10-2013

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Daifeng He

Jennifer M. Mellor
William & Mary, jmmell@wm.edu

Recommended Citation

He, Daifeng and Mellor, Jennifer M., Do Changes in Hospital Outpatient Payments Affect the Setting of Care? (2013). *Health Services Research*, 48(5), 1593-1616.
https://doi.org/10.1111/1475-6773.12069

HSR Health Services Research

DOI: 10.1111/1475-6773.12069
RESEARCH ARTICLE

Do Changes in Hospital Outpatient Payments Affect the Setting of Care?

Daifeng He and Jennifer M. Mellor

Objective. To examine whether decreases in Medicare outpatient payment rates under the Outpatient Prospective Payment System (OPPS) caused outpatient care to shift toward the inpatient setting.

Data Sources/Study Setting. Hospital inpatient and outpatient discharge files from the Florida Agency for Health Care Administration from 1997 through 2008.

Study Design. This study focuses on inguinal hernia repair surgery, one of the most commonly performed surgical procedures in the United States. We estimate multivariate regressions of inguinal hernia surgery counts in the outpatient setting and in the inpatient setting. The key explanatory variable is the time-varying Medicare payment rate specific to the procedure and hospital. Control variables include time-varying hospital and county characteristics and hospital and year-fixed effects.

Principal Findings. Outpatient hernia surgeries fell in response to OPPS-induced rate cuts. The volume of inpatient hernia repair surgeries did not increase in response to reductions in the outpatient reimbursement rate.

Conclusions. Potential substitution from the outpatient setting to the inpatient setting does not pose a serious threat to Medicare's efforts to contain hospital outpatient costs.

Key Words. Outpatient prospective payment system, Medicare payment reform, substitution, setting of care

To contain outpatient health care spending, the Centers for Medicare & Medicaid Services (CMS) replaced the prior cost-based system for reimbursing hospital outpatient services in August 2000 with the Outpatient Prospective Payment System (OPPS). Under OPPS, CMS groups hospital outpatient services into ambulatory payment classifications (APCs) based on clinical and cost similarity and sets a common payment rate for all services in the same APC (CMS 2010a). Hospitals are reimbursed at the predetermined rate for services in a given APC instead of the actual costs incurred. Evidence suggests that OPPS reduced the generosity of Medicare payments for outpatient care overall (Becker unpublished data) and reduced Medicare payments for the most common outpatient surgical procedures (He and Mellor 2012).

We examine whether the outpatient reimbursement cuts triggered by OPPS led hospitals to shift Medicare services from the outpatient setting into the inpatient setting. Although prior research has examined the effect of inpatient reimbursement on the setting of care (e.g., Coulam and Gaumer 1991), no prior study has examined whether OPPS-induced payment changes altered the setting of care. As the first to examine OPPS's effects outside the outpatient department, we provide insight on OPPS's potential to control health care costs broadly defined.

Because OPPS caused reimbursement rates to rise or fall to varying degrees depending on the procedure and the hospital's historical payment, analyzing its effects requires procedure-specific payment rates at the hospital-level, pre- and post-OPPS.[1] This study focuses on inguinal hernia repair surgeries performed in Florida hospitals from 1997 through 2008. One of the most common surgeries in the United States, inguinal hernia repair is performed in both inpatient and outpatient settings. Evidence shows that outcomes and satisfaction are similar in both settings even among older patients (Mitchell and Harrow 1994; Mattila et al. 2011). This suggests that providers may have the discretion to treat patients in either setting. Furthermore, the diagnosis of inguinal hernia is usually made by physical examination alone, so hernia repair surgery is unlikely to be affected by OPPS-induced changes in the payment of other procedures. This facilitates identification of the causal effect of changes in hernia outpatient reimbursement rates.

We find that the average hospital experienced 4–10 percent cuts in Medicare payment rates for inguinal hernia repair surgeries over the 5-year period that OPPS was fully phased-in. Hospital fixed-effects regression results suggest that OPPS-induced cuts in outpatient hernia repair reimbursements decreased the volume of some *outpatient* hernia repair surgeries; however, we find no evidence that hospitals increased the number of *inpatient* hernia surgeries in response to outpatient payment cuts. Because hospitals' ability to substitute hernia repair surgery across settings likely exceeds that of other common outpatient procedures, we conclude that outpatient cost containment efforts like OPPS are not seriously threatened by substitution to the inpatient setting.

Address correspondence to Jennifer M. Mellor, Ph.D., Department of Economics, College of William and Mary, P.O. Box 8795, Williamsburg, VA 23187-8795; e-mail: jmmell@wm.edu. Daifeng He, Ph.D, is also with the Department of Economics, College of William and Mary Williamsburg, VA.

BACKGROUND

Prior to OPPS, Medicare used several payment methods for hospital outpatient services.[2] Payments could be based on hospitals' reasonable costs or customary charges, the lesser of costs or charges, or a blended rate that combined the lesser of costs or charges with a fee schedule. Partly because existing methods provided little incentive for hospitals to lower costs, Congress established the OPPS for hospital outpatient services. Effective August 2000, OPPS is a fee schedule that groups similar hospital outpatient services into roughly 800 ambulatory payment classifications (APCs) and sets predetermined payments per service for all services in each APC (CMS 2010a).[3] Thus, regardless of the actual treatment cost, all services in an APC are reimbursed at the same amount, with some adjustments for local labor costs, certain types of hospitals, and outlier cases.

A large literature has examined prospective payment systems (PPS) in inpatient, skilled nursing, rehabilitation, and psychiatric facilities,[4] but only two existing studies have examined the effects of OPPS. Becker (unpublished data) found that OPPS lowered the generosity of reimbursement overall and decreased costs of outpatient care. He and Mellor (2012) found that, on average, OPPS-induced rate cuts either decreased or had no effect on Medicare volume, but increased private fee-for-service (FFS) volume.

Although decisions involving the provision and setting of patient care are most often attributed to physicians, changes in hospital payments may lead to the substitution of services across care sites. In the Ellis and McGuire (1986) model of physician behavior in response to prospective payment, the physician acts as the sole decision maker in patient care and as an agent to two principals—the patient and the hospital. The model predicts that if the physician places a greater value on hospital profits relative to patient benefits, a prospective payment system for hospital care can lead to the underprovision of hospital care. The literature on physician-hospital collaboration identifies various mechanisms hospitals may use to influence physician behavior. As described in Mark et al. (1998), collaboration can take the form of hospital strategies such as sharing financial statements, prices, costs, and practice profiles with physicians, or involving physicians in governance and budgeting. More formally, hospitals and physicians may share an affiliation and thus share administrative services or, in the most integrated systems, capital assets and risk-based contracting. Prior studies show that physician-hospital integration can influence health care delivery and outcomes. Madison (2004) found that hospitals using an integrated salary model (i.e., employing salaried physicians) exhibited greater treatment intensity, and Cuellar and Gertler (2006) found that fully integrated organizations had better patient quality measures.

These types of collaborative strategies and affiliations may increase the relative weight that physicians place on hospital profits, and consequently, changes in hospital payment rates may alter physician practice. We posit that changes in hospital payment can work through the agency relationship to influence physician decisions about the site of care, and we test whether reductions in outpatient reimbursement rates lead to the substitution of hospital care from the outpatient to the inpatient setting.

Prior empirical studies suggest that hospital inpatient payment changes caused hospital inpatient services to migrate to outpatient settings.[5] Leader and Moon (1989) showed that after inpatient PPS was introduced, surgery rates among Medicare enrollees rose significantly in ambulatory settings. Hadley and Swartz (1989) found that inpatient PPS significantly decreased Medicare hospital days and increased all-payer hospital outpatient surgical visits. Hadley, Zuckerman, and Feder (1989) found that some hospitals exhibited large declines in inpatient discharge rates coinciding with large increases in outpatient visits, which is "consistent with the view that these hospitals [we]re substituting outpatient care for inpatient care" (p. 362).[6] Our study provides the first evidence on whether changes in hospital outpatient rates led outpatient care to be substituted toward the inpatient setting.

METHODS AND DATA

Study Setting

We use hospital inpatient and outpatient discharge data from the Florida Agency for Health Care Administration from 1997 to 2008, a period that includes the introduction of OPPS in 2000 and its full phase-in by 2004.[7] We focus on short-term general hospitals; there are about 200 such hospitals in our Florida sample.[8]

National datasets cannot be used to measure the hospital- and procedure-specific payment and volume variables required for this analysis. Medicare outpatient claims from the pre-OPPS years have limited information on specific procedures (ResDAC 2010). The National Hospital Discharge Survey and the National Hospital Ambulatory Medical Care Survey are too small to construct hospital-specific counts of volume. Several state discharge databases have available data in multiple pre-OPPS years; we chose Florida as Medicare utilization in the state accounts for over 8 percent of all Medicare spending nationwide (CMS 2007).

Selection of Study Procedures

We focus on surgical procedures used in the open repair of inguinal hernia, a condition that occurs when soft tissue protrudes through the abdominal wall. Inguinal hernia repair is one of the most commonly performed surgeries in the United States. Nearly 770,000 such surgeries are performed annually at an average cost of $2,000 to $2,500 per case (Rutkow 2003, p. 1045). At a total cost approaching almost $2 billion, "it is naïve to think that health care policy makers would not be interested" in expenditures on hernia repair (Rutkow 2003, p. 1045).

Inguinal hernia repair serves as a useful case study of the effects of payment rate changes on setting of care for additional reasons. First, hernia repair surgery in the Medicare population is commonly performed in both inpatient and outpatient settings in the same hospital. Among Medicare patients in 2003 nationally, 72.6 percent of all hernia repair surgeries performed in hospitals occurred in the outpatient setting.[9] In an average hospital in our Florida sample, 78.5 percent of all hernia repairs were done as outpatient surgeries in 2007. Thus, important variation in the site of care exists.

Second, patient outcomes following inguinal hernia repair are similar whether the surgery is performed on an inpatient or outpatient basis. Mitchell and Harrow (1994) compared the outcomes of Medicare patients who underwent open inguinal hernia repair surgery in both inpatient and outpatient settings and found that rates of surgical complications and mortality were not significantly different. In a randomized clinical trial, Mattila et al. (2011) compared patients aged 65 years and older receiving inguinal hernia repairs in inpatient and outpatient settings and found no significant differences in patient outcomes or satisfaction between the groups. These findings suggest that differences in setting of care are less likely to reflect preferences for higher quality of care.

Third, measurement of hernia repair in this study is unlikely to be affected by OPPS-induced changes in the payment rates for other procedures, such as diagnostic and screening procedures. The diagnosis of hernia is highly accurate with physical examination alone (van de Berg et al. 1999; Kraft et al. 2003); in patient guidelines for inguinal hernia diagnosis, the Society for Surgery of the Alimentary Tract (SSAT) notes that "ultrasound or other radiologic studies are not required" (SSAT 2006). This makes hernia repair surgery less dependent on other procedures or their reimbursement rates. In contrast, other surgical treatments (e.g., removal of cancerous lesions) may depend on screening and diagnostic procedures (e.g., colonoscopy). Furthermore, because there is limited progression of inguinal hernia, most delays in diagnosis and treatment would not eliminate hernia repair surgery in favor of another surgical procedure; in contrast, delays in the diagnosis and treatment of other conditions may rule out one approach (e.g., lumpectomy) in favor of another (e.g., mastectomy). These features help us to identify the effect of payment changes in hernia repair procedures separately from any effects of OPPS-induced payment changes for various diagnostic and screening procedures.

Measures of Inguinal Hernia Repair Surgeries by Setting

For each hospital and year in our sample, we construct separate counts of inguinal hernia repair surgeries performed in the outpatient setting and in the inpatient setting; both counts are done for discharges where the primary payer was fee-for-service Medicare. We identify outpatient hernia repair surgeries from CPT codes and inpatient surgeries from ICD-9-CM procedure codes. To select the relevant procedure codes, we used the Clinical Classification Software (CCS) developed by the Agency for Healthcare Quality and Research (AHRQ 2012a,b).

The CCS assigns multiple CPT and ICD-9 procedure codes to CCS 85 (inguinal and femoral hernia repair). Of the 19 CPTs codes in CCS 85, we eliminated four procedures pertaining to femoral hernia and six procedures used to treat children. As the clinical studies cited earlier showed comparable patient outcomes following open inguinal hernia repair, we excluded four CPTs used for laparoscopic hernia repair. Payment rate data for one open inguinal hernia repair procedure (CPT 49521) are not available for a large share of hospitals in our sample. Our analysis thus includes four procedures used in the open repair of inguinal hernia (CPTs 49505, 49507, 49520, and 49525). For each procedure, we count the times the CPT was recorded as the principal procedure or as one of up to nine other procedures on outpatient discharge records, by hospital and year. Of the ICD-9-CM procedures in CCS 85, we excluded codes for femoral hernia repair and laparoscopic repair of inguinal hernia, and included 14 procedures used in the open repair of inguinal hernia (5300–5305 and 5310–5317).[10] We count the times any of these 14 procedures appear as the principal procedure or as one of up to nine other procedures on inpatient discharge records, by hospital and year.

Table 1 reports descriptive statistics for open inguinal hernia repair surgeries by setting in our sample hospitals in 1999. Sample sizes vary by procedure (based on the availability of payment rate data) and by setting (based on the availability of discharge records).[11] Panel A reports the mean number of times the procedure was performed in the outpatient setting as the principal procedure and as either the principal or other procedure. CPT 49505 is the most commonly used of the four outpatient procedures; the average hospital performed 24.6 surgeries involving that procedure in that year. Panel B reports the mean count of hernia procedures in the inpatient setting. There were 8.2 inpatient open inguinal hernia repair surgeries performed as the principal or other procedure per hospital in 1999.

Payment Rate Measures

We next construct hospital-specific Medicare payment rates to outpatient departments for each of the open inguinal hernia repair procedures described above (CPTs 49505, 49507, 49520, and 49525). For the post-OPPS years, we obtain quarterly CMS publications reporting payments by ambulatory payment classification (APC) along with quarterly crosswalks from CPT to APC.[12] We create hospital-specific measures by adjusting APC payment rates using the hospital wage index and we create annual measures by averaging the quarterly data.

To obtain hospital- and procedure-specific payments in the pre-OPPS years, we follow the algorithm developed in He and Mellor (2012) to impute hospital- and procedure-specific charges from the total charge field on the discharge record. The algorithm identifies CPT-specific charges for 58–94 percent of the hospitals in our sample depending on the CPT.[13] Once we obtain procedure- and hospital-specific charges, we apply hospital-specific outpatient surgery payment-to-charge ratios imputed from 1997 to 1999 annual Medicare cost reports.

Figure 1 illustrates median Medicare payment rates (in 2008 dollars) over time for each of the four procedures. Median payment rates decreased by 4–10 percent between 1999 and 2004 (before and after the full phase-in of OPPS), and the majority of hospitals (51–60 percent, depending on the procedure) experienced a decrease in payment rate in this time period. About 40–45 percent of the procedure-specific within-hospital variation in payment rates over the 12 years in our sample occurs in the years around the implementation of OPPS, and a large portion (between 80–88 percent) of the 1999–2004 payment variation represents decreases in payments from the prior year.

Table 1: Summary Statistics (Based on 1999 Data)

Variable Name		*Mean*	*SD*	*N*
Panel A: Counts of outpatient procedures				
Principal procedures	49505	23.13	28.62	181
	49507	1.74	2.60	133
	49520	3.82	4.76	171
	49525	1.94	4.79	111
Principal and other procedures	49505	24.55	29.87	181
	49507	1.95	2.90	133
	49520	4.03	4.95	171
	49525	2.03	4.80	111
Panel B: Counts of inpatient procedures				
Principal procedures	49505	5.96	5.68	177
	49507	6.07	5.73	149
	49520	5.94	5.72	173
	49525	6.23	5.64	133
Principal and other procedures	49505	8.21	7.49	177
	49507	8.40	7.53	149
	49520	8.14	7.47	173
	49525	8.61	7.39	133
Panel C: Hospital-level controls				
Not-for-profit ownership (*nfprofit*)		0.45	0.50	183
Public ownership (*govt*)		0.11	0.31	183
Teaching (*teaching*)		0.03	0.18	183
Acute care beds (*acutebeds*)		236	166	183
Proportion of female hernia patients *(p_prop_female)*		0.17	0.08	173
Proportion of black hernia patients *(p_prop_black)*		0.06	0.11	173
Proportion of Hispanic hernia patients *(p_prop_hisp)*		0.08	0.21	173
Proportion of hernia patients aged 75–85 *(p_prop_7585)*		0.42	0.13	173
Proportion of hernia patients over age 85 *(p_prop_85up)*		0.12	0.08	173
Proportion of hernia patients w/CPD *(p_prop_cpd)*		0.09	0.10	173
Proportion of hernia patients w/diabetes *(p_prop_diabetes)*		0.06	0.06	173
Proportion of hernia patients w/renal disease *(p_prop_renal)*		0.002	0.007	173
Proportion of hernia patients w/principal diagnosis of hernia *(p_prop_samediag)*		0.71	0.17	173
Panel D: County-level controls				
Total population (in thousands) (*totpop*)		340.2	441.2	45
Proportion black (*c_prop_black*)		0.12	0.07	45

continued

Table 1. *Continued*

Variable Name	*Mean*	*SD*	*N*
Proportion Hispanic (*c_prop_hisp*)	0.08	0.09	45
Proportion female (*c_prop_female*)	0.51	0.02	45
Proportion age 65 and up (*c_prop_age65*)	0.19	0.08	45
Median household income (in thousands of $) (*c_medhhinc*)	35.8	5.6	45
Unemployment rate (*c_unemprate*)	12.2	3.1	45
Number of procedures performed in ASCs (*c_ASC_count*)	117	150	45

Note. Parentheses indicate the abbreviated variable name used in tables of regression results. The number of Florida counties in our dataset is smaller than the total number of counties (67) in the state because (a) some counties do not have hospitals; (b) some small hospitals are not required to report data to the Florida AHCA, and (c) some hospitals have missing data on other variables. Missing data on the sole hospital in a county means that county is no longer included in the sample. In the regressions, counts of procedures performed in ASCs are defined separately for each of the procedures in this study; above we report the mean and standard deviation of the average count across all procedures. Data on hospital beds, teaching status, and ownership are from annual issues of the *Hospital Beds and Services List* published by the Florida AHCA. Population data are from the U.S. Census Bureau and the Florida Legislature's Office of Economic and Demographic Research. County income and unemployment rates are from the Bureau of Labor Statistics.

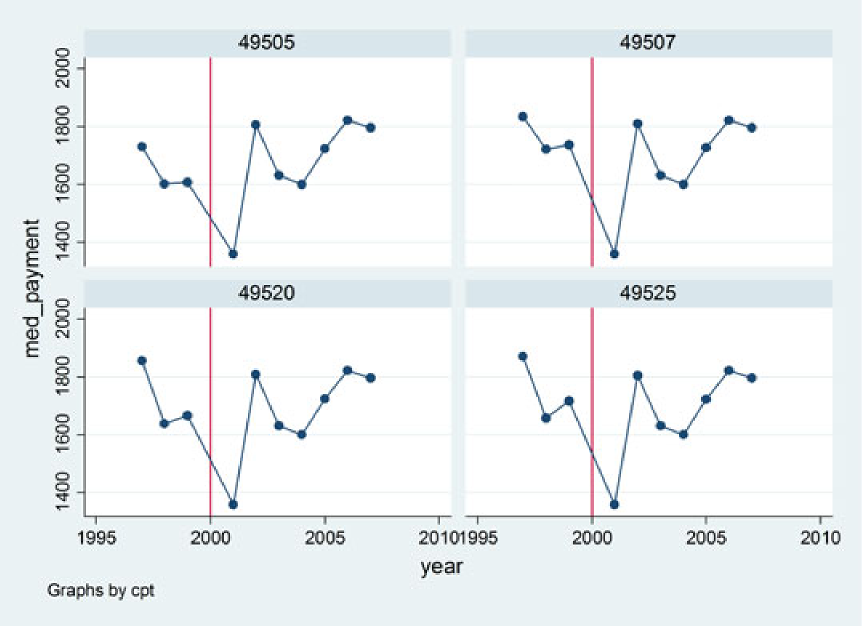
These data suggest that OPPS resulted in meaningful declines in payment rates for these procedures across hospitals.

Empirical Approach

To examine how OPPS-induced payment changes affected the setting of care, we estimate separate regression models of outpatient and inpatient open inguinal hernia repair surgery counts. In each regression, the dependent variable is the log of surgery counts of either a specific outpatient procedure or the inpatient hernia procedures in a given hospital and year, for years from 1997 to 2008.[14] The key explanatory variable is the Medicare hospital outpatient department reimbursement rate for a given procedure in a given hospital and year. The estimated coefficient on the payment variable can be interpreted as a price elasticity of volume given the log–log specification. If hospitals engage in substitution across site of care in response to cuts in outpatient payment rates, the price elasticity will be positive in the outpatient volume regressions and negative in the inpatient volume regressions.

Because OPPS also affected Medicare beneficiaries' cost sharing, we control for coinsurance amounts in 2008 dollars for each procedure in each hospital and year. For the post-OPPS years, we calculate coinsurance amounts

Figure 1: Median Payment Rates



from CMS quarterly releases of the OPPS PPS pricer documentation.[15] For the pre-OPPS years, when coinsurance was set at 20 percent of charges (MedPAC 1999), we apply this percentage to our imputed hospital- and procedure-specific charges.

We also include the hospital-year-level and county-year-level controls shown in Table 1. We control for the hospital's ownership status, teaching status, and bed size, and we control for the demographic and clinical characteristics of patients constructed from the combined sample of inpatient and outpatient Medicare FFS discharges for open inguinal hernia repair. We measure the proportions of hernia repair surgeries performed on female (vs. male) patients, patients aged 75–84 years, or 85 years and up (vs. under 75), and black or Hispanic (vs. white) patients. We also control for the proportion of discharges with a primary diagnosis of inguinal hernia[16] and the prevalence of various comorbidities.[17]

County-year-level controls include estimates of the total population, the proportions of the population age 65 and up, female, Hispanic and black, the median household income in 2008 dollars, and the unemployment rate. To control for market-level changes affecting hospitals, we include the number of times a given CPT procedure for hernia repair was performed in ASCs located in the same county as the hospital. Because ASC volume may be endogenous to Medicare payment, we test whether our results are sensitive to the inclusion of this measure, and they are not.[18]

We include year- and hospital- fixed effects and a full set of three-digit zipcode-year dummies. Year-fixed effects help to control for Medicare hospital inpatient payments and physician reimbursements for hernia, as most variation in these payments comes from annual updates to nationwide payment schedules. The three-digit zipcode-year dummies control for any factors that vary over time at that level of geography and may influence hospital surgical volumes. For example, the zipcode-year dummies help to control for remaining sources of variation in Medicare reimbursements for inpatient hernia surgery to inpatient hospitals and physicians, such as changes in the local hospital wage index used to adjust inpatient and physician reimbursements.[19] These dummies also control for the outpatient private pay price (often measured at the three-digit zipcode level in prior studies (Yip 1998; He and Mellor 2012) and the volume of and reimbursement rates for ambulatory surgeries performed in physician offices to the extent those vary at the three-digit zipcode level.[20] Nonetheless, there may be some residual variation over time and within individual hospitals that we are unable to capture with these zipcode-year dummies.

RESULTS

The main regression results are reported in Tables 2 and 3 for outpatient and inpatient volumes, respectively. In columns (1) through (4), the dependent variables are based on counts of principal procedures alone; in columns (5) through (8), the dependent variables are based on counts of principal and other procedure codes combined. For each price elasticity of volume estimate we report three standard errors: the unclustered standard errors in parentheses followed by robust standard errors clustered by county and by hospital (the first and second sets of brackets, respectively).

In the outpatient hernia models (Table 2), the elasticity estimates are positive and several are statistically significant, suggesting that outpatient hernia surgeries fell in response to OPPS-induced rate cuts. In the inpatient hernia models (Table 3), the elasticity estimates are very small, ranging from −0.05 to 0.15 in the principal procedure count models, and none of the

Table 2: Payment Effects on Outpatient Surgery Counts

	log (Counts of Principal Procedures)				*log (Counts of Principal and Other Procedures)*			
Variables	*49505* (1)	*49507* (2)	*49520* (3)	*49525* (4)	*49505* (5)	*49507* (6)	*49520* (7)	*49525* (8)
log(payment)	0.08 (0.14)	0.40 (0.17)**	0.31 (0.14)**	0.14 (0.19)	0.16 (0.13)	0.46 (0.17)***	0.25 (0.14)*	0.09 (0.19)
	[0.19]	[0.16]**	[0.16]*	[0.25]	[0.18]	[0.15]***	[0.16]	[0.27]
	[0.20]	[0.19]**	[0.15]**	[0.22]	[0.19]	[0.18]**	[0.16]	[0.22]
log(coins)	−0.05 (0.13)	−0.40 (0.15)***	−0.22 (0.14)	−0.14 (0.18)	−0.11 (0.12)	−0.46 (0.16)***	−0.17 (0.14)	−0.10 (0.18)
log(ASC_count)	−0.06 (0.04)	−0.03 (0.05)	−0.04 (0.05)	−0.03 (0.06)	−0.04 (0.04)	−0.02 (0.05)	−0.00 (0.05)	−0.02 (0.06)
tot pop	−0.00 (0.00)**	−0.00 (0.00)**	−0.00 (0.00)	−0.00 (0.00)	−0.00 (0.00)	−0.00 (0.00)*	−0.00 (0.00)	−0.00 (0.00)
c_prop_black	−11.01 (6.89)	−3.84 (7.83)	−8.41 (7.38)	−2.35 (10.90)	−9.60 (6.60)	−5.71 (7.90)	−5.94 (7.32)	−11.72 (11.00)
c_prop_hisp	3.41 (3.89)	12.36 (7.45)*	3.87 (4.36)	−2.58 (5.43)	2.48 (3.72)	11.61 (7.51)	2.35 (4.32)	−1.58 (5.48)
c_prop_female	30.10 (16.10)*	−9.85 (25.92)	22.74 (23.00)	−20.04 (41.20)	35.28 (15.42)**	−15.41 (26.14)	18.35 (22.82)	−28.20 (41.57)
c_prop_age65	−5.83 (3.42)*	4.60 (4.50)	−2.31 (3.73)	2.44 (6.02)	−0.75 (3.27)	6.20 (4.54)	0.63 (3.71)	−0.43 (6.07)
unemprate	−0.04 (0.18)	−0.07 (0.22)	0.01 (0.20)	−0.47 (0.29)	−0.07 (0.18)	−0.11 (0.22)	0.05 (0.20)	−0.49 (0.29)*
unemprate^2	−0.00 (0.01)	0.00 (0.02)	−0.01 (0.02)	0.03 (0.02)	0.00 (0.01)	0.01 (0.02)	−0.01 (0.02)	0.03 (0.02)
medhhinc	−0.08 (0.08)	0.11 (0.10)	−0.18 (0.08)**	0.03 (0.15)	−0.10 (0.07)	0.08 (0.10)	−0.16 (0.08)*	−0.06 (0.15)
medhhinc^2	0.00 (0.00)	−0.00 (0.00)	0.00 (0.00)***	−0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)**	0.00 (0.00)
p_prop_female	−0.31 (0.21)	0.46* (0.26)	−0.17 (0.24)	−0.08 (0.36)	−0.34* (0.20)	0.42 (0.26)	−0.11 (0.24)	0.08 (0.36)
p_prop_black	−0.37 (0.26)	−0.04 (0.31)	−0.13 (0.29)	0.28 (0.41)	−0.47 (0.24)*	0.03 (0.31)	−0.10 (0.28)	0.45 (0.41)
p_prop_hisp	0.25 (0.20)	0.14 (0.24)	−0.05 (0.22)	−0.13 (0.31)	0.27 (0.19)	0.09 (0.24)	−0.03 (0.22)	−0.03 (0.31)
p_prop_age7585	0.05 (0.17)	−0.06 (0.21)	−0.29 (0.18)	−0.04 (0.26)	0.01 (0.16)	−0.09 (0.21)	−0.25 (0.18)	−0.17 (0.27)
p_prop_age85	−0.72 (0.24)***	−0.56 (0.30) *	−0.43 (0.28)	0.05 (0.40)	−0.62 (0.23)***	−0.59 (0.30)*	−0.44 (0.28)	−0.11 (0.41)
p_prop_samediag	0.40 (0.14)***	0.33 (0.18)*	0.45 (0.17)***	0.36 (0.22)*	0.44 (0.14)***	0.37 (0.18)**	0.59 (0.16)***	0.49 (0.22)**
p_prop_cpd	−1.45 (0.22)***	−0.14 (0.30)	−0.17 (0.26)	−0.51 (0.44)	−1.10 (0.21)***	−0.04 (0.30)	−0.06 (0.25)	−0.62 (0.44)
p_prop_diabetes	−0.83 (0.40)**	−0.54 (0.52)	−0.01 (0.42)	−0.01 (0.66)	−0.99 (0.38)***	−0.38 (0.52)	−0.13 (0.42)	−0.03 (0.67)
p_prop_renal	−2.65 (1.22)**	3.58 (2.18)	−0.93 (1.52)	−3.93 (3.09)	−1.08 (1.17)	3.24 (2.20)	−0.92 (1.50)	−4.09 (3.12)
nfprofit	−0.01 (0.14)	−0.19 (0.16)	0.22 (0.16)	−0.08 (0.23)	−0.10 (0.14)	−0.18 (0.16)	0.18 (0.16)	−0.02 (0.23)

continued

Table 2. *Continued*

	log (Counts of Principal Procedures)				*log (Counts of Principal and Other Procedures)*			
Variables	*49505* *(1)*	*49507* *(2)*	*49520* *(3)*	*49525* *(4)*	*49505* *(5)*	*49507* *(6)*	*49520* *(7)*	*49525* *(8)*
govt	−0.22 (0.23)	−0.02 (0.27)	−0.10 (0.24)	0.33 (0.40)	−0.38 (0.22)*	0.01 (0.27)	−0.15 (0.24)	0.37 (0.40)
teaching	0.05 (0.21)	0.12 (0.24)	0.20 (0.21)	−0.08 (0.42)	0.10 (0.20)	0.13 (0.24)	0.18 (0.21)	−0.20 (0.42)
acute beds	0.00 (0.00)	0.00 (0.00)	−0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	−0.00 (0.00)	0.00 (0.00)
Constant	−6.07 (7.93)	4.01 (12.52)	−4.13 (11.22)	13.52 (20.40)	−11.18 (7.59)	7.28 (12.62)	−3.49 (11.13)	21.18 (20.59)
No. of observations	1,196	1,000	1,127	773	1,196	1,000	1,127	773
R^2	0.272	0.285	0.238	0.309	0.259	0.290	0.252	0.317
No. of hospitals	195	187	189	177	195	187	189	177

Note. All models also include hospital and year-fixed effects and three-digit zipcode-year dummies. Unclustered standard errors are reported in parentheses. For the key explanatory variable, the first row of brackets reports robust standard errors clustered by county and the second row of brackets reports robust standard errors clustered by hospital. Statistical significance is indicated by *** for .01 level, ** for .05 level, and * for .10 level.

Table 3: Payment Effects on Inpatient Surgery Counts

	log (Counts of Principal Procedures)				*log (Counts of Principal and Other Procedures)*			
Variables	*49505 (1)*	*49507 (2)*	*49520 (3)*	*49525 (4)*	*49505 (5)*	*49507 (6)*	*49520 (7)*	*49525 (8)*
log(payment)	−0.05 (0.12)	−0.15 (0.13)	0.02 (0.12)	0.04 (0.14)	−0.04 (0.12)	−0.15 (0.13)	0.03 (0.11)	0.10 (0.13)
	[0.18]	[0.18]	[0.19]	[0.19]	[0.17]	[0.16]	[0.18]	[0.16]
	[0.14]	[0.16]	[0.15]	[0.16]	[0.14]	[0.14]	[0.14]	[0.14]
log(coins)	−0.02 (0.11)	0.02 (0.12)	0.00 (0.12)	−0.18 (0.13)	−0.05 (0.11)	0.02 (0.12)	−0.02 (0.11)	−0.22 (0.12)*
log(ASC_count)	−0.09 (0.04)**	−0.05 (0.04)	−0.03 (0.04)	0.07 (0.04)*	−0.05 (0.04)	−0.03 (0.04)	0.02 (0.04)	0.07 (0.04)*
tot pop	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)*	0.00 (0.00)	0.00 (0.00)
c_prop_black	−1.12 (6.16)	1.17 (6.20)	3.44 (6.17)	5.12 (6.31)	−1.96 (5.83)	−0.58 (5.81)	2.18 (5.83)	3.24 (5.96)
c_prop_hisp	1.85 (3.48)	−4.25 (5.48)	1.98 (3.56)	1.21 (3.83)	1.21 (3.29)	−3.79 (5.14)	1.75 (3.36)	1.10 (3.61)
c_prop_female	−6.02 (14.41)	−15.85 (16.10)	−7.73 (14.88)	−23.47 (17.88)	−18.75 (13.62)	−26.41 (15.09)*	−18.52 (14.06)	−26.26 (16.89)
c_prop_age65	1.07 (3.06)	0.95 (3.62)	1.27 (3.08)	4.62 (3.62)	1.54 (2.89)	1.28 (3.39)	1.82 (2.91)	2.74 (3.42)
p_prop_female	−0.05 (0.16)	0.15 (0.18)	0.01 (0.17)	0.04 (0.19)	−0.07 (0.16)	0.14 (0.17)	−0.01 (0.16)	0.01 (0.18)
p_prop_black	0.01 (0.01)	−0.01 (0.01)	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)	−0.01 (0.01)	0.01 (0.01)	0.01 (0.01)
p_prop_hisp	−0.09 (0.07)	−0.15 (0.07)**	−0.08 (0.07)	−0.15 (0.07)**	−0.09 (0.07)	−0.15 (0.07)**	−0.10 (0.07)	−0.14 (0.07)**
p_prop_age7585	0.00 (0.00)	0.00 (0.00)**	0.00 (0.00)	0.00 (0.00)**	0.00 (0.00)	0.00 (0.00)**	0.00 (0.00)	0.00 (0.00)*
p_prop_age85	−0.06 (0.18)	−0.04 (0.18)	−0.07 (0.19)	0.16 (0.19)	−0.04 (0.17)	−0.04 (0.17)	−0.06 (0.18)	0.14 (0.18)
p_prop_samediag	0.31 (0.22)	0.49 (0.23)**	0.36 (0.23)	0.47 (0.23)**	0.14 (0.21)	0.31 (0.22)	0.20 (0.22)	0.31 (0.22)
p_prop_cpd	0.11 (0.18)	0.15 (0.19)	0.07 (0.18)	0.02 (0.19)	0.18 (0.17)	0.24 (0.18)	0.16 (0.17)	0.07 (0.18)
p_prop_diabetes	0.14 (0.15)	0.14 (0.15)	0.16 (0.15)	0.21 (0.15)	0.23 (0.14)	0.25 (0.14)*	0.26 (0.14)*	0.34 (0.15)
p_prop_renal	0.18 (0.21)	0.28 (0.21)	0.27 (0.22)	0.21 (0.22)	0.10 (0.20)	0.22 (0.20)	0.19 (0.20)	0.15 (0.21)**
unemprate	−0.09 (0.13)	0.07 (0.14)	−0.04 (0.13)	0.04 (0.14)	−0.00 (0.12)	0.10 (0.13)	0.02 (0.12)	0.14 (0.13)
unemprate^2	0.71 (0.20)***	0.70 (0.20)***	0.59 (0.20)***	0.86 (0.22)***	0.42 (0.19)**	0.42 (0.19)**	0.31 (0.19)*	0.59 (0.21)***
medhhinc	1.01 (0.36)***	0.82 (0.36)**	0.90 (0.36)**	0.75 (0.38)**	1.22 (0.34)***	1.15 (0.34)***	1.14 (0.34)***	1.04 (0.36)***
medhhinc^2	0.54 (1.05)	1.02 (1.47)	0.25 (1.19)	−0.92 (1.42)	0.77 (1.00)	1.22 (1.38)	0.02 (1.12)	−0.73 (1.34)
nfprofit	−0.07 (0.13)	−0.18 (0.13)	−0.06 (0.13)	−0.18 (0.13)	−0.01 (0.12)	−0.11 (0.12)	−0.01 (0.12)	−0.06 (0.13)

continued

Table 3. *Continued*

	log (Counts of Principal Procedures)				log (Counts of Principal and Other Procedures)			
Variables	*49505* (1)	*49507* (2)	*49520* (3)	*49525* (4)	*49505* (5)	*49507* (6)	*49520* (7)	*49525* (8)
govt	−0.45 (0.20)**	−0.25 (0.21)	−0.40 (0.20)**	−0.30 (0.22)	−0.28 (0.19)	−0.20 (0.20)	−0.23 (0.19)	−0.14 (0.20)
teaching	−0.02 (0.18)	−0.16 (0.20)	−0.03 (0.19)	−0.11 (0.21)	−0.01 (0.17)	−0.15 (0.19)	−0.05 (0.18)	−0.05 (0.20)
acute beds	0.00 (0.00)*	0.00 (0.00)	0.00 (0.00)*	0.00 (0.00)	0.00 (0.00)	−0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Constant	6.07 (7.09)	11.62 (7.91)	5.21 (7.34)	14.50 (9.05)	13.34 (6.70)**	17.64 (7.41)**	11.87 (6.93)*	16.82 (8.55)**
No. of observations	1,197	1,121	1,181	1,086	1,197	1,121	1,181	1,086
R^2	0.206	0.224	0.198	0.247	0.194	0.227	0.189	0.227
No. of hospitals	195	192	192	191	195	192	192	191

Note. All models also include hospital and year-fixed effects and three-digit zipcode-year dummies. Unclustered standard errors are reported in parentheses. For the key explanatory variable, the first row of brackets reports robust standard errors clustered by county and the second row of brackets reports robust standard errors clustered by hospital. Statistical significance is indicated by *** for .01 level, ** for .05 level, and * for .10 level.

estimates is statistically significant. Thus, we see no evidence that outpatient payment cuts shifted surgical volume toward the inpatient setting. We also estimate the models in Tables 2 and 3 in which we weight the observations based on either the hospital's number of acute care beds or the hospital's combined number of inpatient and outpatient hernia discharges in 1999. All three approaches yield very similar results.

We consider several reasons for the small and insignificant effects on inpatient volume observed in Table 3. First, it is possible that hospitals experiencing the largest rate cuts under OPPS were also experiencing a trend of declining inpatient volume for some unknown exogenous reason.[21] This kind of preexisting trend could work against the policy response, leading to muted results in the inpatient volume regressions in Table 3. To test whether such a trend exists in the pre-OPPS period, we conduct a falsification test by creating a "fake payment" by assigning the payment from 2004 (the year OPPS went into full effect) to 1999. We then estimate our regressions using data from the three pre-OPPS years. If there was a preexisting trend of declining inpatient volume in hospitals with significant payment decreases under OPPS, our fake payment coefficient would be negative and significant. However, the results reported in Table 4 rule this out. In no case is the fake payment coefficient statistically significant.[22]

It is possible that requiring all hospitals to have the same response obscures heterogeneous effects by hospital type. Many studies show that regulations affecting Medicare, including inpatient PPS, have more pronounced effects on hospitals with larger shares of Medicare patients (e.g., Salkever 2000). To test whether "highly exposed" hospitals experience payment-induced changes in inpatient volume, we interact the log payment variable with the hospital's share of outpatient and inpatient discharges in which Medicare FFS was the primary payer, measured in the last year prior to OPPS (1999).[23] The results from this exercise suggest that outpatient payment cuts had no effect on inpatient volume even among the highly exposed hospitals. None of the interaction term coefficients or the payment elasticities is statistically significant. We also estimated our regressions on a sample of hospitals with at least 1 year of no missing payment data between 1997 and 1999. This restriction omits hospitals with payment data in only the years after the policy change, so it may have the advantage of linking the within-hospital payment variation more closely to OPPS. Nonetheless, we observe the same pattern of results as in the larger sample: reductions in outpatient payments reduce outpatient surgical volume but have no effect on inpatient surgical volume even if we allow effects to vary by Medicare share. Finally, we considered the

Table 4: Falsification Test of Pre-Trending in Inpatient Counts

	log (Counts of Principal Procedures)				*log (Counts of Principal and Other Procedures)*			
Variables	*49505* *(1)*	*49507* *(2)*	*49520* *(3)*	*49525* *(4)*	*49505* *(5)*	*49507* *(6)*	*49520* *(7)*	*49525* *(8)*
log(fake_payment)	−0.09 (0.19)	−0.03 (0.21)	−0.07 (0.18)	−0.22 (0.20)	−0.14 (0.18)	−0.09 (0.19)	−0.13 (0.17)	−0.25 (0.19)
	[0.24]	[0.27]	[0.21]	[0.32]	[0.22]	[0.25]	[0.19]	[0.30]
	[0.18]	[0.18]	[0.16]	[0.19]	[0.17]	[0.17]	[0.16]	[0.18]
No. of observations	485	408	469	372	485	408	469	372
R^2	0.275	0.309	0.289	0.380	0.277	0.332	0.293	0.376
No. of hospitals	177	148	170	133	177	148	170	133

Note. All models control for the additional variables listed in Tables 2 and 3 as well as hospital and year-fixed effects and linear zipcode-specific time trends. Unclustered standard errors are reported in parentheses. For the key explanatory variable, the first row of brackets reports robust standard errors clustered by county and the second row of brackets reports robust standard errors clustered by hospital. Statistical significance is indicated by *** for .01 level, ** for .05 level, and * for .10 level.

possibility that hospital surgical volume was affected both by the hospital's own payment rates under OPPS and by changes in competitors' prices. We constructed two controls for competitors' prices: the average payment to other hospitals in the Hospital Referral Region where the hospital is located, and the average payment to other hospitals in the county where the hospital is located. The addition of each control slightly increased some own-price elasticities in the outpatient volume models; results from the inpatient volume models were nearly identical.[24]

Discussion and Conclusion

Changes to hospital outpatient reimbursement are one means of controlling growth in outpatient spending; one threat to the effectiveness of this approach is that hospitals could alter the site of care when rates in the outpatient setting drop. It is generally believed that the introduction of Medicare inpatient PPS led to substitution from the inpatient setting and toward the outpatient setting. Because inpatient care is more resource-intensive than outpatient care, substitution toward the inpatient setting could undermine the cost containment goals of the policy. We study whether OPPS-induced changes in outpatient payments increased inpatient volume for inguinal hernia repair surgery. Our results offer no evidence that such rate cuts led hospitals to increase the number of inpatient surgeries, and they suggest that the substitution of inpatient care for outpatient care does not pose a serious threat to efforts to contain costs through OPPS, at least in the case studied here. This finding has important policy implications in light of rapid growth in Medicare outpatient spending (MedPAC 2009, 2010), continuing reductions in real Medicare payments to hospital outpatient departments under the Affordable Care Act (CMS 2010b), and renewed interest in all-payer rate programs that extend government-determined reimbursement rates to private insurers (e.g., NCSL 2010; Murray 2012; Pauly and Town 2012).

This study is limited by its focus on open inguinal hernia repair surgeries; however, this focus has its advantages. The debate about the appropriate setting of care for hernia repair is still ongoing, as evidenced by recent research on differences in outcomes across care settings after hernia repair (e.g., Mattila et al. 2011). In contrast, there are well-established guidelines for the setting of care for other common outpatient procedures. For example, 99.6 percent of all lens and cataract procedures performed in U.S. hospitals occur on an outpatient basis (AHRQ 2007) and routine endoscopic procedures have long been performed in physician offices and ASCs (Pike 2002). We expect that the potential to substitute hernia surgeries from the outpatient to inpatient setting exceeds the potential to substitute common outpatient procedures such as colonoscopy, endoscopy, and cataract removal, and this broadens the generalizability of our results.

Finally, our results suggest that OPPS reduced the outpatient volume of some types of hernia procedures without increasing inpatient volume. This pattern could suggest that more hernia repairs are taking place in other ambulatory settings, or that there was overutilization of outpatient surgery in the pre-OPPS period or delays or reductions in necessary care in the post-OPPS period. Without additional data on patient outcomes and treatment in other ambulatory settings, we are unable to investigate these alternate explanations; future research on these possibilities would be worthwhile.

Acknowledgments

Joint Acknowledgment/Disclosure Statement: The authors gratefully acknowledge the helpful comments and suggestions of the editors and two anonymous reviewers, as well as financial support from the Robert Wood Johnson Foundation's Changes in Healthcare Financing and Organization (HCFO) initiative and the Schroeder Center for Health Policy at the College of William & Mary. They are also grateful for helpful advice from anonymous reviewers at HCFO, David Becker, and Lauren Hersch Nicholas. Amy Filipek and Elizabeth Vestal provided excellent research assistance.

Disclosure: None.

Disclaimer: None.

Notes

1. The OPPS-induced payment change depends on the APC group to which the procedure was assigned, the local wage index, and costs in the pre-OPPS years for a given hospital.
2. OPPS pertains to the reimbursement of hospitals; separate fee schedules are used to reimburse physicians' professional services and other types of outpatient facilities such as ambulatory surgery centers.
3. See Wynn (2005) and He and Mellor (2012) for additional information on the features of OPPS.

4. See, for example, Cutler (1995), Norton et al. (2002), White (2003), McCall et al. (2003), Sood, Buntin, and Escarce (2008), and Grabowski, Afendulis, and McGuire (2011), as well as reviews by Salkever (2000) and Chalkley and Malcomson (2000).
5. Evidence suggests that physician payment changes can also alter the site of care. See, for example, Long, Settle, and Stuart (1986), Cohen (1993), Baker and Royalty (2000), and Decker (2009).
6. For other evidence of the association between PPS and outpatient utilization, see Fisher (1987, 1988), Mitchell, Wedig, and Cromwell (1989), and Menke (1990).
7. Children's hospitals and cancer hospitals met permanent "hold harmless" provisions, and critical access hospitals are exempt from OPPS altogether. We exclude those hospitals from our sample.
8. The exact number varies slightly over time depending on entry/exit and the fact that facilities with fewer than 200 visits in a quarter are exempt from reporting.
9. Figures are based on the authors' calculations using the combined number of inguinal and femoral hernia repairs from AHRQ (Agency for Healthcare Quality and Research) (2007), tables 5 and 9 and figure 15. Counts of inguinal hernia repairs by site of care are not available, but almost all groin hernias (96 percent) are inguinal (Bax, Sheppard, and Crass 1999).
10. The AHRQ CCS tool does not include a crosswalk from each specific CPT to a particular subset of these 14 ICD-9-CM procedures. Similarly, other cross coders (e.g., Ingenix 2010) link the full set of ICD-9-CM procedures to each individual hernia CPT in our group.
11. Some hospitals have either inpatient discharges or outpatient discharges, but not both. This may be because some hospitals do not have outpatient departments; this would explain why sample sizes are generally smaller in Panel A compared with those in Panel B.
12. These are available at www.cms.gov/PCPricer/OutPPS and www.irp.com/apc/apc_ref.html.
13. The match rate is particularly low for CPT 49521, which is excluded from our analysis.
14. Because OPPS was implemented on August 1, 2000, we exclude 2000 from our regression analysis. We also exclude 2001–2003, the transitional corridor period, when hospitals were not fully subject to OPPS.
15. See www.cms.gov/PCPricer/OutPPS, accessed October 20, 2010.
16. These include ICD-9-CM diagnosis codes 550.00, 550.01, 550.02, 550.03, 550.10, 550.11, 550.12, 550.13, 550.90, 550.91, 550.92, 550.93, v64.41.
17. We use diagnosis codes on discharge records and in Deyo, Cherkin, and Ciol (1992) to identify the following comorbid conditions: malignant neoplasms, diabetes, hypertensive heart conditions, ischemic heart disease, congestive heart failure, chronic obstructive pulmonary disease, and renal disease. These conditions are similar to those used in Mitchell and Harrow (1994). A few of these comorbid conditions were not identified in any of the hernia repair discharges in our sample.
18. Estimated payment elasticities are nearly identical in size and significance whether the ASC procedure count is controlled for or not, which suggests ASC procedure volume and HOPD payment rates are not correlated.

19. Other sources of variation in DRG price are the hospital's DSH payments and teaching status. Dafny (2005) claims that most price variation comes from the DRG weight.
20. We lack data on physician office visit volume and reimbursement rates for physicians' professional services. The finest level of geography for which the physician reimbursement data from Truveen Health Analytics (formerly MarketScan) are available is the three-digit zipcode; our three-digit zipcode-year dummies control for *any* factors, including physician reimbursement rates and office visit volume, that vary at the three-digit zipcode level.
21. Payment rate changes were exogenously introduced through OPPS; however, potential endogeneity of the payment variable remains something of a concern because the size of the payment rate change depended on hospitals' pre-OPPS cost-based reimbursement levels, leaving hospitals with the highest cost-based pre-OPPS payments to face the largest payment reduction when OPPS was in full effect.
22. We cannot rule out the possibility of contemporaneous trends during the OPPS period.
23. Mean Medicare share is 23 percent in 1999.
24. These results are available upon request.

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Supporting Information

Additional supporting information may be found in the online version of this article:

Appendix SA1: Author Matrix.