Does procedure profitability impact whether an outpatient surgery is performed at an ambulatory surgery center or hospital?

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Abstract:

Ambulatory surgery centers (ASCs) are small (typically physician owned) healthcare facilities that specialize in performing outpatient surgeries and therefore compete against hospitals for patients. Physicians who own ASCs could treat their most profitable patients at their ASCs and less profitable patients at hospitals. This paper asks if the profitability of an outpatient surgery impacts where a physician performs the surgery. Using a sample of Medicare patients from the National Survey of Ambulatory Surgery, we find that higher profit surgeries do have a higher probability of being performed at an ASC compared to a hospital. After controlling for surgery type, a 10% increase in a surgery's profitability is associated with a 1.2 to 1.4 percentage point increase in the probability the surgery is performed at an ASC. Copyright © 2010 John Wiley & Sons, Ltd.

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Article:

1. INTRODUCTION

What is the impact of profitability on whether a physician performs a surgery at an ambulatory surgery center (ASC) or a hospital outpatient department (HOPD)? A physician with ownership in an ASC may treat his most profitable patients at an ASC and his least profitable patients at an HOPD. This type of cherry picking (or cream skimming) behavior would maximize a physician's income because he receives a share of the facility fee his patients pay the ASC, but receives none of the facility fee his patients would pay the HOPD. However, this behavior could reduce the profitability of HOPDs. This could be problematic since hospitals claim to subsidize certain healthcare services, like uncompensated care, with the profit earned from their HOPD (Abelson, 2004).

An ASC differs from a hospital due to its small size and the limited number of healthcare services it offers. ASCs provide outpatient surgery and few of the additional services a hospital might provide, such as inpatient surgery or emergency room services. As described by MedPAC (2004, 2009), from 1997 to 2006, roughly 94% of ASCs were for-profit, 99% were freestanding clinics, and 88% were located in urban areas. The number of ASCs has steadily grown, from 2462 facilities in 1997 to 4700 in 2006. Exit of ASCs has been minimal, with an average of 1.7% of facilities exiting annually during this time. According to Casalino et al. (2003), in 2001, 3371 Medicare-certified ASCs competed for patients amongst themselves and approximately 3859 HOPDs.

ASCs also differ from hospitals in that groups of physicians typically own the facility. These physicians face complex decisions regarding how many and which patients to treat at an ASC versus a hospital. Besides profit, a physician might find performing surgeries at an ASC desirable if the ASC offers a more convenient location than the hospital, nicer amenities, a more comfortable setting, or greater flexibility in scheduling procedures. Physician-owners' decisions about which patients to treat at their ASCs as opposed to hospitals could be influenced by both economic and non-economic considerations. They could maximize profits by treating patients for whom the profit margin is the highest at their ASCs. Alternatively, they could maximize patient outcomes by treating the patients who are the sickest or most at risk for complications at the HOPD, which has better resources to take care of patients in critical condition. Most likely, physicians optimize along both these dimensions.

ASCs are potentially socially beneficial for multiple reasons. First, by providing competition to hospitals, the presence of ASCs could lead to lower market prices, improved quality of care, or both. Next, ASCs could reduce healthcare expenditures as they perform outpatient surgeries at a lower cost than hospitals because they do not have the same overhead (Kelly, 2003). Medicare accounts for an ASC's lower overhead by providing lower reimbursement rates for many of the surgeries performed at ASCs compared to those performed at HOPDs.1 Additionally, ASCs can provide greater convenience for both patients and physicians. If physicians act as perfect agents for patients, the ability to sort patients between the two locations on the basis of patients' needs and preferences would lead to welfare gains.

However, the incentive problems created by physician ownership of ASCs could have adverse effects. First, inefficiencies in health-care delivery would result if physicians assign patients to hospitals or ASCs on the basis of profitability instead of patient needs. Second, cherry picking by physicians could reduce the profitability of HOPDs, impacting hospitals' ability to provide unprofitable services such as charity care. Anecdotal evidence suggests that ASCs have the potential to cause hospitals financial harm. For example, an administrator of a hospital in St. Louis, Missouri claimed that between 2000 and 2005, the percentage of the hospital's revenue coming from outpatient services, which tend to be the most profitable, fell from 52 to 31%. The administrator contended that the primary reason for the decline was the opening of a nearby ASC that specialized in orthopedic surgery (Feldstein, 2006). As reported by Casalino et al. (2003), in its first quarter financial report from 2003 the Hospital Corporation of America (HCA) (which at the time owned over 350 hospitals and other healthcare facilities) attributed one third of its lower than expected earnings per share to the increase in competition from ASCs and physician-owned specialty hospitals. According to the authors, some hospital executives expressed concern that cherry picking by ASCs was hurting hospital profitability. However, these executives stated that ‘they did not have evidence to demonstrate the extent of cherry picking, while medical group leaders denied that such selective referral is an objective for their facilities’.

This paper examines the link between physician profit motives and surgery location by estimating the relationship between the profitability of a surgical procedure and the probability the procedure is performed at an ASC instead of a hospital. We utilize the National Survey of Ambulatory Surgery (NSAS), which contains information on over 86 000 outpatient surgeries performed on Medicare patients, along with information from the Centers for Medicare and Medicaid Services (CMS) that describes the profitability of each surgery. We estimate a positive relationship between the profitability of a surgery and the probability a physician performs the surgery at an ASC using models with controls for patient characteristics and year-fixed effects. This result is robust to the use of two different profit measures as well as the inclusion of controls for surgery type, state, and whether the procedure is performed in a metropolitan statistical area (MSA). We conclude that a 10% increase in profitability is associated with a 1.2 to 1.4 percentage point increase in the probability a physician performs a procedure at an ASC.

2. LITERATURE REVIEW

While no previous studies have estimated the relationship between profitability and whether a patient receives treatment at an ASC or hospital, some research examines other determinants of surgical location as well as the effect of ASCs on hospital volume. Wynn et al. (2004) found that patients undergoing cataract surgery at an HOPD were more likely to be female, older, African American, and Medicaid-eligible compared to those treated at an ASC. Patients treated at a hospital also suffered from more risk factors, such as hypertension or diabetes. Patients undergoing colonoscopy at an ASC or HOPD were not found to differ in their distribution of gender, age, or race, although patients treated at a hospital were more likely to be disabled and Medicaid-eligible. Also, for both categories of surgery, patients undergoing multiple procedures were more likely to be treated at an ASC rather than at a hospital. Wynn et al.'s findings suggest that both profit motives (represented by Medicaid-eligibility) and patient health (represented by risk factors and disabilities) impact the surgery location decision. Gabel et al. (2008) found that physicians with ownership in ASCs were more likely to refer insured patients to the facilities they owned and Medicaid patients to hospitals.2 Bian and Morrisey (2007) found that an increase in the number of ASCs per 100 000 people in an MSA was associated with a decrease in hospital outpatient surgery volume but no change in inpatient surgery volume. The reduction in outpatient volume would mean lower profits unless hospitals substitute toward higher-margin procedures.

A related literature examines the impact of specialty hospitals on general hospitals. Specialty hospitals share similarities with ASCs, such as physician ownership and the provision of specialized services, so their effects on hospitals may mirror those of ASCs to some degree. Barro et al. (2006) showed that markets with specialty hospitals are associated with lower expenditures for cardiac care without significant changes in mortality, for all hospitals in a market, not just the specialty hospital. However, those authors and Greenwald et al. (2006) found that specialty hospitals treated healthier patients than general hospitals. In a similar paper, Carey et al. (2009) looked at entry of specialty hospitals and found that hospitals facing competition from specialty hospitals increased their service offerings in response to entry, particularly in the case of cardiac services. Finally, Mitchell (2008) reported that after obtaining ownership in specialty hospitals, physicians changed their clinical behavior by increasing the uses of certain healthcare services for injured workers with back and spine disorders.

3. DATA AND CONSTRUCTION OF PROFIT VARIABLES

Our primary data source is the NSAS, which includes a sample of patients insured by Medicare who underwent outpatient surgery at either hospitals or ASCs in the United States from 1994 through 1996 and also 2006.3 The survey collected the following information for each surgery: whether the patient received surgery at a hospital or ASC; the month and year of the surgery; the patient's age, gender, discharge status, source of payment, anesthesia information, diagnoses codes, and surgical procedure codes.

To calculate the profitability of a patient's surgery from the perspective of a physician with ownership in an ASC, we determine the facility fee an ASC collects and an estimate of the cost it incurs for performing a surgery. The facility fee represents the payments for the non-physician inputs into a surgery such as nursing care, pharmaceuticals, and supplies. The ASC facility fee for each surgery comes from the CMS website (CMS, 2009). Although it does not apply to the data in this paper, in 2008 CMS instituted a new reimbursement system where the ASC facility fee for a particular procedure is roughly equal to 65% of the corresponding HOPD facility fee. Between the mid 1980s and 2008, CMS assigned one of nine different payment rates to a large set of procedures (2464 in 2004) that were performed at ASCs. Over time, CMS adjusted the facility fee occasionally to account for inflation. Payments were also adjusted for geographic factors, although our data do not contain enough detailed geographic indicators to compute these adjustments.4 Additionally, if multiple procedures were performed during one surgical encounter, the facility received the full payment for the procedure with the highest reimbursement rate and half the payment for the additional procedures. During this time, CMS reimbursed hospital outpatient departments very differently. Before 2000, hospitals were reimbursed on a ‘cost plus’ system. In August 2000, CMS switched to a prospective payment system that assigned reimbursement rates to each surgery based on the estimated cost of each surgery rather than grouping large numbers of surgeries into nine payment groups as with ASC reimbursement.

During the time period of our analysis, Medicare reimbursed all the procedures performed at ASCs within a category at the same rate. However, these surgeries did not necessarily cost the same amount to perform, so certain procedures were more profitable than others. In particular, two of the nine categories contain over half of the surgeries Medicare allows ASCs to perform. The surgeries within these categories are very diverse, creating variability in the profitability of each surgery.

To determine an ASC's profit from performing a surgery, the ASC's cost of performing that surgery must also be known. Virtually, no cost data exist regarding surgeries performed at ASCs, so we use indirect estimates of surgical costs.5 Since 2000, CMS has annually estimated the median cost of performing a particular surgery at an HOPD. While the median cost of performing a surgery at an HOPD differs in absolute terms from the median cost of performing that surgery at an ASC, the relative cost between the ASC and the HOPD should be similar for most surgeries. This assumption comes from MedPAC's (2004) suggestion to Congress that CMS align the reimbursement rates for ASCs and HOPDs. As they stated in the report,

> ‘Using similar procedure groups and relative weights in the ASC and HOPD payment systems would make it easier to align rates for the same services across settings. Although the actual rates might not be the same in each setting, the relative payment difference between a colonoscopy and upper gastrointestinal endoscopy, for example, would be similar in each site of care.’

Using this assumption, we can estimate the profitability of a surgery with the following expression:

$$\text{profrate}_{it} = \frac{\text{FacFee}_{iht} + 0.5 * \sum_{n=1}^{x} \text{FacFee}_{int}}{\text{HOPDMedianCost}_{iht}}$$

The numerator represents the total reimbursement a facility receives for surgical encounter i in year t, which may or may not include multiple procedures. This reimbursement consists of the full facility fee FacFeeiht for the procedure with the highest reimbursement (identified by subscript h), plus 50% of the facility fee for each of x additional procedures. The denominator HOPDMedianCostiht represents the median cost of performing the procedure with the highest reimbursement at a hospital, as calculated by CMS using hospital cost-to-charge ratios specific to each hospital's cost centers. We do not add in costs for secondary procedures because the CMS cost estimates represent the cost of the non-physician inputs into surgery, so it is unlikely that performing an additional procedure during a surgical encounter increases the costs by 50% of the cost estimate for that procedure. Ignoring the costs for the secondary procedure is not critical to our results: the results remain very similar if we add in 25, 50, or 75% of the costs for secondary procedures, or if we exclude reimbursements from secondary procedures.6

As mentioned previously, CMS only began computing the median costs in 2000, while the NSAS data consist of the years 1994–1996 and 2006. For 2006, we use the 2006 CMS cost information (Centers for Medicare & Medicaid Services, 2006). For 1994–1996, we estimate the costs using the 2000 CMS cost information through the following formula (Centers for Medicare & Medicaid Services, 2001):

$$\text{HOPDMedianCost}_{iht} = \text{HOPDMedianCost}_{ih,2000} \frac{\text{CPI}_{\text{MC}_t}}{\text{CPI}_{\text{MC}_{2000}}}$$

where t = 1994, 1995, or 1996; CPI_{MC} is the consumer price index (CPI) for medical care in year t; and $\text{CPI}_{\text{MC}_{2000}}$ is the average CPI for medical care over the last six months of 1999 and the first six months of 2000 (the 12 months CMS used to compute the 2000 costs). Equation (2) therefore approximates the ratio of the cost of performing surgery in 1994–1996 to the cost of performing surgery in 2000 with the ratio of the price of medical care in 1994–1996 to the price of medical care in 2000, effectively adjusting the median cost to year *t* dollars.

An alternative measure of profitability comes from a proposed rate change CMS tried to implement in 1998. CMS attempted without success to update the aforementioned Medicare reimbursement rates for ASCs – which were based on 1986 costs – several times during the 1990s. In 1998, CMS constructed a new method for grouping outpatient surgeries, the Ambulatory Payment Classification (APC). CMS grouped procedures into an APC that were clinically similar and had similar costs. The APC system divided roughly 2464 ASC approved surgeries into 137 reimbursement categories rather than the 9 that were used. Compared to the current ASC reimbursement system, reimbursements for each APC category should be relatively closer to the actual cost of performing a surgery from that APC. CMS never implemented this system, but they did publish the proposed reimbursement rates (Health Care Financing Administration, 1998). If the proposed reimbursement rates are a good estimate of how much it actually costs to perform a surgery at an ASC, the ratio between the actual and proposed reimbursement rate provides an estimate of the profitability of a surgery. We therefore define

$$\text{PayDiffRatio}_{it} = \frac{\text{FacFee}_{iht} + 0.5 * \sum_{n=1}^{x} \text{FacFee}_{int}}{\text{ProposedPayRate}_{iht}}$$

where ProposedPayRate*iht* is the proposed reimbursement rate of the procedure performed at the surgical encounter with the highest reimbursement rate. We approximate the costs in 1994–1996 and 2006 with the 1998 proposed reimbursement system using an equation analogous to (2):

$$\text{ProposedPayRate}_{iht} = \text{ProposedPayRate}_{ih,1998} \frac{\text{CPI}_{\text{MC}_t}}{\text{CPI}_{\text{MC}_{1998}}}$$

where t = 1994, 1995, 1996, or 2006 and $\text{CPI}_{\text{MC}_{1998}}$ is the CPI for medical care in 1998.

A limitation of our data is that the NSAS classifies each patient's surgery using The International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) system. However, Medicare reimburses surgeries using the Current Procedural Terminology Fourth Edition (CPT) system. That is, if a patient had an arthroscopy in the NSAS, the code for the arthroscopy in the NSAS would not match with the code for the arthroscopy in the Medicare data that describes the profitability of the surgery. We obtained a crosswalk from the National Bureau of Economic Research that links these two coding systems, but the crosswalk does not provide a one-to-one match for all codes. A particular ICD-9-CM code may be associated with multiple CPT codes. If a code matches to multiple CPT codes, the reimbursement and cost information for all the matched CPT codes are averaged so the ICD-9-CM code is reimbursed at that average amount and costs that average amount to perform.7 After dropping outliers, our sample contains 86 551 observations represented by 506 different ICD-9 codes.8 Most of the sample occurs from 1994 to 1996, as only 5058 observations are from 2006.

We present the summary statistics for the variables used in the analysis in Table I. About 55% of the surgeries in our sample were performed at an ASC. The average profit margin is 1.4 using the profrate measure and 1.9 using the paydiffratio measure. Surgeries on the eye and digestive system are overwhelmingly the most common types of procedures performed.

Table I. Summary statistics

Variable	**Mean (standard deviation)**
Treated at an ASC	0.546
	(0.498)
Age	75.423
	(6.592)
Male	0.403
	(0.491)
Multiple Procedures	0.518
	(0.500)
Second Insurance: Private	0.639
	(0.480)
Second Insurance: Medicaid	0.080
	(0.271)
Second Insurance: Other	0.026
	(0.160)
Number of Diagnoses	1.536
	(1.014)

General Anesthesia	0.032
	(0.176)
Nervous	0.009
	(0.096)
Eye	0.557
	(0.497)
Ear	0.004
	(0.065)
Nose/Mouth	0.008
	(0.087)
Respiratory	0.013
	(0.114)
Cardiovascular	0.006
	(0.075)
Digestive	0.255
	(0.436)
Urinary	0.059
	(0.235)
Male Genital	0.006
	(0.079)
Female Genital	0.006
	(0.079)
Musculoskeletal	0.037
	(0.189)
Integumentary	0.032

	(0.175)
ProfRate	1.434
	(0.509)
PayDiffRatio	1.892
	(0.381)
N	86 551
Unique ICD9 codes	506

4. METHODS

We estimate linear probability models of the following form:

$$\mathrm{ASC}_{it} = \alpha + \beta \ln(\mathrm{profmeas}_{it}) + \mathbf{Controls}_{it}\ \delta + \tau_t + \varepsilon_{it}$$

ASC*it* is an indicator variable equal to 1 if patient *i* in year *t* was treated at an ASC and 0 if he was treated at a hospital, while profmeas*it*represents either profrate*it* or paydiffratio*it*. The model also includes a set of control variables ***Controls*** and year-fixed effects *τt*, while *εit*is the error term. We compute clustered standard errors at the ICD-9 code-by-year level to account for possible correlation in unobservable determinants of surgery location within ICD-9 code-year groups.

We use a linear probability model with a logarithmic functional form for the profit measure because this specification allows for straightforward interpretation, as *β* is the approximate effect of a 100% increase in profitability on the probability a patient is treated at an ASC. The percentage interpretation gives the magnitude of the change in profitability and also makes the estimates for *profrate* and*paydiffratio* more comparable than they would be otherwise. Our results are robust to the use of probit models and also models that use the level instead of the log of profitability.[9]

We include several controls, many of which are motivated by the findings of Wynn *et al*. (2004). First, we control for gender, age, and age squared. An older patient is likely unhealthier than a younger patient and may therefore be a worse candidate for treatment at an ASC. Next, we include the patient's number of diagnosis codes and number of diagnosis codes squared since more diagnosis codes likely indicates worse health. We also include dummy variables for whether the patient received general anesthesia and whether he underwent multiple procedures. Both variables are indications that the procedure is relatively complex and therefore less likely to occur at an ASC. We also control for whether in addition to Medicare the patient paid for his procedure with private insurance, Medicaid, or another type of insurance. These variables should help proxy for income, since Medicaid recipients are generally poor while higher income individuals are more likely to have private insurance.

Given the difficulties in constructing profitability measures as discussed in Section 3, measurement error in these variables is a concern. While measurement error will reduce the precision of our estimation, it is not clear that our estimators will be systematically biased.[10] We address the issue of measurement error by using the two different measures of profitability. If the results are similar using both measures, it will increase our confidence that bias from measurement error is not driving our results.

Apart from measurement error, in Equation (5) our estimator of β is unbiased under the assumption that profitability is uncorrelated with the error term. This assumption would be invalid if surgeries performed on certain body parts or systems are more profitable than others and also more amenable to being performed at ASCs for reasons aside from profitability. Table II reports the mean profit margins and proportion of surgeries performed at an ASC by surgery type. We group surgeries into those related to the: nervous system, eye, ear, nose/mouth, respiratory system, cardiovascular system, digestive system, urinary system, male genital, female genital, musculoskeletal system, integumentary, and also surgeries related to miscellaneous procedures. Among these 13 categories, eye surgeries have by far the highest probability of occurring at an ASC and are also among the most profitable. While this may partially reflect a causal relationship, unobservable factors such as the low probability of serious complications likely contribute to the high proportion of eye surgeries that occur at an ASC. Since over half of the sample consists of eye procedures, failing to account for surgery category may result in a spurious positive relationship between procedure profitability and the probability it is performed at an ASC. We therefore also estimate models that include a set of surgery type-by-year effects, created by interacting each of the surgery type dummy variables by each of the year-fixed effects. We use surgery type-by-year-fixed effects instead of merely surgery type-fixed effects in order to allow the impacts of surgery types on the probability of treatment at an ASC to change over time. We choose that approach to account for the significant changes in ASC prevalence during our sample period.

Table II. Mean and standard deviations for key variables by surgery type

Variable	ASC	ProfRate	PayDiffRatio
Nervous	0.270	0.971	1.516
	(0.444)	(0.361)	(0.473)

Variable	**ASC**	**ProfRate**	**PayDiffRatio**
Eye	0.684	1.498	1.986
	(0.465)	(0.510)	(0.324)
Ear	0.465	0.922	1.614
	(0.499)	(0.283)	(0.583)
Nose/Mouth	0.295	1.052	1.607
	(0.456)	(0.369)	(0.551)
Respiratory	0.230	1.348	1.556
	(0.421)	(0.326)	(0.363)
Cardiovascular	0.060	0.812	1.376
	(0.238)	(0.318)	(0.652)
Digestive	0.390	1.561	1.825
	(0.488)	(0.453)	(0.346)
Urinary	0.426	1.066	1.832
	(0.495)	(0.247)	(0.409)
Male Genital	0.527	1.791	2.168
	(0.500)	(0.747)	(0.331)
Female Genital	0.235	0.941	1.583
	(0.425)	(0.202)	(0.313)

Variable	ASC	ProfRate	PayDiffRatio
Musculoskeletal	0.395	0.935	1.608
	(0.489)	(0.266)	(0.449)
Integumentary	0.278	1.196	1.775
	(0.445)	(0.555)	(0.512)
Miscellaneous	0.404	0.878	1.441
	(0.494)	(0.366)	(0.369)

In the models with surgery type-fixed effects, we identify β on the basis of variation in profitability between procedures performed on the same body part or system. While this should reduce omitted variable bias, it also eliminates much of the potentially meaningful variation in profitability, raising the issues of over controlling and multicollinearity. Over controlling occurs if we control for the mechanisms through which the independent variable of interest affects the dependent variable (Wooldridge, 2006, p. 203–204). Since profitability should not determine the part of the body on which a surgery is performed (instead, the opposite is probably true), we do not expect that over controlling is a problem in our analysis.11 Multicollinearity does not bias coefficient estimators but does inflate standard errors. If the multicollinearity is severe, estimates may be too imprecise to be useful. To assess the extent of multicollinearity in our estimation, we compute variance inflation factors (VIFs) for the profitability measure.12 Researchers typically conclude that multicollinearity is a problem if the VIF is greater than 10 (Wooldridge, 2006, p. 99).

Controlling for surgery type should, to some degree, also address the concern that the NSAS data do not contain information on which physician performs each surgery, preventing the inclusion of controls for the physician's level of ownership in ASCs. This omission could bias our estimators upward since financially motivated physicians may be both more likely to perform profitable procedures and also to own a share of an ASC and therefore perform surgeries there. Controlling for surgery type should reduce the extent of this bias because a financially motivated physician's best opportunity to influence the profitability of the procedures he performs lies in his choice of specialty, and surgery type-fixed effects are similar to physician specialty-fixed effects.

We estimate additional models to address the issue that the majority of our sample consists of data from 1994 to 1996, raising the question of the applicability of the results. There is little reason to expect that physicians would have responded to financial incentives in the mid 1990s but not today, or vice versa. A body of research spanning many years suggests that physicians respond to financial incentives, so this response does not appear to be limited to a specific time period.13 While we therefore feel it is unlikely that the direction of the effect of profitability on P(ASC) has changed since the 1990s, the magnitude may be different given the changes in ASC market structure. We estimate two additional models in order to examine this possibility. First, we include the interaction of profitability with an indicator variable equal to one if the year is 2006. If the interaction term is significant, this would provide evidence that the effect has changed over time. Second, we restrict the sample to the 2006 wave and compare the coefficient estimate to the estimate obtained using all four years.

In a final robustness check, we account for unobservable determinants of surgery location that vary by state and area population density by including state-fixed effects and a binary variable reflecting whether the surgery takes place in an MSA. In particular, these variables proxy for the average ASC ownership share of physicians in the area and therefore further addresses the concern of bias from omitting physician ownership share. ASC presence varies considerably by state, suggesting that average physician ownership share also varies considerably by state since these characteristics should be highly correlated.14 Similarly, ASCs are much more prevalent in urban than rural areas, so average physician ownership share is likely higher in urban areas. We suspect that if bias from omitting physician ownership stakes is a serious problem in our analysis, including state effects and the MSA dummy will impact our results to some degree, although not as much as if we were able to control for ownership stakes directly. Since the public use NSAS data do not contain geographic identifiers narrower than Census region, for the state effects regressions we use the restricted NSAS data, graciously made available by the U.S. Census Bureau and accessed at the Triangle Census Research Data Center in Durham, NC. The restricted data and MSA variable were only available for the 2006 wave, so our regressions that include state-fixed effects and MSA consist of only that year.15

5. RESULTS

Table III displays the coefficient estimates for the profitability variables from the regressions discussed in Section 4. The left half of the table uses profrate as the profitability measure, while the right half uses paydiffratio. Column (1) reports the results from the estimation of Equation (5), while column (2) adds the surgery type-by-year effects, column (3) adds the interaction term, column (4) restricts the sample to 2006, and column (5) adds the state effects and MSA dummy.

At the bottom of the table, we also report the number of observations, R2, and VIF for the profitability variable.

Table III. Effect of profitability on the probability that the patient was treated at an ASC

	Profit measure = ln(profrate)					**Profit measure=ln(paydiffratio)**				
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Profit	0.158	0.120	0.122	0.125	0.131	0.237	0.135	0.135	0.241	0.285
	[0.064]*	[0.043]**	[0.045]**	[0.075]†	[0.064]*	[0.098]*	[0.066]*	[0.068]*	[0.135]†	[0.128]*
Profit*Year 2006	—	—	−0.057	—	—	—	—	−0.018	—	—
			[0.082]					[0.124]		
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	No	No	No	No	Yes	No	No	No	No
Year-by-Surgical-Type Fixed Effects	No	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes
State Fixed Effects and MSA	No	No	No	No	Yes	No	No	No	No	Yes
Years	All	All	All	2006	2006	All	All	All	2006	2006
Observations	86 551	86 551	86 551	5058	5058	86 551	86 551	86 551	5058	5058
R^2	0.145	0.195	0.195	0.134	0.322	0.142	0.192	0.192	0.137	0.327
VIF	1.090	1.445	1.502	1.656	1.815	1.338	1.527	1.592	1.520	1.683

1. Robust standard errors, clustered by ICD9 code-year, are in brackets. †Significant at 10%; *significant at 5%; **significant at 1%.

Robust standard errors, clustered by ICD9 code-year, are in brackets. †Significant at 10%; *significant at 5%; **significant at 1%

Table IV. Full regression output for preferred specification (all years; year-by-surgical-type fixed effects)

1. Robust standard errors, clustered by ICD9 code-year, are in brackets. †Significant at 10%; *significant at 5%; **significa
1%. Effects of a 1 standard deviation increase are in parentheses.

Ln(profrate)	0.120	—
	(0.037)	
	[0.043]**	
ln(paydiffratio)	—	0.135
		(0.025)
		[0.066]*
Age in Years	0.016	0.017
	(−0.009)	(−0.008)
	[0.006]*	[0.006]**
Age Squared	−0.0001	−0.0001
	[0.00004]**	[0.00004]**
Male	0.014	0.012
	[0.006]*	[0.006]*
Multiple Procedures	0.012	−0.006
	[0.021]	[0.030]
Second Insurance: Private	0.117	0.119
	[0.011]**	[0.011]**
Second Insurance: Medicaid	0.107	0.110
	[0.015]**	[0.015]**
Second Insurance: Other	0.105	0.108
	[0.022]**	[0.022]**
Number of Diagnoses	−0.158	−0.159
	(−0.114)	(−0.114)
	[0.019]**	[0.018]**
Number of Diagnoses Squared	0.009	0.009
	[0.002]**	[0.002]**
General Anesthesia	−0.083	−0.083
	[0.028]**	[0.028]**

In all regressions, the coefficient estimates for the profit measure variables are significant and positive, implying that as a patient's surgical procedure increases in profitability, he has a greater probability of receiving treatment at an ASC. In the regressions without the surgery type-by-year effects, a 10% increase in profitability increases P(ASC) by 1.6 percentage points using profrate as the profit measure and 2.4 percentage points using paydiffratio. Column (2) shows that including surgery type-by-year effects shrinks the estimated effects and makes them less sensitive to the choice of profit measure. A 10% increase in profitability now increases P(ASC) by 1.2 percentage points using profrate and 1.4 percentage points using paydiffratio. Including surgery type-by-year effects does not lead to a multicollinearity problem, as the VIFs are under two. In fact, including them improves the precision of the estimates, reflecting the strong correlation between body part/system and surgery location. We therefore prefer the model with the surgery type-by-year effects to the model without them, and we include them in all subsequent regressions.

As seen in columns (3) and (4), we cannot conclude that the average effect of profitability on P(ASC) changed between the mid-1990s and 2006. The interaction term between the profit variable and the year 2006 indicator is highly insignificant using both profit measures. The coefficient estimate for profrate obtained with the 2006 subsample is virtually identical to the estimate obtained with the full sample. When paydiffratio is used the estimate is larger with the 2006 subsample, but the estimate from the full sample is within one standard error so we cannot conclude that this difference reflects anything other than sampling error.

Column (5) shows that adding the state effects and MSA dummy has little impact on the coefficient estimates reported in column (4) but increases the R^2 considerably.16 These results suggest that the probability an outpatient surgery is performed at an ASC depends heavily on location – likely because of the variation in ASC presence between different areas – but that location does not influence the profitability measures conditional on the controls.

In Table IV, we report more complete regression output for our preferred specification, which corresponds to column (2) from Table III.17 The results for the controls are in most cases as expected and consistent with the findings of Wynn et al. (2004). The marginal effect of age on P(ASC) becomes negative after about 70 years of age and is therefore negative for most of our sample. Men are slightly more likely than women to be treated at an ASC. Patients undergoing multiple procedures in one surgical encounter are more likely to be admitted into an ASC. Having a second form of insurance is associated with an increase in P(ASC), while an increase in the number of diagnosis codes reduces P(ASC). Receiving general anesthesia leads to a statistically significant reduction in P(ASC).

We can use these results to evaluate the economic significance of the effect of profitability on surgery location by comparing it to the effects of the control variables. Since it is not obvious how a 10% increase in profitability compares in magnitude to a one unit increase in the control variables, we compute the effect of a one standard deviation increase at the mean for profitability as well as the other non-binary variables in the model – age and number of diagnosis codes. We report the effects of these one standard deviation increases in parentheses beneath the coefficient estimates. Increasing profitability by one standard deviation at the mean increases P(ASC) by 2.5–3.7 percentage points. For comparison, a one standard deviation increase in age at the mean leads to a drop in P(ASC) of 0.8–0.9 percentage points. A one standard deviation increase in the number of diagnosis codes – which is a proxy for patient health – has a greater impact, decreasing P(ASC) by 11.4 percentage points. Our other control variables are dummies, so for them we focus on the coefficient estimates instead of standard deviation increases. The effect of a one standard deviation increase in profitability is stronger than the effects of being male and having multiple procedures, but weaker than the effects of having a second form of insurance and receiving general anesthesia (a proxy for procedure complexity).18 Overall, we conclude that profitability has an important impact on surgery location but is only one of several factors that play a role. In fact, patient health and procedure complexity may be more important determinants than profitability. The surgery location decision certainly appears more complex than physicians simply assigning their most profitable patients to an ASC and their least profitable patients to a hospital.

6. CONCLUSION

In this paper, we provide a first step in understanding how a surgical procedure's profitability impacts the decision of physicians to perform it at an ASC instead of a hospital. After controlling for surgery type, we find that a 10% increase in a patient's profit margin is associated with a 1.2 to 1.4 percentage point increase in the probability a physician treats a patient at an ASC. Our results are robust to the use of two different profit measures and controls for state and whether the procedure was performed in an MSA.

While our estimation of a positive effect is consistent with cherry picking behavior among physicians, it is also consistent with ASCs creating new demand for high-profit procedures, in which case the entry of ASCs would not financially hurt hospitals. Given Bian and Morrissey's (2007) finding that ASC entry does impact hospitals' provision of outpatient surgeries, we consider it unlikely that our results come completely from new demand without any effect on hospitals. Future research should attempt to disentangle the portions of the effect that can be attributed to cherry picking and new demand.

Further, even if ASCs do reduce the average profitability of procedures performed by HOPDs, this does not necessarily mean that they reduce social welfare. Future research should also weigh potential losses from reduced hospital profitability (potentially leading to reduced provision of uncompensated care) against potential gains from the reduced cost of performing outpatient surgeries. Similar to specialty hospitals, ASCs could be introducing beneficial competition that would lower market prices without decreasing the level of quality. Also, ASCs may offer conveniences to physicians and patients that hospitals do not.

An additional avenue for future research is to examine whether the results change after controlling for the operating physician's ownership stakes in ASC facilities. One approach would be to use data that includes the identity of the physician performing the procedure. This would allow for physician-fixed effects, which would eliminate bias from omitting ASC ownership stakes to the extent the stakes are constant over time. Another approach would be to control for ownership stakes directly, potentially using ownership information obtained from the state agencies that oversee the licensing of ASCs. Finally, future work should examine whether our results persist using more recent data and non-Medicare patients.

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1 In 2004, 2150 Medicare outpatient procedures had a higher facility fee at hospitals compared to ASCs.

2 More broadly, in the literature of how physicians respond to financial incentives, several economists have found that changes in price influence the quantity of healthcare services physicians provide. Rice et al. (1999) found that a reduction in Medicare physician fees caused physicians to treat more privately insured patients due to an increase in the relative payments physicians would receive. Yip (1998) found that, following a decline in the Medicare physician fee for performing Coronary Artery Bypass Grafts (CABGs), physicians performed more CABGs both among their privately insured patients and those patients insured by Medicare. In another related area of research, economists have examined whether physicians induce demand in health-care facilities that they own. Hillman et al. (1990) found that 'doctors who own imaging machines ordered four times as many imaging tests as those referring to independent radiologists. Further, they charged more than independent radiologists for similarly complex procedures'. Mitchell and Sunshine (1992) found the same result for physicians who own radiation therapy facilities. These studies, however, do not distinguish between correlation and causality, so they cannot conclude whether these results reflect a profit motive or simply show that physicians who believe the most strongly in imaging are those most likely to invest in the equipment.

3 The sampling frame for hospitals consisted of all non-institutional hospitals listed in the SMG Marketing Group/Verispan Hospital Market Database that were not operated by the federal government, had at least six beds, and had an average patient stay of less than 30 days. The sampling frame for ASCs consisted of facilities listed in the SMG Marketing Group/Verispan Freestanding Outpatient Surgery Center Database or the CMS Provider-of-Services file that were certified by CMS for Medicare participation, excluding those that specialized in dentistry, podiatry, abortion, family planning, or birthing. The NSAS is a complex survey, but we do not use sampling weights since they are not available in the 1994–1996 data.

4 However, there is little reason to suspect that this will affect our conclusions. The state-fixed effects and MSA dummy variable discussed in Section 4 should reduce any resulting bias.

5 CMS conducted ASC cost surveys in 1986 and 1994, but they did not keep records of these surveys.

6 We do not present these results, but they are available on request.

7 In cases where an ICD-9-CM code matches to multiple CPT codes, we construct the simple average of possible payment rates.

8 We define an outlier as a patient above the 99th percentile or below the 1st percentile for either profit measure. Also, we require patients to have information for both profit variables to be included in the sample.

9 Results from these models are available on request.

10 Under the assumption that our observed profitability measures are uncorrelated with the extent of the measurement error, the estimators of β are unbiased but the standard errors will be inflated. Alternatively, if we assume that the actual profitability measures are uncorrelated with the extent of the measurement error, our estimators will be biased toward zero and the standard errors will again be inflated (Wooldridge, 2006, p. 318–320). Because our profitability measures are ratios instead of levels, there is no clear reason to suspect that both these assumptions are invalid. Therefore, it seems unlikely that measurement error will cause us to overestimate the effect of profitability on the probability a surgery is performed at an ASC.

11 If physicians induce demand, profitability could influence whether or not a procedure is performed. However, conditional on the procedure being performed (and therefore being in the sample), profitability should not determine which body part the surgery targets. For example, if a patient needs eye surgery, a doctor cannot instead perform a digestive procedure simply because it is more profitable.

12 VIF = 1/(1 − R2), where R2 is from the regression of the log of profitability on the other independent variables.

13 For examples, see Mitchell (2008), Young et al. (2007), Conrad et al. (1998), Gruber and Owings (1996), Hemenway et al. (1990), Hillman et al. (1989), and Hickson et al. (1987).

14 Southern and western states have the most ASCs per capita, likely because state policies in these areas allow for easier entry of ASCs, while northeast states have the fewest. A similar

phenomenon is found in location of specialty hospitals as noted by the October 2003 report by the U.S. General Accounting Office (GAO, 2003).

15 We also estimated models including region fixed effects using the public NSAS data from 1994–1996. Adding region-fixed effects made virtually no difference to the coefficient estimates. These results are available on request.

16 In unreported regressions (results available on request), we show that the results remain very similar if we add only the state effects or only the MSA variable, as opposed to adding them both at the same time.

17 Full regression output from the other specifications is available on request.

18 The strong impact of paying with a second form of insurance may itself reflect a profit motive, although if this was the case we would expect to find a larger difference between the effects of having private insurance and having Medicaid. Perhaps physicians feel that having any type of second insurance lowers the risk that payment will not be made.

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