The Effects of Physician and Hospital Integration on Medicare Beneficiares' Health Outcomes

Koch, Wendling and Wilson (2021)

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- Lower incentives to innovate
- Higher prices

Motivation

This ambiguity has led to growth in empirical research analyzing the effects of integration in health care.

Key challenge:

- Quality is difficult to measure and observe
- Integration is difficult to measure

Existing literature has pointed out the absence of causal relationship studies between provider integration and quality.

Thus, this paper aims to study the relationship between hospital and physician integration on the quality of care, broadly defined.

Research Question

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  - What are the effects of acquisitions on a set of health outcomes representing the progression of hypertension and diabetes into worse health states?

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  1. Identify effects of integration trough physician acquisitions by hospital systems associated with health outcomes of interest .
  2. Measure health using **health states** outcomes rather than treatments or utilization-based measures such as re admissions.
  3. Employ novel estimation procedures to control for potential confounding factors by a difference in difference and two different propensity score matching techniques.

Preview of Findings

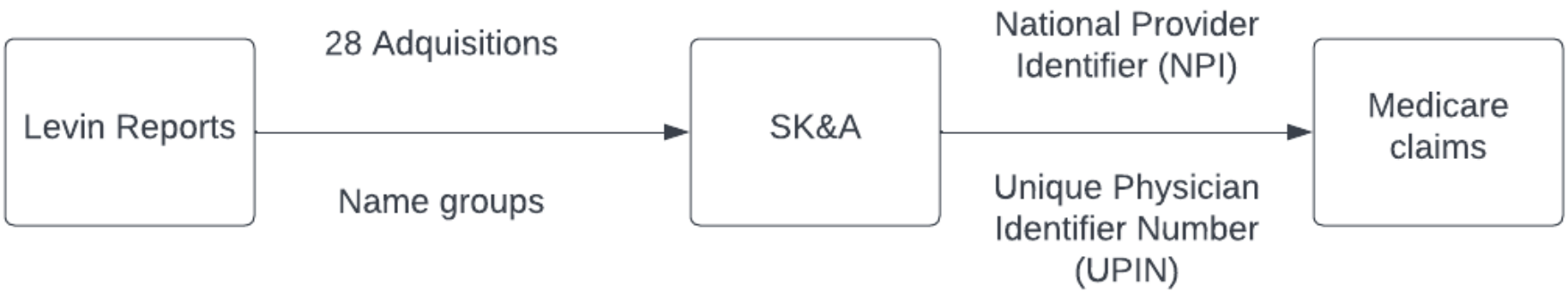
- Hospital acquisitions of existing physician practices have little effect on health outcomes of interest.

Data

Period 2005 to 2012

- Ambulatory and hospital claims from Medicare.
- SK&A (Office-based Provider Database)
- Levin Health Care Acquisition Reports.

Treatment group assignment



Control group assigment

- Patients of other providers not identified as part of the acquisitions.

Propensity Score Matching

Logistic Probability Model

$$\Pr\left(A_i = 1 \mid X; \Theta_A\right) = f\left(\alpha + \beta_i X_i^i + \beta_d X_i^d + \beta_g X_i^g + \epsilon_i\right)$$

- X_i^i are patient characteristics for patient i
- X_i^d are the characteristics of providers visited by patient i (include number of physician visits)
- X_i^g are characteristics of the physician groups visited by patient i.

Account for patient heterogeneity, X_i^i, using the patient's birth cohort, race, sex, health condition, and urbanicity.

TABLE 1.—SUMMARY AND BALANCE STATISTICS FOR THE MEDICARE SAMPLE, 2006–2012

	All potential controls		Matched nonacquired		Acquired		Normalized differences	
Variable	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Match	Potential Controls
Propensity Score	0.023	0.048	0.136	0.117	0.145	0.126	0.074	1.274
				Demographic characteristics				
White	0.871	0.336	0.918	0.275	0.917	0.276	−0.003	0.151
Male	0.370	0.483	0.380	0.485	0.383	0.486	0.005	0.026
Age	76.71	7.81	77.66	7.44	77.60	7.44	−0.008	0.117
Metro >1MM	0.450	0.497	0.468	0.499	0.466	0.499	−0.004	0.032
Metro 500K-1MM	0.211	0.408	0.248	0.432	0.230	0.421	−0.042	0.045
Metro <500K	0.115	0.319	0.093	0.291	0.096	0.295	0.010	−0.061
Nonmetro	0.223	0.417	0.191	0.393	0.208	0.406	0.043	−0.038
				Health condition diagnoses				
Hypertension	0.863	0.344	0.900	0.300	0.905	0.294	0.015	0.131
Diabetes	0.374	0.484	0.379	0.485	0.384	0.486	0.010	0.020
Circulatory	0.919	0.272	0.953	0.213	0.955	0.206	0.014	0.150
Musculoskeletal	0.817	0.387	0.868	0.339	0.872	0.335	0.012	0.151
Sense organs	0.669	0.470	0.725	0.447	0.723	0.447	−0.003	0.117
Gastrointestinal	0.636	0.481	0.709	0.454	0.713	0.452	0.011	0.166
Injury	0.597	0.491	0.667	0.471	0.675	0.469	0.017	0.162
Endocrine	0.584	0.493	0.600	0.490	0.602	0.490	0.004	0.037
Signs/Symtoms	0.555	0.497	0.630	0.483	0.645	0.479	0.029	0.183
Respiratory	0.525	0.499	0.591	0.492	0.599	0.490	0.016	0.149
Skin conditions	0.440	0.496	0.484	0.500	0.490	0.500	0.012	0.101
				Provider characteristics				
Family practice	0.560	0.496	0.625	0.484	0.634	0.482	0.020	0.152
Other	0.429	0.495	0.480	0.500	0.483	0.500	0.005	0.107
Radiology	0.209	0.407	0.251	0.434	0.259	0.438	0.016	0.117
Cardiology	0.154	0.361	0.195	0.396	0.216	0.412	0.053	0.162
Opthalmology	0.129	0.335	0.141	0.348	0.143	0.350	0.004	0.041
Podiatry	0.100	0.300	0.118	0.323	0.117	0.322	−0.002	0.055
Firm size <5	0.854	0.353	0.850	0.357	0.848	0.359	−0.004	−0.017
Firm size 5–24	0.688	0.463	0.750	0.433	0.755	0.430	0.012	0.150
Firm size 25–49	0.376	0.484	0.453	0.498	0.501	0.500	0.096	0.254
Firm size 50–99	0.320	0.467	0.407	0.491	0.457	0.498	0.100	0.283
Firm size 100–200	0.296	0.457	0.387	0.487	0.419	0.493	0.065	0.258
Firm size >200	0.323	0.468	0.491	0.500	0.491	0.500	−0.001	0.346
Observations	39,826,077		1,093,109		1,030,742			

Health Outcomes Acquisition Effects

Discrete-time Hazard Model

$$\begin{aligned}\Pr\left(h_{it}=1 \mid X_{it}, \Theta\right) =& \Lambda\left(\alpha+\theta_{PM} PM_{it}+\beta_M M_i+\delta_{ZIP}+\delta_t\right. \\ &\left.+\beta_x X_{it}+\beta_{M*y}\left(M_i \times yr_{it}\right)+u_{it}\right).\end{aligned}$$

This model considers the probability that we observe a positive realization of our health outcome variable in the contemporaneous period, $h_{it} = 1$.

θ_{PM} effect of interest, represents the clinical clinical benefits (or harm) attributable to the acquisition.

$\Lambda(.)$ takes a linear functional form for the full sample and a proportional hazard model for the matched sample estimator.

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$$\Pr\left(h_{it}=1 \mid X_{it}, \Theta\right) = \Lambda\left(\alpha + \theta_{PM} PM_{it} + \beta_M M_i + \delta_{ZIP} + \delta_t + \beta_x X_{it} + \beta_{M*y}\left(M_i \times yr_{it}\right) + u_{it}\right).$$

- M, acquisition indicator variable
- PM, post acquisition indicator variable
- X_{it}, patient and provider characteristics
- δ_t, quarter-year fixed effects
- δ_{ZIP} , three-digit ZIP code fixed effects
- β_{M*y}, acquisition-specific time trend

TABLE 2.—SUMMARY OF NEW CONDITION DIAGNOSES FOR MATCHED SAMPLE, 2006–2012

	Matched Sample			Preacquisition			Postacquisition		
Outcome	Observations	Mean	Standard Deviation	Observations	Mean	Standard Deviation	vations	Mean	Standard Deviation
Women				Full sample					
Mortality	677,829	0.0123	0.1104	393,075	0.0107	0.1028	243,334	0.0157	0.1243
				Diabetes sample					
Mortality	244,369	0.0171	0.1297	133,231	0.0151	0.122	99,570	0.0198	0.1393
Asymptomatic	223,094	0.0058	0.0763	121,523	0.008	0.089	88,168	0.0052	0.072
Glaucoma	181,275	0.0055	0.0743	102,918	0.0056	0.0745	71,285	0.0044	0.0665
Symptomatic	155,016	0.0259	0.1589	85,174	0.0317	0.1752	57,836	0.0214	0.1447
				Hypertension sample					
Mortality	613,928	0.0132	0.1141	349,180	0.0115	0.1068	230,092	0.0163	0.1267
AMI	574,484	0.0058	0.076	328,527	0.0070	0.0835	207,225	0.0056	0.0748
Acute cardiac	323,628	0.0427	0.2021	203,296	0.0455	0.2084	95,219	0.0396	0.195
Ischemic heart	361,774	0.0250	0.1560	217,080	0.0286	0.1667	117,934	0.0184	0.1343
Men				Full sample					
Mortality	415,280	0.0138	0.1166	247,730	0.0123	0.1101	146,603	0.0168	0.1286
				Diabetes sample					
Mortality	169,387	0.018	0.133	95,730	0.0165	0.1275	66,790	0.0208	0.1428
Asymptomatic	153,737	0.0064	0.08	88,905	0.0069	0.0829	60,221	0.0057	0.075
Glaucoma	131,769	0.0052	0.0718	78,735	0.0057	0.0751	51,177	0.0043	0.0651
Symptomatic	106,175	0.028	0.1649	62,009	0.0344	0.1822	38,215	0.0233	0.1507
				Hypertension sample					
Mortality	370,265	0.0148	0.1207	215,780	0.0134	0.1148	137,538	0.0175	0.1311
AMI	335,366	0.0079	0.0887	198,270	0.0093	0.0959	119,150	0.0074	0.0855
Acute cardiac	189,629	0.0458	0.209	121,420	0.0503	0.2185	55,094	0.0411	0.1984
Ischemic heart	157,908	0.0359	0.186	94,964	0.0435	0.2039	45,535	0.0257	0.1583

Results

TABLE 3.—POSTACQUISITION EFFECTS ON HEALTH-STATE TRANSITION PROBABILITIES FROM THREE ESTIMATORS

	Difference-in-difference		Blocking estimator		Matching estimator	
Outcome	Women	Men	Women	Men	Women	Men
			Full sample			
Mortality	0.0012*	0.0008	0.0018	0.0020	0.0130	0.0003
	(0.0004)	(0.0005)	(0.0031)	(0.0073)	(0.0093)	(0.0086)
			Diabetes sample			
Mortality	0.0013*	0.0000	0.0022	0.0021	−0.0061	−0.0001
	(0.0006)	(0.0009)	(0.0051)	(0.0064)	(0.0132)	(0.0122)
Asymptomatic	−0.0007	0.0004	−0.0004	0.0010	−0.0037	0.0216
	(0.0004)	(0.0005)	(0.0036)	(0.0043)	(0.0188)	(0.0209)
Glaucoma	0.0004	0.0002	0.0003	0.0005	−0.0053	−0.0108
	(0.0005)	(0.0006)	(0.0037)	(0.0045)	(0.0254)	(0.0273)
Symptomatic	−0.0028*	−0.0030	−0.0022	−0.0017	0.0113	0.0083
	(0.0012)	(0.0015)	(0.0082)	(0.0118)	(0.0128)	(0.0132)
			Hypertension sample			
Mortality	0.0011*	0.0008	0.002	0.0022	0.0141	−0.0005
	(0.0004)	(0.0005)	(0.0035)	(0.0071)	(0.0094)	(0.0087)
AMI	−0.0013*	−0.0019*	−0.0011	−0.0018	−0.0359*	−0.0097
	(0.0003)	(0.0005)	(0.0024)	(0.0066)	(0.013)	(0.0118)
Acute cardiac	−0.003*	−0.0059*	−0.0019	−0.0061	0.0079	0.0020
	(0.001)	(0.0015)	(0.0087)	(0.0193)	(0.0071)	(0.0070)
Ischemic heart	−0.0029*	−0.0077*	−0.0014	−0.0013	−0.0183	−0.0214*
	(0.0007)	(0.0016)	(0.0061)	(0.0213)	(0.0094)	(0.0107)

*Statistically significant at the 5% C.I. Standard error in parentheses. Marginal effects are percentages/100. Marginal effect estimates are calculated as $ME = \Lambda(X\hat{\beta} + \hat{\theta}_{PM}) - \Lambda(X\hat{\beta})$ for a 77-year old in the 452 three-digit ZIP code among the treated 1Q2006 for matching. Controls include race, physician specialty, patient ZIP code, major ICD-9 condition characteristics, age, firm size, number of doctors seen, age category interactions with sex, and quarter dummies. OLS and blocking also control for five-digit ZIP codes interacted with race, are estimated separately for men and women, and control for more specialties. Linear model estimates are simply the postmerger coefficient estimates. The male difference-in-difference mortality estimate is 3.8×10^{-6}.

Results

TABLE 4.—POSTACQUISITION COEFFICIENT ESTIMATES FROM THREE MATCHING ESTIMATOR SPECIFICATIONS

	Pair fixed effects			Full set of controls			Age and quarter only		
Outcome	Women	Men	R^2	Women	Men	R^2	Women	Men	R^2
				Full sample					
Mortality	0.0869	−0.0085	0.2946	0.0535	0.0013	0.1911	0.038	−0.0142	0.0526
	(0.0487)	(0.0559)		(0.0384)	(0.0414)		(0.0351)	(0.0386)	
				Diabetes sample					
Mortality	0.0936	−0.1083	0.3588	−0.0253	−0.0004	0.1769	−0.0347	−0.0246	0.0434
	(0.089)	(0.0995)		(0.0545)	(0.0575)		(0.0496)	(0.0538)	
Asymptomatic	−0.0456	0.2844	0.215	−0.0165	0.0968	0.0792	−0.1051	−0.0015	0.0065
	(0.1244)	(0.1512)		(0.0847)	(0.0946)		(0.0792)	(0.0893)	
Glaucoma	0.1152	−0.4553	0.4206	−0.0223	−0.0445	0.0907	0.0364	−0.0387	0.0103
	(0.1949)	(0.228)		(0.1069)	(0.1132)		(0.0981)	(0.1055)	
Symptomatic	0.0774	−0.082	0.2319	0.0463	0.0355	0.0766	0.0621	0.0207	0.0106
	(0.085)	(0.095)		(0.0528)	(0.0567)		(0.0487)	(0.0529)	
				Hypertension sample					
Mortality	0.0825	−0.0224	0.2902	0.0579	−0.0025	0.1851	0.0532	−0.0164	0.0492
	(0.0501)	(0.0577)		(0.039)	(0.0421)		(0.0358)	(0.0394)	
AMI	−0.1229	−0.1465	0.3956	−0.1581*	−0.0481	0.2266	−0.1615*	−0.1000	0.0068
	(0.0744)	(0.0808)		(0.0557)	(0.0585)		(0.0504)	(0.0535)	
Acute cardiac	0.0251	−0.026	0.2936	0.0344	0.0097	0.1586	−0.0008	−0.0318	0.0076
	(0.0421)	(0.0524)		(0.031)	(0.0346)		(0.0273)	(0.0309)	
Ischemic heart	−0.1086*	−0.0166	0.3179	−0.0747	−0.087*	0.1956	−0.1365*	−0.1282*	0.0128
	(0.0538)	(0.0692)		(0.0388)	(0.0434)		(0.034)	(0.0384)	

*Statistically significant at the 5% confidence interval. Standard errors reported in parentheses. Matched-pair fixed-effects model estimated using procedure outlined by Chamberlain (1980). Fixed effects in that model represent indicators for matches between an acquired physician's patient and a nonacquired physician's patient from the propensity score procedure. Fixed-effect model includes quarter and year dummies but not the interactions. Marginal effects from the fixed-effects model cannot be recovered. Marginal effects from the other specifications provided in table C-9.

Robustness Check Heterogeneous Acquisition Effects

Heterogenous group effects

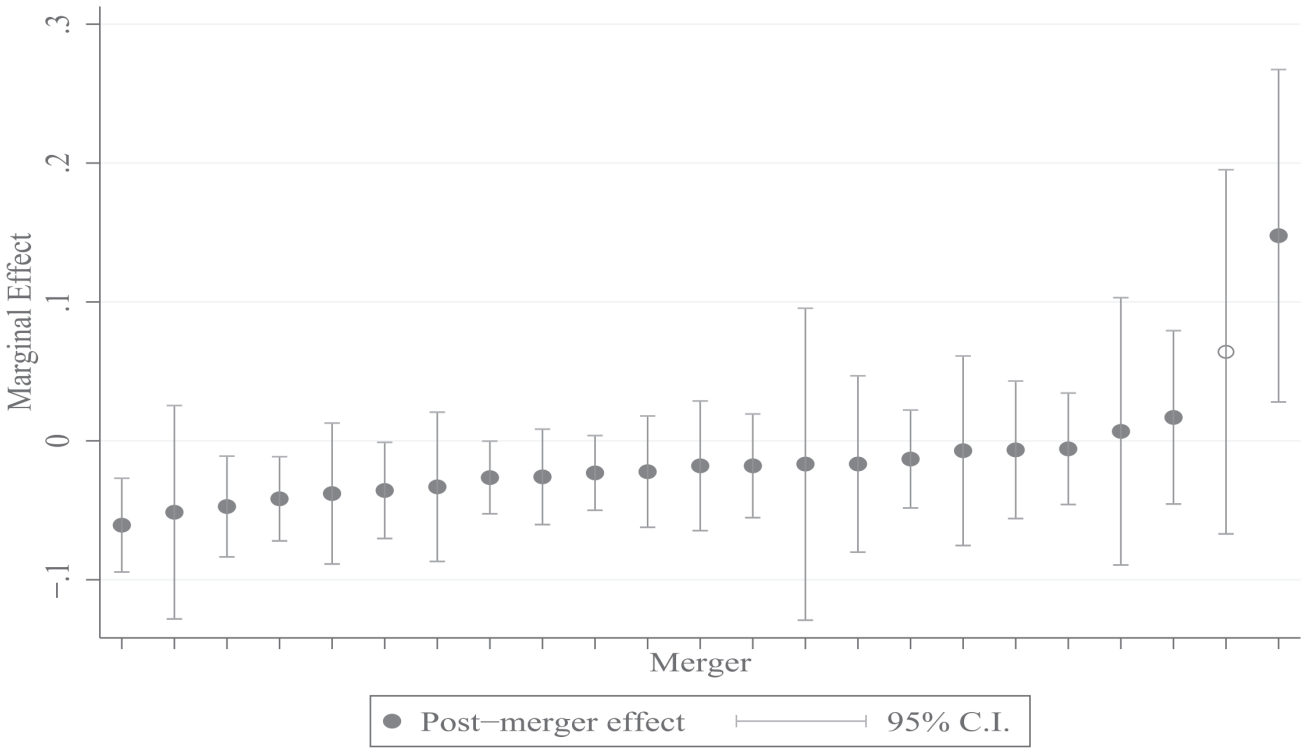
$$\Pr(h_{it} = 1 \mid X_{it}, \Theta) = \Lambda\Bigg(\alpha + \sum_{g \in G} \theta_p^g M_{it}^g P_{ost}^g + \sum_{g \in G} \theta_M^g M_{it}^g + \beta_x X_{it} + \beta_{M*y}(M_i \times yr_{it}) + \delta_{ZIP} + \delta_t + u_{it}\Bigg)$$

Heterogenous time effects

$$\Pr(h_{it} = 1 \mid X_{it}, \Theta) = \Lambda\Bigg(\alpha + \sum_{l=-15}^{15} \theta_l l_{it} + \sum_{l=-15}^{15} \theta_{fl}(l_{it} \times fem_i) + \beta_M M_i + \beta_{fM}(fem_i \times M_i) + \beta_x X_{it} + \beta_{M*y}(M_i \times yr_{it}) + \delta_{ZIP} + \delta_t + u_{it}\Bigg)$$

Effects by Acquisition

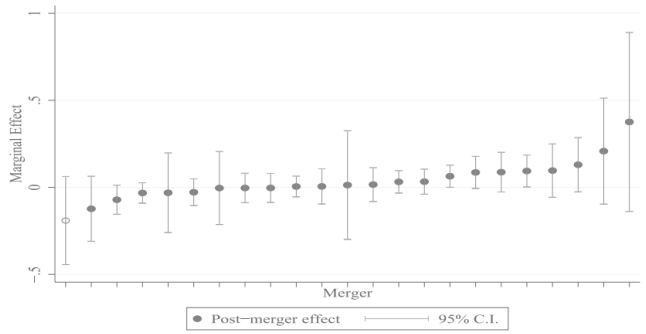
FIGURE 1.—MARGINAL EFFECT ESTIMATES SEPARATELY BY ACQUISITION: FULL MATCHING SAMPLE MORTALITY



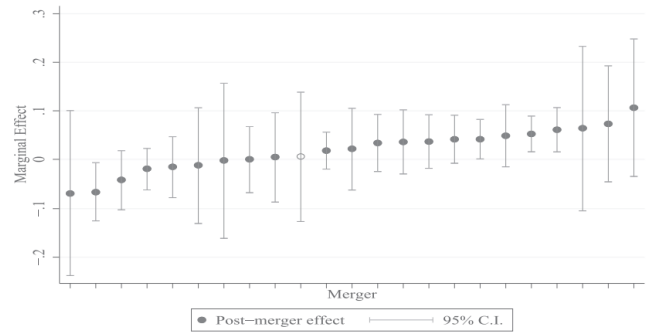
Marginal effect estimates are reported as percentages/100. The effects are combined for the following mergers (open circle): Butler/DiCuccio; Good Samaritan/NY Institute; Texas Children's/Women's Specialists'; Christ Hospital/Hyde Park Internists; Scripps Health/Penn Elm and Theda Care/Nelson Family.

Effects by Acquisition

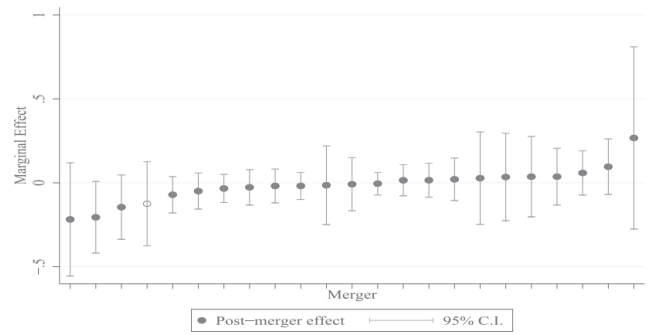
FIGURE 2.—MARGINAL EFFECTS SEPARATELY BY ACQUISITION: DIABETES



(a) Asymptomatic complications

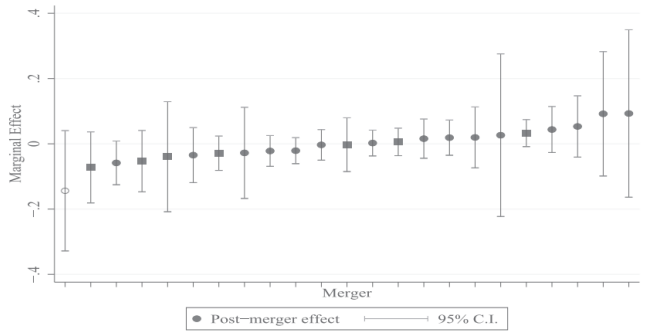


(b) Symptomatic complications

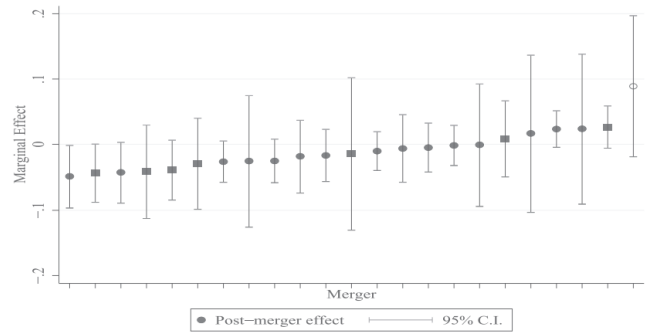


(c) Glaucoma

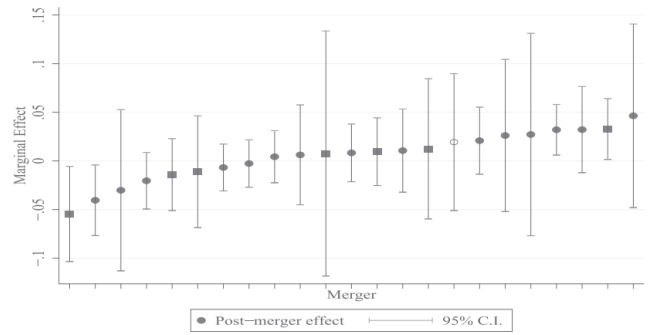
FIGURE 3.—MARGINAL EFFECTS SEPARATELY BY ACQUISITION: HYPERTENSION



(a) AMI



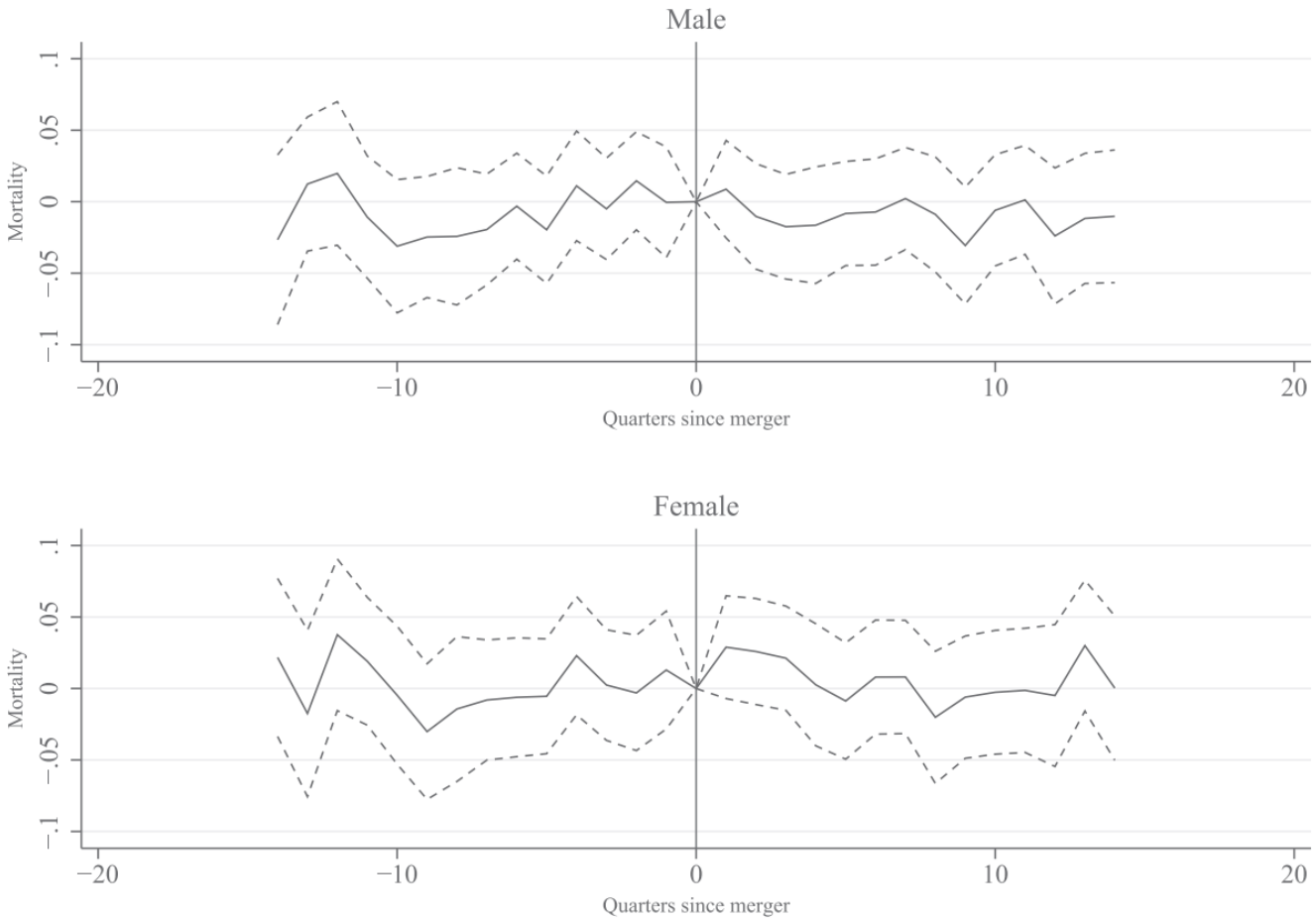
(b) Ischemic heart disease



(c) Acute cardiac conditions

Time-Specific Effects - Full Sample

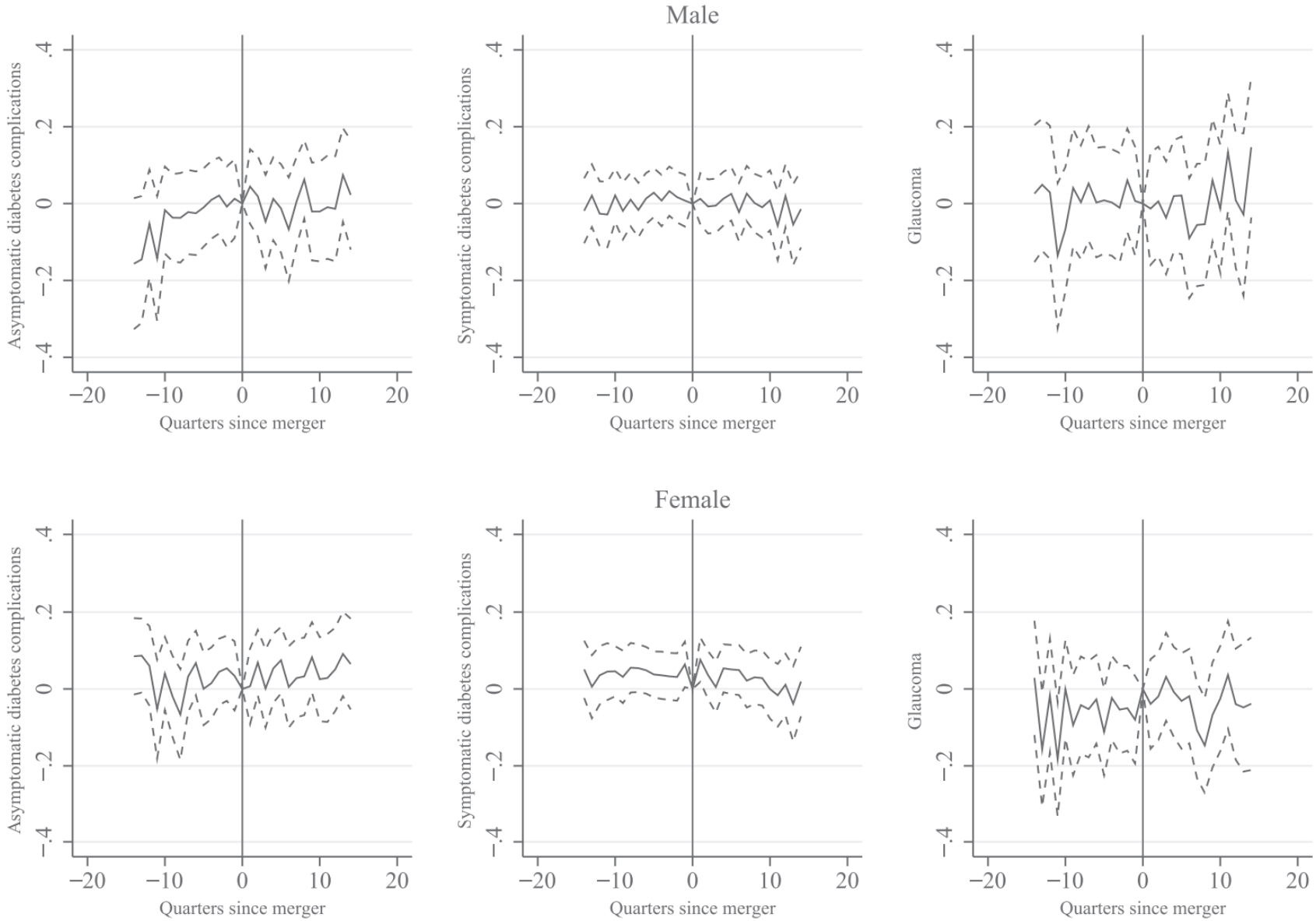
FIGURE 4.—PRE- AND POSTMERGER MARGINAL EFFECTS: MORTALITY



Marginal effect estimates are reported as percentages/100 on the *y*-axis.

Time-Specific Effects by Gender - Diabetes Conditions

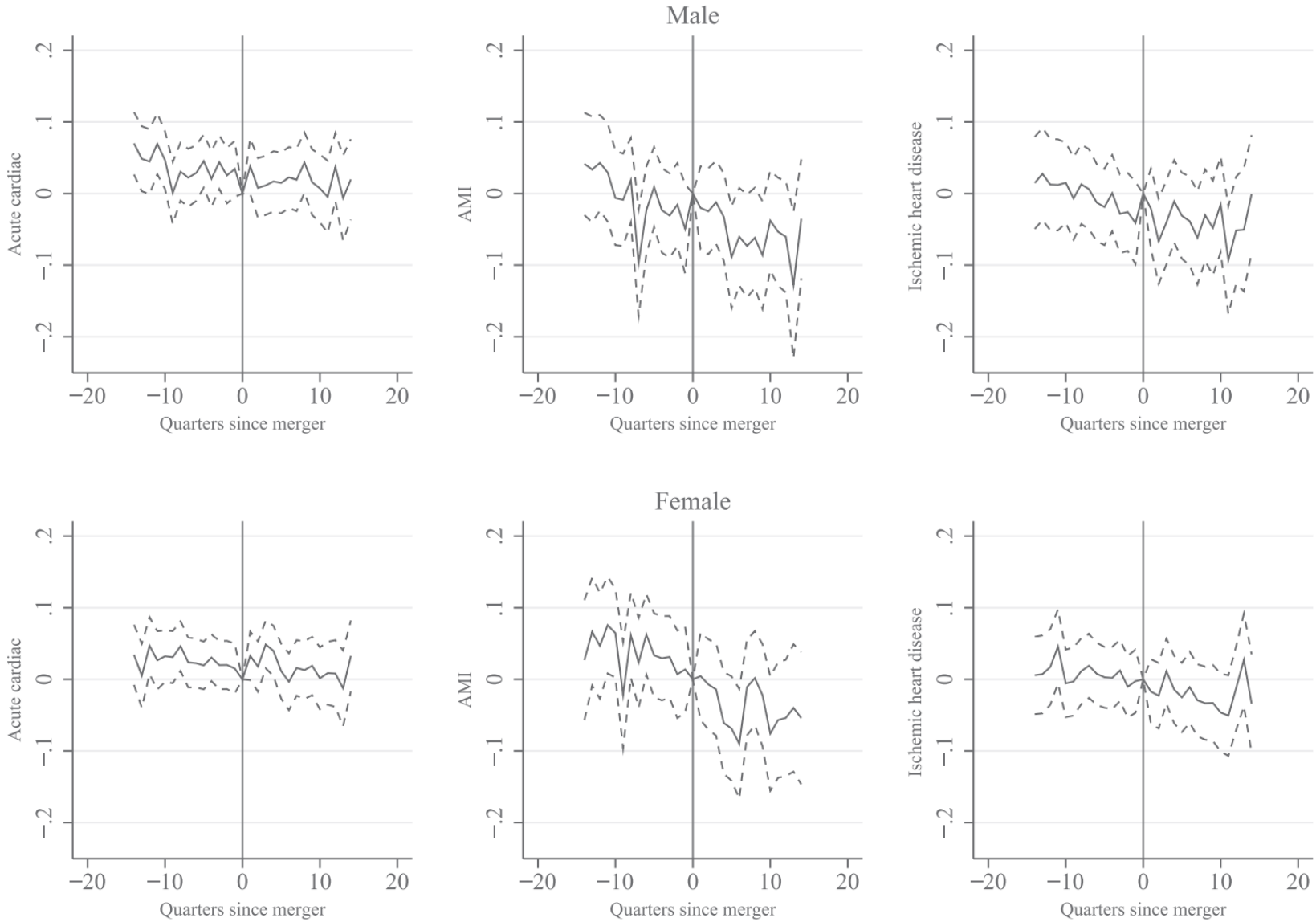
FIGURE 5.—PRE- AND POSTMERGER MARGINAL EFFECTS: DIABETES



Marginal effect estimates are reported as percentages/100 on the y-axis.

Time-Specific Effects by Gender - Hypertension Conditions

FIGURE 6.—PRE- AND POSTMERGER MARGINAL EFFECTS: HYPERTENSION



Marginal effect estimates are reported as percentages/100 on the *y*-axis.

Threats

- Full sample estimates might be biased given the Levin Reports likely miss some acquisitions, some physicians were unobservably acquired by hospitals during the sample period. $\Longrightarrow$ Matched sample estimator is driving the main conclusion.
- Vertical acquisitions may also increase physician concentration. If so, horizontal concentration may lessen competition for quality and thus offset efficiencies associated with vertical integration. *confounding horizontal effects*.

Discussion and Conclusion.

- It is possible that the transactions could lead to efficiencies for other health conditions or along other dimensions of performance (i.e., cost efficiencies) that the authors do not consider.
- There is little evidence that physician integration into hospital systems affect health outcomes (as the authors measure them).