Does the Profitability of an Outpatient Surgery Influence where it is Performed? A Look at Ambulatory Surgery Centers and Hospitals

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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 potentially treat their most profitable patients at their ASCs and less profitable patients at hospitals, reducing hospitals' profit. This paper asks if the profitability of an outpatient surgery impacts where a physician performs the surgery. Using data from the National Survey of Ambulatory Surgery, we find that higher profit surgeries do have a higher probability of receiving treatment at an ASC compared to a hospital. After controlling for the type of surgery performed, we find that a 10% increase in a surgery's profitability is associated with a 1 to 2 percentage point increase in the probability the surgery is performed at an ASC.

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1. INTRODUCTION AND BACKGROUND

Do Ambulatory Surgery Centers (ASCs) perform more profitable surgeries than Hospital Outpatient Departments (HOPDs)? A physician with ownership in an ASC may treat his most profitable patients at the ASC and his least profitable patients at a 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 to the HOPD. However, this behavior could reduce the profitability of a HOPD, which could be problematic since hospitals often claim they subsidize certain healthcare services, like uncompensated care, with the profit earned from their HOPD (Abelson, 2004).

<INSERT TABLE I HERE>

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 shown in Table I, ASCs are typically for-profit freestanding clinics solely owned by physician investors (MedPAC, 2005). According to Casalino *et al.* (2003), in 2001 3,371 Medicare-certified ASCs competed for patients amongst themselves and approximately 3,859 HOPDs. ASCs could potentially reduce healthcare expenditures for consumers, as outpatient surgeries cost less to perform at ASCs because they do not have the same overhead as hospitals (Kelly, 2003). This is reflected in Medicare's lower reimbursement rates for many of the surgeries performed at ASCs compared to those performed at HOPDs. In 2004, 2,150 Medicare outpatient procedures had a higher facility fee at hospitals compared to ASCs.

However, anecdotal evidence suggests that ASCs have the potential to cause hospitals serious financial harm (Casalino *et al.*, 2003). For example, an administrator of a hospital in St.

Louis, MO claimed that between 2000 and 2005 the percentage of the hospital's revenue coming from outpatient services, which tend to be profitable for hospitals, 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. In its first quarter financial report from 2003, the Hospital Corporation of America (HCA) (which owns 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 (Casalino *et al.*, 2003).

Competition from ASCs could reduce hospital profits in two ways: by reducing hospital outpatient surgery volume and – if physicians cherry pick – by reducing the average profitability of the outpatient surgeries that hospitals do ultimately perform. Bian and Morrisey (2007) examined the first of these possibilities. They found that an increase in the number of ASCs per 100,000 people in a Metropolitan Statistical Area 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.

We examine the second of these possibilities by estimating the relationship between the profitability of a surgical procedure and the probability a physician performs the procedure at an ASC instead of a hospital. A ceteris paribus positive effect would provide evidence that cherry picking behavior occurs among physicians with an ownership stake in ASCs, although to some degree ASCs creating new demand for high-profit procedures could also create such an effect.[1] While no studies to date have estimated the relationship between profitability and the decision of a physician to treat a patient at an ASC or hospital, some research suggests that a connection is

[1] Based on Bian and Morrisey's (2007) findings that some outpatient surgeries migrate from hospitals to ASCs after the entry of ASCs, we find it unlikely that a positive effect would be entirely due to new demand with no impact on hospitals.

possible. 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. Also, Wynn *et al.* (2004) found that, for both cataract surgeries and colonoscopies, patients treated at a HOPD were more likely to be Medicaid eligible than those treated at an ASC.[2] Casalino *et al.* (2003) reported that 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" (p. 62). It is certainly possible theoretically that the typical physician owner does not treat his most profitable patients at an ASC. His ownership share may be small enough that the income he would collect from the ASC facility fee may be small in comparison to the physician fee, so he may not go to the trouble of sorting patients into ASCs or HOPDs based on profit. The effect of procedure profitability on location of treatment is therefore an empirical question.[3]

To see if the profitability of a patient influences where that patient is treated, this paper utilizes the National Survey of Ambulatory Surgery (NSAS). This dataset contains information

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[2] They also found that patients undergoing cataract surgery at a HOPD were more likely to be female, older, and African American compared to those treated at an ASC. Patients treated at a hospital also suffered from more risk factors, such as hypertension or diabetes, and were considered to be greater health risks. 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. For both categories of surgery, patients in the western part of the country had a higher probability of receiving treatment at an ASC. Also, for both categories of surgery, patients undergoing multiple procedures were more likely to be treated at an ASC rather than at a hospital. The authors also concluded that regardless of the location of surgery, adverse outcomes following surgery occurred infrequently for both categories of surgery.

[3] 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. This result implies that physicians have a strong income effect. In another related area of research, economists have examined how 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.

on over 88,000 outpatient surgeries performed on Medicare patients. We also use information from the Centers for Medicare & 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 and methods of sample construction, as well as the inclusion of controls for surgery type and geographic region. We conclude that a 10% increase in profitability is associated with a 1 to 2 percentage point increase in the probability a physician performs a procedure at an ASC.

2. DATA

Our primary data source is the NSAS, which examines a sample of patients insured by Medicare who underwent outpatient surgery from 1994 through 1996 and also 2006. The survey collected the following information for each surgery: if 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 and surgical procedure codes; and (except for 2006) the geographic region where the surgery occurred.

To calculate a patient's profitability from the perspective of a physician with ownership in an ASC, we determine the facility fee an ASC collects and the costs they incur for performing a surgery. For Medicare patients, the facility fee may greatly exceed the cost associated with performing that surgery because Medicare bases the facility fees it pays to ASCs on a 1986 survey that asked ASCs their costs for performing a surgery. Since then, Medicare has adjusted the facility fee occasionally to account for inflation. However, during the time frame of the NSAS, CMS did not adjust the facility fee to account for greater efficiency in performing certain outpatient surgeries.[4] Since it is unlikely the cost of performing surgeries has changed at the same rate for all outpatients surgeries, over time some procedures likely became more profitable than others. It is these more profitable surgeries that physicians should have a greater incentive to perform at the ASC.

The ASC facility fee for each surgery comes from the CMS website (CMS, 2009). In 2004, Medicare grouped 2,464 surgical procedures into 9 reimbursement categories. Since Medicare reimburses all the procedures in a category at the same rate, but they do not necessarily cost the same amount to perform, certain procedures are more profitable to perform 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. Therefore, there is 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. Unfortunately, virtually no cost data exist regarding surgeries performed at ASCs. CMS conducted ASC cost surveys in 1986 and 1994, but they did not keep records of these surveys. Therefore, indirect estimates of surgical costs must be used. Since 2000, CMS has annually estimated the median cost of performing a particular surgery at a HOPD. While the median cost of performing a surgery at a 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) recent suggestion to Congress that Medicare align the reimbursements rates for ASCs and HOPDs. As they stated in the report,

[4] Recently, CMS has instituted a new reimbursement system where the ASC facility fee for a particular procedure equals 67 percent of the corresponding HOPD facility fee.

"**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.**"

This means the actual cost of performing a surgery at an ASC would differ from the actual cost of performing a surgery at a HOPD but the relative costs should be similar for most surgeries. Using this assumption, we can estimate the profitability of performing procedure *i* at an ASC with the following expression.

(1) $$\text{profrate}_i = \frac{\text{FacFee}_i}{\text{HOPDMedianCost}_i}$$

$HOPDMedianCost_i$ represents the median cost of performing surgery *i* at a hospital using Medicare claims from July 1, 1999 through June 30, 2000 (Centers for Medicare & Medicaid Services 2001). Since physicians receive the same physician fee for performing a surgery at either an ASC or HOPD, the profit measures only include the facility fee (FacFee_i). Using this method, we could rank every surgery performed in the NSAS by its profitability. However, this measure does not give the absolute level of profit for each surgery.

An alternative measure of profitability comes from a proposed rate change Medicare tried to implement in 1998. During the time period of our data, Medicare based its ASC facility fee schedule on a 1986 survey that measured the cost of performing surgery at an ASC. It is unlikely that the fee schedules released several years after that 1986 survey represented the true cost of performing surgery. CMS attempted, without success, to update the reimbursement system several times during the 1990's. For example, 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 cost similar amounts to provide. The APC system divided roughly 2,464 ASC approved surgeries into 137 reimbursement categories rather than the 9 currently 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 for this system (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

$$\text{(2)} \qquad \text{PayDiffRatio}_i = \frac{\text{FacFee}_i}{\text{ProposedPayRate}_i}$$

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 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 (NBER) 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. We therefore consider two types of samples: a "full sample" that includes all ICD-9-CM codes and a "matched sample" that includes only those ICD-9-CM codes that had a unique match to a CPT code. In the full sample, 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. After dropping outliers, our full and matched samples contain 88,123 and 34,581 observations, respectively.[5] The full sample represents surgeries described by 498 different ICD-9 codes while the matched sample represents surgeries described by 170 different ICD-9 codes. Most of the sample occurs from 1994 to 1996, with only 5,621 observations in the full sample from 2006.

We also utilize NSAS data on age; number of diagnosis codes; gender; whether or not the patient underwent multiple procedures; whether or not he paid for his procedure with private insurance, Medicaid, or another type of insurance in addition to Medicare; and whether or not he received general anesthesia. In some models, we also include "surgery type" dummy variables that describe either the part of the body or system of the body where the operation occurred. We include dummies for the nervous system, eye, ear, nose/mouth, respiratory system, cardiovascular system, digestive system, urinary system, male genital, female genital, musculoskeletal system, integumentary, and miscellaneous procedures.

<INSERT TABLE II HERE>

In Table II, we present summary statistics for both the full and matched samples. Across the two samples, most variables have similar summary statistics. In the matched sample, patients undergoing multiple procedures or eye procedures are more common and patients undergoing digestive procedures are less common. In both samples, surgeries on the eye and digestive system are overwhelmingly the most common types of procedures performed.

3. METHODS

[5] 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.

We estimate linear probability models of the following form:

(3) $$ASC_{ij} = \alpha + \beta \ln(profmeas_{ij}) + \boldsymbol{Controls_{ij}\delta} + \tau_j + \varepsilon_{ij}$$

ASC_{ij} is an indicator variable equal to 1 if patient *i* in year *j* was treated at an ASC and 0 if he was treated at a hospital, while $profmeas_i$ represents either $profrate_i$ or $paydiffratio_i$. The model also includes a set of control variables *Controls* and year fixed effects τ_j, while ε_{ij} is the error term.

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 a sense of 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.

We include several controls, some of which come from Wynn *et al*. (2004), to influence whether a physicians performs a procedure at an ASC. 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 own private insurance.

Given the difficulties in constructing profitability measures as discussed in Section 3, measurement error in these variables is a concern. While this will reduce the precision of our estimation, it is not clear that our estimators will be systematically biased.[6] Since no perfect measures of profitability exist, we address the issue of measurement error by using the two different measures of profitability and both the full and matched samples. If the results are similar using all four approaches, it will increase our confidence that bias from measurement error is not driving our results.

<INSERT TABLE III HERE>

Aside from measurement error, in equation (3) 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 III reports the mean profit margins and proportion of surgeries performed at an ASC by surgery type. Among the thirteen 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 the

[6] Under the assumption that our observed profitability measures are uncorrelated with the extent of the measurement error, the estimators of β are consistent 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 of 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.

estimation of a spurious positive relationship between procedure profitability and the probability it is performed at an ASC. We therefore also estimate models that include the set of surgery type dummy variables. Additionally, we estimate models including surgery type-by-year effects. This allows the impacts of surgery types on the probability of treatment at an ASC to change over time, which may be particularly important given the significant changes in ASC prevalence during our sample period.

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.[7] 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, in the models with surgery type effects we compute variance inflation factors (VIFs) for the profitability measure.[8] 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

[7] 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 the body part. For example, if a patient needs eye surgery, a doctor cannot instead perform a digestive procedure simply because it is more profitable.
[8] VIF = $1/(1-R^2)$, where R^2 is from the regression of the log of profitability on the other independent variables.

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 effects are similar to physician specialty effects.

<INSERT TABLE IV HERE>

We next account for unobservable determinants of surgery location that vary by region by including region-by-year fixed effects.[9] In particular, controlling for region captures the average ASC ownership share of physicians in the region and therefore further addresses the concern of bias from omitting physician ownership share. ASC presence varies considerably by region, suggesting that average physician ownership share also varies considerably by region since these characteristics should be highly correlated. As shown in Table IV, the south and west have 40% more ASC operating rooms per capita than the Midwest and 161% more than the Northeast. We suspect that if bias from omitting physician ownership stakes is a serious problem in our analysis, including region-by-year effects will impact our results to some degree, though not as much as if we were able to control for ownership stakes directly. The 2006 data does not include region identifiers, so in the regressions that include the region-by-year effects we use data from 1994 through 1996.

Because the majority of our sample consists of data from 1994 to 1996, we also estimate models using only 2006 data to see if the effect of profitability on surgery location has changed

[9] We use U.S. Census regions (Northeast, Midwest, South, and West) as geographic identifiers. The NSAS data do not contain more precise geographic identifiers such as state or county.

since the 1990s. ASCs are more prevalent today, so treating patients at an ASC is a more viable option for many physicians, suggesting the effect may have become stronger over time.

4. RESULTS

Table V reports the coefficient estimates from the regressions without the surgery type effects. We estimate equation (3) with both of the profit measures and with both the full and matched samples. In all regressions, the coefficient estimates on 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. A 10% increase in profitability increases P(ASC) by between 1.0 and 3.8 percentage points. The magnitudes are largest in the full sample and when using *paydiffratio* as the profit measure. The results for the controls are in most cases as expected and consistent with the results of Wynn *et al.* (2004).[10]

<INSERT TABLE V HERE>

Table VI displays the results from the regressions that control for surgery type. In both halves of the table, the first and third columns include surgery type fixed effects while the second and fourth columns include surgery type-by-year fixed effects. In all specifications, the relationship between profitability and P(ASC) remains positive and statistically significant. The magnitudes are much less sensitive to specification changes than they were in Table V. A 10% increase in profitability is now associated with a 1.0 to 1.9 percentage point increase in P(ASC), or a 1.8% to 3.5% increase relative to the sample mean in the full sample. Failing to account for the body part or system on which a procedure is performed does seem to lead to biased

[10] The marginal effect of age on P(ASC) becomes negative after 63 years of age and is therefore negative for our entire 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 statistically significant reduction in P(ASC) in the full sample. Patients were substantially more likely to be treated at an ASC in 2006 than in the 1990s, likely because of the increase in ASC presence over time.

estimators, as all four point estimates from the regressions with surgery type fixed effects are smaller than the corresponding baseline estimates from Table V. Moreover, three of the four estimates including surgery type fixed effects lie outside of the 95% confidence intervals from the corresponding baseline estimates. However, including surgery type-by-year effects instead of surgery type effects does not impact the results. Controlling for surgery type does not appear to lead to a multicollinearity problem, as the VIFs range from 1.5 to 2.8 and the coefficients are estimated precisely. In all, we therefore consider the estimates from Table VI to be more reliable than those from Table V.

<INSERT TABLE VI HERE>

Table VII reports the results from the region effects regressions. Since adding region effects will drop 2006 from the sample, we first restrict the sample to 1994 through 1996 and estimate the models with surgery type-by-year effects but not region effects to establish a reference point. We present these results in the first and third columns of both halves of the table. The point estimates are almost identical to those from Table VI that included all four years. In the second and fourth columns, we add the region-by-year effects. The estimates remain very similar, so we find no evidence that our estimators are biased due to the omission of unobservable region characteristics. We suspect that, since there is large regional variation in ASC presence and adding region-by-year effects does not affect our results, controlling for ASC ownership stake more directly would also not substantially affect our results. However, future research with different data is necessary to rule out this possibility.

<INSERT TABLE VII HERE>

In Table VIII, we present the results from restricting the sample to 2006. In both halves of the table, the first and third columns exclude the surgery type effects while the second and fourth columns include them. The matched sample contains only 680 observations, and accordingly the estimates are too imprecise to be useful. We therefore focus our discussion on the results from the full sample. Profitability is statistically significant and positively associated with P(ASC) in all four specifications. In the regressions with surgery type dummies, a 10% increase in profitability increases P(ASC) by 1.8 to 3.0 percentage points. These magnitudes are somewhat larger than those estimated using the 1994 to 1996 data, which is not surprising given the proliferation in ASCs between 1997 and 2006. We therefore suspect that, if anything, our results for the entire sample would be stronger if our data were more recent.

<INSERT TABLE VIII HERE>

We can use our results to evaluate the economic significance of the effect of profitability on surgery location by comparing it to the effect of the control variables. Since it is not obvious how a 10% increase in profitability compares in magnitude to a one unit increase in our control variables, for purposes of comparison we compute the effect of a one standard deviation increase at the mean.[11] In the four full-sample regressions with all years and controls for surgery type in Table VI, increasing *profrate* by one standard deviation at the mean increases P(ASC) by 3.9, 4.4, 3.2, and 3.1 percentage points, for an average of 3.7 percentage points. For comparison, a one standard deviation increase in age at the mean leads to an average drop in P(ASC) of 0.9 percentage points across the four regressions. 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 an average of 11.1 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

[11] In the full sample, a 10% increase in *profrate* at the mean is an increase of 0.29 standard deviations, while for *paydiffratio* it is an increase of 0.54 standard deviations.

having multiple procedures, but weaker than the effects of having a second form of insurance and receiving general anesthesia (a proxy for procedure complexity).[12] Overall, 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.

Another way to assess the economic significance of our results is to use them to estimate the average effect among physicians who have an ownership share in ASCs. This effect is stronger than that for the entire sample since many physicians do not own a share of an ASC and therefore do not perform operations at one. In Appendix A, we perform a back-of-the-envelope calculation of this parameter in both the 1990s and 2000s using the average of our estimates in Tables VII and VIII, respectively. We find that, for a patient being operated on by a physician who owns a share of one or more ASCs, a 10% increase in profitability is associated with a 3.59 percentage point (5.7%) increase in P(ASC) in the 1990s and a 3.7 percentage point (5.9%) increase in the 2000s. While our calculation is crude, it suggests that physician-owners do respond to profit incentives in a meaningful way.

To summarize, the effect of profitability on surgery location is economically meaningful and implies a strong response among physicians with an ownership stake in ASCs, but profitability appears to be only one of many factors that play a role. The surgery location decision is certainly more complex than physicians simply assigning their most profitable patients to an ASC and their least profitable patients to a hospital.

[12] The strong impact of paying with a second form of insurance may itself reflect a profit motive, although if this were 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.

5. 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 profit margin is associated with a 1 to 2 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, two methods of sample construction, and controls for region.

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.

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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8. TABLES

Table I
Characteristics of ambulatory surgical centers in the U.S. (1997 - 2004)

	1997	1998	1999	2000	2001	2002	2003	2004
Number of new facilities	237	228	162	295	446	309	365	315
Number of closed or merged facilities	40	46	20	53	103	83	75	66
Total facilities	2462	2644	2786	3028	3371	3597	3887	4136
Percentage of ASCs that are for profit	93	94	94	94	94	95	95	96
Percentage of ASCs that are nonprofit	6	6	6	6	5	5	5	4
Percentage of ASCs that are in urban areas	90	89	89	88	88	87	87	87
Percentage of ASCs that are freestanding	99	99	99	99	99	99	99	99
Percentage of ASCs that are hospital owned and operated	1	1	1	1	1	1	1	1

Source: MedPAC (2004) analysis of provider of services file from CMS

Table II – Summary Statistics
Sample Mean Value (Standard Deviation in Parentheses)

Variable	Full Sample	Matched Sample
Treated at an ASC	0.550 (0.497)	0.587 (0.492)
Age	75.457 (6.597)	75.711 (6.539)
Male	0.405 (0.491)	0.371 (0.483)
Multiple Procedures	0.527 (0.499)	0.764 (0.425)
Second Insurance: Private	0.638 (0.480)	0.764 (0.425)
Second Insurance: Medicaid	0.080 (0.271)	0.089 (0.284)
Second Insurance: Other	0.027 (0.161)	0.024 (0.154)
Number of Diagnoses	1.545 (1.025)	1.453 (0.981)
General Anesthesia	0.032 (0.177)	0.037 (0.189)
Nervous	0.010 (0.098)	0.004 (0.063)
Eye	0.563 (0.496)	0.749 (0.433)
Ear	0.004 (0.061)	0.002 (0.044)
Nose/Mouth	0.007 (0.082)	0.002 (0.044)
Respiratory	0.013 (0.114)	0.005 (0.069)
Cardiovascular	0.003 (0.055)	0.002 (0.050)
Digestive	0.256 (0.436)	0.143 (0.350)
Urinary	0.061 (0.238)	0.012 (0.107)
Male Genital	0.007 (0.084)	0.013 (0.115)
Female Genital	0.006 (0.078)	0.0002 (0.013)
Musculoskeletal	0.007 (0.176)	0.028 (0.166)
Integumentary	0.031 (0.174)	0.031 (0.173)
ProfRate	0.865 (0.303)	0.830 (0.170)
PayDiffRatio	1.175 (0.216)	1.296 (0.170)
N	88,123	34,581
Unique ICD9 codes	442	147

Table III - Mean Value (Standard Deviation in Parentheses)

Variable	ASC	ProfRate	PayDiffRatio
Nervous	0.258 (0.438)	0.583 (0.243)	0.848 (0.157)
Eye	0.687 (0.464)	0.915 (0.326)	1.254 (0.201)
Ear	0.462 (0.499)	0.477 (0.074)	0.808 (0.141)
Nose/Mouth	0.307 (0.462)	0.566 (0.170)	0.988 (0.394)
Respiratory	0.232 (0.422)	0.750 (0.139)	0.903 (0.188)
Cardiovascular	0.083 (0.277)	0.590 (0.211)	1.135 (0.434)
Digestive	0.386 (0.487)	0.923 (0.162)	1.126 (0.120)
Urinary	0.437 (0.496)	0.606 (0.192)	1.033 (0.074)
Male Genital	0.528 (0.500)	1.174 (0.428)	1.421 (0.208)
Female Genital	0.236 (0.425)	0.532 (0.052)	0.944 (0.071)
Musculoskeletal	0.399 (0.490)	0.482 (0.144)	0.835 (0.139)
Integumentary	0.281 (0.449)	0.742 (0.341)	1.127 (0.306)
Miscellaneous	0.282 (0.450)	0.503 (0.161)	0.977 (0.303)

Table IV – ASC Density Statistics by Region in 1999

Region	ASCs per 100,000 Residents	Average Number of Operating Rooms per ASC	Total Number of ASC Operating Rooms per 100,000
Northeast	0.597	2.228	1.330
Midwest	0.862	2.867	2.471
South	1.355	2.557	3.465
West	1.631	2.123	3.463

Population information obtained from http://www.census.gov/popest/states/tables/NST-EST2008-01.xls. Information on number of ASCs and number of operating rooms in ASCs obtained from analysis of CMS Provider of Services File from year 1999.

Table V
Effect of independent variables on the probability the patient was treated at an ASC

	Full Sample		Matched Sample	
ln(profrate)	**0.198** **[0.005]****	-	**0.098** **[0.011]****	-
ln(paydiffratio)	-	**0.376** **[0.008]****	-	**0.256** **[0.018]****
Age in Years	**0.025** **[0.005]****	**0.024** **[0.005]****	0.002 [0.008]	-0.0002 [0.008]
Age Squared	**-0.0002** **[0.00003]****	**-0.0002** **[0.00003]****	-0.0002 [0.00005]	0.000002 [0.00005]
Male	**0.008** **[0.003]****	**0.008** **[0.003]****	**0.034** **[0.005]****	**0.035** **[0.005]****
Multiple Procedures	**0.133** **[0.003]****	**0.098** **[0.003]****	**0.159** **[0.006]****	**0.139** **[0.006]****
Year 1995	**0.015** **[0.004]****	**0.013** **[0.004]****	-0.007 [0.006]	-0.009 [0.006]
Year 1996	**0.021** **[0.004]****	**0.012** **[0.004]****	**-0.015** **[0.006]***	**-0.021** **[0.006]****
Year 2006	**0.354** **[0.006]****	**0.335** **[0.006]****	**0.323** **[0.019]****	**0.299** **[0.019]****
Second Insurance: Private	**0.129** **[0.004]****	**0.129** **[0.004]****	**0.154** **[0.006]****	**0.153** **[0.006]****
Second Insurance: Medicaid	**0.119** **[0.006]****	**0.121** **[0.006]****	**0.169** **[0.010]****	**0.168** **[0.010]****
Second Insurance: Other	**0.114** **[0.010]****	**0.116** **[0.010]****	**0.169** **[0.017]****	**0.168** **[0.017]****
Number of Diagnoses	**-0.239** **[0.005]****	**-0.225** **[0.005]****	**-0.227** **[0.008]****	**-0.208** **[0.008]****
Number of Diagnoses Squared	**0.019** **[0.001]****	**0.017** **[0.001]****	**0.017** **[0.001]****	**0.014** **[0.001]****
General Anesthesia	**-0.077** **[0.008]****	**-0.081** **[0.008]****	-0.015 [0.013]	-0.017 [0.013]
Constant	-0.289 [0.178]	**-0.312** **[0.177]+**	**0.558** **[0.290]***	**0.575** **[0.289]***
Observations	88123	88123	34581	34581
R-squared	0.152	0.154	0.124	0.128

Robust standard errors in brackets

+ significant at 10%; * significant at 5%; ** significant at 1%

Table VI
Effect of a patient's profitability on the probability the patient was treated at an ASC
Including controls for surgical type

	Full Sample				Matched Sample			
ln(profrate)	**0.130** **[0.005]****	**0.148** **[0.005]****	**-**	-	**0.098** **[0.016]****	**0.098** **[0.016]****	-	-
ln(paydiffratio)	-	-	**0.188** **[0.009]****	**0.186** **[0.009]****	-	-	**0.186** **[0.026]****	**0.176** **[0.026]****
Age in Years	**0.015** **[0.005]****	**0.014** **[0.005]****	**0.016** **[0.005]****	**0.015** **[0.005]****	-0.003 [0.007]	-0.003 [0.007]	-0.003 [0.007]	-0.003 [0.007]
Age Squared	**-0.0001** **[0.0000]****	**-0.0001** **[0.0000]****	**-0.0001** **[0.0000]****	**-0.0001** **[0.0000]****	0.00001 [0.00005]	0.00001 [0.00005]	0.00001 [0.00005]	0.00001 [0.00005]
Male	**0.015** **[0.003]****	**0.015** **[0.003]****	**0.014** **[0.003]****	**0.013** **[0.003]****	**0.030** **[0.005]****	**0.030** **[0.005]****	**0.029** **[0.005]****	**0.030** **[0.005]****
Multiple Procedures	**0.029** **[0.004]****	**0.028** **[0.004]****	**0.011** **[0.003]****	**0.008** **[0.003]****	**0.062** **[0.008]****	**0.062** **[0.008]****	**0.066** **[0.008]****	**0.066** **[0.008]****
Second Ins.: Private	**0.118** **[0.004]****	**0.117** **[0.004]****	**0.120** **[0.004]****	**0.119** **[0.004]****	**0.145** **[0.006]****	**0.145** **[0.006]****	**0.146** **[0.006]****	**0.145** **[0.006]****
Second Ins.: Medicaid	**0.106** **[0.006]****	**0.104** **[0.006]****	**0.108** **[0.006]****	**0.107** **[0.006]****	**0.158** **[0.010]****	**0.158** **[0.010]****	**0.157** **[0.010]****	**0.157** **[0.010]****
Second Ins: Other	**0.104** **[0.010]****	**0.105** **[0.010]****	**0.106** **[0.010]****	**0.108** **[0.010]****	**0.159** **[0.017]****	**0.159** **[0.017]****	**0.160** **[0.017]****	**0.159** **[0.017]****
Number of Diagnoses	**-0.149** **[0.005]****	**-0.150** **[0.005]****	**-0.149** **[0.005]****	**-0.151** **[0.005]****	**-0.185** **[0.009]****	**-0.185** **[0.009]****	**-0.186** **[0.009]****	**-0.186** **[0.009]****
Number of Diag. Squared	**0.008** **[0.001]****	**0.008** **[0.001]****	**0.008** **[0.001]****	**0.008** **[0.001]****	**0.012** **[0.001]****	**0.012** **[0.001]****	**0.012** **[0.001]****	**0.012** **[0.001]****
General Anesthesia	**-0.088** **[0.008]****	**-0.090** **[0.008]****	-0.088 [0.008]	-0.091 [0.008]	**-0.023** **[0.013]+**	**-0.021** **[0.013]+**	**-0.023** **[0.013]+**	**-0.021** **[0.013]+**
Constant	-0.069 [0.175]	-0.048 [0.175]	-0.162 [0.175]	-0.172 [0.175]	**0.542** **[0.287]+**	**0.471** **[0.288]+**	**0.462** **[0.287]+**	0.390 [0.288]
Year Fixed Effects	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**
Surgical Type Fixed Effects	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**
Year-by-Surgical-Type Fixed Effects	**NO**	**YES**	**NO**	**YES**	**NO**	**YES**	**NO**	**YES**
Observations	88123	88123	88123	88123	34581	34581	34581	34581
R-squared	0.191	0.198	0.189	0.194	0.147	0.149	0.147	0.149
VIF	1.491	1.580	1.489	1.501	2.374	2.382	2.708	2.757

Robust standard errors in brackets.
+ significant at 10%; * significant at 5%; ** significant at 1%

Table VII
Effect of a patient's profitability on the probability the patient was treated at an ASC – 1994-1996
Including controls for surgical type

	Full Sample				Matched Sample			
ln(profrate)	**0.147** [0.005]**	**0.144** [0.005]**	-	-	**0.098** [0.016]**	**0.092** [0.016]**	-	-
ln(paydiffratio)	-	-	**0.182** [0.010]**	**0.169** [0.010]**	-	-	**0.180** [0.026]**	**0.159** [0.026]**
Individual Controls	YES	YES	YES	YES	YES	YES	YES	YES
Year-by-Surgical-Type Fixed Effects	YES	YES	YES	YES	YES	YES	YES	YES
Year-by-Region Fixed Effects	NO	YES	NO	YES	NO	YES	NO	YES
Observations	82502	82502	82502	82502	33901	33901	33901	33901
R-squared	0.192	0.205	0.189	0.201	0.151	0.174	0.151	0.174
VIF	1.551	1.566	1.489	1.500	2.391	2.395	2.779	2.784

Robust standard errors in brackets.

+ significant at 10%; * significant at 5%; ** significant at 1%

Table VIII
Effect of a patient's profitability on the probability the patient was treated at an ASC – 2006
Including controls for surgical type

	Full Sample				Matched Sample			
ln(profrate)	**0.150** **[0.018]****	**0.176** **[0.026]****	-	-	0.111 [0.085]	-0.145 [0.117]	-	-
ln(paydiffratio)	-	-	**0.250** **[0.037]****	**0.295** **[0.049]****	-	-	**0.268** **[0.128]***	-0.017 [0.161]
Individual Controls	YES	YES	YES	YES	YES	YES	YES	YES
Surgical Type Fixed Effects	NO	YES	NO	YES	NO	YES	NO	YES
Observations	5621	5621	5621	5621	680	680	680	680
R-squared	0.123	0.141	0.120	0.140	0.090	0.131	0.093	0.130
VIF	1.165	2.178	1.123	1.614	1.052	1.918	1.064	1.736

Robust standard errors in brackets.

+ significant at 10%; * significant at 5%; ** significant at 1%

9. APPENDIX A: EFFECT AMONG PHYSICIAN OWNERS

The parameter β that we estimated in Sections 3 and 4 is the average effect of surgery profitability on the probability the surgery is performed at an ASC among all physicians in our sample, some of whom presumably do not own a share of an ASC. Ideally, we would estimate the effect of profitability on surgery location for physicians with an ownership share. In this section, we perform a back-of-the-envelope calculation to estimate this parameter.

Assuming that the entire effect estimated in the preceding sections is driven by physicians who hold an ownership stake in ASCs, β can be expressed as

(4) $$\beta = \phi\gamma + (1-\phi)*0$$

where ϕ is the proportion of physicians in the sample who hold an ownership stake in ASCs and γ is the effect on their behavior. An ideal equation would account for the fact that different physician investors own different percentages of ASC facilities, since larger ownership stakes provide stronger incentives to cherry pick. We use a simplified equation in order to make calibration possible. Our approach computes the average effect among all physician investors, which should suffice to develop a general understanding of the extent of their response. Solving (4) for γ yields

(5) $$\gamma = \frac{\beta}{\phi}$$

We were unable to obtain data on the percentage of physicians performing outpatient surgery who own a share of an ASC, so we approximate ϕ as follows. Suppose μ is the proportion of outpatient surgeries that are performed at an ASC and σ is the proportion of the surgeries that an ASC-owning physician performs at ASCs. Assume that all physicians perform the same number of surgeries,

(6) $\mu = \phi\sigma$

Rearranging and combining (5) and (6) yields

(7) $\gamma = \frac{\beta\sigma}{\mu}$

We compute γ in two time periods: the mid-1990s since most of our observations are from 1994 to 1996 and the mid-2000s to provide a more recent estimate. For β in the 1990s, we use the average of our estimates from the regressions including region-by-year effects in Table VII, which is 0.142. For β in the 2000s, we use the average from the regressions including surgery type effects in Table VIII, 0.234. According to the American Hospital Association (2006), approximately 25% of outpatient surgeries occurred at ASCs in 1995 while approximately 40% occurred at ASCs in 2005. We therefore set μ equal to 0.25 in the 1990s and 0.4 in the 2000s. Data on the percentage of surgeries ASCs owners perform at ASCs is difficult to obtain, so we use information from a case study performed by Lynk and Longley (2002) involving a hospital and an ASC in Hammond, LA. In the month following the entry of the ASC in 1997, the 18 physician investors at the ASC performed approximately 63.2% of their surgeries at the ASC, and the percentage remained similar over the subsequent three years.[13] Assuming that this percentage is constant across all physicians and years (admittedly a strong assumption), we set σ equal to 0.632 for both the 1990s and 2000s. Performing the calculation in (7) yields

(8) $\gamma_{1990s} = \frac{0.142 * 0.632}{0.25} = 0.359$

(9) $\gamma_{1990s} = \frac{0.234 * 0.632}{0.4} = 0.370$

[13] Exhibit 1 indicates that the physician investors performed approximately 180 surgeries at the ASC, while Exhibit 2 indicates that these investors performed approximately 105 surgeries at the hospital. We use these two numbers to calculate the percentage.

We therefore find that a 10% increase in profitability is associated with a 3.59 percentage point increase in the probability physicians who own a share of an ASC perform an outpatient surgery at an ASC instead of a hospital in the mid-1990s, and a 3.7 percentage point increase in the mid-2000s. If physicians who own a stake in ASCs perform 63.2% of their surgeries at an ASC, these effects represent 5.7% and 5.9% increases.