Appendix For Online Publication:

Physician Group Influences on Treatment Intensity and Health:
Evidence from Physician Switchers

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Appendix A Additional Tables and Figures

Table A.1: 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.2: Difference-in-Differences, Additional Specialties

	(1) Ln(Pmt/Pt)		(2) Ln(Pmt)		(3) Share(30-Day Readm)		(4) Share(30-Day Mort)		(5) Share(365-Day Mort)	
Panel A. All Specialties										
$\Delta_{pmt/pt}$*Post Switch	0.085***	(0.009)	0.052***	(0.011)	0.001	(0.001)	-0.001	(0.001)	-0.001	(0.001)
$\Delta_{pmt/pt}$*Qtr=0	0.011	(0.007)	-0.024**	(0.009)	0.002	(0.002)	-0.002	(0.001)	-0.002	(0.002)
Constant	5.193***	(0.000)	7.083***	(0.000)	0.246***	(0.000)	0.093***	(0.000)	0.282***	(0.000)
Observations	2997461		2997461		2997461		2997461		2997461	
Dep. Var. Mean	5.192		7.082		0.246		0.093		0.282	
Panel A. Not Internal Medicine										
$\Delta_{pmt/pt}$*Post Switch	0.060***	(0.007)	0.021*	(0.008)	0.002	(0.001)	-0.000	(0.001)	-0.001	(0.001)
$\Delta_{pmt/pt}$*Qtr=0	0.005	(0.007)	-0.031**	(0.009)	0.002	(0.002)	-0.002	(0.002)	-0.004	(0.002)
Constant	5.176***	(0.000)	7.047***	(0.000)	0.246***	(0.000)	0.091***	(0.000)	0.276***	(0.000)
Observations	2450115		2450115		2450115		2450115		2450115	
Dep. Var. Mean	5.175		7.045		0.246		0.091		0.276	

Fixed effects for physician-episode and hospital-year-quarter. Standard errors in parentheses 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.3: Compare Specifications

	(1) Ln(Pmt/Pt)	(2) Ln(Pmt/Pt)	(3) Ln(Pmt/Pt)
$\Delta_{pmt/pt}$*Post Switch	0.266***	0.266***	0.256***
	(0.037)	(0.038)	(0.039)
$\Delta_{pmt/pt}$*Qtr=0	0.067**	0.067**	0.064**
	(0.023)	(0.023)	(0.024)
Constant	5.268***	5.268***	5.269***
	(0.001)	(0.001)	(0.001)
Observations	529465	529465	528154
Adjusted R^2	0.674	0.674	0.674
Dep. Var. Mean	5.267	5.267	5.268
Specification	Main	Bayes	Non-Switchers

Fixed effects for physician-episode and hospital-year-quarter. Standard errors in parentheses are two-way clustered at the physician and group levels. Omitted category is an indicator for quarters $\in [-10, -1]$. Column (1) re-states the main results. Column (2) reports the results estimated using the empirical Bayes adjusted measure of $\Delta_{pmt/pt}$. Column (3) reports results estimated for a version of $\Delta_{pmt/pt}$ that is calculated only based on non-switching physicians in the origin and destination groups.

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

Table A.4: Difference-in-Differences by Hospital Medicare Share

	(1) Ln(Pmt/Pt)	(2) Ln(Pmt/Pt)	(3) Ln(Pmt/Pt)	(4) Ln(Pmt/Pt)
$\Delta_{pmt/pt}$*Post Switch	0.376***	0.181**	0.222***	0.242***
	(0.079)	(0.056)	(0.048)	(0.053)
$\Delta_{pmt/pt}$*Qtr=0	0.084	-0.018	0.086**	0.087*
	(0.049)	(0.050)	(0.031)	(0.042)
Constant	5.269***	5.268***	5.268***	5.268***
	(0.001)	(0.001)	(0.001)	(0.001)
Observations	529465	529465	529465	529465
Dep. Var. Mean	5.272	5.274	5.272	5.272
Medicare Share Quantile	1	2	3	4
Share Range	.045–.396	.397–.457	.457–.509	.509–1.231

Estimates come from a single model with interactions for the different Medicare-share quartiles, including fixed effects for physician-episode and hospital-year-quarter. Standard errors in parentheses are two-way clustered at the physician and group levels. Omitted category is an indicator for quarters $\in [-10, -1]$. Medicare share quantiles are calculated for a physician's attributed hospital in a given year-quarter and are based on the American Hospital Association annual survey. Shares for a small number of hospitals exceed one due to measurement error.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A.5: Difference-in-Differences, Additional Outcomes

	(1) Ln(Patients)		(2) Ln(Pmt)		(3) Ln(HCPCS)		(4) Ln(Procedures)		(5) Ln(LOS)	
Panel A. $\Delta_{pmt/pt}$										
$\Delta_{pmt/pt}$*Post Switch	0.010	(0.023)	0.290***	(0.056)	0.078**	(0.030)	0.022	(0.022)	0.001	(0.006)
$\Delta_{pmt/pt}$*Qtr=0	-0.027	(0.016)	0.036	(0.032)	-0.010	(0.020)	-0.013	(0.016)	-0.003	(0.014)
Constant	2.184***	(0.001)	7.250***	(0.001)	3.058***	(0.001)	1.705***	(0.001)	2.046***	(0.000)
Dep. Var. Mean	2.185		7.250		3.059		1.706		2.046	
Panel B. Δ_{size}										
Δ_{size}*Post Switch	-0.030***	(0.008)	-0.050***	(0.012)	-0.042***	(0.010)	-0.026***	(0.008)	-0.003	(0.003)
Δ_{size}*Qtr=0	-0.028***	(0.007)	-0.026*	(0.012)	-0.026**	(0.009)	-0.022**	(0.007)	0.003	(0.005)
Constant	2.184***	(0.001)	7.250***	(0.001)	3.058***	(0.001)	1.704***	(0.001)	2.046***	(0.000)
Dep. Var. Mean	2.185		7.250		3.059		1.706		2.046	
Observations	529465		529465		529465		529465		529465	

This table reports estimated coefficients from Equation 7 for internists. Post Switch is an indicator variable that is equal to 1 for all quarters $\in [1, 10]$. Fixed effects are included for physician-episode and hospital-year-quarter. Standard errors in parentheses are two-way clustered at the physician and group levels. Omitted category is an indicator for quarters $\in [-10, -1]$. HCPCS is the Healthcare Common Procedural Coding System code recorded as the specific line item in a given claim. "Pt" abbreviates patient. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A.6: 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

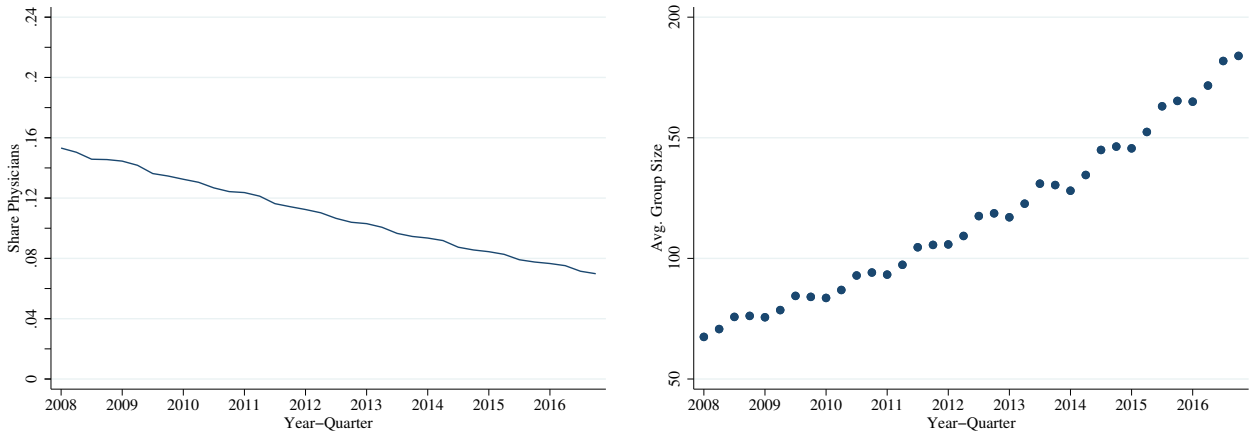
This table reports the inpatient evaluation and management (E&M) codes used in our analysis of billing intensity. Common inpatient E&M codes were identified from University of Southern California medical group compliance guidelines. Average reimbursement is calculated from the carrier files as the sum 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.

Table A.7: Horse Race Model of Change in Intensity and Change in Size

	(1) Ln(Pmt/Pt)	(2) Ln(Pmt/Pt)	(3) Ln(Pmt/Pt)
$\Delta_{pmt/pt}$*Post Switch	0.266***		0.268***
	(0.037)		(0.037)
$\Delta_{pmt/pt}$*Qtr=0	0.067**		0.067**
	(0.023)		(0.023)
Δ_{size}*Post Switch		-0.015	-0.020**
		(0.008)	(0.007)
Δ_{size}*Qtr=0		0.005	0.005
		(0.007)	(0.007)
Constant	5.268***	5.268***	5.268***
	(0.001)	(0.001)	(0.001)
Observations	529465	529465	529465
Dep. Var. Mean	5.267	5.267	5.267

All models include fixed effects for physician-episode and hospital-year-quarter. Standard errors in parentheses are two-way clustered. Δ_{size} is the change in group size as measured by the number of physicians.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure A.1: Group Trends in Hospitals Over Time

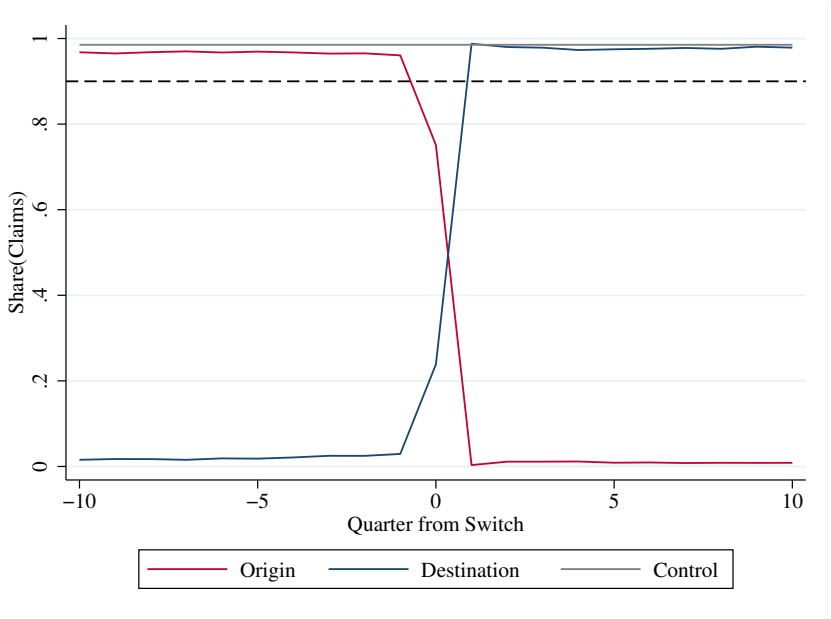


(a) Share(Physicians) In Solo Practice

(b) Group Size

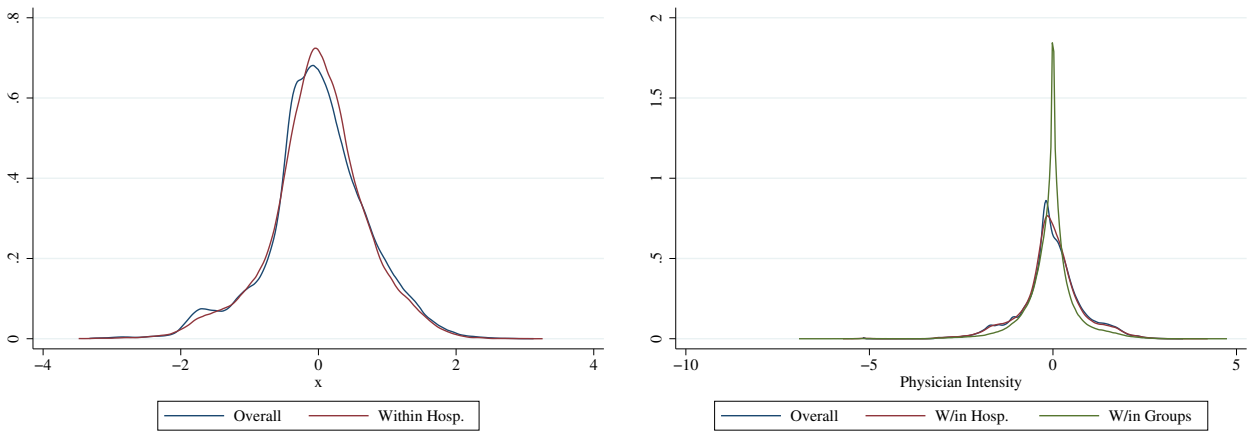
This figure plots trends in group size among physicians practicing in hospitals by year-quarter during our study period (2008-2016). Panel (a) plots the share of physicians in a group size of 1 (which we characterize as solo practice) over time. Panel (b) plots average group size over time. Group size 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.

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



This figure plots the average share of physicians' HCPCS that are associated with their origin and destination groups 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 Group and Physician Intensity

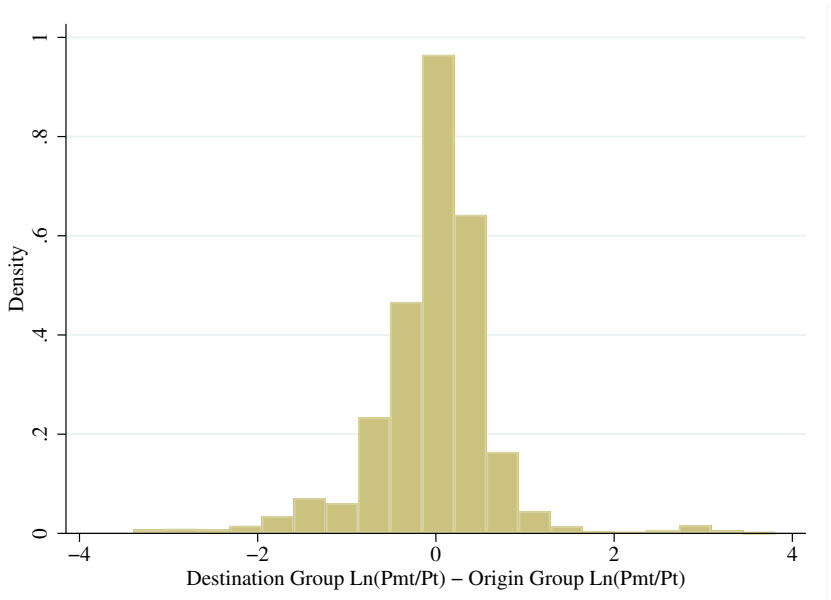


(a) Group Intensity, All Specialties

(b) Physician Intensity, All Specialties

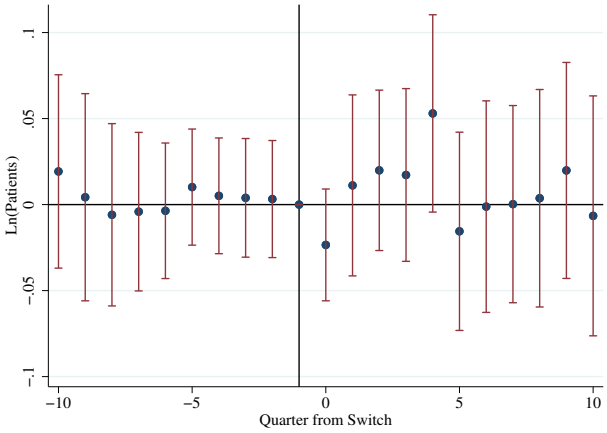
This figure plots variation in physician and group intensity among physicians of all specialties, as measured by average log reimbursement per patient-quarter per physician. Group intensity is calculated as described above, and average physician intensity is calculated across all quarters. Panels (a) 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 0.73 and 0.70, respectively. The standard deviation for overall, within-hospital, and within-group intensity for physicians is 0.84, 0.84, and 0.66, respectively.

Figure A.4: Distribution of $\Delta_{pmt/pt}$

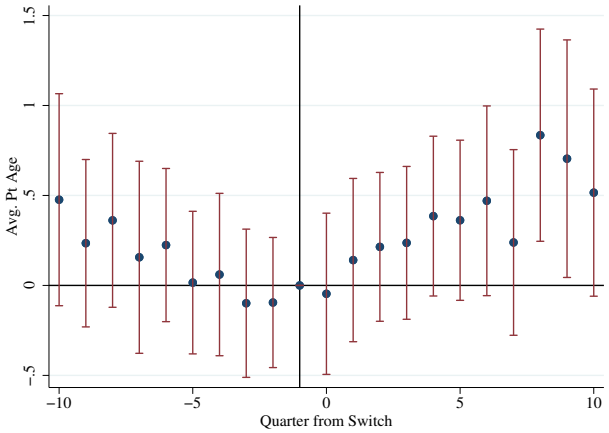


This figure plots the distribution of (non-demeaned) $\Delta_{pmt/pt}$ for physicians in our main empirical sample. $\Delta_{pmt/pt}$ has a mean of -0.032 and a standard deviation of 0.68.

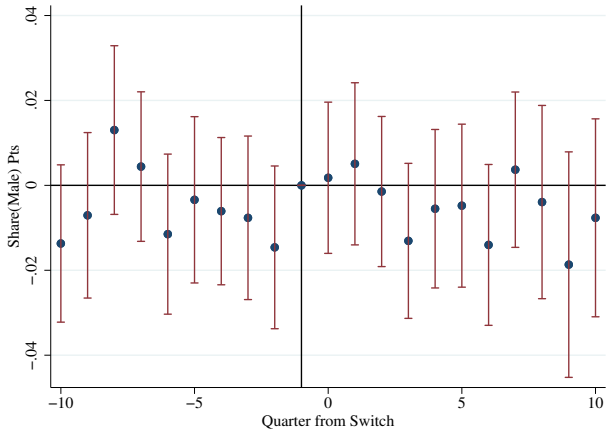
Figure A.5: Test for Balance of Patient Characteristics Across Switch, Internists



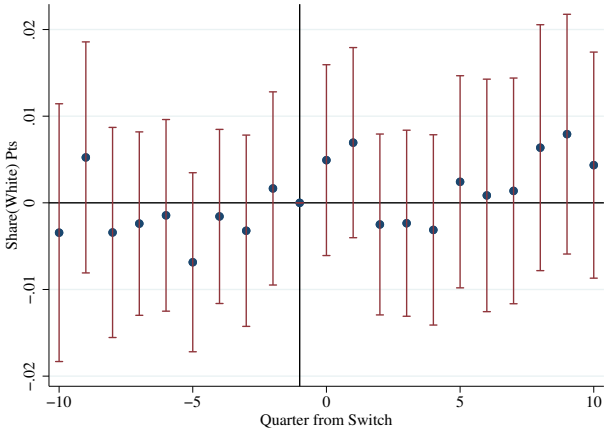
(a) Log Patients Across Switch



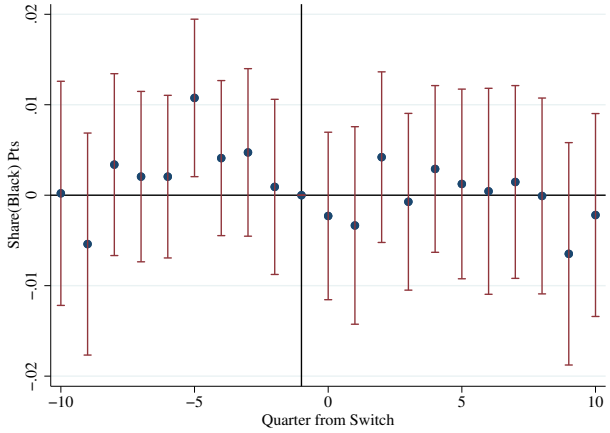
(b) Patient Age Across Switch



(c) Patient Sex Across Switch



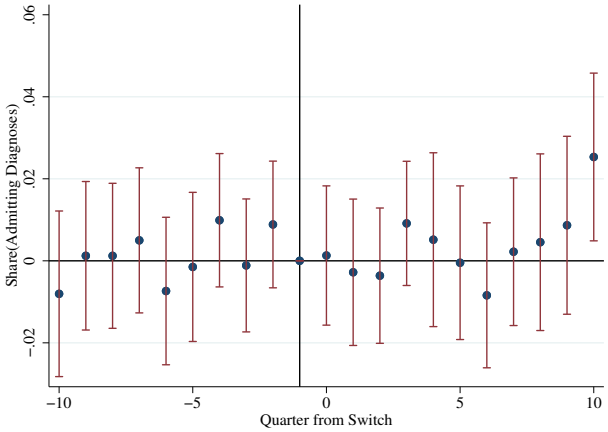
(d) Share of White Patients Across Switch



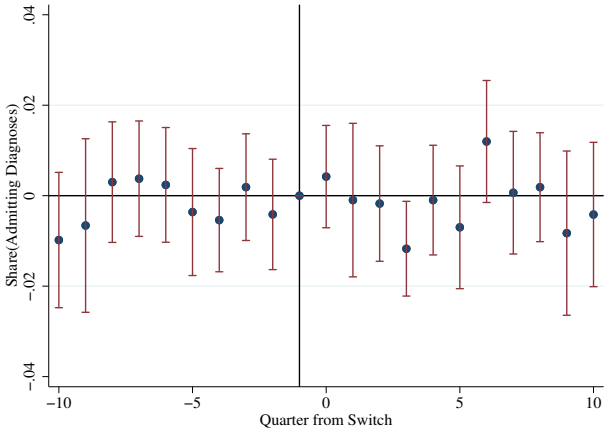
(e) Share of Black Patients Across Switch

This figure plots changes in patient characteristics across the switch, scaled by $\Delta_{pmt/pt}$ (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.

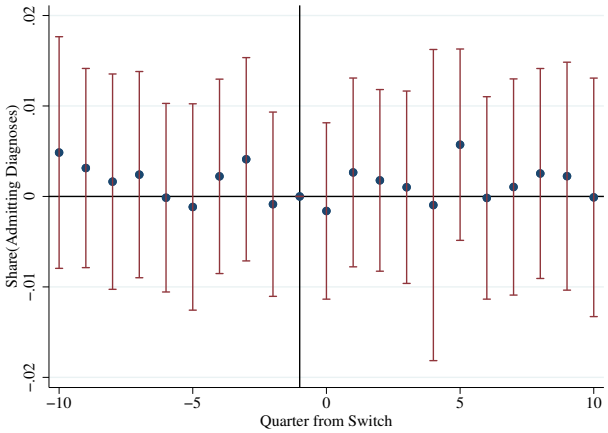
Figure A.6: Most Common ICD Admitting Diagnostic Sections, 1-5



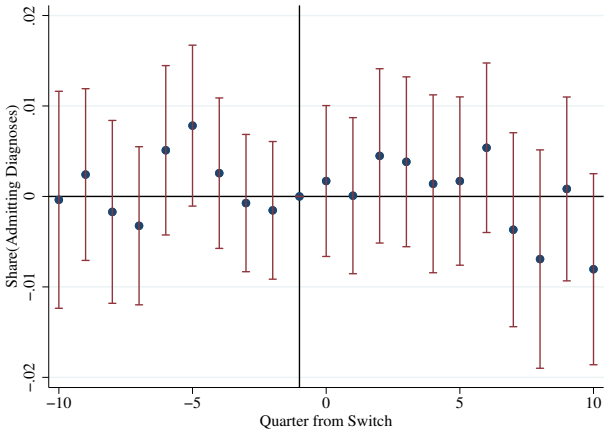
(a) Circulatory System



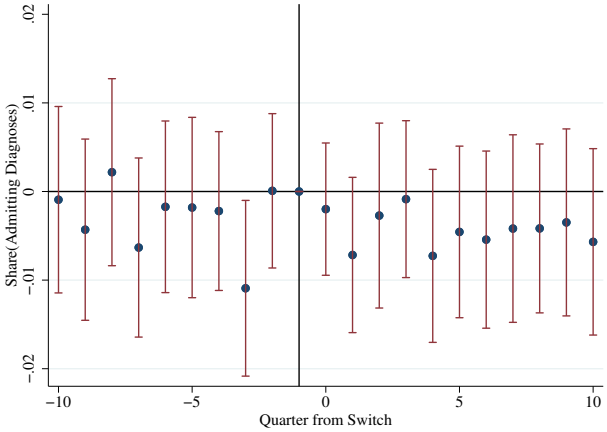
(b) Symptoms, Signs, and Ill-Defined Conditions



(c) Respiratory System



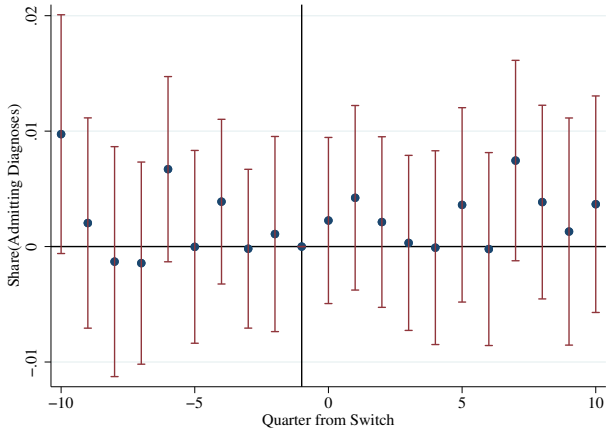
(d) Genitourinary System



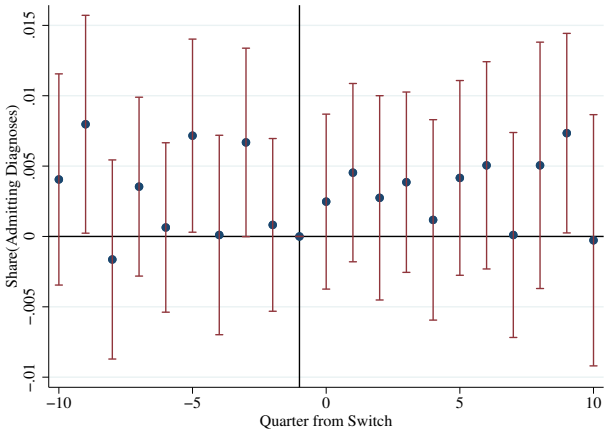
(e) Digestive System

This figure plots changes in the shares of the top five most common hierarchical ICD-CM-9 and ICD-CM-10 sections across a physician's switch between groups, scaled by $\Delta_{pmt/pt}$ (i.e. plots of θ_qs from Equation 6 with ICD sections as the dependent variable). Included are 95% confidence intervals using standard errors that are two-way clustered at the physician and group level.

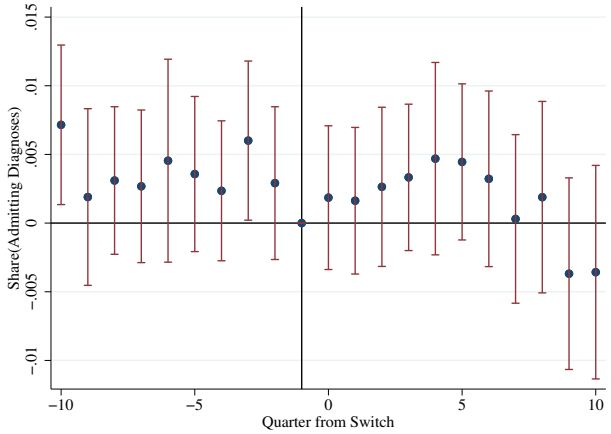
Figure A.7: Most Common ICD Admitting Diagnostic Sections, 6-10



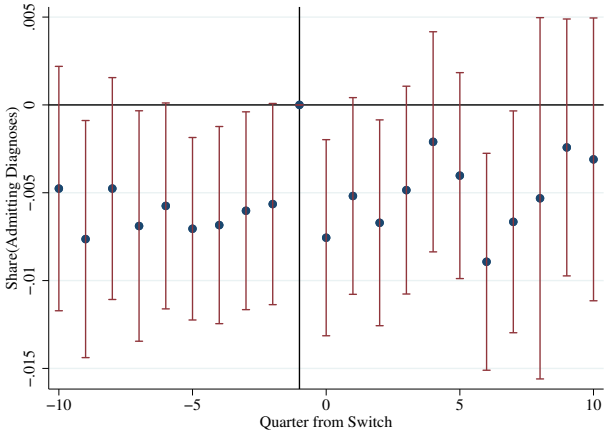
(a) Endocrine, Nutritional and Metabolic Diseases, and Immunity Disorders



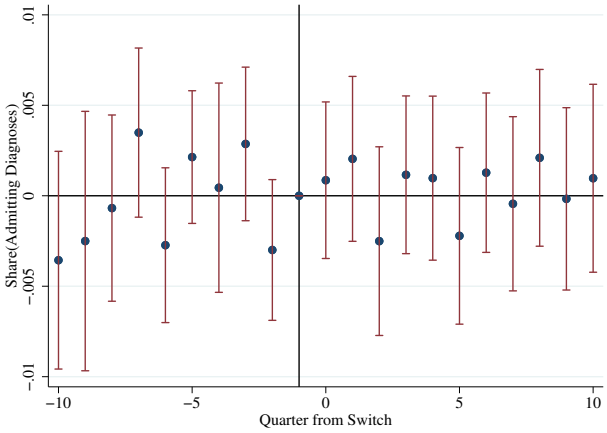
(b) Injury and Poisoning



(c) Infectious and Parasitic Diseases



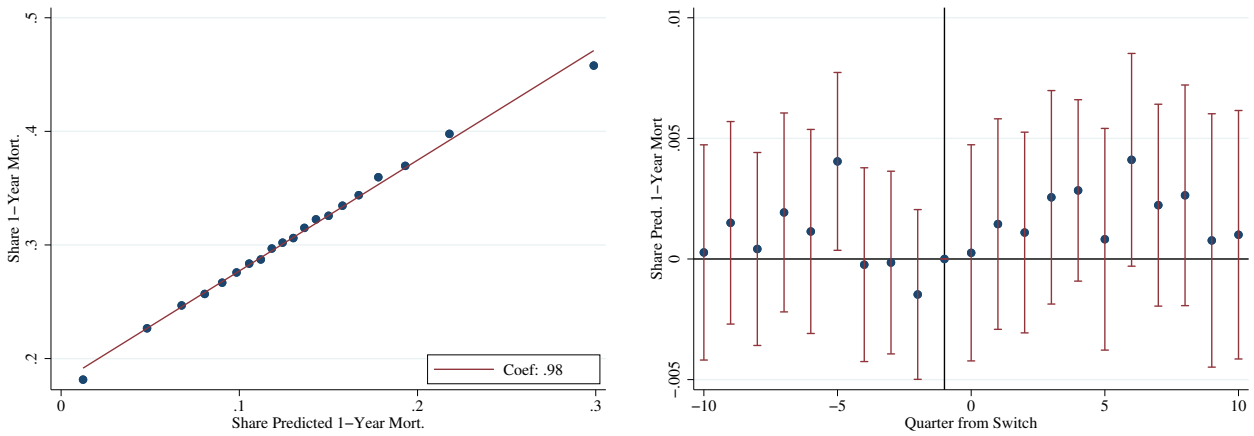
(d) Musculoskeletal System and Connective Tissue



(e) Blood and Blood-forming Organs

This figure plots changes in the shares of the top six through tenth most common hierarchical ICD-CM-9 and ICD-CM-10 sections across a physician's switch between groups, scaled by $\Delta_{pmt/pt}$ (i.e. plots of θ_qs from Equation 6 with ICD sections as the dependent variable). Included are 95% confidence intervals using standard errors that are two-way clustered at the physician and group level.

Figure A.8: Balance in Predicted Mortality

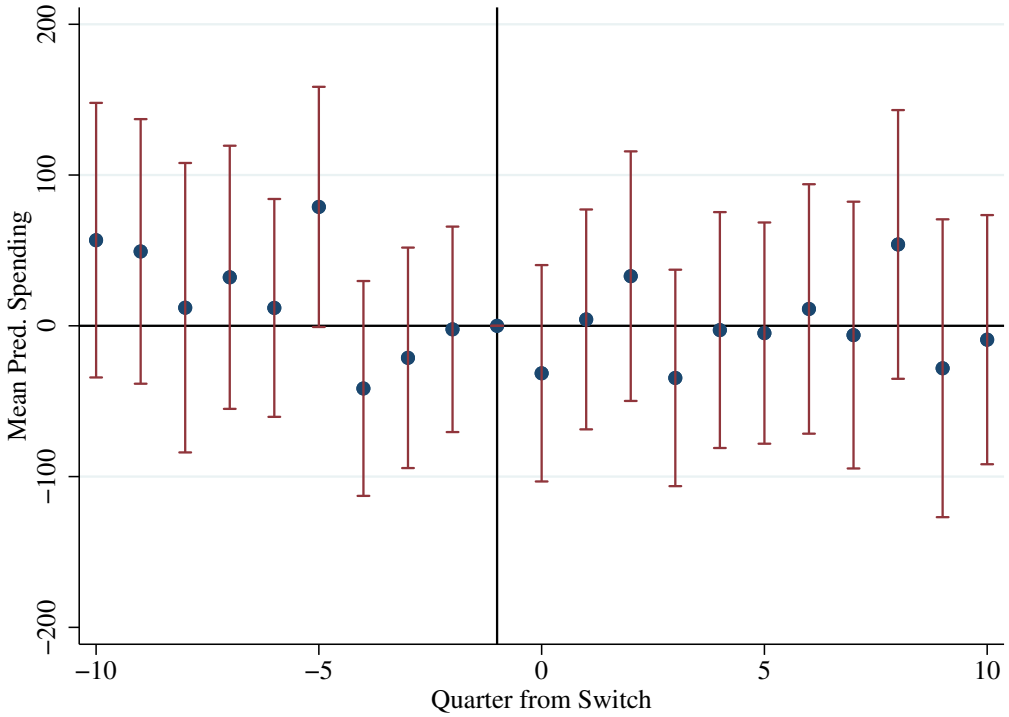


(a) Share(1-Year Mort.) v. Share(Predicted 1-Year Mort.)

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

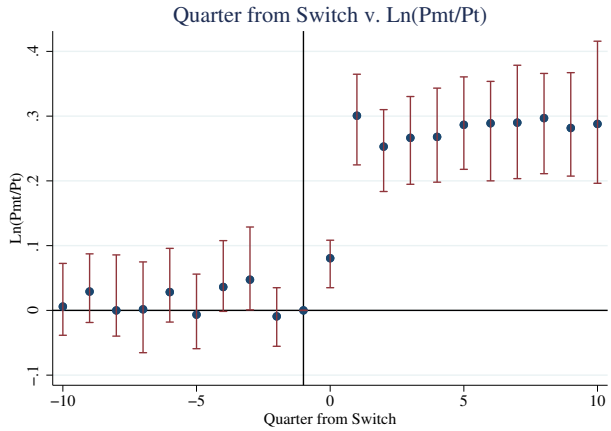
This figure shows balance in predicted patient mortality across the group switch. Panel (a) plots the relationship between the observed share of a physician's patients with 1-year mortality and the share of a physician's patients with predicted 1-year mortality (based on the approach discussed below). 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 $\Delta_{pmt/pt}$ (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.9: Predicted Spending



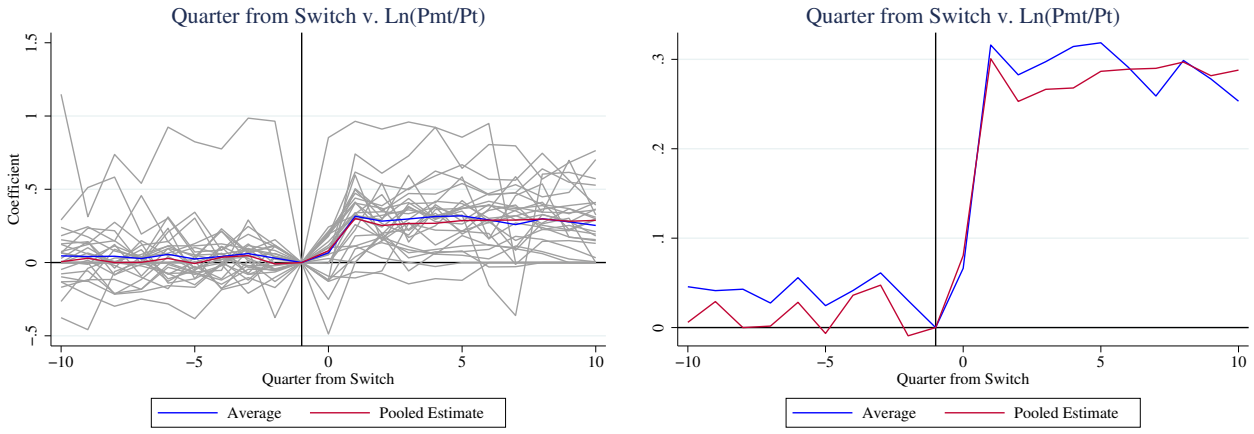
Predicted inpatient spending is calculated in the following steps. First, we estimate the relationship (in a linear model) between inpatient spending associated with a given hospitalization and patient age (in vigintiles), sex, race, and comorbidity indicators recorded in 2012, with 2012 being the midpoint 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 inpatient spending 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 inpatient spending 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.10: Physician Treatment Intensity Relative to a Change in Group Intensity, 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 $\Delta_{pmt/pt}$ 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) $\Delta_{pmt/pt}$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.11: Treatment Intensity Event Study by Switch-Quarter Cohort, Internists

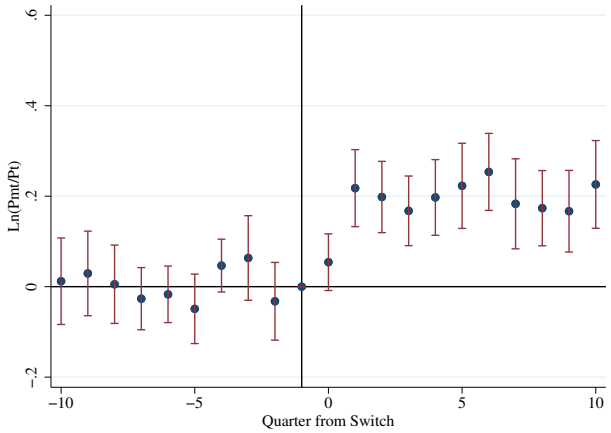


(a) With Switcher Cohorts

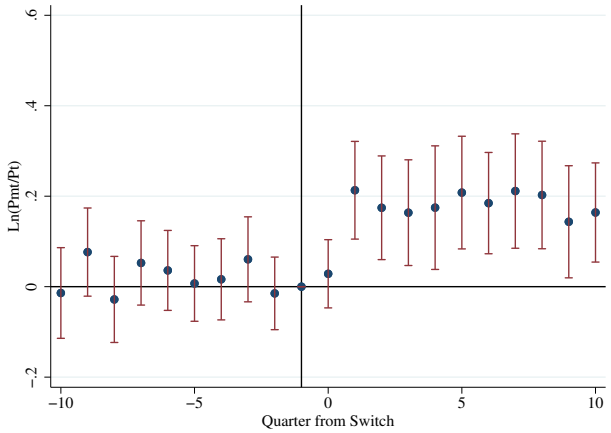
(b) Average v. Pooled Estimates

This figure plots the θ_qs obtained from estimating Equation 6 on each cohort of switchers, as defined by quarter of switch. Estimates of difference in intensity relative to switch time (relative to controls) for individual switcher cohorts are plotted in gray in (a). The blue line plots the average of these estimates, and the red line plots the original estimates from running the model on the pooled (all switcher cohort) sample in (a) and (b). 95% confidence intervals are excluded for ease of comparison of the different trend lines.

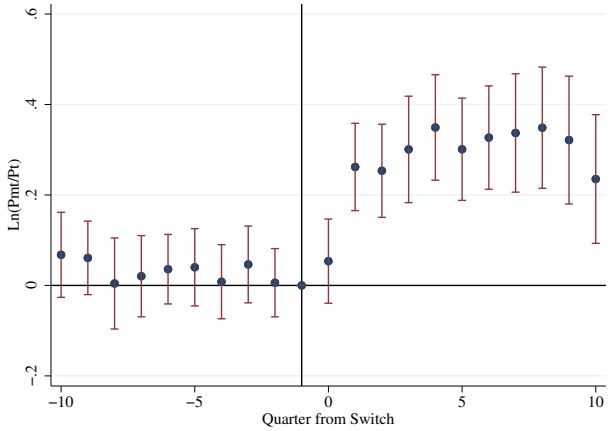
Figure A.12: Physician Treatment Intensity Relative to a Change in Group Intensity, By Quartile of Physicians' Years Experience



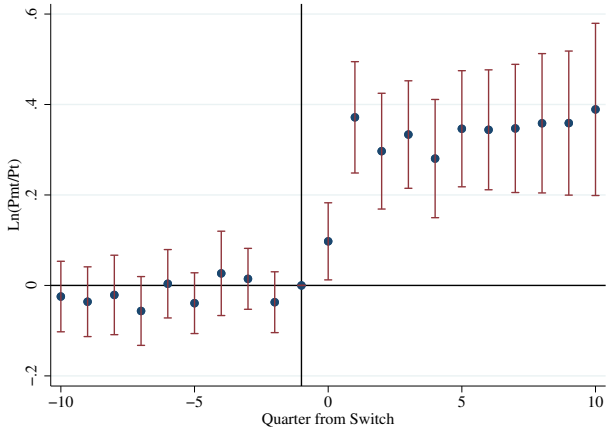
(a) Years Experience: 2 - 14



(b) Years Experience: 15 - 19



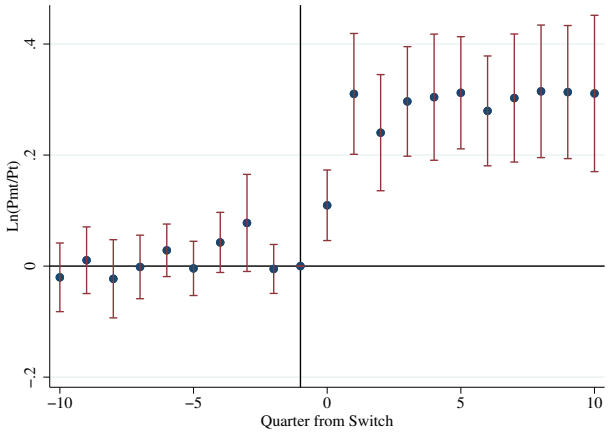
(c) Years Experience: 20 - 27



(d) Years Experience: 28 - 56

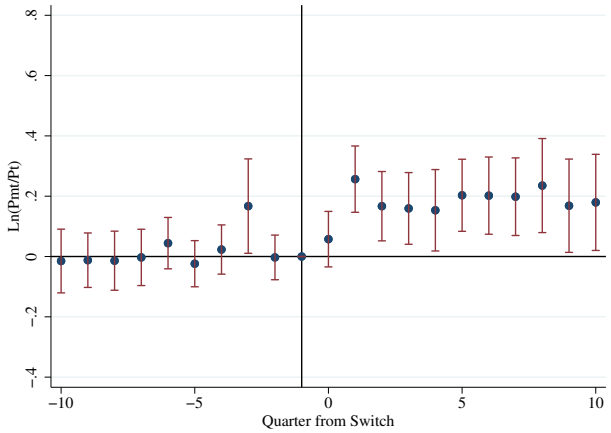
This figure plots the θ_q's estimated from Equation 6, scaled by $\Delta_{pmt/pt}$, by quartiles of years of experience, as measured by years from medical school graduation relative to 2016. Quartiles are defined by switchers' years of experience. Year of graduation is obtained from the Physician Compare 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.13: Physician Treatment Intensity Relative to a Change in Group Intensity, Scaled by Destination Intensity

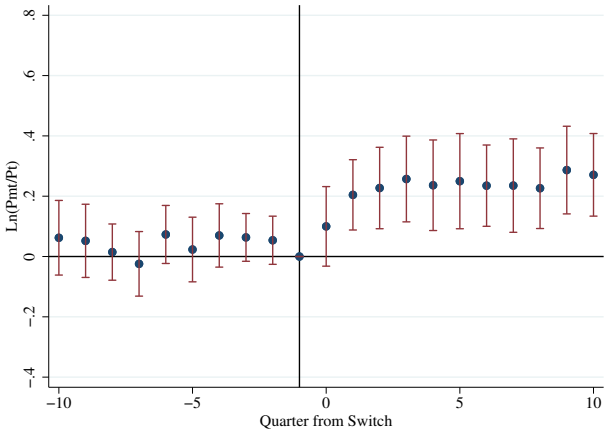


This figure plots the θ_qs when scaled by the destination group's pre-switch intensity instead of $\Delta_{pmt/pt}$. The coefficients around the switch can be interpreted as the increase in physician intensity corresponding to an increase in (pre-switch) destination group intensity before physician p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

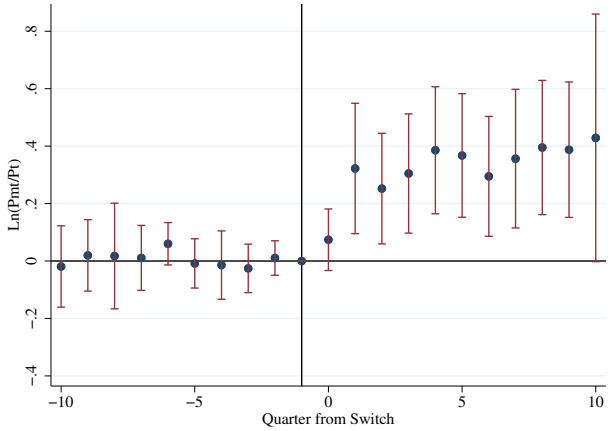
Figure A.14: Physician Treatment Intensity Relative to a Change in Group Intensity, by Quartile of Origin Group Intensity



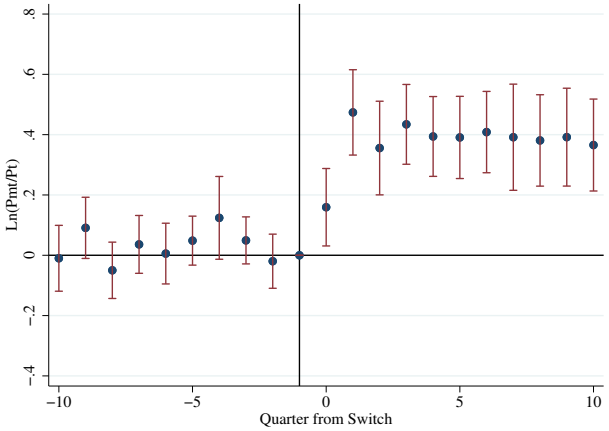
(a) Origin Intensity, 2.04 - 5.2



(b) Origin Intensity, 5.2 - 5.35



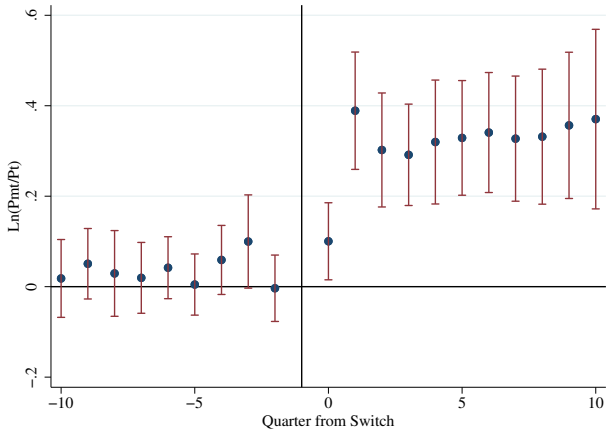
(c) Origin Intensity, 5.35 - 5.52



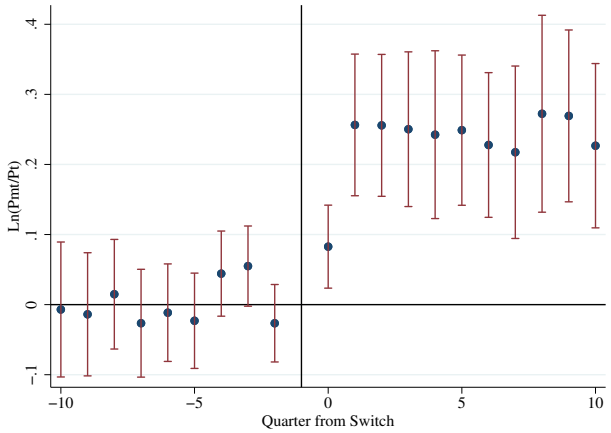
(d) Origin Intensity, 5.52 - 6.56

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.

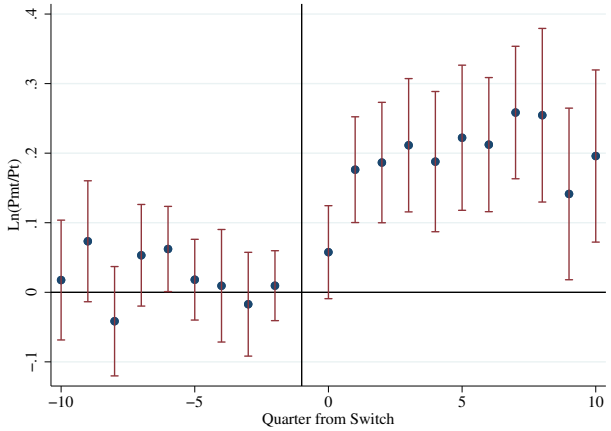
Figure A.15: Physician Treatment Intensity Relative to a Change in Group Intensity, by Quartile of Physician's Pre-Switch Intensity



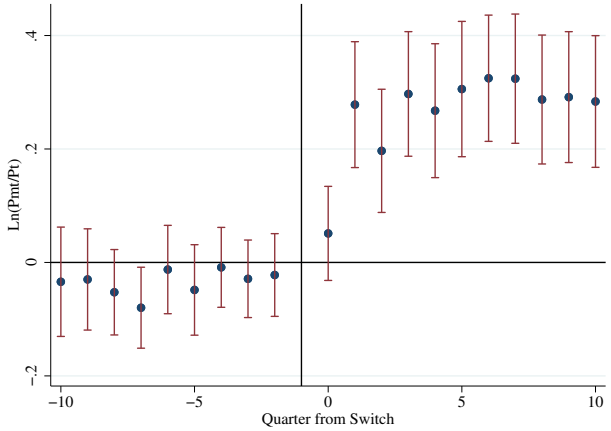
(a) Ln(Pmt/pt): 3.61 - 7.36



(b) Ln(Pmt/pt): 7.36 - 7.92



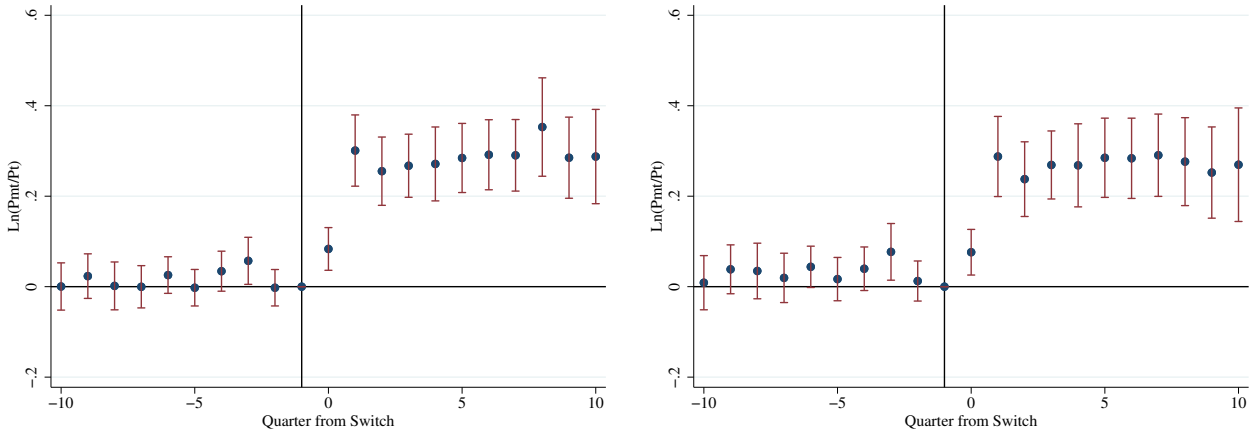
(c) Ln(Pmt/pt): 7.93 - 8.33



(d) Ln(Pmt/pt): 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/patient) 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.16: Physician Treatment Intensity Relative to a Change in Group Intensity, 5 and 20 Minimum Patients per Group per Quarter

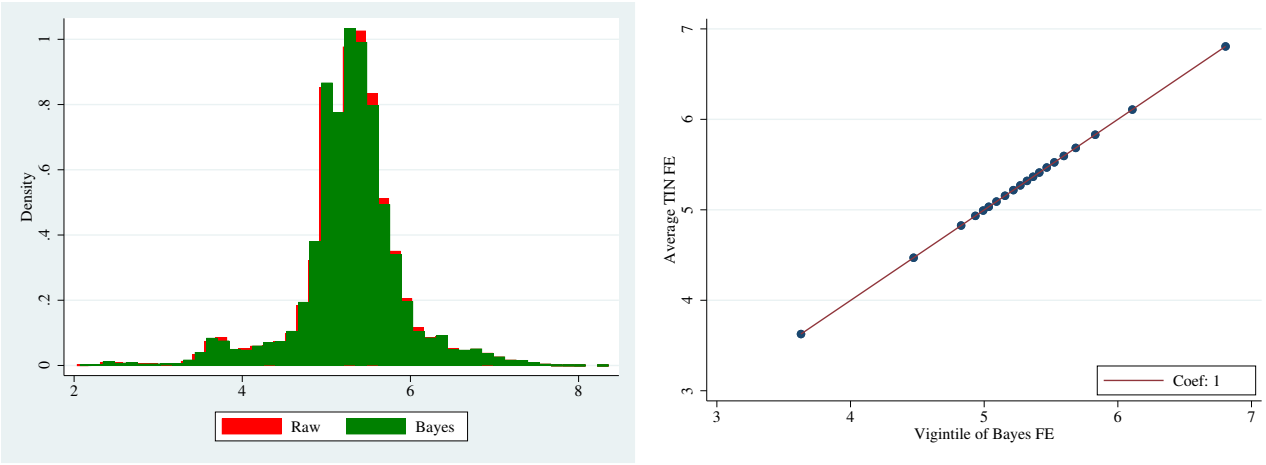


(a) Min. 5 Patients

(b) Min. 20 Patients

This figure plots the θ_qs estimate from Equation 6, scaled by $\Delta_{pmt/pt}$. 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.17: Bayesian Shrinkage to Characterize Group Intensity

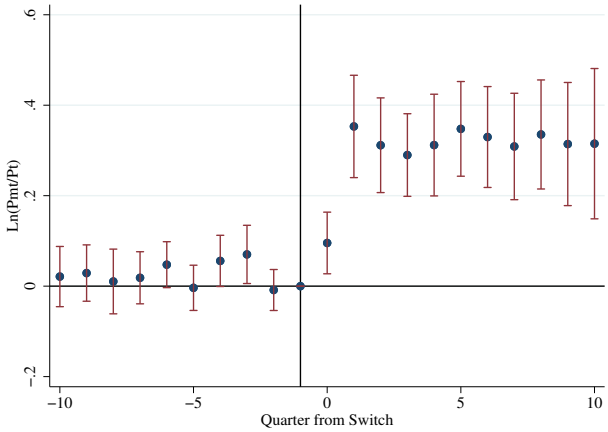


(a) Distribution of $\Delta_{pmt/pt}$

(b) Vigintile Plot

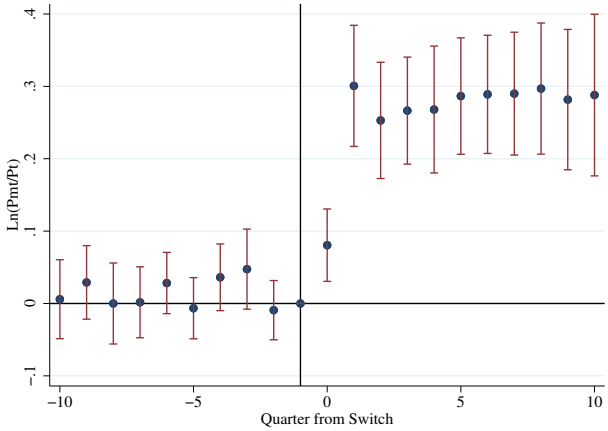
This figure shows the relationship between the "raw" measure of the change in group intensity and the empirical Bayes adjusted measure. Panel (a) plots the distribution of $\Delta_{pmt/pt}$ for the raw and Bayes adjusted measures. Panel (b) plots vigintiles (and corresponding averages) of the two measures.

Figure A.18: Physicians with No ICU Claims



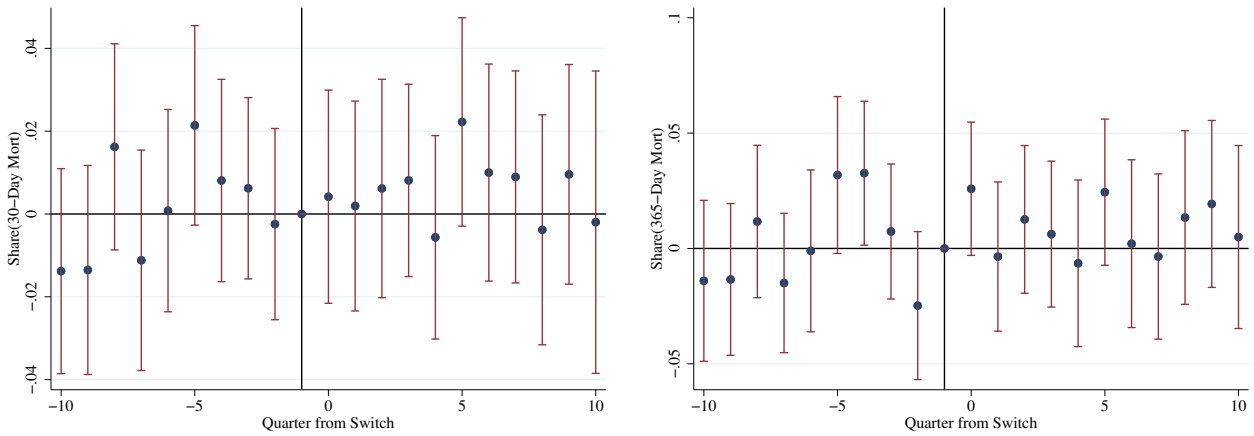
This figure plots the θ_qs estimated from Equation 6 estimated on physicians with no ICU claims.

Figure A.19: Event Study with Patient Controls



This figure plots the θ_qs estimated from a version of Equation 6 that includes controls for average patient age, share of male patients, share of white patients, share of Black patients, and share of Hispanic patients per physician-quarter.

Figure A.20: Mortality Rates for Patients Age>85 Relative to a Change in Group Intensity

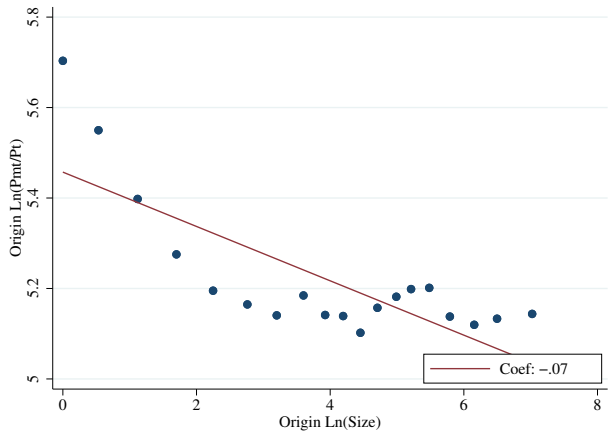


(a) 30-Day Mortality

(b) One-Year Mortality

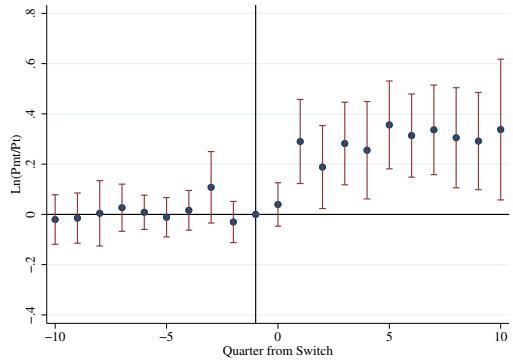
This figure plots the θ_qs estimated from Equation 6, scaled by $\Delta_{pmt/pt}$. The outcomes are the share of a physician's hospitalizations (in a given quarter) for patients 85 years old and older that resulted in death within 30 and 365 days of admission. Included are 95% confidence intervals using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

Figure A.21: Group Intensity v. Group Size

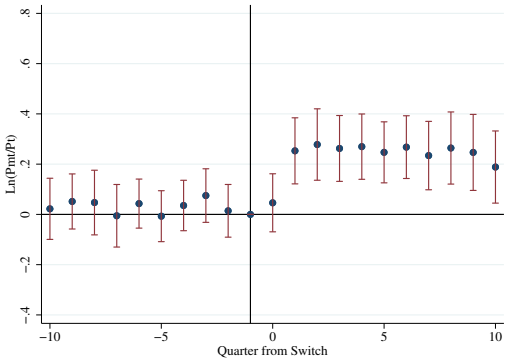


This figure plots the (unadjusted) relationship between vigintiles of (log) origin group intensity and (log) origin group size for switchers and non-switchers, where group intensity for non-switchers is calculated as the simple (leave-in) average of all physician group member's intensity across all quarters (group members include switchers, non-switchers, and other physicians excluded from the sample).

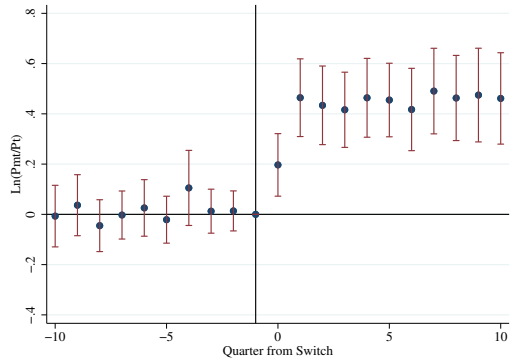
Figure A.22: Physician Treatment Intensity Relative to a Change in Group Intensity, By Δ_{size} Quartile



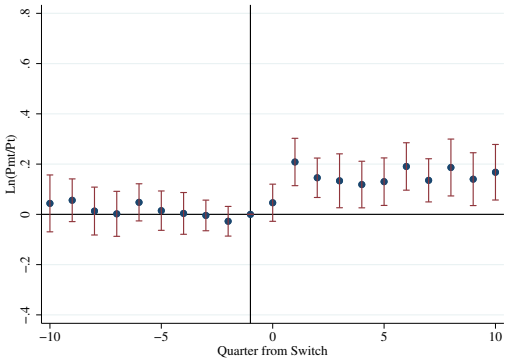
(a) Δ_{size}: -5.02 - -0.66



(b) Δ_{size}: -0.65 - 0.41



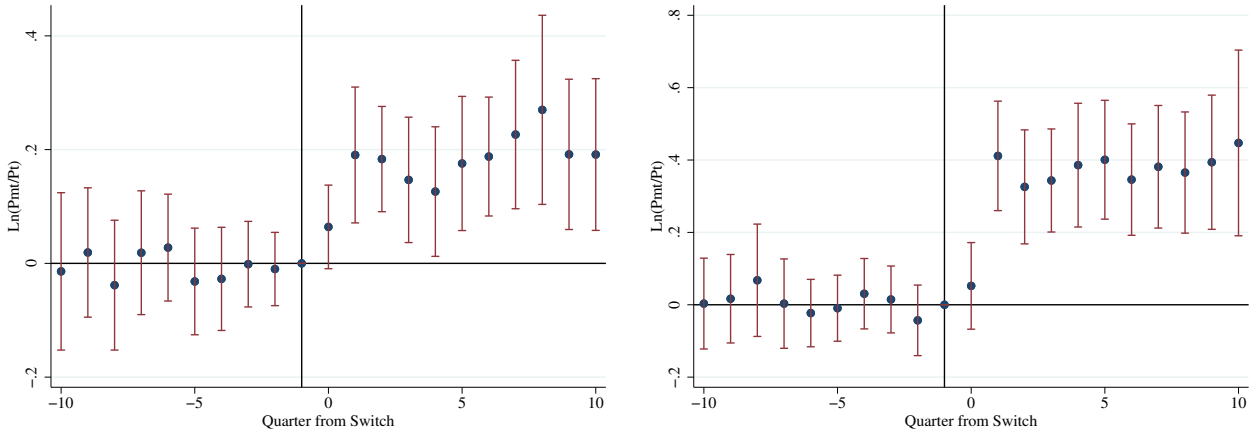
(c) Δ_{size}: 0.41 - 1.51



(d) Δ_{size}: 1.51 - 6.05

This figure plots the θ_q's (scaled by $\Delta_{pmt/pt}$) 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.23: Physician Treatment Intensity Relative to a Change in Group Intensity, By Change in Share of Internists in a Group

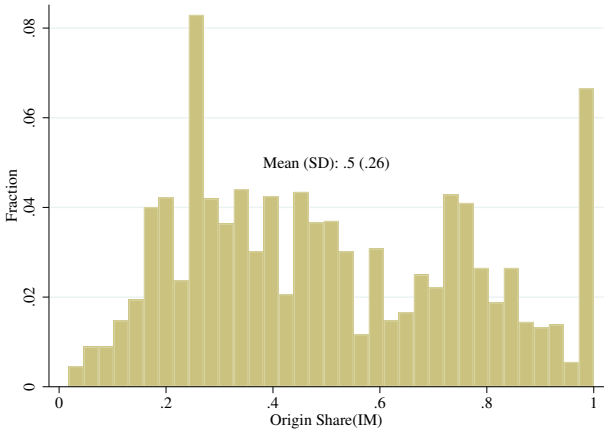


(a) Bottom Quartile

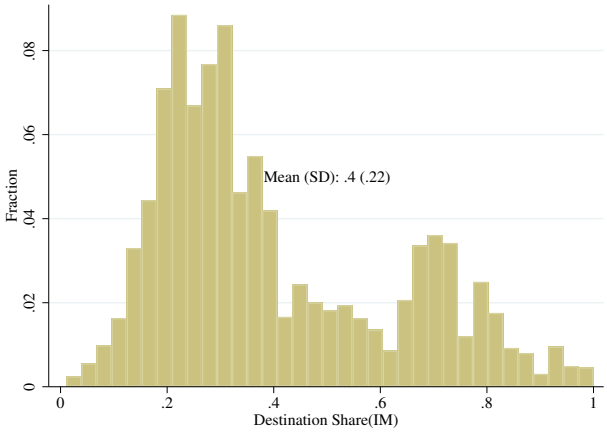
(b) Top Quartile

This figure plots the θ_q's estimated from Equation 6 on the bottom and top quartiles of the change in the share of internists between origin and destination groups. Included are 95% confidence intervals using standard errors that are two-way clustered at the physician and group level.

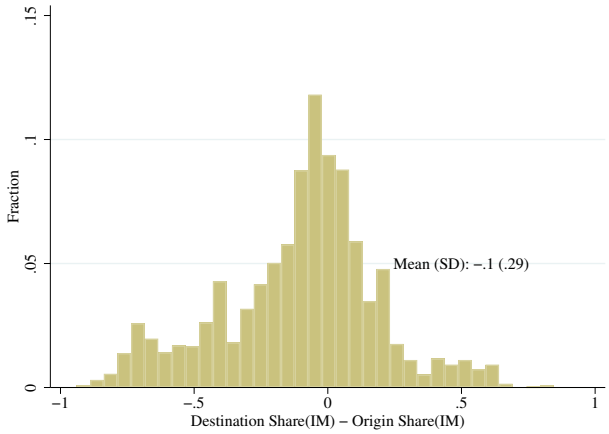
Figure A.24: Distribution of Share(Internists)



(a) Origin Groups



(b) Destination Groups



(c) Change in Share(Internists)

This figure plots the distribution of the share of internists in the switching physician's origin group (panel a) and destination group (panel b), and the change in the share of internists between origin and destination groups (panel c).

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.