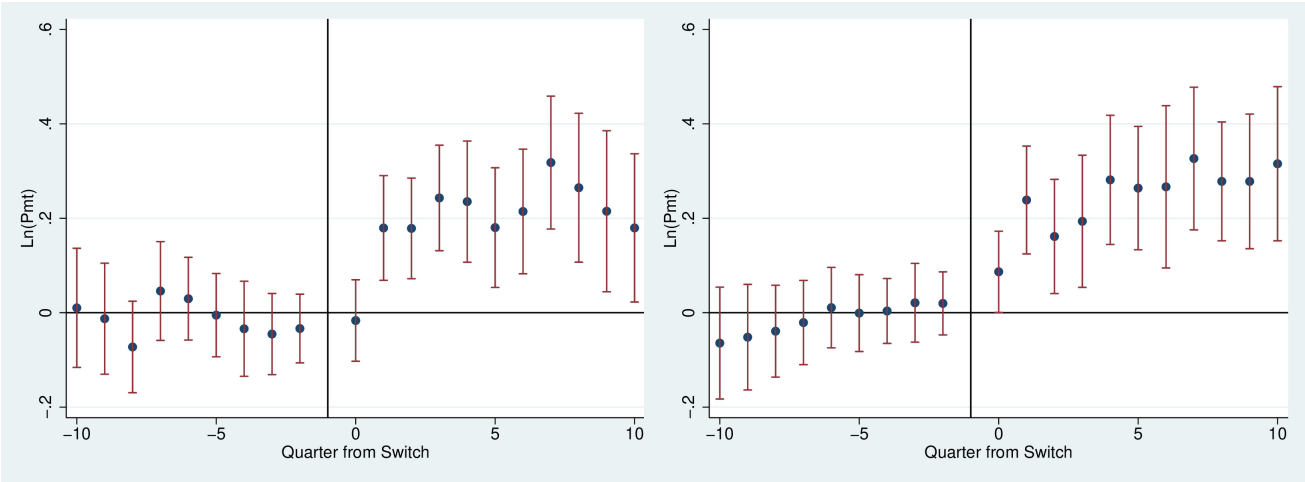
This figure plots the θ_qs estimated from Equation 6 by quartile of origin group intensity, as measured by average pre-switch log reimbursement per physician per quarter (excluding the switching physician) in $q \in [-4, -1]$. Included are 95% confidence intervals using standard errors that are two-way clustered at the physician and group level.

Figure A.9: Event Study, Ln(Pmt), by Quartile of Physician's Pre-Switch Intensity



(a) Ln(Pmt)=3.61–7.36

(b) Ln(Pmt)=7.36–7.92

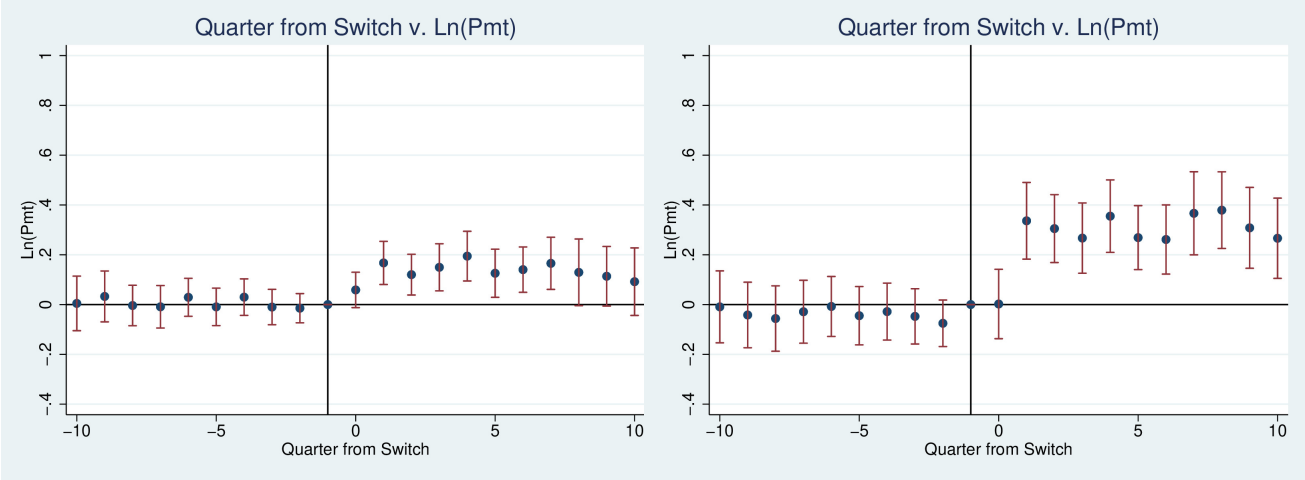


(c) Ln(Pmt)=7.93–8.33

(d) Ln(Pmt)=8.34–9.9

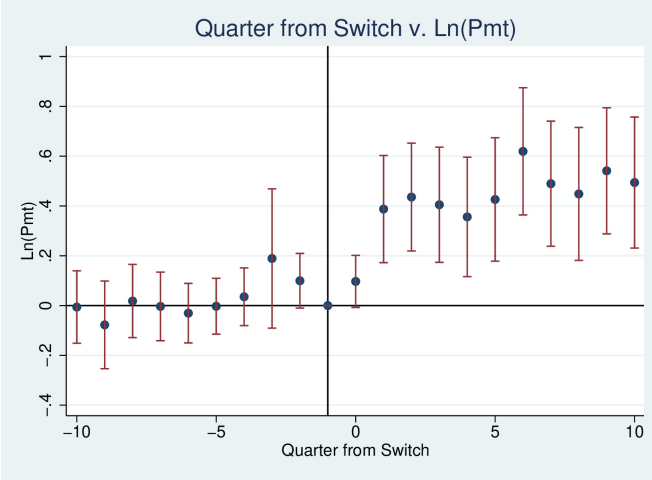
This figure plots the θ_qs estimated from Equation 6 by quartile of a physician's pre-switch intensity. Pre-switch intensity is measured as the average ln(reimbursement) per physician-quarter across pre-switch quarters $q \in [-10, -1]$. Included are 95% confidence intervals using standard errors that are two-way clustered at the physician and group level.

Figure A.10: Event Study, Pre v. Post Physician Switch, By Origin Group Size Quartile, Internists

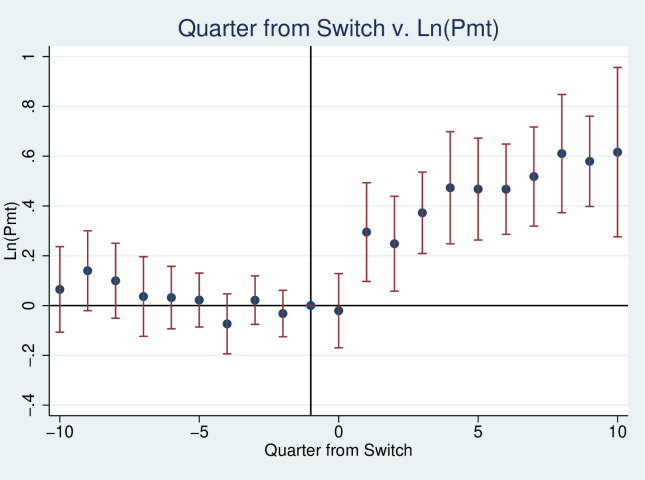


(a) Size: 2–15

(b) Size: 16–46



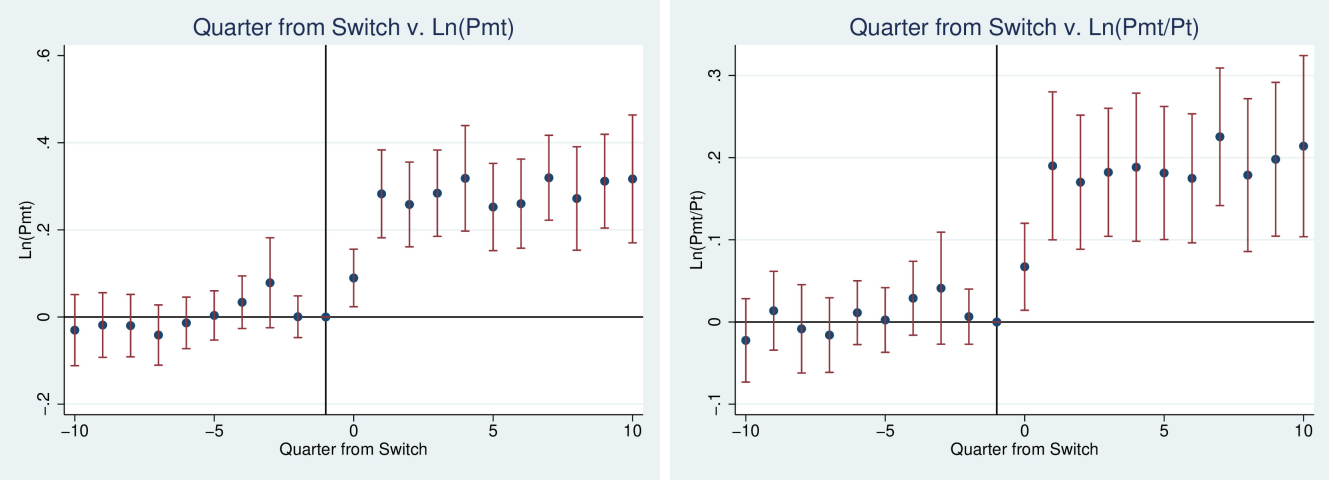
(c) Size: 46-104



(d) Size: 105–1,109

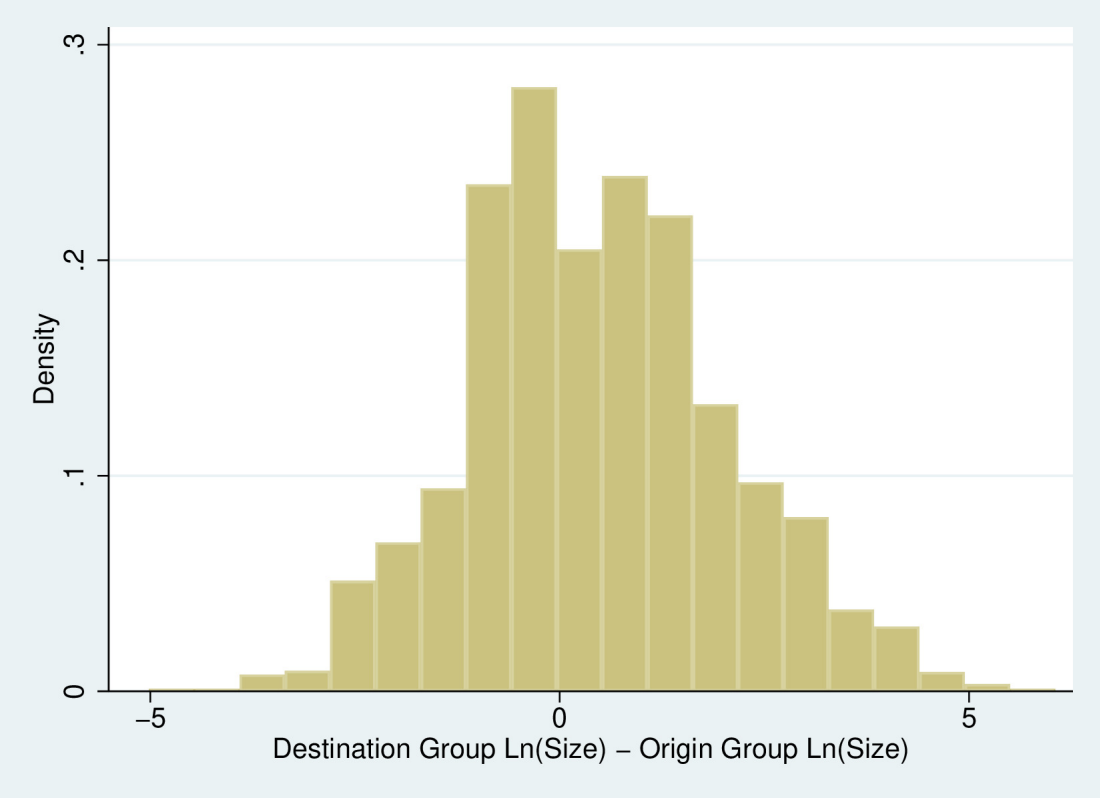
This figure plots the θ_qs from Equation 6 by quartile of origin group size. Included are 95% confidence intervals using standard errors that are two-way clustered at the physician and group level.

Figure A.11: Event Study, Pre v. Post Switch, Scaled by Destination Intensity, Internists



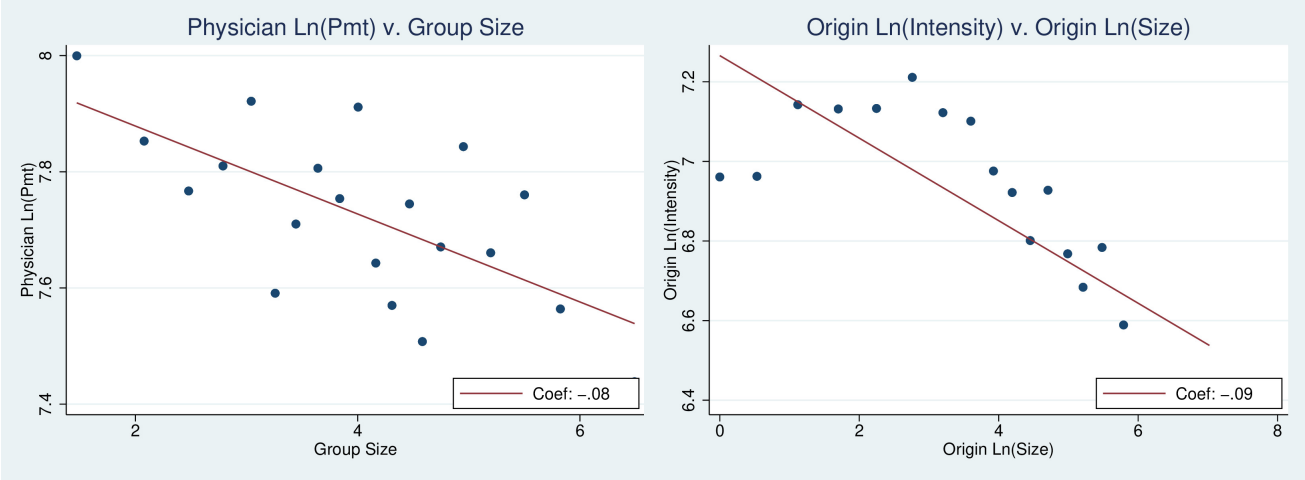
This figure plots the θ_qs when scaled by the destination group's pre-switch intensity instead of Δ_{pmt}. The coefficients around the switch can be interpreted as the increase in physician intensity corresponding to an increase in (pre-switch) destination group intensity (i.e. the intensity of the destination group before physician p joins that group and potentially has some affect on colleagues in that group). Included are 95% confidence intervals using standard errors that are two-way clustered at the physician and group level.

Figure A.12: Distribution of Δ_{size}, Internists



This figure plots the distribution of (non-demeaned) Δ_{size}, the difference in log group size between the origin and destination groups, for internists. Δ_{size} has a mean of 0.47 and a standard deviation of 1.57.

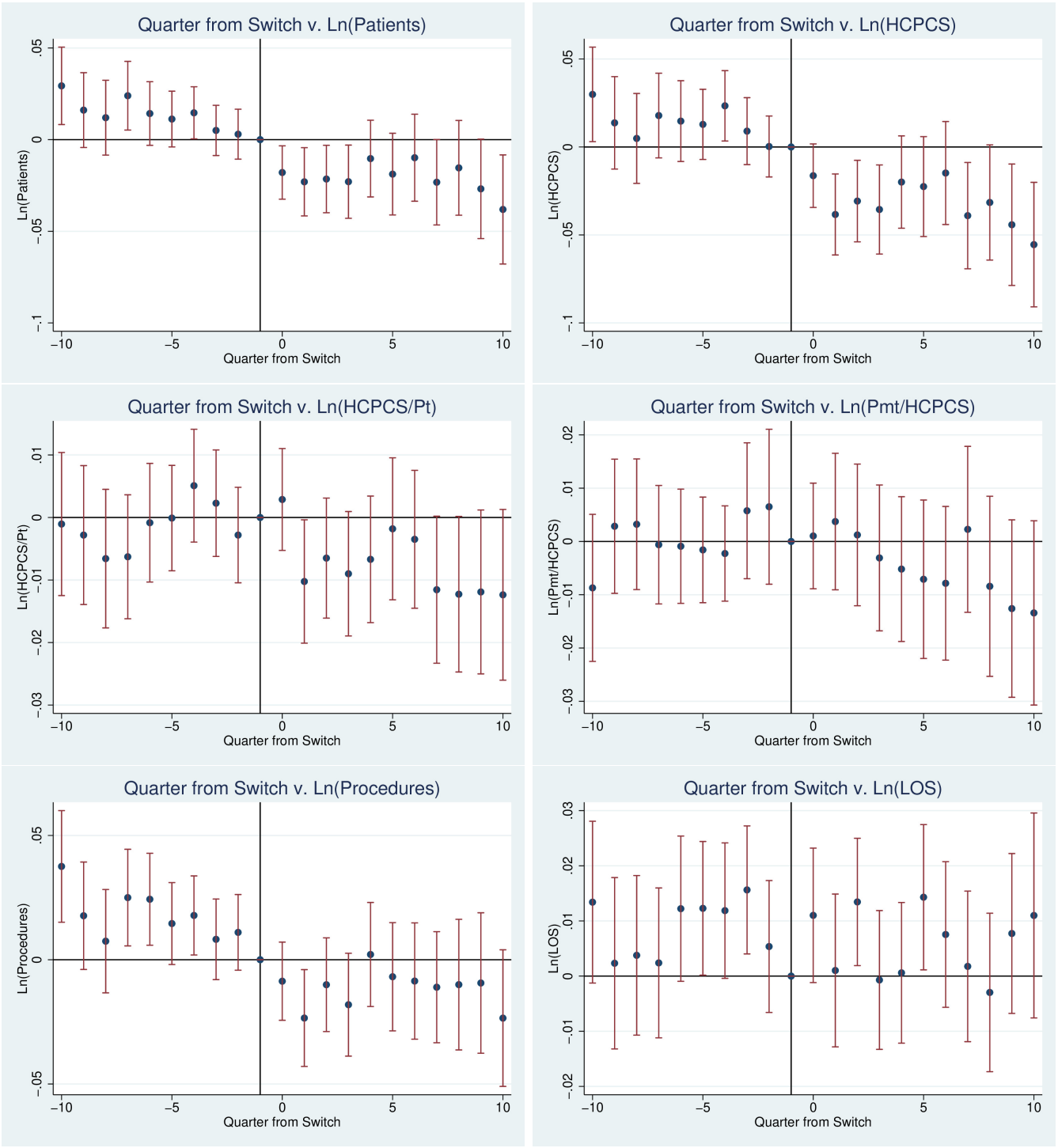
Figure A.13: Intensity v. Group Size, Internists



(a) Physician Intensity v. Origin Group Size (b) Origin Group Intensity v. Origin Group Size

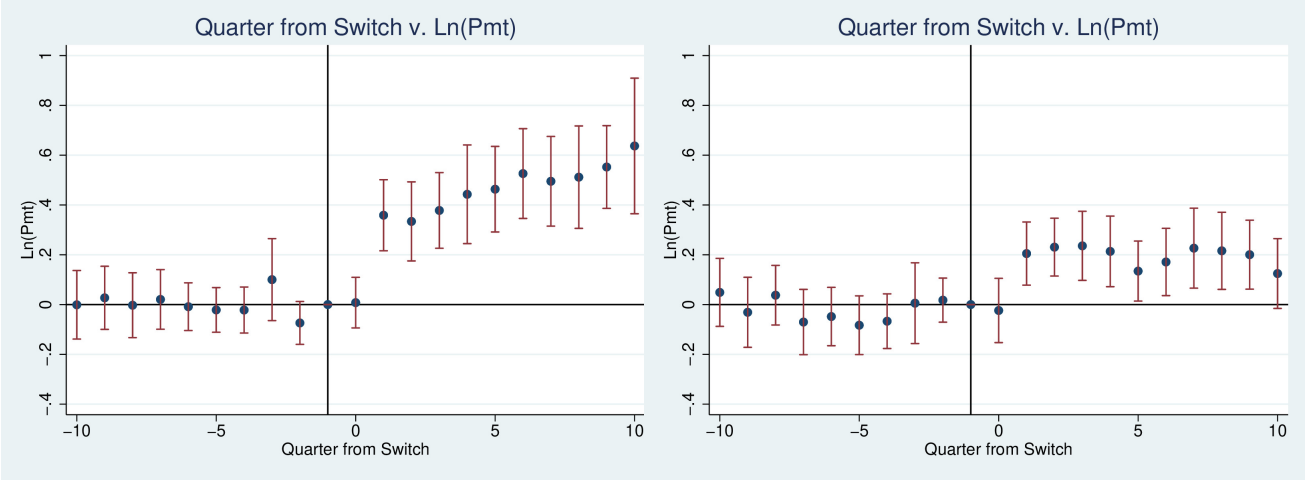
This figure plots the relationship between group and physician intensity and group size for internists. Panel (a) plots the (unadjusted) relationship between log physician intensity and log group size for switchers. We identify vigintiles of group size, and collapse the physician-quarter-level data to averages at these vigintiles, plotted here. The coefficient and standard error are obtained from regression of un-collapsed (i.e. physician-quarter level) switcher physician intensity on group size, with no additional controls. Panel (b) similarly plots the (unadjusted) relationship between vigintiles of ln(intensity) and ln(size) for origin groups for switchers and non-switchers, where origin group intensity for non-switchers is calculated as the simple (leave-in) average of all physician group member's intensity across all quarters (group members include switchers, non-switchers, and other physicians excluded from the sample).

Figure A.14: Event Study, Pre v. Post Group Switch, Scaled by Δ_{size}, Internists

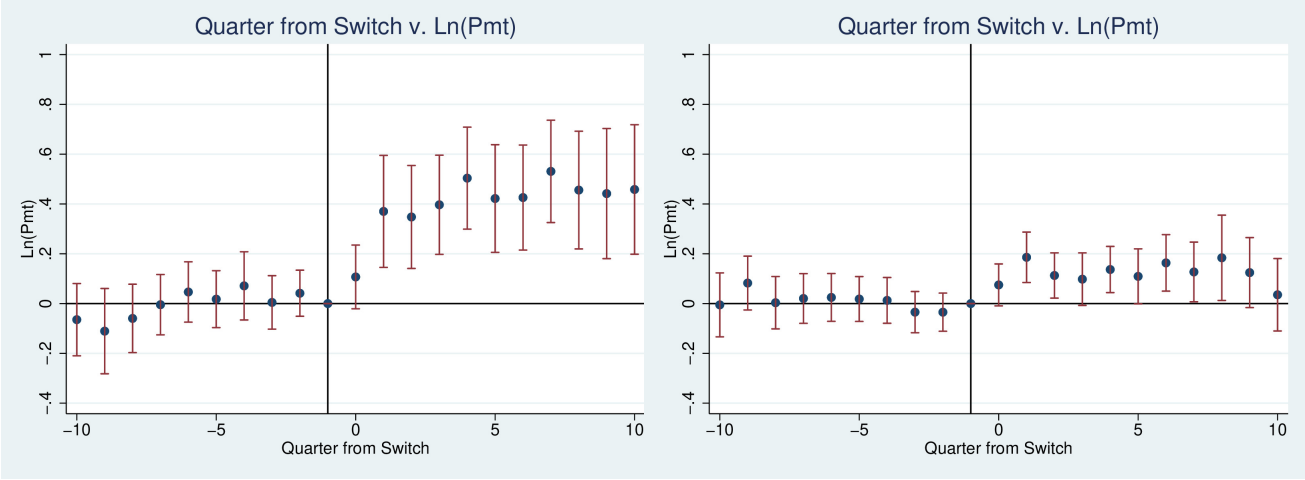


This figure plots the θ_q's estimated from Equation 6 for internists, substituting Δ_{size} for Δ_{pmt}, for additional measures of treatment intensity. Included are 95% confidence intervals using standard errors that are two-way clustered at the physician and group level.

Figure A.15: Event Study, Pre v. Post Group Switch, By Δ_{size} Quartile, Scaled by Δ_{pmt}, Internists



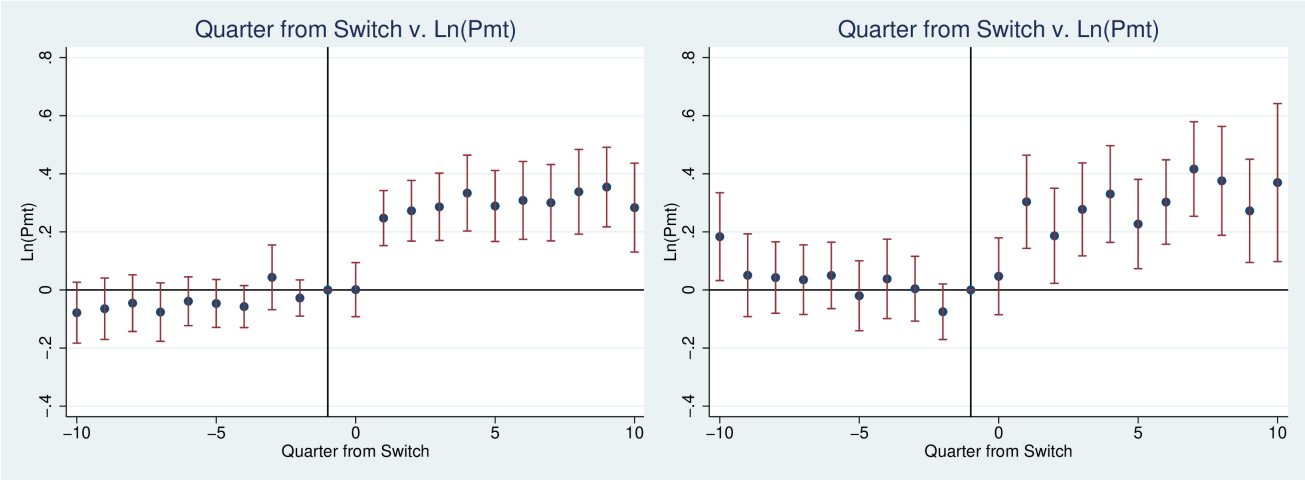
(a) $-5.02 \leq \Delta_{size} < -0.66$ (b) $-0.65 \leq \Delta_{size} < 0.41$



(c) $0.41 \leq \Delta_{size} < 1.51$ (d) $1.51 \leq \Delta_{size} < 6.05$

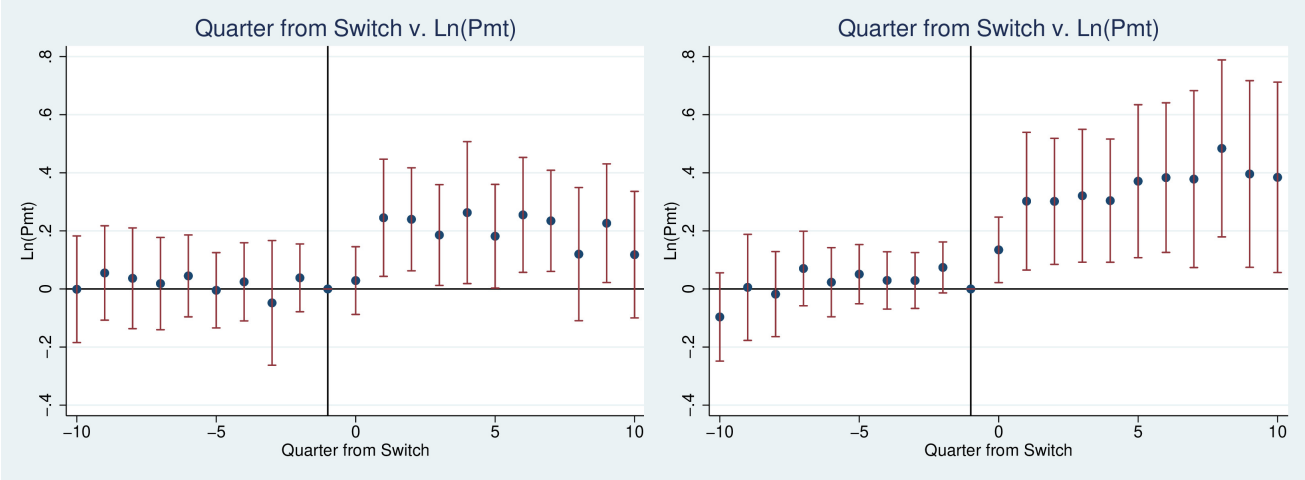
This figure plots the θ_q's (scaled by Δ_{pmt}) estimated from Equation 6 by quartile of (un-demeaned) Δ_{size}. Included are 95% confidence intervals using standard errors that are two-way clustered at the physician and group level.

Figure A.16: Event Study, Pre v. Post Group Switch, By Destination Group Size Quartile, Scaled by Δ_{pmt}, Internists



(a) Size: 1–29

(b) Size: 29–70

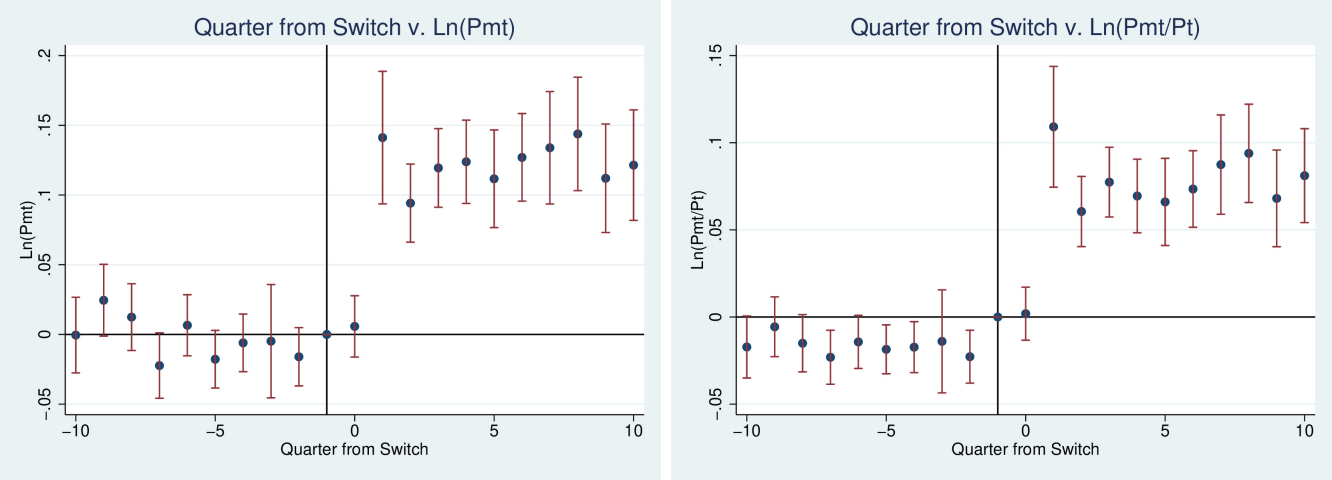


(c) Size: 70–151

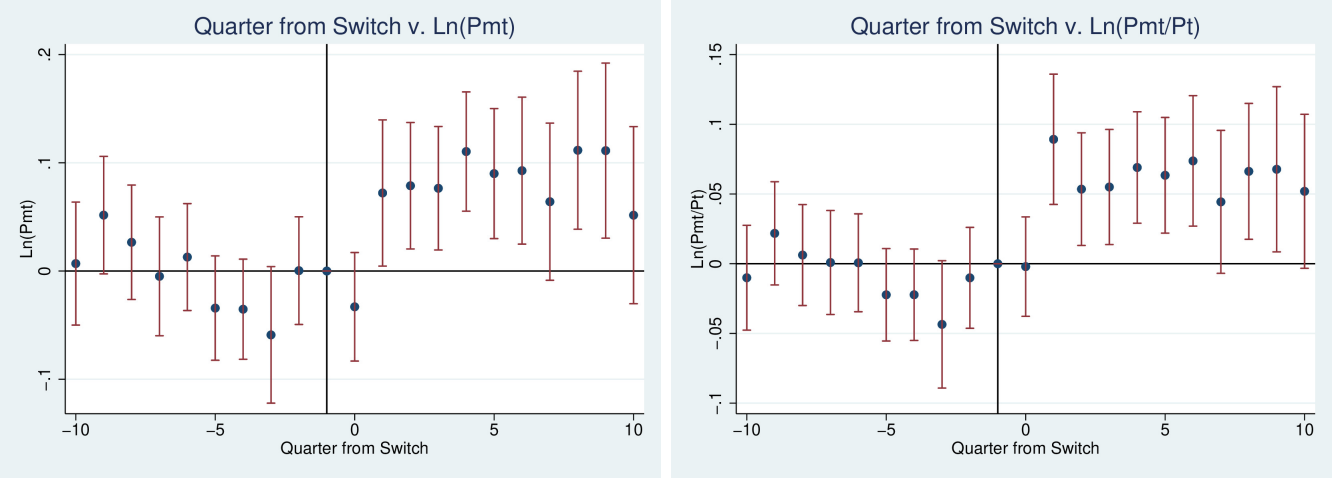
(d) Size: 181–2,053

This figure plots the θ_q's (scaled by Δ_{pmt}) estimated from Equation 6 by quartile of the size of the destination group as measured in the pre-switch period. Included are 95% confidence intervals using standard errors that are two-way clustered at the physician and group level.

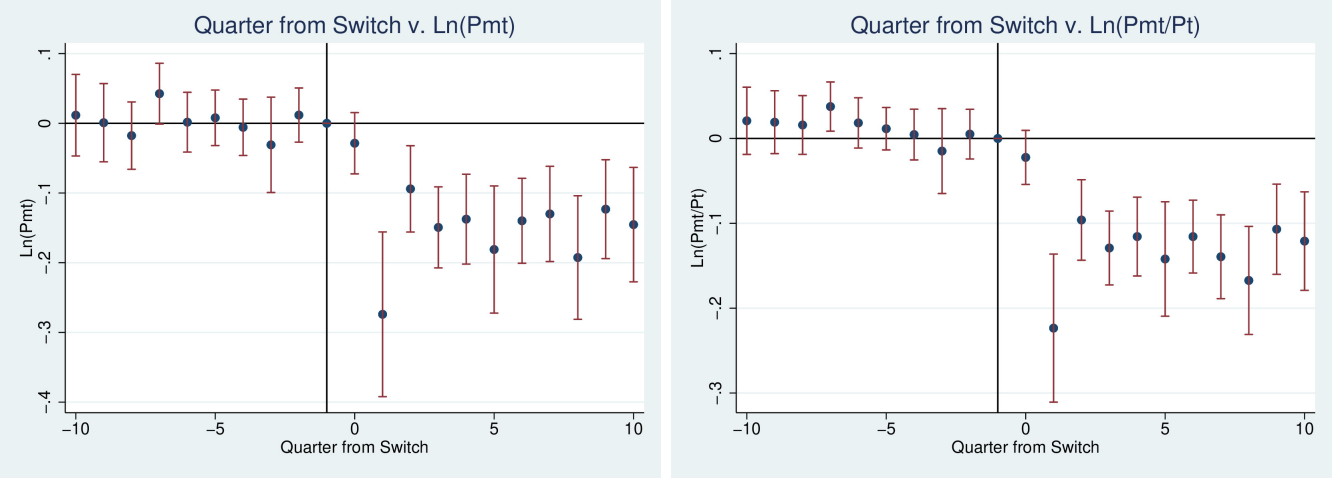
Figure A.17: Event Study, Pre v. Post Group Switch, Scaled by Δ_{pmt}, All Specialties



(a) Pooled Δ_{pmt}



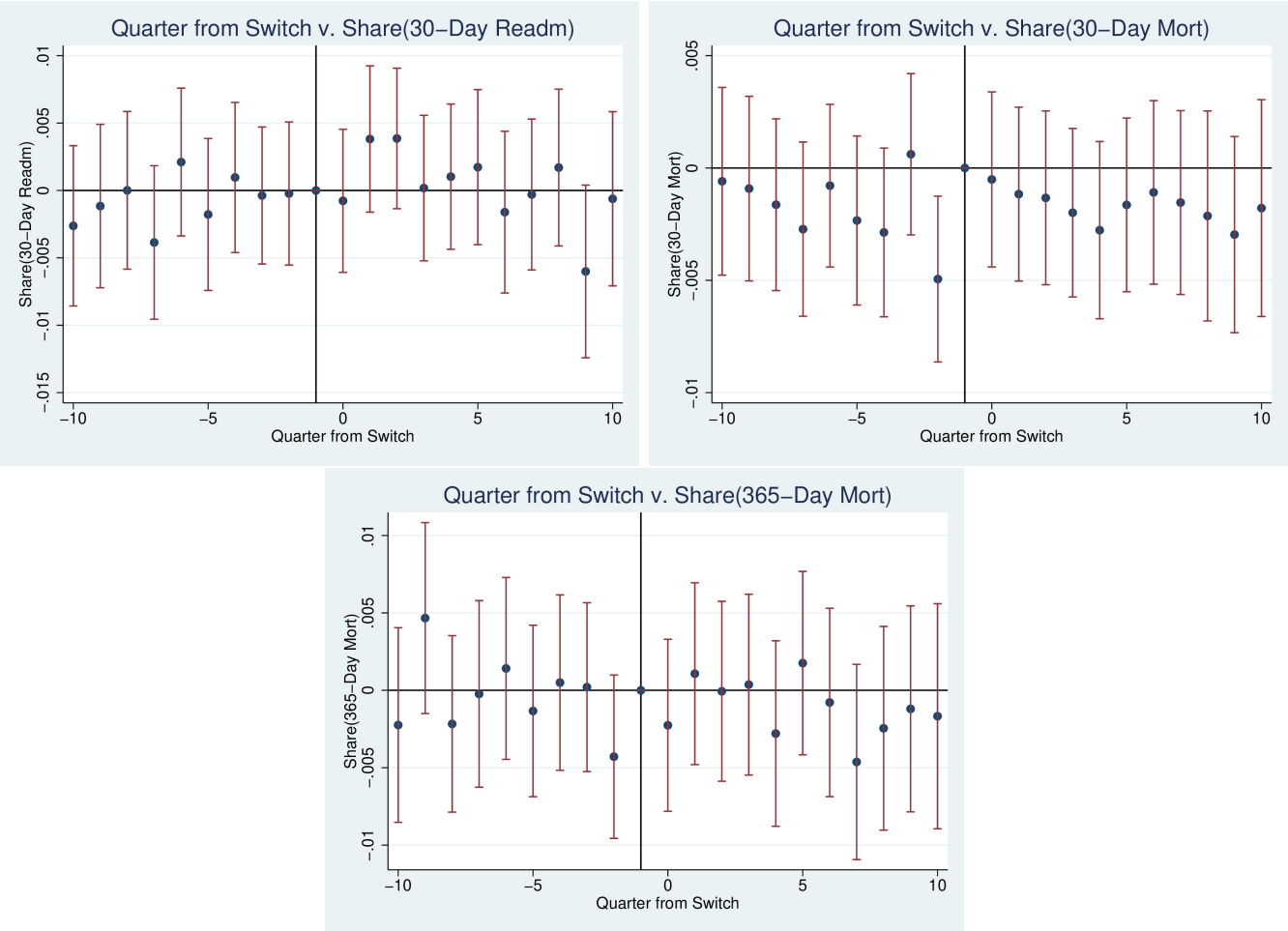
(b) $\Delta_{pmt} > 0$



(c) $\Delta_{pmt} < 0$

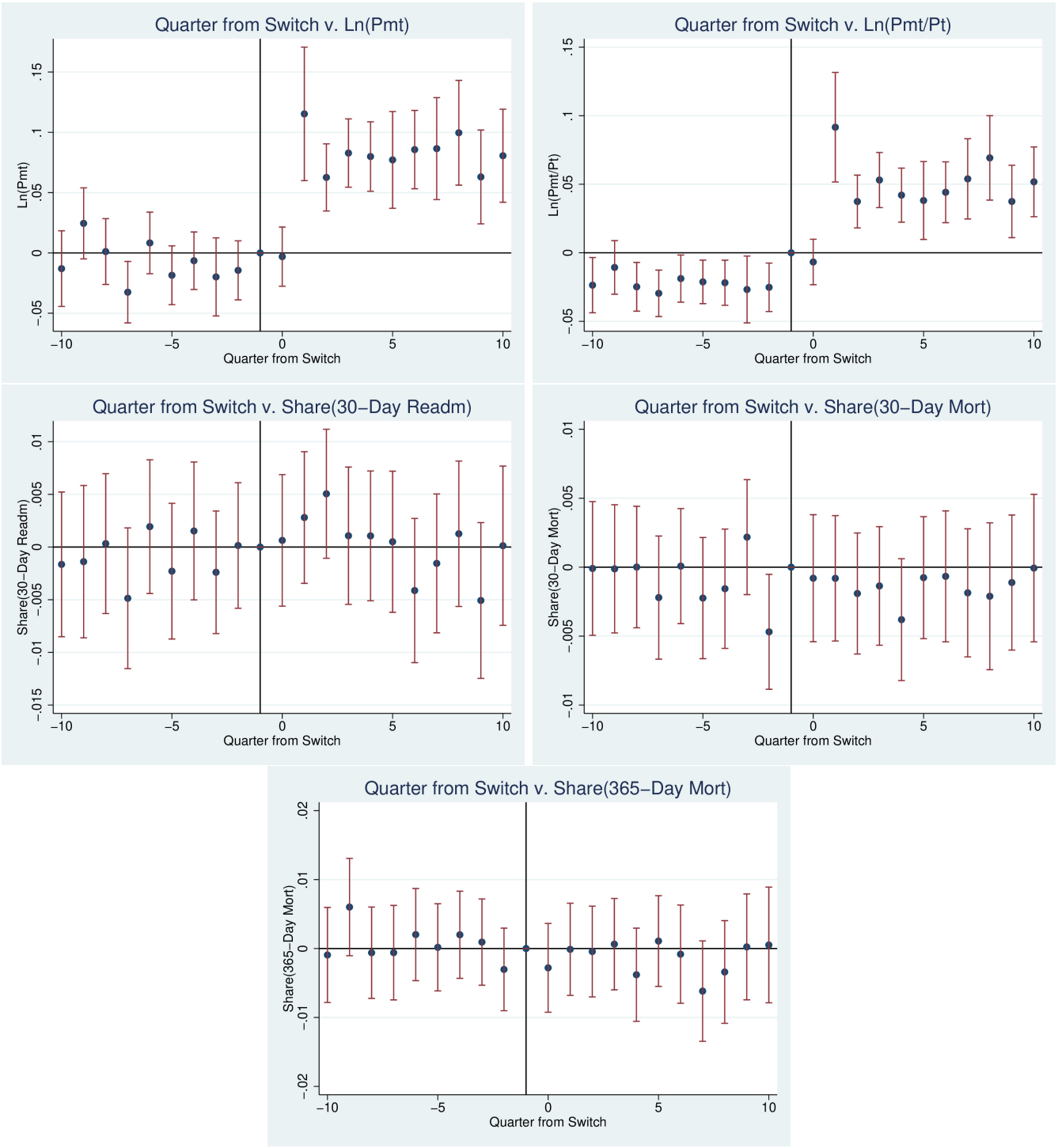
This figure plots the θ_q's estimated from Equation 6 for log reimbursement per physician per quarter (left column) and log reimbursement per patient per physician per quarter (right column), scaled by Δ_{pmt}, for all specialties. In panels (b) and (c), we estimate Equation 6 separately for $\Delta_{pmt} > 0$ and $\Delta_{pmt} < 0$, respectively. Included are 95% confidence intervals using standard errors that are two-way clustered at the physician and group level.

Figure A.18: Event Study, Pre v. Post Group Switch, Scaled by Δ_{pmt}, Quality of Care Measures, All Specialties



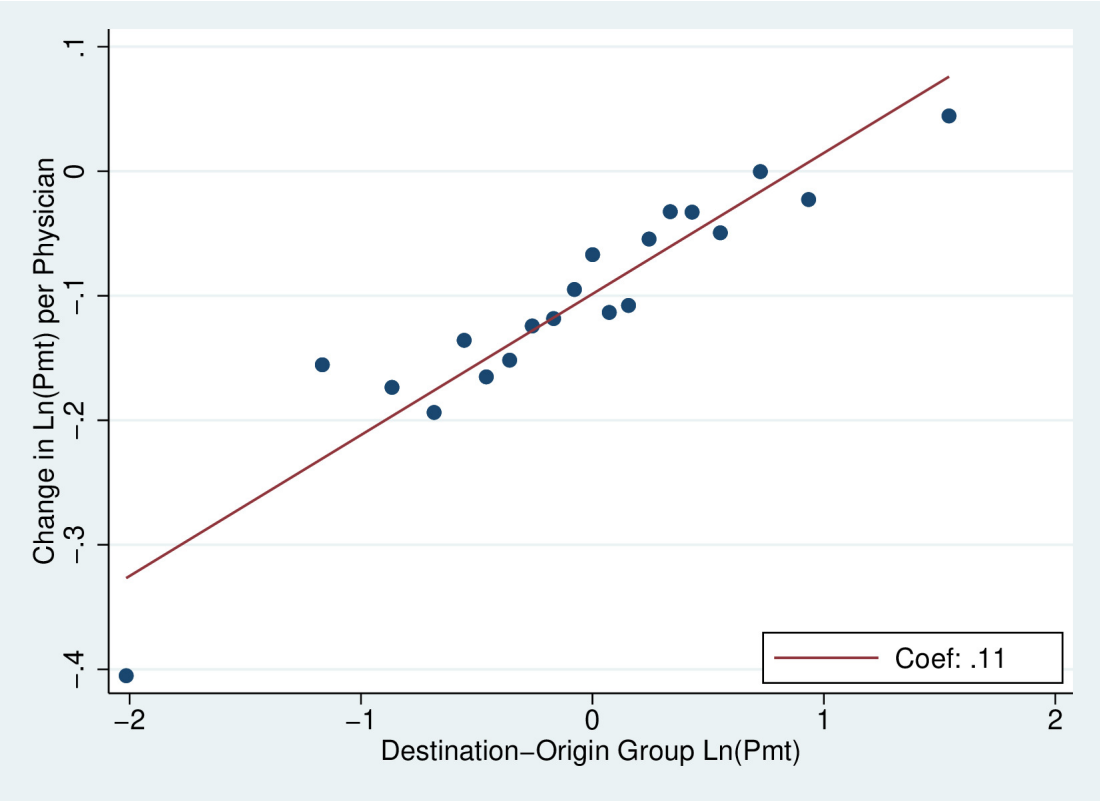
This figure plots the θ_q's estimated from Equation 6, scaled by Δ_{pmt}, for all specialties. Included are 95% confidence intervals using standard errors that are two-way clustered at the physician and group level.

Figure A.19: Event Study, Pre v. Post Group Switch, Scaled by Δ_{pmt}, Non-Internal Medicine Physicians



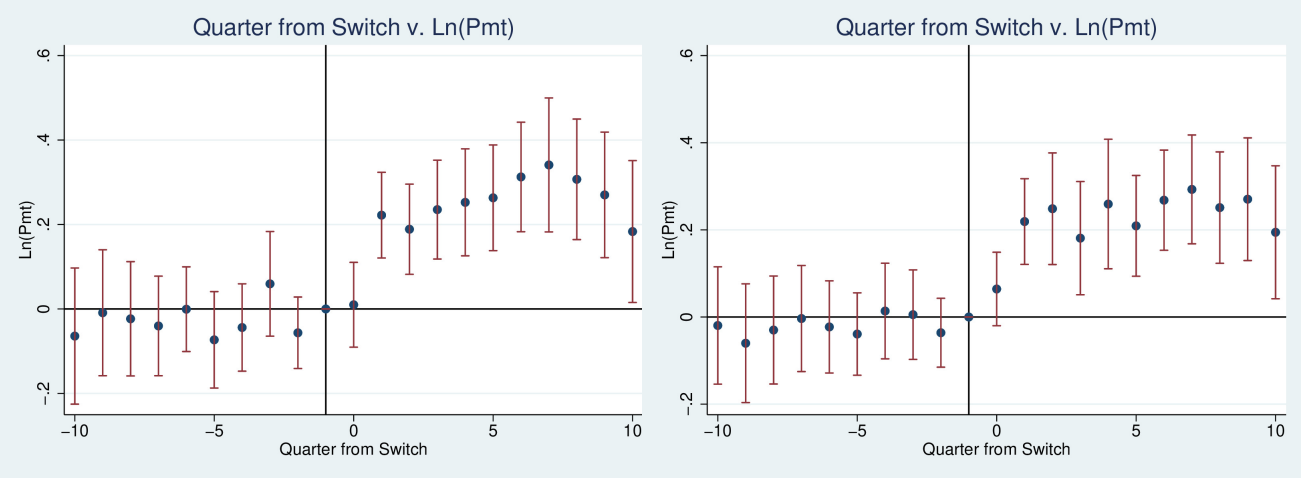
This figure plots the θ_q's estimated from Equation 6, scaled by Δ_{pmt}, for physicians who do *not* have a specialty of internal medicine. Included are 95% confidence intervals using standard errors that are two-way clustered at the physician and group level.

Figure A.20: Changes in Physician-Level Reimbursement per Patient-Quarter v. Destination-Origin Reimbursement per Patient-Quarter Group Differences, by Vigintile, All Specialties



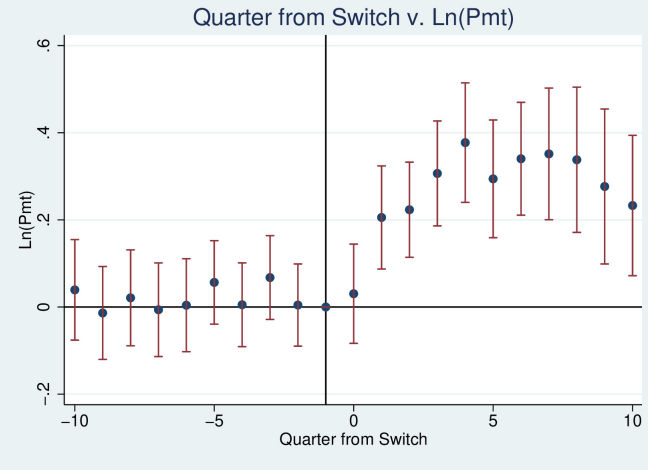
This figure if analogous to Figure 4 but includes physicians of all specialties.

Figure A.21: Event Study, Pre v. Post Group Switch, By Quartile of Physicians' Years Experience, Scaled by Δ_{pmt}, Internists

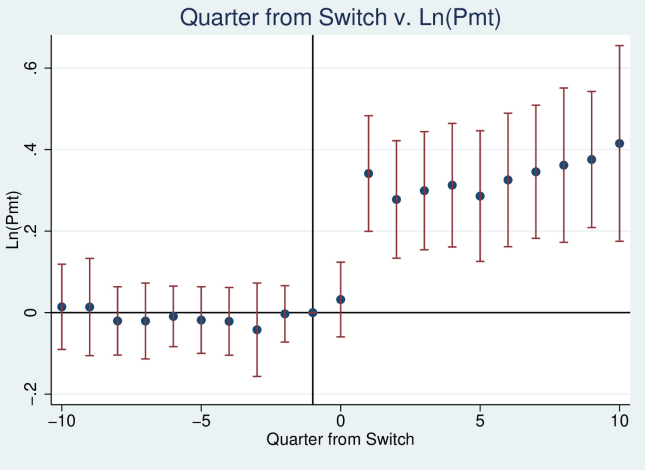


(a) 2–14

(b) 15–19



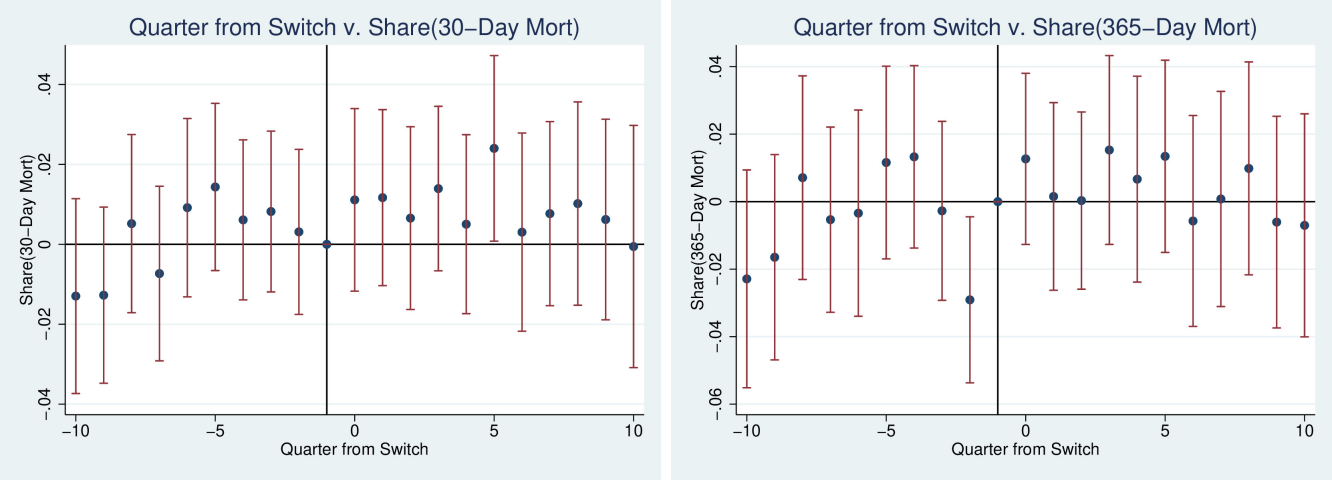
(c) 20–27



(d) 28–56

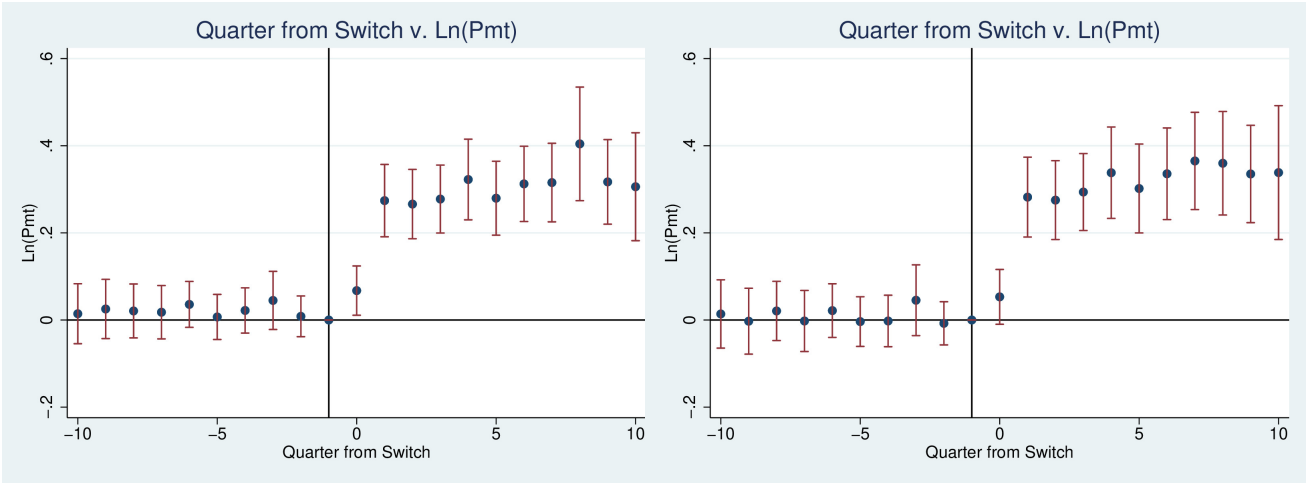
This figure plots the θ_q's estimated from Equation 6, scaled by Δ_{pmt}, by quartiles of years of experience, as measured by years from medical school graduation relative to 2016. Quartiles are defined by switchers' years of experience. Year of graduation is obtained from the Physician Compare database. Of the 3,242 internist physician-episodes in the sample, 2,986 (92%) can be matched to the Physician Compare database. Included are 95% confidence intervals using standard errors that are two-way clustered at the physician and group level.

Figure A.22: Event Study, Pre v. Post Group Switch, Mortality Rates for Patients Age>85, Internists



This figure plots the θ_qs estimated from Equation 6, scaled by Δ_{pmt}. The outcomes are the share of a physician's hospitalizations (in a given quarter) for patients 85 years old and older that resulted in death within 30 and 365 days of admission. Included are 95% confidence intervals using standard errors that are two-way clustered at the physician and group level.

Figure A.23: Event Study, Pre v. Post Group Switch, 5 and 20 Minimum Patients per Group per Quarter, Internists

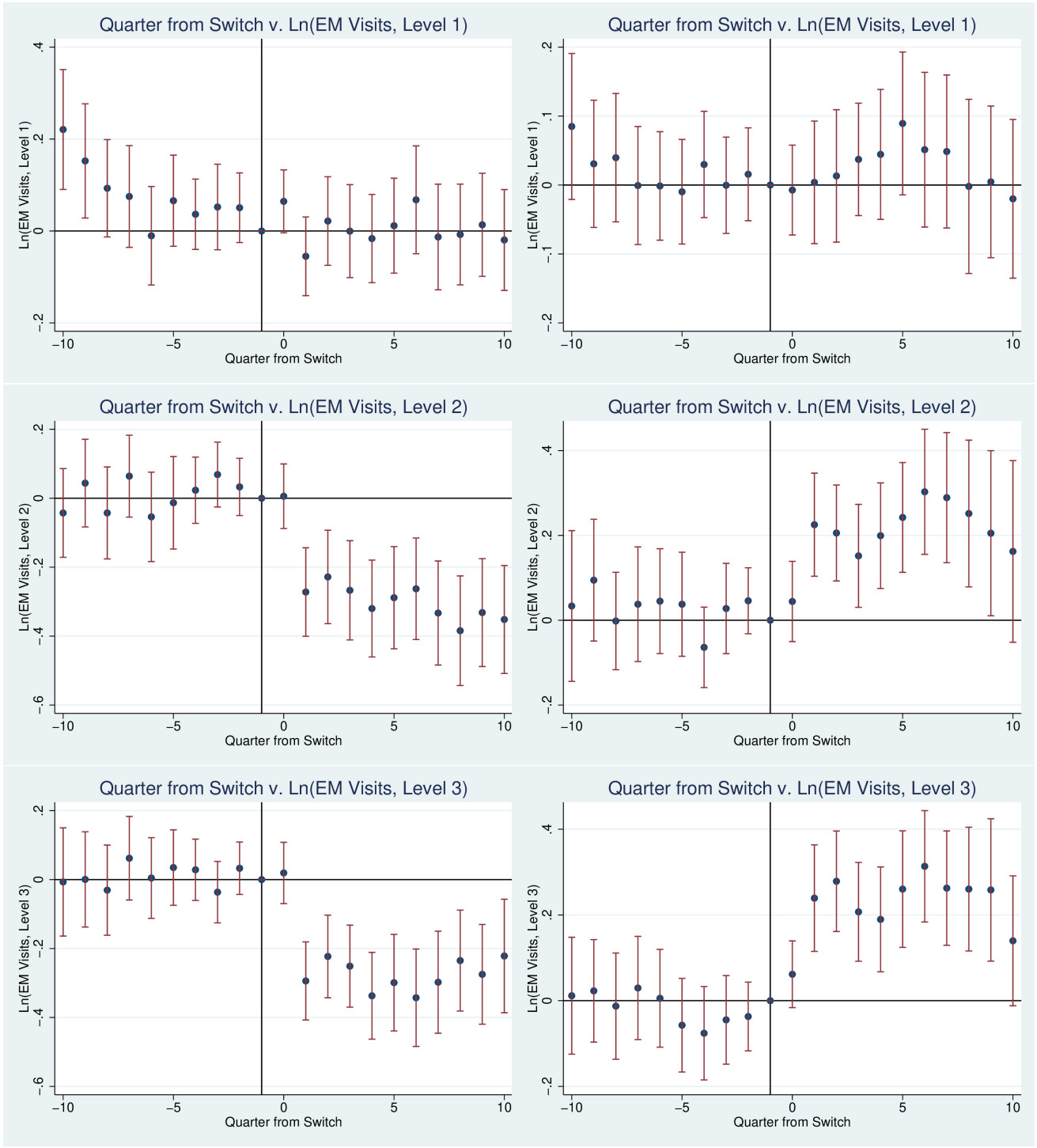


(a) Min. 5 Patients

(b) Min. 20 Patients

This figure plots the θ_qs estimate from Equation 6, scaled by Δ_{pmt}. Panel (a) plots the results from estimating the model on a sample where each switcher's group treats a minimum of 5 patients per quarter in the pre-period. Panel (b) plots the results from estimating the model on a sample where each switcher's group treats a minimum of 20 patients per quarter in the pre-period. Included are 95% confidence intervals using standard errors that are two-way clustered at the physician and group level.

Figure A.24: Event Study, Pre v. Post Group Switch, E&M Visits by Level, Internists



(a) $\Delta_{pmt} < 0$ (b) $\Delta_{pmt} > 0$

This figure plots the θ_qs estimated from Equation 6, scaled by Δ_{pmt}. The outcomes are the log number of E&M visits of a particular level of intensity (levels 1 through 3). Column (a) plots the θ_qs for physicians that switch to less-intensive groups, while column (b) plots the θ_qs for physicians that switch to more-intensive groups. Included are 95% confidence intervals using standard errors that are two-way clustered at the physician and group level.

Appendix B Modeling Treatment Intensity

We propose the following conceptual model to motivate our main estimating equation. In the spirit of Ellis and McGuire (1986) and Finkelstein et al. (2016), we model physician p's utility from treating patients with a given level of intensity y as a function of her perceived benefit to the patient, which can be affected by observable characteristics of her patients, $B(y, X_{pt})$, minus the personal cost to the physician, $PC_p(y)$, such as the opportunity cost of a given level of intensity. Further, the physician trades off perceived benefit and personal cost at some rate, η_p. Thus, physician utility u_p can be written as: $u_p = \eta_p B(y, X_{pt}) - PC_p(y)$. Embedded in $B(y, X_{pt})$ is a physician's own time-invariant preferences for intensity, which is allowed to vary with patient characteristics.

We approximate the expectation of the optimal level of y_{pt} chosen by physicians as a simple linear relationship: $E(y^*_{pt}|\{i, p, t, X_{pt}\}) = \tilde{\alpha}_p + X_{pt}\lambda + \sum_{q=-Q}^{Q} \gamma'_q \mathbb{1}\{Q_{pt} = q\}$. $\tilde{\alpha}_p$ is a physician fixed effect (as in Equation 6) that includes physician p's preference for intensity, her personal costs to providing a given level of intensity, and other unobservable characteristics such as her particular skill level. X_{pt} are controls for observable patient characteristics that affect optimal levels of care (such as demographic characteristics). Finally, we allow physicians who switch groups to change their intensity for reasons related to the move by including indicators for quarter relative to a group switch, which occurs at $q = -1$. Relative time for non-switchers is normalized to 0.

Meanwhile, a group, g, is a firm that in the healthcare setting is assumed to choose a level of intensity that maximizes the profits from providing that given level of intensity, $\pi_{ght}(y)$, in addition to the sum of all physician members' $p \in P$ utility, $\sum_p^P u_p$, which takes into account the benefits to patients. As indicated by the h in the subscript, group profits depend in part on their contract with the hospital h in which their member physicians practice in a given quarter t. Group management can affect profits in a number of ways, including economies of scale in coding, managing referrals within the group, and managing incentive conflicts across the physicians with rules and norms. The relevant objective function determining a physician's intensity in a given quarter is:

$$y^*_{pt} = \arg\max_y \left(\psi_g \sum_p^P u_p + \pi_{ght}(y) \right) \tag{8}$$

where ψ_g represents the relative importance a group places on their physician members' utility versus profits.

The maximization of Equation 8 implies a relationship between billing intensity and physician preferences, profit considerations, and group-specific preferences trading off profits and physician utility. Putting together group and physician objectives results in an empirical model as in Section 3 (in the spirit of Abowd et al. (1999)):

$$Y_{pght} = \tilde{X}_{pt}\lambda + D\alpha + G\gamma + \varepsilon_{pght}$$

where $\tilde{X}_{pt}$ is a matrix of observable, time-varying patient characteristics and indicators for time relative to the switch, and λ is the corresponding vector of coefficients on these time-varying elements; D is a matrix of indicators for the individual physician, and α is the corresponding vector of individual physician effects; and G is a matrix of indicators for the group effect, and γ is the corresponding vector of group effects. This is the model we explore in the main text.

A limitation of this approach is that we cannot identify the relative importance of each of these hypothetical mechanisms by which groups affect members' intensity; they remain somewhat of a "black box" encapsulated within the group fixed effect, although we do explore differences in billing behavior as well as robustness checks where we find similar results across a range of group types. Rather, this

paper seeks to explain whether group affiliation helps explain why physicians vary in their treatment intensity.