



WHY SURGEON OWNERS OF AMBULATORY SURGICAL CENTERS DO MORE SURGERY THAN NON-OWNERS

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Finally, any errors in the report are solely my own.

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TABLE OF CONTENTS

List of Tables	6
List of Figures	8
Executive Summary	9
Introduction	17
Policy Context	17
POLICY ISSUE 1: MEDICAL COST CONTAINMENT	17
POLICY ISSUE 2: REGULATING PHYSICIAN OWNERSHIP	18
POLICY ISSUE 3: IMPROVING ACCESS TO CARE	19
POLICY ISSUE 4: FISCAL CHALLENGES FACING HOSPITALS	19
POLICY ISSUE 5: SETTING REIMBURSEMENT RATES	20
POLICY ISSUE 6: TRENDS OF WORKERS' COMPENSATION PATIENTS AND PAYORS	20
Scope of This Study	20
Findings from Previous Studies	21
Conceptual Framework, Methods, and Data	24
Conceptual Framework	24
Data	26
Identifying Surgeon Owners	27
Empirical Methods	30
QUANTIFYING THE REASONS THAT OWNERS DO MORE SURGERY THAN NON-OWNERS	31
EFFECT OF OWNERSHIP ON SITE OF SERVICE	34
EFFECT OF OWNERSHIP ON PAYOR MIX	35
Terminology	37
Limitations	37
Generalizing the Results	38
Major Findings	40
Why Do Owners Do More Surgery Than Non-Owners?	40
Impact of Ownership on Site of Service	44
Impact of Ownership on Payor Mix	46
Discussion and Policy Considerations	50
Technical Appendix A: Data	54

Technical Appendix B: Comparisons of “Ownership” Measures	58
Technical Appendix C: Methodology and Full Estimates	66
Technical Appendix D: Supplemental and Sensitivity Analyses	90
Glossary	94
References	95

LIST OF TABLES

2.1	Variables Identifying Surgeon Owners / 28
2.2	Illustration of How Frequent User Owners Are Defined in the Data / 29
2.3	Variables for Decomposition of Owner/Non-Owner Differential in Surgeries Performed / 31
2.4	Variables for Determining the Shift of Surgeries and All Procedures to Surgeon-Owned ASCs / 35
2.5	Variables for Determining the Shift in Payor Mix / 36
3.1	Impact of Ownership of ASCs on the Shift of Site of Service / 46
3.2	Impact of Ownership of ASCs on Payor and Plan Type / 48
TA.A1	Patient Characteristics / 57
TA.B1	Variables Identifying Surgeon Owners / 59
TA.B2	Overlap of Ownership Measures / 61
TA.B3	Tetrachoric and Pearson Correlations among Ownership Measures / 61
TA.C1	Relationship between a Surgeon's Surgery Volume and Five Explanatory Factors, Using Board Owner Measure (negative binomial regressions) / 72
TA.C2	Relationship between a Surgeon's Surgery Volume and Five Explanatory Factors, Using Frequent User Owner-50 Measure (negative binomial regressions) / 73
TA.C3	Relationship between a Surgeon's Surgery Volume and Five Explanatory Factors, Using Threshold Owner-30 (negative binomial regressions) / 74
TA.C4	Relationship between Percentage of a Surgeon's Total Procedure Volume Performed at an ASC and a Surgeon's KSWC Surgery Volume / 75
TA.C5	Impact of Ownership of ASC on Site of Service for KSWC Surgery (OLS regressions) / 77
TA.C6	Impact of Ownership of ASC on Site of Service for All Procedures (OLS regressions) / 78
TA.C7	Impact of Ownership of an ASC on a Surgeon's Surgery Volume Covered by Workers' Compensation / 80
TA.C8	Impact of Ownership of an ASC on a Surgeon's Surgery Volume Covered by Commercial Indemnity / 81
TA.C9	Impact of Ownership of an ASC on a Surgeon's Surgery Volume Covered by Commercial HMO / 82
TA.C10	Impact of Ownership of an ASC on a Surgeon's Surgery Volume Covered by Commercial PPO / 83
TA.C11	Impact of Ownership of an ASC on a Surgeon's Surgery Volume Covered by Medicare / 84
TA.C12	Impact of Ownership of an ASC on a Surgeon's Surgery Volume Covered by Medicare HMO / 85
TA.C13	Impact of Ownership of an ASC on a Surgeon's Surgery Volume Covered by Medicaid / 86
TA.C14	Impact of Ownership of an ASC on a Surgeon's Surgery Volume Covered by Medicaid HMO / 87
TA.D1	Relationship between a Surgeon's Surgery Volume and Five Explanatory Factors, Using Frequent User Owner-75 Measure (negative binomial regressions) / 91

[TA.D2](#) Relationship between a Surgeon's Surgery Volume and Five Explanatory Factors, Using Threshold Owner-50 Measure (negative binomial regressions) / 92

[TA.D3](#) Relationship between a Surgeon's Surgery Volume and Five Explanatory Factors, Using Threshold Owner-30-Q Measure (negative binomial regressions) / 93

LIST OF FIGURES

- [A](#) Factors That Explain Why Surgeon Owners Do More Surgery / 12
- [1.1](#) Annual Number of KSWC Surgeries Performed in Florida, 1997–2004 / 21
- [2.1](#) ASC Efficiency Gains: Relationship between Percentage of KSWC Surgeries Performed at ASCs and a Surgeon's Surgery Volume / 34
- [3.1](#) Average Surgeon's Surgery Volume by Ownership Measure / 41
- [3.2](#) Factors That Explain Why Surgeon Owners Do More Surgery / 43
- [3.3](#) At the Onset of Ownership: Percentage of Surgeries Performed in ASCs and a Surgeon's Surgery Volume / 44
- [3.4](#) Percentage of a Surgeon's Procedures That Were Performed in ASCs, by Ownership Measure / 45
- [3.5](#) Number of Surgeries by Primary Payors and Facility Type / 49
- [TA.A1](#) Sample Construction / 55
- [TA.A2](#) Distribution of KSWC Surgeries in the Sample / 56
- [TA.B1](#) Prevalence of Surgeon Ownership, by Ownership Measure / 59
- [TA.B2](#) Stability of Ownership: Ownership Duration, by Ownership Measure / 63
- [TA.B3](#) Stability of Ownership: Number of Distinct Ownership Periods among Owners with at Least One Complete Year of Ownership, by Ownership Measure / 63
- [TA.B4](#) Multiple ASC Ownership: Percentage of Owners Who Owned Multiple ASCs, by Ownership Measure / 64
- [TA.B5](#) Multiple ASC Ownership: Percentage of Owners Who Owned 2 or 3 ASCs at the Same Time / 65
- [TA.C1](#) A Surgeon's Response to Ownership and ASC Efficiency / 67
- [TA.C2](#) Distribution of Surgeons' Outpatient Surgery Volume / 71
- [TA.C3](#) Distribution of the Percentage of a Surgeon's Procedure Volume That Was Performed at ASCs / 76

EXECUTIVE SUMMARY

The last two decades have seen substantial growth in the use of ambulatory surgical centers (ASCs) and the number of physicians who have ownership interests in these centers. In 1996, approximately 2,200 ASCs were in use nationwide, and by 2009, 5,260 (MedPAC, 2007 and 2011, reporting on Medicare-certified ASCs). Surveys suggest that 83 to 88 percent of ASCs are physician-owned (American Hospital Association, 2006; ASC Coalition, n.d.).

There are many reasons for the growth in ASCs. Newly available surgical technology and access to capital have lowered barriers for small groups or individuals to start their own clinics. Private equity firms and investors have identified ASCs as profit opportunities. Payors encouraged the use of these lower-cost facilities, which provided savings.¹ ASCs successfully secured relationships with physicians, providing physicians with both more control over their work conditions and financial incentives to shift their work volume to the ASCs. By focusing on convenience and efficiency, ASCs have become popular among both patients and physicians, and are now the dominant setting for many types of surgery.

THE CONCERN

Some studies have found that surgeon owners of ASCs perform more surgeries than surgeons who are not owners (e.g., Mitchell, 2010; Hollingsworth et al., 2010; Gabel et al., 2008; Lynk and Longley, 2002). These studies raise a concern about potential conflicts of interest that may influence treatment decisions and be inconsistent with high priority national goals of containing the rising costs of medical care while maintaining quality care.

Federal and state policymakers have debated and enacted regulations concerning physicians who own surgery centers, imaging equipment, laboratories, and other entities. Some regulations require physicians to disclose their ownership interest to the patient; others prohibit physicians from referring patients to entities where they have financial interests, also known as *self-referring*. For example, Medicare requires a surgeon to disclose ownership of an ASC to a patient prior to surgery at that ASC. In 2011, legislation was passed in California prohibiting doctors who own many kinds of medical businesses from referring their workers' compensation patients to those businesses, or from using products from those businesses in their practices.² This law, effective January 1, 2012, requires physicians who own these types of businesses, including ASCs, to inform insurers of their ownership. However, the law allows physician owners of ASCs to send patients to their own ASC for surgery, with payor preauthorization. Previously, California allowed self-referrals to ASCs, yet prohibited self-referrals to other types of entities.

ASCs have escaped much self-referral regulation because the use of ASCs provides other benefits. Having lower reimbursement rates today than hospitals, ASCs are now more cost-effective than hospitals from the perspective of the payor. Advocates for ASCs argue that surgeons can schedule surgeries more efficiently at ASCs than at hospitals. They claim that many studies on ownership do not adequately account for gains in efficiency: when surgeons become owners of ASCs, their increases in surgery volume may simply be due to a more efficient use of their time.

¹ Throughout this report, we use the term *cost* to mean the market value or amount paid of medical services and goods delivered, similar to how gross domestic product or the size of an industry is calculated. It can also be thought of as the cost from the perspective of payors, e.g., patients and insurance carriers. It does not refer to intermediary costs, such as the costs to ASCs or hospitals for providing services. While such costs should not be overlooked, we expect that they are captured by the final market value of a service, assuming facilities hold a profit.

² There are many different kinds of businesses included in this legislation, including those that sell pharmacy goods and medical implants.

STUDY OBJECTIVE AND SCOPE

This study identifies and quantifies the major factors that we expect would explain why surgeon owners perform more surgery than non-owners. The study isolates the efficiency gains described earlier from the impact of financial incentives that arise from ownership. The study further identifies several other reasons for this larger surgery volume, isolating and quantifying the effects of each.

Unfortunately, this study does not address whether any of the additional surgeries were necessary surgeries or not. This is a critically important question that merits additional research.

DATA AND METHODS

This study uses data on common orthopedic outpatient surgeries: knee, shoulder, and wrist arthroscopies and carpal tunnel release surgery (also referred to as *KSWC surgeries*). The data includes all orthopedic surgeons working in Florida from 1997 through 2004—a period of substantial growth in ASCs that continued until 2008–2009, when it was disrupted by the recession. This study is unique in several ways.

- It measures the effect of the financial incentives due to ownership by comparing the number of surgeries that each surgeon owner did while an owner with when he or she was not an owner. Most other studies compare owners with non-owners.
- Because data that identify physician owners is not readily available, many studies use different measures to approximate ownership. This study uses three previously developed measures to identify surgeons who were likely to be owners and compares their results side-by-side. These measures are described further below.
- It isolates the effect of financial incentives attendant to ownership from other reasons that physician owners are observed to do more procedures than non-owners—in particular, the fact that higher-volume surgeons are more likely to be recruited to become owners, as well as that surgeons can experience efficiency gains from shifting their workload to ASCs. Isolating these factors allows us to interpret the financial incentives effect as causal, not just as an association.

MAJOR FINDINGS

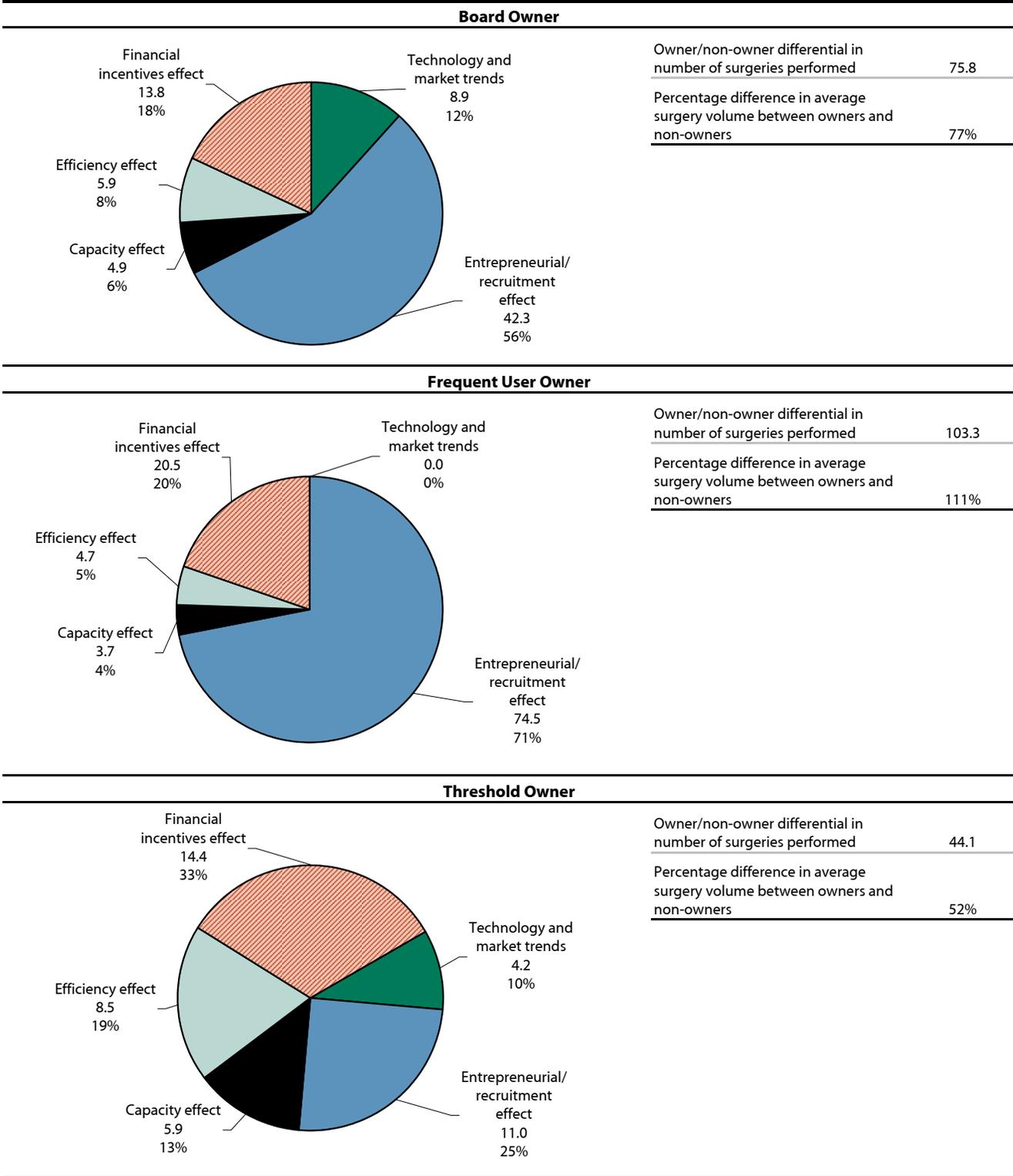
- The average surgeon owner did substantially more KSWC surgeries than the average non-owner. That difference ranged from an average of 44 to 103 surgeries annually. The principal objective of this study is to quantify the major reasons for this *owner/non-owner differential*.
- Figure A illustrates the decomposition of the owner/non-owner differential. The text that follows describes the factors that were hypothesized to explain the differential, how each factor contributed to a surgeon's surgery volume, and how much of the differential each factor explained. In order to figure out why owners do more than non-owners, one has to think about why one surgeon does more surgery than another. Then we can measure the factor's contribution in explaining the owner/non-owner differential in surgeries performed.
- The factor explaining the largest share of the owner/non-owner differential in surgeries performed is what we call the *entrepreneurial/recruitment effect*—that is, the tendency of surgery centers to recruit higher-volume surgeons to be owners; the tendency of higher-volume surgeons to initiate the development of a surgery center; and the tendency that those attributes which lead a surgeon to be an owner (such as an entrepreneurial outlook)

are the same attributes that make a surgeon do more surgery.³ The entrepreneurial/recruitment effect accounts for one- to three-quarters of the average owner/non-owner differential in surgeries performed, depending upon the measure used to identify surgeon owners.

- When surgeons increased their use of ASCs and reduced their use of hospital outpatient departments (HOPDs), they experienced an increase in efficiency that allowed them to do more surgeries; this is what we call *efficiency gains*. If the average surgeon shifted 10 percent of his or her surgery volume from HOPDs to ASCs, he or she would be able to do 1.3 to 3.5 percent more surgery. For example, if a surgeon performed 100 surgeries a year and shifted 10 of them from a HOPD to an ASC, she or he would be able to do approximately 1.3 to 3.5 more surgeries per year, on average. This benefit could be experienced equally by both owners and non-owners. However, since owners, on average, experienced larger shifts to ASCs due to ownership, they had larger gains in absolute numbers of surgeries performed. The efficiency effect explained a small portion of the average owner/non-owner differential in surgeries performed. See Figure A.
- The *financial incentives* from owning an ASC led surgeon owners to do more KSWC surgeries per year than they would have done had they not become owners. They increased their surgery volumes by 14 to 22 percent due to the financial incentives, or 15 to 25 surgeries per year for the average surgeon who became an owner—compared with the number of surgeries that each of these surgeons performed prior to becoming an owner. This effect explained 14 to 21 surgeries in the difference in surgeries performed per year between owners and non-owners, or 18 to 33 percent. This estimate is net of effects of any additional surgeries that these surgeon owners did due to the technology and market trends, changes in the size of their facility network, and the efficiency gains from substantially increasing their use of ASCs, relative to hospitals. It is also independent of the sizeable entrepreneurial/recruitment effect that we measured.
- When surgeons changed the number of facilities at which they performed surgeries (the size of their network), they may have changed their capacity to do more surgery or expanded the geographic range of their patient population, impacting the number of patients seen. We found that an addition of one facility to a surgeon's network was associated with an increase of 11 to 12 KSWC surgeries per year, or 11 to 12 percent of his or her volume. Likewise, a removal of a facility was associated with a decrease of 11 to 12 KSWC surgeries per year. We also found that the fluctuation in facility network size explains very little of the owner/non-owner differential in the number of surgeries performed. At first blush, the *capacity effect* may seem low. However, it is useful to remember that this effect is an average effect across all surgeons: some surgeons expanded their networks, others contracted them; some added an ASC, while others added or removed a hospital from their networks. When adding a facility, surgeons may have simply transferred surgeries to the facility instead of increasing their caseloads. The change in network size does contribute to the owner/non-owner differential, albeit in a relatively small way. At the time of ownership, some owners added an ASC, some consolidated and removed a hospital, and others did not change their capacity. Thus the factor did not explain much of the differential in the number of surgeries performed.
- During the study period, both medical technology and market phenomena changed substantially. There were improvements to scope technology, increasing availability of ASCs, changes in patient preferences for less invasive surgeries, and changes in prices paid for these surgeries. Due to these *technology and market trends*, by 2004, the average surgeon did 36 to 42 more KSWC surgeries per year than in 1997. This was a 46 to 54 percent increase. Since these important trends benefited both owners and non-owners, they did not explain much of the owner/non-owner differential.

³ The entrepreneurial/recruitment effect, for example, captures the phenomenon that ASCs locate in areas where the demand for surgery is higher than elsewhere and where the surgery volume of doctors who reside in these areas is likely to be higher than that of surgeons in other areas.

Figure A Factors That Explain Why Surgeon Owners Do More Surgery



Notes: The numbers in the pie charts show how much of the owner/non-owner differential in surgeries performed is due to a given factor. The top number is the number of surgeries contributing to the differential that is due to a given factor. The bottom number is the percentage of the differential that is due to a given factor. Data are based on Florida administrative ASC and hospital outpatient records for KSWC surgeries that occurred between 1997 and 2004 and Florida Division of Corporations annual corporate filings between 1997 and 2004. The sample includes orthopedic surgeons in Florida between 1997 and 2004. A surgeon's surgery volume is the number of KSWC surgeries that he or she performed in an ASC or HOPD in a given year.

Key: ASC: ambulatory surgical center; HOPD: hospital outpatient department or facility; owner/non-owner differential: difference in average annual surgery volumes between owners and non-owners; surgery or KSWC surgery: a knee, shoulder, or wrist arthroscopy, or carpal tunnel surgery.

- Surgeon owners shifted a substantial share of their patients to their affiliated ASCs when they became owners. Prior to becoming an owner, the average surgeon performed 12 to 32 percent of their surgery volume and procedures at their future affiliated ASC.⁴ After becoming an owner, the average surgeon performed 59 to 66 percent at their affiliated ASC.
- Relative to the types of patients they would have treated had they not been owners, owners of ASCs provided more surgeries to patients covered by workers' compensation, commercial indemnity insurance, and Medicare. These payors were higher-paying insurers at the time of the data. Due to owner financial incentives, the average surgeon increased the number of workers' compensation patients by 17 to 23 percent and the number of patients with commercial indemnity insurance by 20 to 51 percent. Surgeons did not increase the number of patients covered by Medicaid and certain health maintenance organization (HMO) plans.
- This study does not address whether the additional surgeries done as a result of the financial incentives were necessary surgeries or not. If necessary, then surgeon ownership improved access to surgical care for those who previously did not have access—in particular, those covered by more generous reimbursement plans, which at the time of the data were workers' compensation, commercial indemnity insurance, and Medicare. If the surgeries were unnecessary, then surgeon ownership was a cost driver and merits increased regulatory attention. This question deserves additional research using data on patient outcomes.

IDENTIFYING SURGEON OWNERS

There is no precise empirical measure of physician ownership that is readily available. Most studies have used proxies for ownership. A proxy is a measure that is highly correlated with the measure that is actually desired—identifying physicians who are owners. The better the proxy, the more accurate our estimates are of the true effects of physician ownership.⁵

Prior studies have used three proxies. Each has advantages and limitations. We describe each measure of ownership below. In this study, we report results for each of the proxies so that the reader can compare and contrast them.

- *Board Owners:* The board owner measure identifies surgeons who served on the board of directors of an ASC. Yee (2011) analyzed Florida physicians who referred or performed colonoscopies from 1997 through 2004. Yee (2011) found that board members, on average, increased the number of colonoscopies they performed by 16 percent when they served as board members compared with when they were not board members of ASCs.
- *Frequent User Owners:* The frequent user owner measure identifies surgeons who were the top contributors, in terms of surgeries, of freestanding ASCs. Specifically, for each ASC in any given year, we determined which surgeons performed surgery at the ASC and ranked them in order of most frequent to least frequent users of that ASC. The most frequent user, or top user, was labeled as a frequent user owner of the ASC, then second, and down the list until the identified surgeons were collectively responsible for at most half of the surgeries at each ASC. These surgeons were identified for each ASC. Gabel et al. (2008) designed this measure and used it to analyze Pennsylvania surgeons in 2003.⁶ Gabel et al. (2008) found that the physician owners so defined were

⁴ Many surgeon owners worked predominantly at hospitals prior to becoming owners. Others treated some of their caseload at their affiliated ASC prior to probable ownership, as determined by our measures of ownership.

⁵ The worse the proxy, the more likely our estimates will be smaller than the true effect of physician ownership.

⁶ The authors identified physicians who were the most frequent users of physician-owned ASCs and deemed each frequent user to be an owner.

“more likely than other physicians to refer well-insured patients to their facilities and route Medicaid patients to hospital outpatient clinics.”

- *Threshold Owners:* Hollingsworth et al. (2010) analyzed Florida surgeons who performed surgeries in 2003–2005 that were commonly done at ASCs. The authors identified surgeons who performed at least 30 percent of their surgeries at a single ASC. These surgeons were deemed to be owners of that ASC. For our study, we call this approach *threshold owners*. Hollingsworth et al. (2010) found “a significant association between physician-ownership and higher surgical volume” of knee and carpal tunnel procedures, colonoscopies, and cataract excisions. Mitchell (2005) used a similar approach in a study of physician ownership of two cardiac specialty hospitals in Arizona from 1997 through 2003. She deemed physicians to be owners if they had at least 10 percent of their cardiac admissions at one of the two hospitals. She also tested the sensitivity of her results to alternative thresholds ranging from 20 to 50 percent. Mitchell (2005) found that “physician-owners treat higher volumes of profitable cardiac surgical diagnosis-related groups (DRGs), higher percentages of low severity cases, and higher percentages of cases with generous insurance compared with physician-non-owners who treat cardiac patients in community hospitals.”

POLICY IMPLICATIONS

The results described in this study have implications on several policy debates for state and federal policymakers, payors, and surgery centers.

- **Containing Medical Costs:** Payors, such as Medicare, have adopted policies and practices that encourage the shift of certain surgeries from inpatient to outpatient settings. During the early period of growth of ASCs, payors and regulators also encouraged the shift from HOPDs to ASCs, often via reimbursement rates and the Certificate of Need process.⁷ The objective was for surgery to be performed at the most cost-effective setting, as part of the effort to slow down the rapid growth of medical costs.⁸ The notion of cost-effectiveness requires measurement of the full costs, savings, and benefits of the shift to ASCs. Patients and doctors may benefit from location, scheduling flexibility, and other amenities available at ASCs. The direct costs and savings are straightforward to compute at the individual case level by examining what was paid in each setting. This study suggests, however, that there may be indirect costs—costs associated with the increased number of surgeries that owners perform in response to the financial incentives attendant to ownership, at least to the extent that any of these additional surgeries are unnecessary.
- **Regulating Physician Ownership:** Legislators and regulators have adopted disclosure requirements or prohibitions on self-referrals. To date, ASCs have been exempted from the Medicare prohibitions. This study finds that surgeon owners performed 14 to 22 percent more KSWC surgeries per year than they did when they were not owners or 15 to 25 more surgeries for per surgeon who became an owner—and that these additional surgeries are attributable to the financial incentives attendant to ownership. Informed by these estimates, policymakers can better determine whether the Medicare exemption continues to be appropriate or not. These estimates are lower than other studies that do not isolate the financial incentive effect from ASC efficiency gains, entrepreneurial/recruitment effects, and other effects that explain the overall owner/non-owner differential in

⁷ For example, Medicare reimbursed ASCs at higher rates than HOPDs for many types of procedures, although not orthopedic ones, until the mid- to late-2000s.

⁸ The term *cost* throughout this report refers to the market value or amount paid of medical services and goods delivered. It does not refer to intermediary costs, such as the costs to ASCs or hospitals for providing services.

the number of surgeries performed.

- **Improving Access to Care:** Surgeons do more surgery when using ASCs, and even more surgery when they become owners. If the additional surgeries either due to ASC efficiency gains or due to financial incentives are medically necessary, then it should be recognized that ASCs and physician ownership can improve access to care. Of course, to the extent that some of these surgeries are unnecessary, they do not improve patient care. As indicated previously, this study does not address the extent to which additional surgeries are medically necessary.
- **Maintaining Access to Care for Certain Populations:** Policymakers increasingly express concern about whether certain populations have adequate access to care. This study finds that when surgeons became owners, on average, they increased their caseload of patients covered by payors that reimburse at higher rates (such as commercial indemnity insurance and workers' compensation) and did not increase their caseload of patients covered by payors that reimburse at lower rates (such as Medicaid).
- **Financing Society's Need for Hospitals:** An important consideration in the current health care reform debates involves the reimbursement rates for hospitals that provide medical training, research, and substantial uncompensated care to low income populations. These hospitals tend to have higher-than-typical fixed costs because of their special roles, and need a broad base of paying patients to amortize these fixed costs. If physician owners shift a substantial portion of their caseloads from HOPDs to ASCs, the problem increases for these hospitals as their patient and revenue base shrinks. Further, if physician owners focus disproportionately on higher-paying insured patients, the hospitals' problems are increasingly worsened. Unfortunately for these hospitals, we found that physician owners shifted a very large share of their caseload to the owned ASC and expanded their caseload of higher-paying insured patients. The findings suggest that 21 to 60 KSWC surgeries per surgeon owner per year would have been performed in non-surgeon-owned facilities (e.g., hospitals) had the owner not been financially incentivized to shift patients to the surgeon-owned ASC.
- **Setting Reimbursement Rates:** It is common for there to be different reimbursement rates for ASCs and HOPDs for the same surgery. However, it is not common for there to be different fees paid to the operating surgeon if the surgery is done in an ASC or done in a HOPD. We found that ASCs allowed surgeons to use their time more efficiently and to do more surgery. So the "cost" or amount of work (e.g., time or effort) to the surgeon is lower for surgeries done in an ASC than for those done in a HOPD. Following a resource-based relative value scale (RBRVS) system, in which reimbursement rates are based partially on the amount of work a physician does, this raises the possibility that payors might consider the merits and demerits of having lower professional reimbursement rates for surgeries done in an ASC, in particular, for those performed by surgeon owners.⁹
- **Developing Trends for Workers' Compensation Patients and Payors:** It is possible that the use of ASCs may become as dominant for orthopedic surgery as they are for eye surgery and gastroenterology. Koenig et al. (2009) has shown that orthopedic services and pain management services are becoming a larger source of revenue for ASCs. Management companies of ASCs indicate orthopedics as the most desirable medical specialty in which to do business (Fields, 2011). Since workers' compensation payors cover a disproportionate percentage of these services, we may expect the issue regarding physician ownership of ASCs to receive more attention in the next decade by regulators that oversee workers' compensation systems.

⁹ Of course, the calculation of the rate differential would have to be designed so as not to create perverse incentives.

APPLYING THE FINDINGS ON FINANCIAL INCENTIVES OF OWNERSHIP

The findings show that surgeon owners performed more surgeries in Florida (1997–2004) as a result of the financial incentives from (co-)owning an ASC. The reader should keep the following in mind when generalizing the findings to other states, to more recent years, and to the impact on overall medical costs and utilization.

When generalizing to other states or even Florida today, the reader should recognize that the larger the profits from surgeries, the larger the impact of these financial incentives will be on medical costs and utilization. During the period of the study, reimbursement rates in Florida for workers' compensation surgeries were relatively low compared with today and with other states. Estimates of the impact may be higher in states with higher reimbursement rates or even in Florida today. Further, if a state's workers' compensation reimbursement rates were relatively higher than that of other payors when compared with Florida during 1997 to 2004, we might expect the financial interest effect in that state to be larger than what we found in this study.

When using the findings to estimate the total impact of ASCs and of physician ownership on medical costs, it is important to recognize that the estimates presented here do not represent a complete picture of this impact. If ASCs yield better patient outcomes, such as a reduction in secondary surgeries or readmissions, system costs may be lowered. On the other hand, financial incentives could lead to additional ancillary costs, even if there were no increase in surgery. For example, carpal tunnel release may be done as either an open or closed procedure. Both are common. The ancillary costs, however, differ. If the financial incentives from ownership lead surgeon owners to use more often the approach that generated the highest revenue for an ASC, one would need to include the ancillary costs in the total cost of ownership. This study did not attempt to measure whether this was material or not.

When generalizing from the study period to today, the reader should remember that the number of surgery centers has grown substantially, at least through 2008–2009. In Florida, the number of ASCs that performed KSWC surgeries grew 5.9 percent annually during our study period. In the United States (2004–2009), the number of Medicare-certified ASCs grew 5.1 percent annually (MedPAC, 2011). Since owners are incentivized and able to do more surgery than non-owners, and most ASCs have physician owners, the growth in the number of ASCs alone would lead to more KSWC surgeries performed, which may contribute to medical costs. However, this study does not address whether patient outcomes improved from these additional surgeries or not.

1

INTRODUCTION

The main purpose of this study is to explain why surgeons who own ambulatory surgical centers (ASCs) do more surgery than non-owners. We specifically study knee, shoulder, and wrist arthroscopies, and carpal tunnel surgeries, referred to as *KSWC surgeries*. In a sample of orthopedic surgeons in Florida, we found that surgeon owners did 52 to 111 percent more surgery than non-owners. Other studies have found similar disparities when examining similar orthopedic surgeries. For example, Mitchell (2010) found that orthopedic surgeon owners of ASCs and specialty hospitals in Idaho were 33 to 129 percent more likely to perform these orthopedic surgeries on their patients than non-owners were on their respective patients. Hollingsworth et al. (2010) found that physician owners of ASCs in Florida performed approximately twice as many similar surgeries than non-owners. At first blush, one might suspect that this is due to financial incentives attendant to ownership. However, there are several other reasons that surgeon owners might do more surgery than non-owners. This study aims to shed light on these reasons and compare how well they explain the owner/non-owner differential in the performance of surgery.

POLICY CONTEXT

Within the past two decades, the use of ASCs has grown dramatically, particularly for orthopedic surgery. Medicare and other payors have encouraged patients to change the site of their procedures from inpatient settings to these less costly outpatient settings. ASCs now predominate as the site of service for many types of surgery, which has brought them to the forefront of recent policy debates.

It is not uncommon for ASCs to have surgeons as investors. Previous studies have found that physician owners of ASCs perform or refer more procedures than non-owners (e.g., Mitchell, 2010; Hollingsworth et al., 2010; Gabel et al., 2008; Lynk and Longley, 2002). In 2009, Medicare and Medicaid policymakers responded to concerns about potential conflicts of interest by requiring disclosure of ownership to Medicare and Medicaid patients prior to surgery.¹ This year, the California legislature made effective the requirement that surgeons treating injured workers disclose ownership to insurers and required that they receive preauthorization from insurers for self-referred surgeries performed on injured workers at ASCs. Several important issues should be considered when designing policies with regard to ASCs and physician ownership and self-referral.

POLICY ISSUE 1: MEDICAL COST CONTAINMENT

Public and private payors have historically encouraged shifting surgeries from inpatient to outpatient settings and from hospital outpatient departments (HOPDs) to ASCs, in order to create competition in an increasingly costly

¹ While disclosure rules are in Conditions for Coverage by Medicare and Medicaid, it may be the case that the rules apply to all patients, not just Medicare and Medicaid, as some practitioners believe.

medical industry (Leader and Moon, 1989). Originally, ASCs were paid more for certain services than HOPDs were. As a result, the number of ASCs grew substantially. Starting in the mid-2000s, the prices paid to ASCs relative to HOPDs by payors have been decreasing, which suggests that they could be helping to contain medical costs.

However, the calculation of how much or how little medical costs are contained depends on direct and indirect costs and savings.² Direct savings in payments per service performed in an ASC rather than a HOPD are straightforward: it is the difference between the amount paid and the amount that would have been paid if the procedure were performed in a HOPD. Often professional fees are the same between ASCs and HOPDs, so the difference would be the difference in the amount paid to HOPDs and to ASCs for the facility portion of services.

However, there may be indirect costs in performing services at ASCs. Indirect costs include additional surgeries that are performed because ASCs are more efficient or because surgeons have additional financial incentives that arise out of ownership. In addition, ancillary medical supplies, devices, and drugs may differ depending on the setting, which likely affects costs. Forms of treatment and the types of patients treated may change as surgeons use ASCs more. Since ASCs are not as equipped as hospitals are to handle complicated cases, a shift in working with ASCs could imply that surgeons will shift their practice toward treating the types of patients who have a lower risk of complication. A shift in working with ASCs could also be associated with a shift in treating patients covered by payors that reimburse at higher rates, because ASCs typically accept only certain types of insurance plans.³ Further, indirect costs may be exacerbated by surgeons being financially aligned with ASC objectives through ownership.

These costs are justified under certain circumstances. For example, additional surgeries may be medically necessary to treat a certain injury or to stabilize it. Each surgery should be an improvement to the patient's *counterfactual* clinical health, or the health level that the patient would have experienced had the patient not had surgery.⁴ The current definitions of medical necessity do not incorporate the idea of cost effectiveness, another way of evaluating the appropriateness of treatment. By how much does a patient's health need to improve in order to justify the surgery? Using a cost-effectiveness argument, each surgery would need to improve the patient's health by as much as the cost of having the surgery.

To the extent that surgeon ownership improves access for those who are in need of surgery and for whom the benefits exceed the costs of having surgery, surgeon ownership would offset the direct and/or indirect costs associated with surgery. However, if additional surgeries are not all necessary, surgeon ownership would be a cost driver and may adversely affect patient outcomes.

POLICY ISSUE 2: REGULATING PHYSICIAN OWNERSHIP

Current regulations regarding physician ownership of any medical facility assume that ownership leads to a significant number of unnecessary surgeries or other procedures. There is consistent evidence that physician owners refer or perform more procedures than non-owners. However, there are many reasons other than financial incentives that this may occur. This study isolates the effect of financial incentives attendant to ownership from other reasons that physician owners are observed to do more procedures than non-owners.

With the assumption that physician ownership leads to adverse effects, legislators and regulators across the

² Aside from the payment for medical services, there are, of course, other cost considerations that are imbedded in the delivery of medical services, such as a patient's time off from work, time spent driving to meet a doctor, a patient's time for recovery, caretakers' time, or a surgeon's time dealing with paperwork.

³ There may be many reasons that ASCs accept only certain types of insurance. Some insurers may not contract with ASCs. Other insurers may offer reimbursement rates that make performing surgeries at ASCs not financially viable, or that are too low for ASCs to find attractive.

⁴ Of course, it can be argued that perceived health is more important than clinical health.

United States have implemented two common approaches that aim to limit the effects: disclosure of ownership to patients and prohibition on referrals made to owned entities, known as *self-referrals*. Federal laws include the Stark laws, Office of Inspector General (OIG) anti-kickback laws (with Safe Harbor exceptions), and conditions for coverage of procedures delivered to Medicare and Medicaid patients. There are a few states that currently have similar workers' compensation regulations which apply to providers of services delivered to injured workers and covered by workers' compensation payors. Texas and California are examples of such states.

Little research has evaluated the efficacy of regulations regarding disclosure of ownership and prohibitions of self-referral, including whether they have the intended effects, no effect, or perverse effects. Furthermore, alternative approaches to counteracting potential conflicts of interest from ownership have not been widely considered.

POLICY ISSUE 3: IMPROVING ACCESS TO CARE

Injured workers sometimes have problems accessing care. On one hand, ASCs, and the efficiencies resulting from surgeon ownership of ASCs, may help injured workers (and other patients) gain access to surgery. By being more efficient, ASCs enable more surgery to be performed than hospitals do. Financial incentives that arise from ownership may be the extra motivation that encourages surgeons to work more and treat more patients, who previously might not have been able to have surgery. To the extent that these additional surgeries are necessary and cost-effective, surgeon ownership improves access.

The improvement in access may vary for different types of patients and populations. Past studies have found that physician owners are associated with fewer Medicaid patients than non-owners, suggesting the possibility that ASCs have reduced access for those covered by Medicaid. Some ASCs accept fewer types of insurance than nearby hospitals, and some insurers may not want to contract with ASCs. It is possible that surgeon ownership of ASCs alters access for patients covered by certain types of insurance.

POLICY ISSUE 4: FISCAL CHALLENGES FACING HOSPITALS

Competition with ASCs can encourage hospitals to become more efficient, but it also could drive some to bankruptcy. Many hospitals serve a special role in society by providing an institution for medical training and research, as well as uncompensated care to low income populations. As such, they have larger fixed costs than ASCs and often need to subsidize their societal functions by treating a broad base of patients, in particular those from whose care they can profit most (David et al., 2011; McLean and Lawson, 2009).

As surgeon owners shift their caseloads to ASCs from hospitals, this narrows the patient base for hospitals. If surgeon owners also focus on more profitable, privately insured patients, this further adds to the fiscal challenges facing these hospitals. These hospitals will need to find ways to pay for their societal functions or will be obliged to stop providing these functions.

ASCs need hospitals too. Hospitals are a safety net in case of complication. Little research has been focused on whether or not this is profitable for hospitals: hospitals receive reimbursement, but at the same time incur the cost of medical technology, capital, and labor to provide services to transfer patients. If providing these emergency-like procedures produces more profit for the hospitals than would have been received from the care of patients whose treatment moved to ASCs, hospitals benefit from sharing the market with ASCs. If it is less profitable and maintaining hospitals in their current structure is a priority, one can imagine financing ASC-backup hospitals by creating revenue- and/or cost-sharing contracts between ASCs and their backup hospitals.

POLICY ISSUE 5: SETTING REIMBURSEMENT RATES

Often different providers are paid different fees for their services. ASCs are paid based on a certain schedule (likely negotiated between individual payors and ASCs) and hospitals are paid based on another schedule. Similarly, physicians are paid based on yet another schedule. Unlike consumer products, fees or reimbursement rates for medical services are aimed to be at-cost rather than based on patient demand.

Paying at-cost or in accord with a resource-based relative value scale (RBRVS) system in essence means that as the cost of providing a service decreases, so should the reimbursement rate.⁵ This is often the argument for why ASCs are paid less than HOPDs today. With regard to surgeon ownership, if surgeon owners can deliver surgeries to patients at their affiliated ASCs at lower costs (including the cost of surgeons' time), perhaps a new type of schedule is needed—one that pays a physician a certain amount depending on where he or she provides the surgery.⁶

POLICY ISSUE 6: TRENDS OF WORKERS' COMPENSATION PATIENTS AND PAYORS

ASCs are currently the dominant setting for eye surgery and gastroenterology in the United States. In our data we found that in Florida in 2003, ASCs surpassed hospitals as the setting for outpatient KSWC surgery (Figure 1.1). Today, ASCs may be or may soon become the dominant site for orthopedic services overall and pain management services. Koenig et al. (2009) showed that orthopedic services performed at ASCs nationwide grew 13 percent between 2000 and 2007, while orthopedic services performed at HOPDs grew 6 percent. They also showed that orthopedic services accounted for 5 percent of ASC payments by Medicare in 2000 and grew to 7 percent in 2007, and pain management services grew from 4 percent to 10 percent of ASC payments from 2000 to 2007.

Workers' compensation payors cover a large percentage of orthopedic and pain management services. Workers' compensation payments to ASCs in Florida rose from \$76.7 million in 2005 to \$92.0 million in 2009, which was one-third of total ASC and hospital outpatient payments (Florida Division of Workers' Compensation, 2010). In addition, our study finds that surgeon owners disproportionately increased the number of workers' compensation cases relative to other payors. Thus, we may expect the issue of physician ownership of ASCs to be a larger issue among workers' compensation regulators in the next decade.

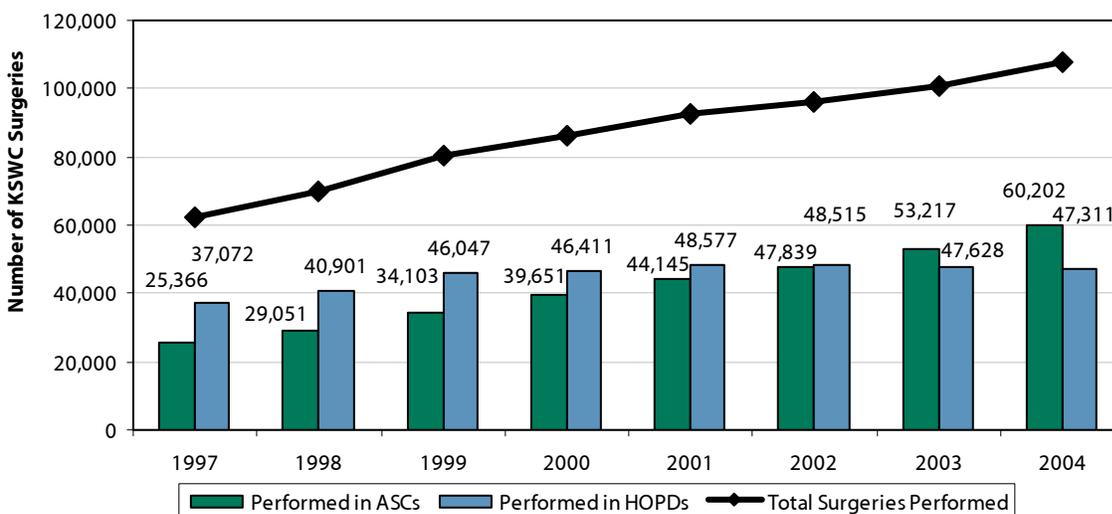
SCOPE OF THIS STUDY

This study addresses the following questions:

- What are the main contributing factors that explain why surgeon owners of ASCs are observed to have higher surgery volumes than surgeon non-owners? How much is due to
 - ASC efficiency gains?
 - financial incentives?
 - recruitment of higher-volume surgeons for ASC ownership?
 - capacity improvements?
 - technology and market trends?

⁵ This report neither supports nor opposes the at-cost or RBRVS system concepts. They are beyond the scope of the study.

⁶ The calculation of the differential rate would have to be carefully designed so as not to create perverse incentives.

Figure 1.1 Annual Number of KSWC Surgeries Performed in Florida, 1997–2004

Notes: Data are based on Florida administrative ASC and hospital outpatient records, provided by the Florida Agency for Health Care Administration, for KSWC surgeries that occurred between 1997 and 2004.

Key: ASC: ambulatory surgical center; HOPD: hospital outpatient department or facility; KSWC surgery: a knee, shoulder, or wrist arthroscopy, or carpal tunnel surgery.

- Do the financial incentives that arise from ownership lead surgeons to
 - increase their surgery volume?
 - shift site of service, i.e., shift surgeries to surgeon-owned ASCs?
 - change the payor mix of their practice, increasing the number of patients covered by payors that reimburse at a higher rate (e.g., workers' compensation, commercial insurance, or group health) and decreasing the number insured by payors that reimburse at a lower rate (e.g., Medicaid)?

The report focuses on commonly performed orthopedic surgeries in a single state, Florida. It uses data from 1997 through 2004 provided by the Florida Agency for Health Care Administration. This study does not address a number of important related questions, such as the impact of surgeon ownership on patient outcomes, whether or not additional surgeries resulting from surgeon ownership or ASC efficiency gains are medically necessary or not, and which is the best way to mitigate any adverse effects from surgeon ownership.

FINDINGS FROM PREVIOUS STUDIES

Previous studies have shown that physicians with financial interests are associated with supplying more services.⁷ Mitchell and Scott (1991) and Mitchell and Sass (1995) showed that physician-owned physical therapy clinics provided 35 to 50 percent more services than non-physician-owned clinics. The findings from Stensland and Winter (2006) indicated that this finding may not apply to cardiac hospitals. Hollingsworth et al. (2010) and Mitchell (2005)

⁷ Financial interests are characterized by a relationship in which the interests of separate entities (such as the ASC and physician) are aligned. Typically these interests are based on contracts that align incentives through financial means, e.g., equity or ownership shares in an ASC, office space, or payment for consulting advice to the ASC.

found that physicians who referred largely to a single ASC or specialty hospital were associated with more procedures than physicians who did not refer largely to a single facility. Mitchell (2010) showed that patients of physician owners in Idaho were between 27 and 129 percent more likely to receive carpal tunnel surgery, rotator cuff repair, and arthroscopic surgery.

A larger body of work has investigated the use of diagnostic imaging. Many have compared physicians who have imaging machinery in or near their offices with those who do not (e.g., Childs and Hunter, 1972; Strasser, Bass, and Brennan, 1987; Hillman et al., 1990; Radecki and Steele, 1990; Hillman et al., 1992; Aronovitz, 1994; Deitch, Sunshine, and Bansal, 1995; Karasick et al., 1995; Mitchell, 1996; and Baumgarten and Nelson, 1997). Baker (2010) showed that “...after orthopedists began billing for MRI, the number of MRI procedures used within thirty days of a first visit increased by about 38 percent.”

There have also been some studies on payor coverage. Gabel et al. (2008) found that physicians who were the most frequent users of a single ASC treated much fewer Medicaid patients than the most frequent users of a single HOPD, and they sent many of their Medicaid patients to hospitals. Mitchell (2005) showed that probable physician owners of a specialty hospital treated fewer Medicaid patients than probable non-owners of that hospital.

Due to limited data, few studies have successfully identified physician owners and have been able to track physicians before and after their ownership acquisition. To date, only two studies have both identified physicians with additional financial incentives (above their usual fee for service) and have looked at changes in having such interests over time. Lynk and Longley (2002) examined one physician-owned ASC in Louisiana and one in South Dakota, and showed that physician investors reduced the number of surgeries they referred to the nearby hospital. Hemenway et al. (1990) analyzed the impact on 15 physicians of a one-time change in physician compensation—from salary to bonuses—for a particular surgical chain. They found that the bonuses were associated with approximately a 20 percent increase in laboratory tests and X-ray films per visit.

Although the literature on physician ownership is extensive, this study aims to further the knowledge in several ways.

- This study focuses on orthopedic surgeries, which have received relatively little attention. Previous studies often focus on diagnostic imaging and non-invasive therapy. Orthopedic surgeries are costly—often eight to ten times as expensive as diagnostic imaging.
- This study employs all previously used proxies for physician ownership of ASCs, and it provides side-by-side analyses of them.
- This study isolates the causal impact of owner financial incentives. Knowing the magnitude of the impact is a necessary first step in predicting what we might expect if regulations on physician ownership were implemented. However, a frequently used statistic in the policy debate is how many more services an owner supplies than a non-owner, which does not control for a variety of factors that contribute to this difference, such as ASC efficiency gains and the fact that higher-volume surgeons are more likely to be owners of ASCs. This study investigates possible explanations for the owner/non-owner differential in surgeries performed and isolates the financial incentives effect.
- This study estimates the efficiency gain from working at ASCs relative to hospitals.
- This study uses data on the universe of ASCs in Florida between 1997 and 2004. Previous studies have often been case studies of single ASCs or states with few ASCs.
- In addition to examining the number of surgeries, this study investigates how financial incentives attendant to ownership lead physician owners to shift the setting for surgical care and to alter the payor mix of their practices.

This report is organized as follows. Chapter 2 discusses the factors that contribute to the disparity in surgery volume between owners and non-owners. It also describes the data and statistical methods. Chapter 3 highlights the major findings. Chapter 4 summarizes the main findings and discusses policy considerations. The four Technical Appendices provide more information on ownership measures used in this study, the data and methodology, including model specification, and results from alternative specifications and sensitivity analyses.

2

CONCEPTUAL FRAMEWORK, METHODS, AND DATA

The observation that surgeon owners of ASCs do more surgery than non-owners could be explained by several reasons. This chapter describes conceptually factors that are hypothesized to explain the disparity between owners and non-owners, the methods used to disentangle each from one another, and the data used to estimate the magnitudes of each factor. We define the utilization outcome measures that are studied and how surgeon owners are identified in the data. We also discuss the limitations of this study and considerations when generalizing the findings to other states and to today. The Technical Appendices provide evaluation of ownership measures, more details on empirical models, sensitivity analyses, and tables of model estimates.

CONCEPTUAL FRAMEWORK

Physicians, in particular surgeons, have great influence on the use of medical care. Through their recommendations and referrals, they can influence whether a particular patient receives surgery or not. A number of factors may influence whether they recommend surgery, such as their perception of clinical benefits to a patient relative to non-intervention. Their perceptions are likely influenced by their education and experience. Physicians also factor into their decisions their perceptions about patient health status, need for treatment, risk of complications, and patient desire for treatment, as well as income reasons.

Some surgeons have financial relationships with ASCs. Surgeons with such relationships may make medical decisions differently from those who do not have such relationships. We expect the data to show that these surgeons do more surgery, although perhaps not for the reasons that one might at first glance consider. Before considering why owners do more surgery than non-owners, it is useful to think about why one surgeon in a given time period does more than another surgeon, or why one surgeon may increase or decrease his or her own volume. There are many reasons that could explain these differences. We narrowed the list of factors to those we hypothesized would affect an owner's volume more so than a non-owner. Factors that most likely contribute to both owners and non-owners equally were not considered. Reasons that surgeon owners of ASCs might do more surgery are detailed below.

Technology and market trends have likely contributed to the growing use of surgery over time. Many orthopedic surgeries, such as arthroscopies, have shifted from inpatient to outpatient facilities, likely due to technology improvements, and thus an increasing number of surgeries are performed in an outpatient setting each year. Similarly, the incidence of surgeon ownership of ASCs has grown substantially over time. This overlap in trends inevitably produces a correlation between ownership and higher use of surgery, even though one did not cause the

other.¹ If owners are more responsive to technology and market trends than non-owners, we may expect to observe owners doing more surgery than non-owners. Market trends include both annual and seasonal trends in the use of KSWC surgery; for example, price changes and demand changes due to an influx into Florida of people during winter months. This study estimates how large the technology and market trends were and how much they contributed to the difference in surgery volumes between owners and non-owners.

The *entrepreneurial/recruitment effect* describes the fact that surgeons who perform a large number of surgeries, or who could potentially perform a large number, are more likely to be owners of ASCs. One reason for this is that surgeons who have large case loads may be sought by ASC managers to become owners or serve on their boards of directors. In this scenario, a larger case load leads to ownership. Knowing this, surgeons who wish to become owners may ramp up their volume in order to be selected. In this sense, the entrepreneurial/recruitment effect is capturing part of the ownership effect, or the additional surgeries that a surgeon performs in order to be recruited as an owner.

The entrepreneurial/recruitment effect also factors in the possibility that surgeons who become owners also may be more attuned to monetary incentives or be more entrepreneurial. As a result, they not only do more surgery and make more income than the average surgeon, but they also may be more aware of and more likely to seek out investment opportunities, such as co-owning or starting their own ASC. The entrepreneurial/recruitment effect also accounts for the possibility that surgeons who are recruited to be ASC owners tend to be located in geographic regions where there is higher demand for and use of surgery. Because certain types of surgeons choose ownership (e.g., those who do a large number of surgeries), we would necessarily observe that surgeon owners do more surgery. This study estimates how much the entrepreneurial/recruitment effect contributes to the owner/non-owner differential in surgery volume and isolates it from the effect of financial incentives that arise from ownership.

The *efficiency effect* describes the phenomenon that a surgeon who works at an ASC is able to perform more surgery than a surgeon who works at a hospital. This may be due to a number of reasons. Advocates for ASCs and orthopedic surgeons argue that ASCs are operationally more efficient than HOPDs.² For example, scheduling at ASCs can be done in ways that maximize the number of surgeries that a surgeon can do in a day or week. There may be lower overhead and administrative costs at an ASC relative to a hospital, which allow surgeons to schedule more surgeries within a certain amount of time as they switch from performing procedures in hospitals to ASCs. Surgeons also may prefer working at ASCs, relative to hospitals, and so decide to work more (e.g., do more surgery) when they work more at ASCs, because they enjoy their jobs more. If patients like ASCs more and a surgeon begins to work more at an ASC, his patients may be more likely to consider surgery as an option. In addition, there may be pressure to do more surgery at ASCs relative to at hospitals, perhaps via peer pressure. Often when surgeons become owners of ASCs, they tend to work more at their owned ASC. Thus, we may observe that owners do more surgery (in whole or in part) because of the efficiency effect. This study determines the efficiency effect, how much it contributes to the owner/non-owner differential, and separates it from the effect of owner financial incentives.

The *capacity effect* pertains to surgeons' ability to schedule more surgery by increasing the size of their practice networks. When adding a facility (ASC or hospital) to the network of places in which he or she performs surgery, a surgeon adds capacity and thus can do more surgery. Consolidating one's network may have the opposite effect, e.g., reducing the number of surgeries. Changing one's network may contribute to the owner/non-owner differential,

¹ For example, a surgeon's surgery volume will be higher in later periods than earlier ones, due to these technology and market trends. If the surgeon became an owner in the later period, we would observe higher volumes simply because the ownership surgery volume was observed in later periods, when the use of surgery was higher overall due to changes in technology. We likewise should also expect surgeon owners collectively to have higher surgery volumes than non-owners, simply because their volumes are observed in later time periods, when the use of surgery was higher due to changes in technology.

² Leblanc, Lalonde, and Lalonde (2007) provide some evidence that more surgeries can be performed at ASCs than at hospitals per unit of time.

because surgeon owners must add the owned ASC to their network, if it was not already part of it. In addition, some owners may consolidate their networks after becoming an owner. Thus, changes in a surgeon's practice network may be correlated with ownership and surgery volume, which may drive some of the difference in volume between owners and non-owners. This study determines the capacity effect, how much it contributes to the owner/non-owner differential, and separates it from the financial incentives effect.

The *financial incentives effect* describes how much financial incentives attendant to ownership affect a surgeon's surgery volume. A surgeon owner may be paid equity shares. The value of the shares improves as the ASC becomes a more successful business. An ASC's revenue is dependent on the number of services it provides and the price or reimbursement rate it receives for delivering services. An ASC's cost includes labor costs of staff, rent, and equipment costs. Like any business, as revenue increases and costs decrease, an ASC's value increases. A surgeon who has equity in an ASC would be incentivized to improve revenue or lower costs.³ The surgeon could do this by recommending more services, such as surgery, to the ASC, and by recommending the services to patients who are covered by insurers that pay higher reimbursement rates or have lower administrative costs for the ASC. Although investors are not paid for their referrals directly, the value of their equity increases as more "profitable" referrals are made to the ASC.

Financial incentives that arise from ownership create a conflict of interest for surgeons, because as owners, they will then be obliged to satisfy the interests of two groups—not just their patients, but their ASC managers as well. Having two groups of people to satisfy, surgeons may alter their practices and make different medical recommendations. If there is an overabundance of necessary surgeries and patients are having access problems, the increased income per surgery due to physician ownership encourages a surgeon to treat more patients. If there is not an overabundance of necessary surgeries, the increased income per surgery may encourage surgeon owners to agree to perform surgery on a borderline case, in which health benefits to the patient may be uncertain but the patient really wants surgery. In the period before they became physician owners, they may have been more reluctant to recommend surgery in these borderline cases.

Technology and market trends, the entrepreneurial/recruitment effect, the efficiency effect, the capacity effect, and owner financial incentives are reasons that we should expect surgeon owners to do more surgery than non-owners. The analytic challenge is to separate each of these effects.

DATA

Without appropriate data, it is difficult to separate the effects mentioned. What is required is data that observes surgeons' practice and ownership patterns over time. In this study, we use precisely that kind of data to study orthopedic surgeons in Florida. We examine the use of commonly performed outpatient orthopedic surgeries: arthroscopies of the knee, shoulder, and wrist, and carpal tunnel surgery. These surgeries are performed in both ASCs and HOPDs.

The data capture all KSWC surgeries performed between 1997 and 2004. During this time, the number of KSWC surgeries performed in Florida nearly doubled, and starting in 2003, ASCs surpassed hospitals as the primary

³ It is also possible that as an owner of an ASC, a surgeon may develop positive perceptions of the ASC. The surgeon may become more aware of the features of the ASC, its quality, and prefer working with the staff there. An owner may receive perquisites because of his or her ownership status, and as a result, prefer recommending patients to have surgery at the ASC. These positive perceptions and perquisites are often bundled with and may result from financial incentives in the ownership package, thus it is reasonable to think of the financial incentives effect as the effect of the package of ownership. Further, if surgeons learn about the quality of ASCs during their ownership period, we would expect the increase in surgeries to persist after their term ends. In Yee (2011), evidence for persistence in increased procedure volume was not found.

setting for these outpatient orthopedic surgeries.

The state of Florida and the time frame were chosen for several reasons. First, Florida is a large state and may be a pioneer in the use of ASCs. In 2007, Florida had the second highest number of ASCs in the United States, second only to California (Fields, 2011). Second, the right kind of data to perform an over-time analysis was available from Florida state agencies. Third, the time frame of the data covers the beginning stages of ASC dominance in orthopedic surgeries in Florida. Stakeholders in states that are undergoing a similar transition today may find the conclusions of this study instructive. Fourth, during our study period, hospitals have not yet had a chance to compete with ASCs, and ASCs have not yet saturated the market. This allows for cleaner isolation of the efficiency and financial incentive effects.

The data, however, is limited in that Florida today may be different from what it was between 1997 and 2004. There are certainly more ASCs today than at that time. Surgeons in Florida today may be more or less responsive to financial incentives, perhaps because the ownership packages have changed. Most trends indicate that the effects estimated in this study will likely be underestimates of the current environment. In addition, Florida is a unique state in some ways. It is a state in which physician dispensing is relatively common. It has, on average, an older population, and so Medicare and Medicaid policies may have a greater impact on medical utilization and costs than in other states.

Our sample includes 694,007 KSWC surgeries that were performed in Florida ASCs and HOPDs by 941 orthopedic surgeons.⁴ The number of ASCs grew from 80 to 140 between 1997 and 2004, whereas the number of HOPDs grew from 170 to 180. The surgeries in our data were covered by workers' compensation, Medicare, group health or commercial insurance, Medicaid, and other payors. Among payors, workers' compensation paid for 14 percent of these surgeries. Group health covered the majority of the surgeries, followed by Medicare.

IDENTIFYING SURGEON OWNERS

Data that identify physician owners are not readily available. Gabel et al. (2008) writes, "There are no publicly available data on which physicians are owners of an [ambulatory surgical center]." Previous studies have typically proxied ownership of ASCs in one of three ways:

- a surgeon who served on the board of directors of a particular ASC (*board owner*),
- a surgeon who is one of the most frequent users of a particular ASC (*frequent user owner*), and
- a surgeon who performs above a minimum threshold percentage of his or her procedures at a particular ASC (referred to in this report as *threshold owner*).

Each measure is correlated with ownership; however, they vary in their precision of identifying owners. We would expect that a measure that is more accurate in identification (i.e., more correlated with ownership) would yield estimates that are closer to the true phenomenon we are trying to estimate, such as the effect of owner financial incentives. Each ownership proxy above likely identifies some surgeons as owners when they are not and conversely, identifies other surgeons as non-owners when they are in fact owners. To the extent that the measure is not accurate, the estimates will be underestimated (biased toward a nil effect). This is discussed in the Limitations section of this chapter. Because they each have advantages and disadvantages, we report findings using all three ownership measures and discuss the differential impacts from using one measure versus another. Table 2.1 defines the

⁴ See Technical Appendix A for how we identify orthopedic surgeons. Technical Appendix A also has more information about data sources, data extraction, and descriptive statistics on the sample studied.

ownership measures used in this report.

The *board owner* measure was created by Yee (2011), who collected information on board directors of ASCs. As a director, a surgeon typically receives remuneration from the ASC, and in return, shares in the responsibility for the financial success of the ASC.⁵ Yee (2011) compared surgeons' surgery volumes during their board terms with their surgery volumes prior to their board terms and after their board terms had ended. In this study, we use the same data on board directors that Yee (2011) used.

Table 2.1 Variables Identifying Surgeon Owners

Short-hand Name	Reference	Variable Description	Variable Definition
Board owner	Yee (2011)	Identifies a surgeon serving on an ASC's board of directors in time period <i>t</i> .	Binary indicator that equals one if a surgeon served on an ASC's board in a particular quarter and zero otherwise.
Frequent user owner	Gabel et al. (2008)	Identifies a surgeon who was a frequent user of an ASC and who collectively with all frequent users accounted for 50 percent of procedures performed at the ASC within the past year from time period <i>t</i> .	Binary indicator that equals one if a surgeon, when ranked by his procedure volume among all surgeons who performed procedures at an ASC, was a surgeon who accounted for the top 50 percent of the ASC's procedure volume in the past year from time period <i>t</i> . It is zero otherwise. See Table 2.2 for more information.
Threshold owner	Hollingsworth et al. (2010)	Identifies a surgeon who did more than 30 percent of his or her procedure volume in the previous 12 months before time period <i>t</i> at a single ASC.	Binary indicator that equals one if a surgeon performed more than 30 percent of his or her procedures in the previous 12 months prior to a particular quarter at a single ASC and zero otherwise.

Notes: A surgeon's procedure volume is the number of outpatient procedures that he or she referred to or performed in an ASC or HOPD in the specified time period. An ASC's procedure volume is the number of procedures that were performed in the ASC in the specified time period.

Key: ASC: ambulatory surgical center.

The *frequent user owner* measure was developed and used by Gabel et al. (2008) to compare frequent users of ASCs with frequent users of hospitals. The logic behind the measure is to determine how much of an ASC's volume is reliant on a given surgeon, and then to choose the top contributing surgeons. Following Gabel et al. (2008), to identify frequent user owners of an ASC, we determined, in any given year, which surgeons performed surgery at the ASC, and ranked them in order of most frequent to least frequent users of that ASC. We then defined as owners the most frequent users that were collectively responsible for half of the surgeries at each ASC. See Table 2.2 for an illustration of this approach.

⁵ Serving on the board of a for-profit entity, like an ASC, is commonly compensated by some sort of remuneration (Allbusiness.com, 2011). While data on payments to ASC board members are not readily and publicly available, sources suggest that directors can be given equity and/or a stipend.

Table 2.2 Illustration of How Frequent User Owners Are Defined in the Data

ASC A		ASC B		ASC C	
Surgeon Name	% of ASC Procedure Volume in Year X	Surgeon Name	% of ASC Procedure Volume in Year X	Surgeon Name	% of ASC Procedure Volume in Year X
Surgeon 1	30	Surgeon 8	30	Surgeon 31	30
Surgeon 2	20	Surgeon 9	11	Surgeon 32	10
		Surgeon 10	9	Surgeon 33	7
50% Cutoff					
Surgeon 3	10	Surgeon 11	8	Surgeon 34	6
Surgeon 4	10	Surgeon 12	7	Surgeon 35	5
Surgeon 5	10	Surgeon 13	6	Surgeon 36	4
Surgeon 6	10	Surgeon 14	5	Surgeon 37	3
Surgeon 7	10	Surgeons 15 to 30 ^a	24	Surgeons 38 to 50 ^a	35
Total volume	100	Total volume	100	Total volume	100

Notes: In order to identify frequent user owners, we first identified, for each ASC, all the surgeons who used that ASC in a given year; in the above example, year X. As we can see, for ASC A, there were 7 surgeons who used that ASC; for ASC B, there were 23 surgeons, etc. Next, we ranked the surgeons based upon how much of the ASC's total procedure volume was performed by each surgeon. For example, Surgeon 1 was responsible for 30 percent of all procedures performed at ASC A, and Surgeon 2 was responsible for 20 percent of all procedures performed at ASC A. Finally, we identified as frequent user owners those surgeons who most frequently used the ASC and who collectively were responsible for half of the surgery performed at that ASC. The 50 percent cutoff is indicated in the table; those who are above the line are identified as surgeon owners; those who are below the line are non-owners.

In the case of ASC C, the top ranked surgeons (Surgeons 31, 32, and 33) were responsible for only 47 percent of the entire procedure volume. This is because we only included in our definition of frequent user owners as many surgeons who were collectively responsible for no more than 50 percent of an ASC's volume.

^a For the purposes of this example, we assume that Surgeons 15 to 30 share evenly in the 24 percent of ASC B's surgery volume; likewise for Surgeons 38 to 50 at ASC C.

The technique used to identify *threshold owners* was developed by Mitchell (2005). In contrast to the frequent user owner measure, which is derived from the perspective of the ASC, the threshold owner measure identifies probable owners from the perspective of a physician. Mitchell (2005) identified probable owners of a cardiac specialty hospital as surgeons who referred more than 10 percent of their cardiac admissions to that specialty hospital. The technique was adapted to ASCs by Hollingsworth et al. (2010), who identified probable owners of ASCs as those who referred more than 30 percent of their caseload to a single ASC instead of 10 percent. In this study, we adopt the Hollingsworth et al. (2010) threshold of 30 percent.

The 30 percent threshold is based on the OIG Safe Harbor regulations, which relax certain anti-kickback restrictions and allow self-referrals for surgeons who derive one-third of their previous 12 months' incomes from procedures that can be performed in ASCs and/or were performed in their owned ASCs, depending on the type of ASC (multi-specialty or single specialty). At first, this may seem counterintuitive, but the regulations are meant to allow self-referrals for surgeons who mainly work on ASC-type procedures and for those who treat their owned ASCs as if they were extensions of their offices.

The advantages of the frequent user owner and threshold owner measures are that they can be used with any data set of medical records that provides unique physician identifiers. Unlike the board owner measure, these measures do not require researchers to pay the costs of data collection.

A drawback is that they are dependent on a cutoff level. The dependency on a cutoff level may potentially cause the measures to be over inclusive or under inclusive, thus labeling some non-owners as owners and vice versa. Using measures that are either over or under inclusive will yield estimates that understate the financial interest effect, which is a common empirical issue called measurement error. Without knowing whether a measure is over or under inclusive, we cannot be sure what behavioral mechanisms drive the biases from measurement error.

The threshold owner measure uses a cutoff level or threshold of 30 percent. Since it is possible that some surgeons refer more than 30 percent of their caseload to ASCs without being owners, a higher cutoff level, such as 50 percent, may be more likely to classify these non-owners as non-owners. The cutoff level for frequent user owners is the point when the collective group of frequent users of an ASC accounts for 50 percent of the ASC's procedure volume. Another cutoff level that may also be reasonable is 75 percent. We report sensitivity of different cutoff levels for frequent user and threshold owner measures in the Technical Appendices.

Proxying surgeon owners with ASC board directors also has advantages and disadvantages. The main advantage is that it is more likely to measure owners rather than probable owners. This proxy also does not rely on surgeon practice patterns to define ownership—such a reliance may confound the direction of causality. A third advantage is that it does not depend on a cutoff level and therefore is not sensitive to the level chosen by the researcher.

The drawback of board membership is that it is under inclusive. In other words, ASC surgeon board directors are likely to be a subset of all surgeon owners. However, using a smaller but more accurate group of probable owners, rather than an over-inclusive group, allows us to better interpret our findings because we can know the source of bias in our estimates. For example, some ASC directors were owners prior to their board terms, and during this time, they may have increased their surgery volumes because of ownership incentives. Thus, we can expect that for these board owners, the increase in surgery volume from board membership (our proxy for ownership) is smaller than the total increase we would have found had we observed their surgery volumes since their beginning of ownership.

Without a large data set that truly identifies surgeon owners, it is difficult to test how severe the biases are from each of the ownership proxies.⁶ However, we can evaluate the behavior of surgeons who are probable owners according to these measures and provide a range of estimates.

The three owner measures overlap in their classification of surgeons. For example, most board members and frequent users are threshold owners. Please see Technical Appendix B for more information on the overlap of measures.

EMPIRICAL METHODS

This section describes the method used to decompose into five explanatory factors the difference in surgery volume between owners and non-owners.⁷ We also discuss the method by which we estimate the impact of the financial incentives attendant to ownership on three aspects of a surgeon's practice: the number of surgeries performed, the shifting of surgeries to surgeon-owned ASCs, and the change in payor mix of a surgeon's practice—increasing the number of patients treated who are covered by payors who reimburse at higher rates.

⁶ Further, if we had a large data set that identified physician owners, we would use that data to determine the effect of ownership, rather than using proxies.

⁷ Theoretically, we mean true owners and non-owners. Empirically, since there are no direct measures of physician ownership that are publicly available, we provide findings based on “probable owners” and “probable non-owners.” Throughout the remaining text, we may simplify the phrase “probable owners” to “owners” and “probable non-owners” to “non-owners,” unless it is critical to the meaning of the sentence to distinguish the difference between the two ways of labeling surgeons.

QUANTIFYING THE REASONS THAT OWNERS DO MORE SURGERY THAN NON-OWNERS

Previous studies have found that owners do more surgery than non-owners. We also observed this phenomenon using our data. Our goal is to know how much of the owner/non-owner differential in surgeries performed is due to the factors defined previously: financial incentives effect, ASC efficiency gains, capacity effect, entrepreneurial/recruitment effect, and technology and market trends. Table 2.3 describes the variables that were used in the analysis.

A surgeon's surgery volume was comprised of all outpatient KSWC surgeries that he or she performed in an ASC or HOPD. The ability to observe all surgeries is critical to answering our research questions. If we only observed the number of surgeries that a surgeon performed at his or her affiliated ASC, we would not be able to isolate the impact of owner financial incentives on surgery volume. Instead, we would have to estimate the combined impact on a surgeon's volume with the impact on shifting patients toward the surgeon's ASC.

By similar logic, we did not focus this study solely on a single payor. Examining the surgery volume associated with only one payor group would couple any effects on utilization with the potential substitution of patients covered by that payor for other payors. In addition, the effects on one payor are sensitive to that payor's prices and costs relative to other payors during the time frame of the data, Florida between 1997 and 2004. The estimates' effect on all payors would be less sensitive to the time frame of the data. Finally, generalizing effects on one payor as the effect on all payors would be a misinterpretation of the impact. By studying all payors and then comparing the impacts on different payors (discussed later in this chapter), we can more precisely answer our research questions and address the concerns of policymakers.

Table 2.3 Variables for Decomposition of Owner/Non-Owner Differential in Surgeries Performed

Variable Goal or Purpose	Variable Description	Variable Definition
Utilization (response) measure		
Response variable that measures utilization/quantity of surgery supplied by a surgeon	Surgeon's quarterly surgery volume	The count of knee, shoulder, and wrist arthroscopies, and carpal tunnel surgeries, that were performed in an ASC or HOPD for which the surgeon was the attending/referring surgeon. Counts are quarterly counts.
Explanatory factors		
Estimate technology and annual market trends	Year indicators	Binary indicators that equal one for a particular year and zero for all other years. For example, the 2004 year indicator equals one for all observations in year 2004 and zero otherwise. The base or reference year in the models estimated is 1997.
Estimate seasonal market trends	Seasonal indicators	Binary indicators that equal one for a particular season or quarter and zero for all other seasons or quarters. The base or reference quarter in the models estimated is the first quarter.
Estimate the entrepreneurial/recruitment effect	Surgeon fixed effects	A set of binary indicators, each equaling one for that particular surgeon and zero for any other surgeon.
Estimate the efficiency effect	Predicted number of surgeries due to a surgeon working more with an ASC	This variable is the end result of a two-step process, which is described as follows: 1) Using a sample of non-owners (as defined by frequent user owner-75), ^a determine the relationship between a surgeon performing a larger percentage of his or her surgeries at ASCs and his or her surgery volume. 2) Using the estimated relationship, extrapolate it to all surgeons, including owners and non-owners. This variable is the estimated number of surgeries that a surgeon should perform due to simply doing the fraction of procedures at ASCs that is observed.

continued

Table 2.3 Variables for Decomposition of Owner/Non-Owner Differential in Surgeries Performed (continued)

Variable Goal or Purpose	Variable Description	Variable Definition
Create the variable that is used to estimate the efficiency effect (above)	Share of total procedure volume that a surgeon refers or performs at ASCs	The percentage of all procedures that a surgeon performs in a given quarter that was performed at any ASC. This is the variable that measures how much a surgeon works at ASCs, and it is used in the first step of the two-step process described above.
Estimate the capacity effect	A surgeon's facility network size	Number of facilities where a surgeon performs procedures in a particular quarter. If a surgeon performed a procedure in an ASC or HOPD in a particular quarter, that facility is counted as being part of that surgeon's facility network. This variable is the count of such facilities.
Estimate the owner/non-owner differential and the financial incentives effect - 1	Board owner	Binary indicator that equals one if a surgeon served on an ASC's board in a particular quarter and zero otherwise.
Estimate the owner/non-owner differential and the financial incentives effect - 2	Frequent user owner	Binary indicator that equals one if a surgeon, when ranked by his procedure volume among all surgeons who performed procedures at an ASC, was among the top surgeons who accounted for at most 50 percent of the ASC's procedure volume in the past year from time period <i>t</i> . It is zero otherwise.
Estimate the owner/non-owner differential and the financial incentives effect - 3	Threshold owner	Binary indicator that equals one if a surgeon performed more than 30 percent of his or her procedures in the previous 12 months prior to a particular quarter at a single ASC and zero otherwise.

Notes: An ASC's procedure volume is the number of procedures that were performed in the ASC in the specified time period. A surgeon's procedure volume is the number of outpatient procedures the surgeon referred or performed in an ASC or HOPD in the specified time period. A surgeon's surgery volume is the number of KSWC surgeries he or she performed in an ASC or HOPD in a given quarter.

^a Frequent user owner-75 identifies probable owners in a way similar to the frequent user owner-50 measure, except it uses a cutoff level of 75 percent of an ASC's procedure volume rather than a 50 percent cutoff level. We excluded surgeons who were not accountable for 75 percent of an ASC's volume because we wanted to lower the chance of including a true surgeon owner. After running some tests, we found that the frequent user owner-75 measure seemed to include some probable owners who were not identified as owners by using the frequent user owner measure. See Chapter 3 for more information on the frequent user owner measure. See Technical Appendix B for more information about the frequent user owner-75 measure.

Key: ASC: ambulatory surgical center; HOPD: hospital outpatient department or facility; surgery or KSWC surgery: a knee, shoulder, or wrist arthroscopy, or carpal tunnel surgery.

We used negative binomial regression analyses to estimate how much larger the surgery volumes of owners were than non-owners and how the difference shrank as we accounted for different effects.⁸ The owner/non-owner differential was estimated for each ownership measure. We separated technology and market trends in the use of surgery by using year and quarter indicators. These variables captured statewide and seasonal trends in the use of KSWC surgery in Florida, which can be attributed to changes in technology, shifts in patient preferences for surgery, price fluctuations or fee schedule changes, legislative changes, and seasonal changes in jobs.⁹ To isolate the entrepreneurial/recruitment effect, we used surgeon fixed effects, which captured differences in one surgeon's

⁸ We used negative binomial regressions rather than ordinary least squares (OLS) because the dispersion of the distribution of surgeon surgery volumes (a count variable) was large relative to the mean, supporting the use of a negative binomial regression. Surgery volumes were also not as normal as one would like in order to use OLS. OLS estimation results are available upon request.

⁹ During the time frame of the data studied in this report (1997–2004), two regulatory changes might potentially have affected the use of KSWC surgeries in Florida: Medicare's initiation of its Hospital Outpatient Prospective Payment System in 2000 and the Florida Division of Workers' Compensation's fee schedule reforms in 2003. Among many changes, the workers' compensation fee schedule reforms increased physician surgery fee schedule amounts from near Medicare to 40 percent above Medicare, and decreased hospital fees for scheduled outpatient surgeries. The Anatomy benchmark report for Florida, published by the Workers Compensation Research Institute, showed that overall surgical prices increased by less than 10 percent in the post-reform period (Eccleston, Petrova, and Zhao, 2009). The price increase was lower than the fee schedule increase because the average price paid for surgery often exceeded the older (lower) fee schedule prior to the reform.

practice from another and the phenomenon that higher-volume surgeons were more likely to become owners of ASCs.¹⁰ We identified the capacity effect by including a variable that measures the size of a surgeon's facility network, i.e., the number of facilities where a surgeon provides services. This captures surgeons' increase in capacity and caseload when they increase their network.

One important challenge in measuring the efficiency effect is to isolate it from the other effects—especially the ownership effect. If owners increase their use of ASCs due to the owner financial incentives, and if there is an efficiency gain from the increased use of ASCs, then the observed increase in the number of surgeries performed by owners will be attributable to the combined efficiency and ownership effects. Fortunately, if there is an efficiency effect, it would also be seen in the experience of non-owners. We use the experience of non-owners to estimate the efficiency effect, hypothesizing that as non-owners increase their use of ASCs (as compared with HOPDs), they benefit from an efficiency effect, and we can observe the increase in the number of surgeries done by non-owners due to the time savings achieved by performing procedures at ASCs.

To implement this empirically, we performed a two-step process. In the first step, we calculated for each non-owner surgeon the percentage of his or her procedures that he or she performed at ASCs, rather than at hospitals. We then estimated how many more KSWC surgeries a surgeon non-owner performed as the percentage of surgeries he or she performed at ASCs increased. Figure 2.1 illustrates this relationship. The relationship ascertained from the first step is then applied to both owners and non-owners. In essence, for owners, we estimated what owners' surgery volumes would have been had they not been owners, but still experienced working with ASCs the same amount as they did. This requires an assumption that the efficiency effects (separate from the ownership effect and other effects) are similar for owners and non-owners.¹¹

In the second step, to measure how much of the owner/non-owner differential was due to efficiency gains, we subtracted each owner and non-owner surgeon's efficiency gain based on the share of procedures he or she performed at ASCs from his or her surgery volume.¹²

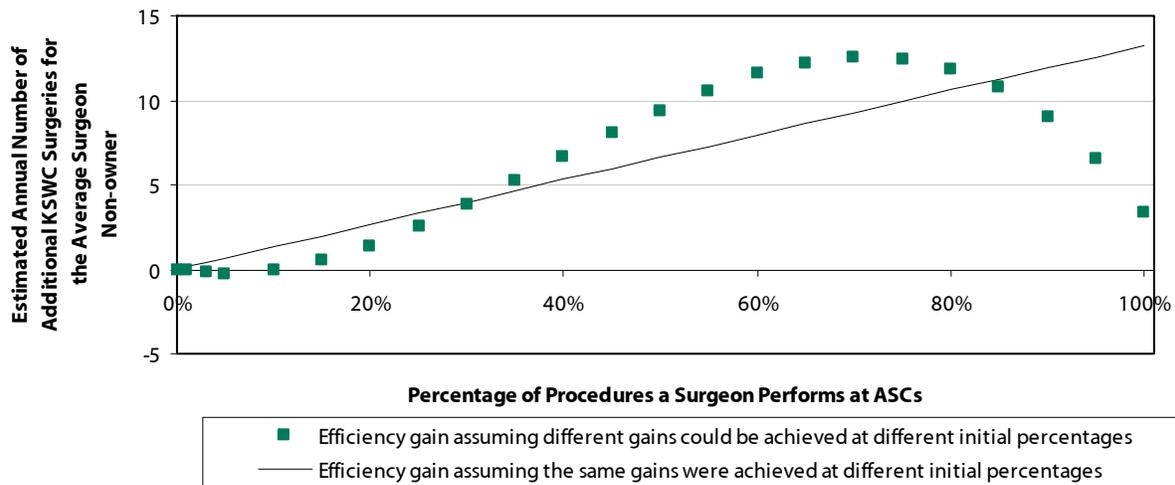
After the above factors were separated from the owner/non-owner differential, the remainder was the impact of owner financial incentives. In other words, the other factors have controlled for hypothesized competing explanations for why surgeon owners do more surgery than non-owners.

By including surgeon fixed effects and time trends in the model, we essentially estimated a slightly more advanced model than the commonly known approach called *difference-in-differences*. Similar to a difference-in-differences approach, our model compares a surgeon owner's surgery volume during ownership with periods of non-ownership, relative to the trend in surgery use among surgeons who were never owners. Unlike a difference-in-differences approach, our model allows each surgeon owner to become an owner in different time periods and allows each to have his or her own average (pre-ownership) surgery volume. The key to identifying the efficiency effect, capacity effect, and financial incentives effect is knowing *when* individual surgeons became owners of ASCs. By knowing when a surgeon became an owner, we can compare the surgeon's supply of services and medical decision making before he or she became an owner and after.

¹⁰ As mentioned earlier, the entrepreneurial/recruitment effect may include part of the ownership effect since surgeons may ramp up their volume in order to become owners. The additional surgeries that a surgeon performs in order to be recruited as an owner are captured by the surgeon fixed effects, and are not attributed to the financial incentives effect.

¹¹ Unfortunately, this assumption cannot be empirically tested. If it could be tested, we would not have to develop this two-part process. One might think that surgeon owners, in addition to receiving ownership shares, would receive special priority or be given more operating room time and a choice of better days of the week, or better times during the day, in which to perform surgery, which translates into the ability for surgeon owners to do more surgery than non-owners. However, because special priority is often bundled with ownership shares—having these shares may even cause special priority—we do not view this priority as the efficiency gain from ASCs *relative to hospitals*. Rather, it is part of the package of becoming an owner and thus is identified with the financial incentives effect.

¹² To be precise, from a surgeon's observed surgery volume, we subtracted the predicted number of surgeries that he or she would have performed in the first quarter of 1997 had he or she worked as much at ASCs as he or she did in the observation quarter.

Figure 2.1 ASC Efficiency Gains: Relationship between Percentage of KSWC Surgeries Performed at ASCs and a Surgeon's Surgery Volume

Notes: For each line, the slope between the two points along the line represents the estimated average number of additional surgeries a surgeon can do per year for the percentage point increase in the surgeon's share of procedure volume shifted from HOPDs to ASCs. The solid line shows the overall average (linear relationship); this line assumes a constant gain—in other words, that a surgeon will increase the amount of surgery performed equally as he or she increases the percentage of surgery performed at ASCs. The curved line assumes that surgeons will increase the amount of surgery performed in different amounts, depending on the percentage of procedures performed at ASCs. For example, those who perform nearly all their procedures at ASCs may experience smaller efficiency gains or even reduce the number of surgeries they perform by further increasing their use of ASCs; however, surgeons who use ASCs less may increase the amount of surgeries performed by a much larger amount if they begin to use ASCs much more frequently.

Data are based on Florida administrative ASC and hospital outpatient records for KSWC surgeries that occurred between 1997 and 2004. The sample includes non-owner orthopedic surgeons in Florida between 1997 and 2004. The non-owner measures used were the frequent user 75 (75 percent cutoff level rather than 50 percent) and board owner. The threshold owner measure was not used because there was not enough variation among non-threshold owners in the shares of procedures surgeons performed at ASCs—almost all shares were below 30 percent. See Chapter 3 for more information on the frequent user owner measure. See Technical Appendix B for more information about the frequent user owner-75 measure.

Key: ASC: ambulatory surgical center; HOPD: hospital outpatient department or facility; KSWC surgery: a knee, shoulder, or wrist arthroscopy, or carpal tunnel surgery.

EFFECT OF OWNERSHIP ON SITE OF SERVICE

It would not be surprising if surgeons began shifting their surgeries and other procedures to the ASCs that they own. To investigate this issue, we estimated OLS regressions that determined what fraction of a surgeon owner's surgery volume was shifted to the affiliated ASC as a result of the financial incentives that arise from ownership. We estimated the change in the average surgeon's share of surgery volume performed at the owned ASCs from when the surgeon was not an owner to when he or she was an owner.

We controlled for technology and market trends that would likely affect the overall shift toward ASCs, possibly due to technology improvements, price changes, or demand for surgery at ASCs. We also controlled for the self-selection of surgeons into ownership, i.e., the possibility that ASCs recruit surgeons who do not yet work with the ASC but who perform a greater number of surgeries than typical. Finally, we controlled for the capacity effect, or the possibility that expanding or shrinking one's facility network may reduce or increase the proportion of surgeries performed at the surgeon-owned ASC. The variables are described in Table 2.4.¹³

¹³ The control variables in Table 2.4 are the same as those defined in Table 2.3. However, because the dependent or outcome variable—proportion of surgeries performed at the surgeon-owned ASC—is different, the interpretation is different.

Table 2.4 Variables for Determining the Shift of Surgeries and All Procedures to Surgeon-Owned ASCs

Variable	Definition
Shift (response) measures	
Surgeon's share of quarterly surgery volume that was performed at the affiliate ASC	The share of a surgeon owner's quarterly surgery volume that was performed at the owned ASC.
Surgeon's share of quarterly total procedure volume that was performed at the affiliate ASC	The share of a surgeon owner's quarterly procedure volume, including surgery and other procedures, that was performed in the owned ASC.
Ownership measures	
Board owner	Binary indicator that equals one if a surgeon served on an ASC's board in a particular quarter and zero otherwise.
Frequent user owner	Binary indicator that equals one if a surgeon, when ranked by his procedure volume among all surgeons who performed procedures at an ASC, was among the top surgeons who accounted for at most 50 percent of the ASC's procedure volume in the past year from time period t . It is zero otherwise.
Threshold owner	Binary indicator that equals one if a surgeon performed more than 30 percent of his or her procedures in the previous 12 months prior to a particular quarter at a single ASC and zero otherwise.
Control variables	
Year indicators	Binary indicators that equal one for a particular year and zero for all other years. For example, the 2004 year indicator equals one for all observations in year 2004 and zero otherwise. These year indicators control for time trends in, for example, the economy or technology that might affect demand and supply of ASCs, and in particular, surgeon-owned ASCs. The base or reference year in the models estimated is 1997.
Seasonal indicators	Binary indicators that equal one for a particular season or quarter and zero for all other seasons or quarters. For example, the first quarter of any year is approximately winter. These indicators control for seasonal changes in the use of ASCs and surgeon-owned ASCs. The base or reference quarter in the models estimated is the first quarter.
Surgeon fixed effects	A set of binary indicators, each equaling one for that particular surgeon and zero for any other surgeon.
A surgeon's facility network size	Number of facilities where a surgeon performs procedures in a particular quarter. If a surgeon performed a procedure in an ASC or HOPD in a particular quarter, that facility is counted as being part of that surgeon's facility network. This variable is the count of such facilities.

Notes: An ASC's procedure volume is the number of outpatient procedures that were performed in the ASC in the specified time period. A surgeon's procedure volume is the number of outpatient procedures the surgeon referred or performed in an ASC or HOPD in the specified time period. A surgeon's surgery volume is the number of KSWC surgeries he or she performed in an ASC or HOPD in the specified time period.

Key: ASC: ambulatory surgical center; HOPD: hospital outpatient department or facility; surgery or KSWC surgery: a knee, shoulder, or wrist arthroscopy, or carpal tunnel surgery.

EFFECT OF OWNERSHIP ON PAYOR MIX

Many ASCs do not accept all forms of insurance. It would not be surprising if surgeon owners of ASCs altered the payor mix of their practice so that they would be treating patients whose insurance coverage is accepted by their ASC. Surgeon owners may also be incentivized to treat patients covered by payors who reimburse at higher rates and may be more profitable. Relative prices paid by payors make reimbursement rates higher for treating some patients than other patients. Unlike non-owners, surgeon owners' incomes are dependent on not only the professional fees for performing services but are also associated with ASC reimbursements.

To investigate the effect of ownership on payor mix, we estimated payor-specific negative binomial regressions. For each type of payor, such as workers' compensation, we estimated the increase or decrease in the number of surgeries performed on patients covered by that payor when a surgeon became an owner, relative to when he or she was not an owner.

We controlled for technology and market trends that may have impacted the use of surgery by certain types of payors, e.g., shifts from one type of payor to another type. We also controlled for the entrepreneurial/recruitment effect, e.g., the possibility that ASCs recruit surgeons who performed a large (or small) number of surgeries covered by the given payor group. Finally, we controlled for the capacity effect, or the possibility that expanding or shrinking one's facility network may reduce or increase the number of surgeries covered by the given payor group. The variables are described in Table 2.5.¹⁴

Table 2.5 Variables for Determining the Shift in Payor Mix

Variable	Definition
Shift (response) measures	
Surgeon's quarterly surgery volume that is covered by a particular payor group	The count of knee, shoulder, and wrist arthroscopies, and carpal tunnel surgeries, that were performed in an ASC or HOPD, referred by the surgeon, and covered by a particular payor group, e.g., workers' compensation, commercial insurance, Medicare, and Medicaid. Counts are quarterly counts.
Ownership measures	
Board owner	Binary indicator that equals one if a surgeon served on an ASC's board in a particular quarter and zero otherwise.
Frequent user owner	Binary indicator that equals one if a surgeon, when ranked by his procedure volume among all surgeons who performed procedures at an ASC, was among the top surgeons who accounted for at most 50 percent of the ASC's procedure volume in the past year from time period <i>t</i> . It is zero otherwise.
Threshold owner	Binary indicator that equals one if a surgeon performed more than 30 percent of his or her procedures in the previous 12 months prior to a particular quarter at a single ASC and zero otherwise.
Control variables	
Year indicators	Binary indicators that equal one for a particular year and zero for all other years. For example, the 2004 year indicator equals one for all observations in year 2004 and zero otherwise. These year indicators control for time trends in, for example, the price or fee schedule changes that might affect demand and supply of surgeries covered by certain payors. The base or reference year in the models estimated is 1997.
Seasonal indicators	Binary indicators that equal one for a particular season or quarter and zero for all other seasons or quarters. For example, the first quarter of any year is approximately winter. These indicators control for seasonal changes in the use of surgery by patients covered by certain payors—for example, a retired population traveling to Florida in the winter, or work injuries that are seasonal. The base or reference quarter in the models estimated is the first quarter.
Surgeon fixed effects	A set of binary indicators, each equaling one for that particular surgeon and zero for any other surgeon.
A surgeon's facility network size	Number of facilities where a surgeon performs procedures in a particular quarter. If a surgeon performed a procedure in an ASC or HOPD in a particular quarter, that facility is counted as being part of that surgeon's facility network. This variable is the count of such facilities.

Notes: An ASC's procedure volume is the number of outpatient procedures that were performed in the ASC in the specified time period. A surgeon's procedure volume is the number of outpatient procedures the surgeon referred or performed in an ASC or HOPD in the specified time period.

Key: ASC: ambulatory surgical center; HOPD: hospital outpatient department or facility; surgery: a knee, shoulder, or wrist arthroscopy, or carpal tunnel surgery.

¹⁴ The control variables in Table 2.5 are the same as those defined in Table 2.3. However, because the dependent or outcome variable—the number of surgeries covered by a given payor—is different, the interpretation is different.

TERMINOLOGY

To improve the readability of this report, we use certain phrases to describe concepts that may be more complicated than the phrase may at first suggest. These phrases are defined below. Additional useful terminology is included in the Glossary.

- *Owner/non-owner differential* or *disparity* describes the average surgery volume of surgeon owners during their ownership periods less the following: the average surgery volume of surgeons who were never owners throughout the time frame of the data, of surgeon owners before ownership, and of surgeon owners after ownership ends (if applicable).
- *Ownership vs. financial incentives that arise from ownership*—When a surgeon becomes an owner, many factors may be influencing his or her surgery volume, besides additional financial incentives. Wherever possible, to prevent confusion, we reserve *ownership* to describe all that happens in the time period when a surgeon is an owner of an ASC and *financial incentives that arise from ownership* to describe the incentive structure that a surgeon faces when he or she is an owner, or the financial aspect of being an owner of an ASC (as proxied by our ownership measures). Similar to previous studies, we compare probable surgeon owners with probable non-owners. In these previous studies, this is called the *ownership effect*, although it also includes the entrepreneurial/recruitment effect and efficiency gains that owners may experience when becoming an owner. In this study, we isolate the effect of the financial aspect of ownership, which provides clearer policy applications.
- *Physician ownership vs. surgeon ownership*—We use the phrase *physician ownership* when discussing the generality of ownership among any type of physician, and *surgeon ownership* when discussing the findings of this report.

LIMITATIONS

In this section, we address the boundaries of this report and carefully specify exactly what is measured and how one can or cannot extrapolate the findings. First, this study uses proxies for ownership. Empirically this will likely underestimate the owner/non-owner differential and the impact of ownership on the use of surgery. With regard to the latter, our methods estimate the average *change* in a surgeon's surgery volume when she or he becomes an owner. If we identify a surgeon as becoming an owner when he or she did not actually become an owner, the change in the surgeon's surgery volume from the previous period to the period of supposed ownership will likely be small, since the surgeon did not actually become an owner and did not experience any new financial incentives. A similar scenario can be said of surgeons who were owners before we identified them as owners. Their change in surgery volume will also be small. Thus, when we average the changes experienced by each surgeon owner, the average will be reduced by inclusion of surgeon non-owners and surgeons who were owners before we measured them as owners.

Another important boundary is that the impact of ownership may affect more than the decisions about surgery, the site of surgery, and who pays for surgery. It may affect the type of surgery or the supplies used in surgery. For example, there are open surgery procedures and endoscopic releases for carpal tunnel syndrome. Both are often reimbursed at the same rate; however, endoscopic releases may be more profitable for ASCs because many patients and payors reimburse additional sums for the disposable kit that is used for this procedure. This study does not examine this type of effect, which is another way in which this report understates the total effect of financial interests on medical costs and utilization.

On a similar note, ownership is just one type of financial relationship between physicians and other businesses in the health care sector. A *Wall Street Journal* article reported that surgeons can also receive royalties from medical device companies and as a result might choose certain medical devices over others (Carreyrou and McGinty, 2010). This study only examines ownership, which may be limited in its scope, but provides a focused analysis of the kind of behavior that potentially may be observed elsewhere.

Due to data limitations, we were not able to study how ownership may have affected the likelihood that a surgeon treated a patient with surgery.¹⁵ Ideally we would be able to measure not just the number of additional surgeries as done in this report, but also whether surgeons changed the probability of treating patients with surgery. The prior shows how many surgeries were actually performed, while the latter shows how surgeon practice behavior changes.

Also due to data limitations, this report does not determine the effects of using ASCs or surgeon ownership on surgery quality or patient outcomes. Surgeon owners who do more surgery at their affiliate ASC may perform with better patient outcomes. In addition, patients may prefer ASCs over hospitals for reasons that are unrelated to health outcomes, such as faster service and better location. We are unable to measure whether ASCs produce better, worse, or the same outcomes as hospitals do. Moreover, we are unable to measure whether repeat surgeries occur more often or less often with a shift in site of surgery, which may impact medical costs.

We are not able to judge whether the additional surgeries either due to efficiency gains from working at ASCs or due to ownership were necessary or not, or whether they were cost-effective. If they were all necessary, this may mean that there had been a considerable access to care problem in the areas where ASCs have developed. If they were unnecessary, this implies that the costs associated with performing surgery—costs to the patient and society—may be unjustified. This is an important direction for future research.

GENERALIZING THE RESULTS

These results may be generalized to other states, time frames, and procedures, although the reader should use caution. The effect we find was identified from orthopedic surgeon owners of ASCs in Florida between 1997 and 2004 and pertains to arthroscopies and carpal tunnel surgeries. A previous study indicated that the effect did extrapolate to other surgeries, namely colonoscopies (Yee, 2011). Arthroscopies, carpal tunnel surgeries, and colonoscopies are typically non-emergency and elective surgeries. One might not expect the findings to apply to emergency procedures, where there is less discretion about the nature and site of care.

In terms of generalizing to other states, Florida is among the states with the highest number of ASCs (American Hospital Association, 2006). However, the prevalence of ASCs is growing in many states. By controlling for annual changes in the use of KSWC surgeries and seasonal aspects in the use of these surgeries, the findings of this report are less prone to events that affected utilization of surgeries between 1997 and 2004 that were specific to Florida. Nevertheless, the validity of comparisons to other states and more recent time periods is still dependent on state regulations regarding physician ownership and facility competition in the market (e.g., Certificate of Need regulations that dictate whether new ASCs and/or HOPDs may open), patient characteristics and demand for orthopedic surgery, physician practice patterns, physician desire to have financial interests, and prices of orthopedic surgeries relative to other procedures.

Owner financial incentives might have a larger impact in a state where surgical reimbursement rates are higher.

¹⁵ The likelihood of surgical treatment would be measured by the number of surgeries a surgeon performs in a given time period divided by the number of patients that the surgeon sees in that time period. The numerator would be a surgeon's surgery volume and the denominator would be the surgeon's total caseload.

CompScope™ Medical reports that Florida workers' compensation surgery prices in 2008 were higher than the median state's surgical prices, despite having lower overall medical prices relative to other states (Yang et al., 2010). The percentage of injured workers who had major surgery was 27 percent, while in the median state, 31 percent of injured workers received major surgery.

The impact of financial incentives attendant to ownership on workers' compensation payors may also be different in other states, depending on how much workers' compensation payors reimburse surgery relative to how much other payors reimburse. The impact of financial interests is particularly dependent on the reimbursement amounts that ASCs receive, because it directly affects ASCs' revenue. But it also depends on the surgeon's reimbursement, because that likely affects how many surgeons in a state treat patients covered by workers' compensation.

For much of the time period of this study, the Florida workers' compensation fee schedule was unusually low for physicians. Yang and Victor (2011) reported that between 2001 and 2004, the workers' compensation nonhospital fee schedule amount for surgery was 104 percent of Medicare's fee schedule amount. Surgery fee schedule amounts increased to 140 percent starting in 2004, and outpatient facility fee schedule amounts decreased from 75 percent of charges to 60 percent of charges (Florida Department of Financial Services, 2003). We would expect ownership to have potentially larger impacts in places where workers' compensation pays substantially more than other payors.

3

MAJOR FINDINGS

This chapter is divided into three sections. First, we present findings that explain why surgeon owners do more surgery than non-owners.¹ Second, we discuss how much financial incentives that arise from ownership affect where surgeries take place, in particular how much surgeon owners shift surgeries to their affiliated ASCs. Third, we present findings on how patients and payors were affected by surgeon ownership, in particular, by how much ownership leads to changes in patient mix that favor patients with higher-paying insurance.

It is important to note that the findings presented in the second and third sections of this chapter isolate the impact of ownership from technology and market trends, as well as the possibility that surgery centers recruit certain types of surgeons to become owners.

WHY DO OWNERS DO MORE SURGERY THAN NON-OWNERS?

To begin, we address the first question that a policymaker might ask: do surgeon owners do more surgery than non-owners? Figure 3.1 illustrates that owners, on average, do more surgery than surgeons who were never classified as owners, according to all ownership measures. On average, surgeon board owners did approximately 180 KSWC surgeries per year, and surgeons who were never board members of an ASC (between 1997 and 2004) did about 96 KSWC surgeries per year. Frequent user owners did approximately 2.4 times more than surgeons who were never frequent user owners of an ASC. Threshold owners did approximately 130 KSWC surgeries per year, while those who never performed 30 percent or more of their procedures at a single ASC only did 80 surgeries per year.

Figure 3.1 also shows that owners, on average, did more surgery when they were owners than they did prior to ownership. The difference in surgery volumes during ownership and prior to ownership ranged from 44 to 81 KSWC surgeries per year, depending on the ownership measure.

The figure indicates that surgery volumes of owners were larger than those who were never owners, even prior to ownership. This suggests that higher-volume surgeons were more likely to become owners. Across all ownership measures, the average surgery volume among owners, either before or during ownership, was higher than it was among those who were never owners.

Most ownership studies compared the average volume among surgeon owners during ownership with the average volume among surgeons who were never owners in the time frame of the data and among surgeon owners before ownership. In other words, previous studies compared the third bar of each set in Figure 3.1 with the (weighted) average of the first and second bars of each set. Depending on the time frame and sample of the data,

¹ As discussed in the previous chapter, there are no direct measures of physician ownership that are publicly available. Thus we measure owners based on three proxy measures. The findings in this chapter are the result of using these proxy measures. However, to simplify the text, we use *owners* to mean *probable owners* and *non-owners* to mean *probable non-owners*, unless it is critical to the meaning of the sentence to distinguish the difference between the two ways of labeling surgeons.

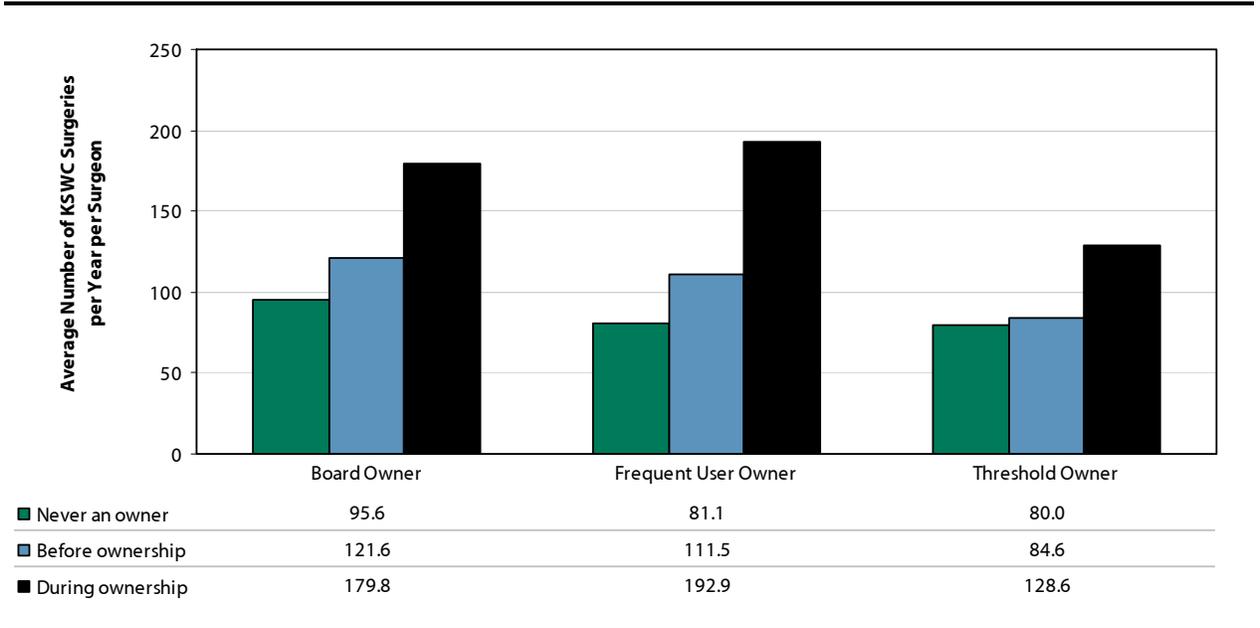
studies may have shown different results from those documented in the figure. Many studies provided only this kind of analysis and showed that owners did more services than non-owners.

In this report, we investigate further to uncover why such disparities between owners and non-owners occur. We identified five explanatory factors (discussed in the previous chapter): technology and market trends, ASC efficiency gains, the capacity effect, the entrepreneurial/recruitment effect, and the effect of financial incentives that arise from ownership.

In Florida in 2004, we found that the average surgeon did 36 to 42 more KSWC surgeries per year than in 1997. Surgeons increased their surgery volumes between 3 and 11 percent per year, having larger rates of growth in earlier years than in later years. However, technology and market trends benefitted both owners and non-owners. These trends explained less than 12 percent of the owner/non-owner differential in surgeries performed, depending on the ownership measure used. Of the five explanatory factors, they explained the least amount of the differential.

By contrast, the entrepreneurial/recruitment effect explained 25 to 71 percent of the owner/non-owner differential in surgery volume, depending on the ownership measure used. It was the dominant explanatory factor—because ASCs recruited higher-volume surgeons to become owners, this drove most of the difference in the surgery volumes between owners and non-owners.

Figure 3.1 Average Surgeon's Surgery Volume by Ownership Measure



Notes: Data are based on Florida administrative ASC and hospital outpatient records for KSWC surgeries that occurred between 1997 and 2004 and Florida Division of Corporations annual corporate filings between 1997 and 2004. The sample includes orthopedic surgeons in Florida between 1997 and 2004. For a definition of ownership measures, see Table 2.1. A surgeon's surgery volume is the number of KSWC surgeries he or she performed in an ASC or HOPD in a particular year.

Key: ASC: ambulatory surgical center; HOPD: hospital outpatient department or facility; KSWC surgery: a knee, shoulder, or wrist arthroscopy, or carpal tunnel surgery.

The ASC efficiency effect, or the phenomenon that surgeons do more surgery when they shift to working at ASCs, explains between 5 and 19 percent of the owner/non-owner differential, or approximately 5 to 8 KSWC surgeries per year. When surgeons increased their use of ASCs and reduced their use of HOPDs, they experienced an increase in efficiency that allowed them to do more surgeries. Figure 2.1 shows the relationship, which indicated that the efficiency gains were non-linear in that the marginal gain began to decrease for those who increased their ASC shares above 75 percent. On average, however, if a surgeon performed 100 surgeries a year and shifted 10 of them from a HOPD to an ASC, he or she would be able to do an additional 1.3 surgeries per year.² This benefit accrued to both owners and non-owners. Hence, it does not explain much of the disparity between owners and non-owners.

A surgeon also changed the number of surgeries he or she performed when diversifying or consolidating his or her network and thus changing capacity to do surgery. With an addition or elimination of an ASC or HOPD, a surgeon would change his or her surgery volume, on average, by 11 to 12 KSWC surgeries per year (or 11 to 12 percent), increasing his or her caseload with an addition and decreasing it with consolidation.³ The findings indicate that the fluctuation in surgeons' facility networks explains little (4 to 13 percent) of the owner/non-owner differential in the number of surgeries performed.

The capacity effect likely does not explain much of the owner/non-owner differential due to the many ways surgeon owners can change their facility networks. For many surgeon owners, the facility network size did not change too much when they became owners. Some owners swapped a hospital for the ASC; others may have already had the ASC in their network prior to becoming an owner. A relatively small number of surgeons, in particular those with lower surgery volumes, added an ASC at the time of ownership. Other surgeons, in particular those with large surgery volumes, eliminated a facility around the time of ownership or shortly after. Because many surgeon owners did not change their facility networks, and the surgeon owners who changed their networks may have dropped or added facilities, we did not find that diversifying or consolidating one's network contributed much to the owner/non-owner differential in surgeries performed.

Financial incentives from owning an ASC led surgeon owners to do 14 to 22 percent more KSWC surgeries per year, on average, than they would have done if they had not become owners, depending on ownership measure. The financial incentives explained 18 to 33 percent, or 14 to 21 surgeries, of the owner/non-owner differential in surgery volume. This estimate is net of the effects of any additional surgeries that these surgeon owners did due to technology and market trends, changes in the size of their facility network, and efficiency gains from substantially increasing their use of ASCs. It is also independent of the sizeable entrepreneurial/recruitment effect that we measured.

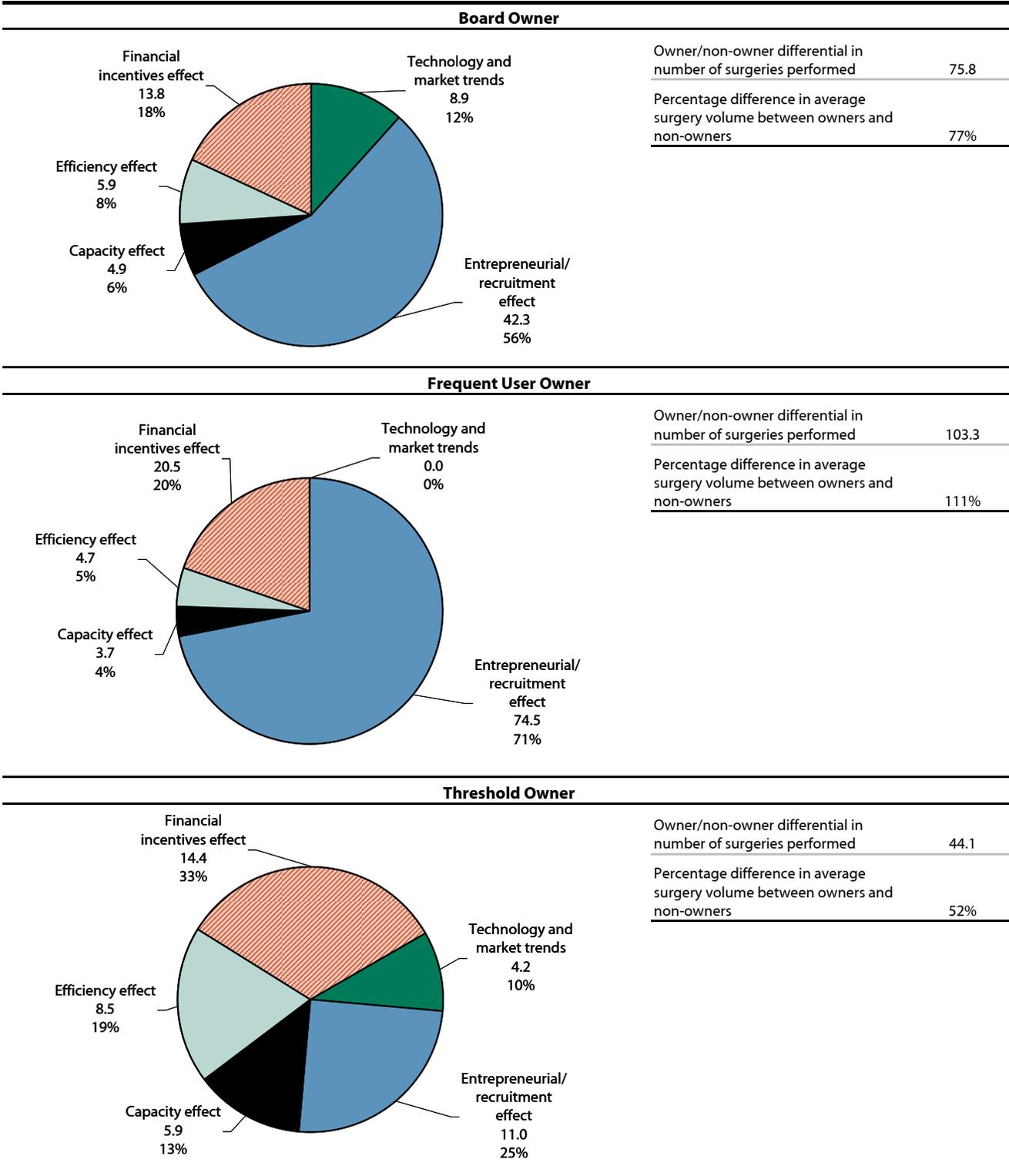
Depending on the ownership measure, the financial incentives aspect of ownership varies in rank among the explanatory factors. For the threshold owner definition of ownership, our measure suggests that financial interests explained 33 percent of the owner/non-owner disparity; however, the other ownership measures suggest that financial interests explained only 18 to 20 percent of the disparity. For the threshold owner definition, we would rank the financial interests due to ownership as the dominant explanation and the entrepreneurial/recruitment effect as second; the other measures would rank the entrepreneurial/recruitment effect as primary and financial interests second.

Figure 3.2 graphically depicts the contribution of each factor in explaining the owner/non-owner differential in the average surgery volume of an orthopedic surgeon.

² This estimate is obtained using OLS estimation. Using negative binomial yields a 3.5 percent increase, or 3.5 surgeries if a surgeon's total volume was initially 100 surgeries.

³ This measure, of course, does not account for the possible improvements in the quality of life or convenience to a surgeon if he or she added a facility.

Figure 3.2 Factors That Explain Why Surgeon Owners Do More Surgery



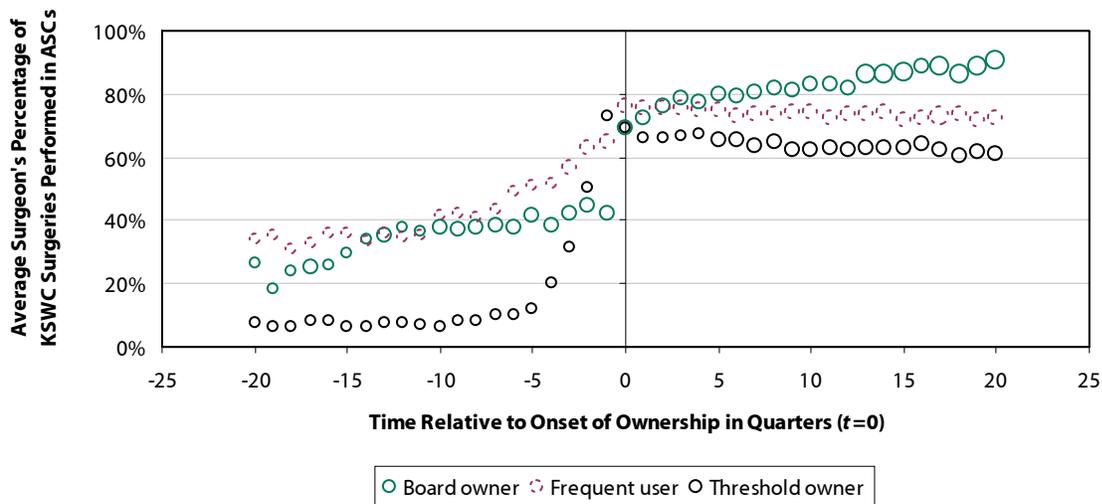
Notes: The numbers in the pie charts show how much of the owner/non-owner differential in surgeries performed is due to a given factor. The top number is the number of surgeries contributing to the differential that is due to a given factor. The bottom number is the percentage of the differential that is due to a given factor. Data are based on Florida administrative ASC and hospital outpatient records for KSWC surgeries that occurred between 1997 and 2004 and Florida Division of Corporations annual corporate filings between 1997 and 2004. The sample includes orthopedic surgeons in Florida between 1997 and 2004. A surgeon's surgery volume is the number of KSWC surgeries that he or she performed in an ASC or HOPD in a given year.

Key: ASC: ambulatory surgical center; HOPD: hospital outpatient department or facility; owner/non-owner differential: difference in average annual surgery volumes between owners and non-owners; surgery or KSWC surgery: a knee, shoulder, or wrist arthroscopy, or carpal tunnel surgery.

IMPACT OF OWNERSHIP ON SITE OF SERVICE

When a surgeon became a probable owner (as defined by our ownership measures), he or she began performing more surgeries at ASCs, relative to hospitals. Figure 3.3 illustrates this fact and demonstrates the type of analysis we performed. At the onset of ASC ownership, we see that board owners jumped discontinuously in their shift to ASC usage. Frequent user owners were more gradual, often because they worked at ASCs prior to probable ownership or becoming a frequent user of an ASC. They likely needed to work their way up to becoming one of the top users of an ASC. In general, prior to probable ownership, threshold owners began with the lowest ASC shares. Because threshold owners are defined as becoming owners when they send more than 30 percent of their cases to an ASC, by construction these ownership measures show that prior to ownership, many of them rarely used ASCs.

Figure 3.3 At the Onset of Ownership: Percentage of Surgeries Performed in ASCs and a Surgeon's Surgery Volume



Notes: The vertical or y-axis is the share of the average surgeon's surgery volume that is performed in ASCs. Bubble diameter represents the size of the average surgeon's surgery volume, or the average number of KSWC surgeries a surgeon did per quarter. The smallest bubble represents approximately 20 surgeries per quarter, and the largest bubble represents approximately 57 surgeries per quarter. Quarter 0 is the quarter in which a surgeon first became an owner. A surgeon's surgery volume is the number of KSWC surgeries that he or she performed in an ASC or HOPD in a given year.

Data are based on Florida administrative ASC and hospital outpatient records for KSWC surgeries that occurred between 1997 and 2004 and Florida Division of Corporations annual corporate filings between 1997 and 2004. The sample includes orthopedic surgeons in Florida between 1997 and 2004.

Key: ASC: ambulatory surgical center; HOPD: hospital outpatient department or facility; KSWC surgery: a knee, shoulder, or wrist arthroscopy, or carpal tunnel surgery.

Figure 3.4 compares probable surgeon owners (before and during probable ownership) with surgeons who were never owners in the time frame of the data. Depending on the ownership measure, never-owners vary in how different they were from surgeon owners prior to their ownership. Surgeons who were never board owners and surgeons prior to board ownership were similar. Surgeons who had not yet passed and surgeons who never passed

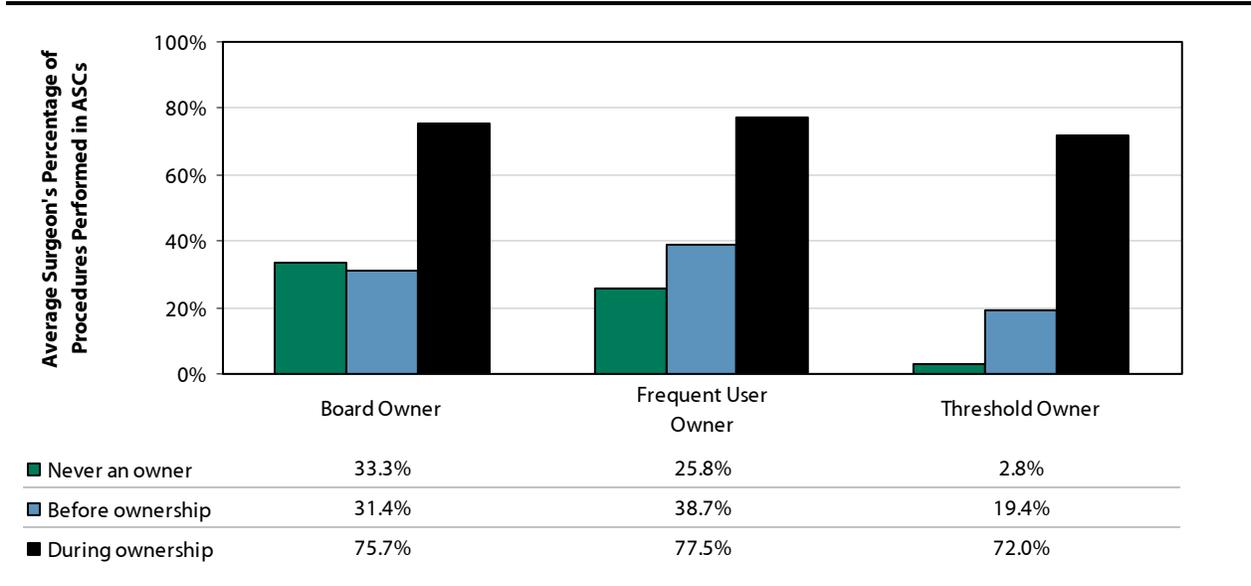
the 30 percent threshold (never threshold owners) were different, in that those who were never threshold owners worked almost solely with hospitals.⁴

All ownership measures indicate that after becoming an owner, surgeons performed much more of their procedures at ASCs than before their ownership periods. During their periods of measured ownership, board owners performed, on average, around 76 percent of their procedures at ASCs, frequent users around 78 percent, and threshold owners around 72 percent.

After controlling for recruitment and self-selection effects, capacity changes, and technology and market trends in the shifting of procedures to ASCs, we found that financial incentives attendant to ownership led orthopedic surgeons to substantially shift not only their surgeries but all procedures to their affiliated ASCs. The findings are in Table 3.1.

Surgeon owners shifted between 28 to 54 percent of their surgery volume to their affiliated ASCs. Prior to ownership, they performed, on average, 12 to 32 percent of their KSWC surgeries at their owned ASC, depending on the ownership measure. Under the influence of ownership, they performed, on average, 59 to 66 percent of their KSWC surgeries at their owned ASC. A similar finding is demonstrated for surgeons' total procedure volumes: surgeons performed 12 to 28 percent of their procedures at their affiliated ASCs prior to ownership, and during ownership, they performed 54 to 61 percent. As we would expect from the previous findings, surgeon-owned ASCs recruited high-volume surgeons and attained a sizeable share of their volumes.

Figure 3.4 Percentage of a Surgeon's Procedures That Were Performed in ASCs, by Ownership Measure



Notes: Data are based on Florida administrative ASC and hospital outpatient records for KSWC surgeries that occurred between 1997 and 2004 and Florida Division of Corporations annual corporate filings between 1997 and 2004. The sample includes orthopedic surgeons in Florida between 1997 and 2004. For a definition of the ownership measures, see Table 2.1.

Key: ASC: ambulatory surgical center; KSWC surgery: a knee, shoulder, or wrist arthroscopy, or carpal tunnel surgery.

⁴ Surgeons who were not threshold owners, but who worked with ASCs a substantial amount, would be those who worked at multiple ASCs, each ASC receiving less than the threshold amount from a given surgeon. This was indeed rare for the 30 percent threshold owners and non-existent for 50 percent threshold owners, i.e., a surgeon would have to work exactly 50 percent at one ASC and 50 percent at another ASC (shown in Technical Appendix B).

Table 3.1 Impact of Ownership of ASCs on the Shift of Site of Service

	Ownership Measure		
	Board Owner	Frequent User Owner	Threshold Owner
KSWC surgery volume			
Average surgeon owner's annual surgery volume before ASC ownership	121.6	111.5	84.6
Average surgeon owner's share of surgery volume performed at affiliate ASC before ownership in that ASC	12%	32%	20%
Estimated percentage point increase in average surgeon owner's share of surgery volume performed at affiliate ASC due to financial incentives attendant to ownership ^a	54 ppt	28 ppt	39 ppt
Total procedure volume			
Average surgeon owner's annual procedure volume before ASC ownership	255.7	238.5	174.9
Average surgeon owner's share of total procedure volume performed at affiliate ASC before ownership in that ASC	12%	28%	17%
Estimated percentage point increase in average surgeon owner's share of total procedure volume performed at affiliate ASC due to financial incentives attendant to ownership ^a	49 ppt	28 ppt	37 ppt

Notes: Data are based on Florida administrative ASC and hospital outpatient records for KSWC surgeries that occurred between 1997 and 2004 and Florida Division of Corporations annual corporate filings between 1997 and 2004. The sample includes orthopedic surgeons in Florida between 1997 and 2004. For a definition of the ownership measures, see Table 2.1. A surgeon's procedure volume is the number of outpatient procedures the surgeon performed in an ASC or HOPD in the specified time period. A surgeon's surgery volume is the number of KSWC surgeries he or she performed in an ASC or HOPD in the specified time period.

^a All estimates are significant at the 1 percent level.

Key: ASC: ambulatory surgical center; HOPD: hospital outpatient department or facility; ppt: percentage points; surgery or KSWC surgery: a knee, shoulder, or wrist arthroscopy, or carpal tunnel surgery.

IMPACT OF OWNERSHIP ON PAYOR MIX

We found that the impact of ownership was larger for some payors than other payors. The findings indicate that ownership led surgeons in Florida to increasingly focus on treating injured workers, patients covered by commercial indemnity plans, and Medicare patients. At the time of the data, these types of insurance likely had the highest reimbursement rates for KSWC surgery.⁵

Table 3.2 shows that ownership resulted in an increase of the number of patients who received KSWC surgery covered by workers' compensation more than it did for insurance carriers of managed care, HMO, and PPO plans. Upon becoming an owner of an ASC, a surgeon increased his or her KSWC surgery volume that was paid by workers' compensation by 17 to 23 percent, depending on the ownership measure. By contrast, when a surgeon became an owner, he or she either did not change or sometimes decreased the number of patients who had their

⁵ Using outpatient knee arthroscopy (CPT 29881) as an example, Medicare reimbursed Florida physicians who performed this procedure in 2001 between \$643.86 and \$740.50, Florida ASCs \$612.00, and Florida hospitals \$1,234.42. The Florida workers' compensation fee schedule amount for physicians performing this procedure in 2001 was \$745.00, for ASCs in 2005 (earliest available, previously not regulated) was \$1,736.00, and for hospitals in 2001 was 75 percent of charges (starting in 2004, it was 60 percent of charges). Medicaid reimbursed physicians performing CPT 29881 between \$327.27 and \$405.81 (specialty maximum), starting January 2005 (earliest available information), and ASCs \$612.00. Florida Medicaid hospital reimbursements for outpatient procedures were not available online. See https://secure.hermanandassociates.com/Medicaid/Opening_Page.htm.

surgeries covered by Medicaid. Among the different ownership measures, findings were mixed for the ownership effect on commercial HMO and PPO plans, although they mainly indicate decreases. These findings have been controlled for entrepreneurial/recruitment effects, capacity effects, and technology and market trends that are associated with ownership and changes in the composition of payors covering KSWC surgeries over time.

Ownership had either no impact or a negative impact on surgeries covered by Medicaid and Medicaid HMO plans. However, since orthopedic surgeons, on average, did not perform many KSWC surgeries on patients covered by these plans, the percentage drop in these surgeries likely did not result in major reductions in the number of patients receiving such surgeries.

The differential impacts across payors suggest that access to surgery for certain patients was affected by ownership. The policy question is whether increasing access to care for those patients covered by the payors with higher reimbursement rates leads to an increase in access to care for those that need care the most. Or does this increase in access to care merely reflect that patients with borderline cases will be more likely to get surgery if they are covered by a payor with a higher reimbursement rate?

Another interesting finding is that in Florida, during our study period, there may have already existed an access to care issue, or at least some payors covered a disproportionately lower volume of surgeries than other payors. Figure 3.5 (more starkly than Table 3.2) shows the distribution across payors of patients who received KSWC surgery between 1997 and 2004. Although Medicaid was the insurer for approximately 12 percent of Floridians, it paid for less than 1 percent of the KSWC surgeries that were performed in ASCs and HOPDs (Florida Agency for Health Care Administration, 2004). The opposite phenomenon could be said for workers' compensation.⁶

A possible explanation for the ownership effect on payors is that ASCs only accept certain types of insurance plans, which has been documented by previous studies (see, for example, American Hospital Association, 2006). When shifting surgeries and patients to affiliate ASCs, surgeon owners were unlikely to shift patients who did not have coverage accepted by their ASCs. Figure 3.5 shows that ASCs were more popular than HOPDs among those covered by commercial indemnity insurance. There was a relatively equal split between ASCs and hospitals for Medicare and workers' compensation payors, and a greater percentage of the commercial HMO and PPO covered patients received surgery at hospitals.

This raises the question of why ASCs accept only certain types of insurance. ASCs might not be as equipped to handle complex surgery cases as hospitals are, and these cases may be associated with certain payors. Reimbursement rates and administrative costs for handling patients are different among payors. Some payors may offer reimbursement rates to ASCs that are too low for them to accept. During the study period, Medicare and potentially other payors reimbursed ASCs at lower rates than hospitals for orthopedic procedures, unlike other services, such as colonoscopies. ASCs that specialize in orthopedic surgeries may have to target higher-rate payors to maintain financial stability. If ASCs and financially-interested physicians are sensitive to reimbursement rates and the costs of providing services, they might seek to provide more services to patients who are covered by higher-rate payors or payors with lower transaction costs.

⁶ In 2004, there were 10.7 lost-time cases per 1,000 employed workers in Florida (Florida Division of Workers' Compensation, 2010). We would expect lost-time cases to be more severe among workers' compensation cases. Therefore, while the workers' compensation system paid for the medical expenses of about 1 percent of the employed population, it paid for 14 percent of the KSWC surgeries in 2004 in our data, suggesting that injured workers are more likely to have these types of surgeries than the general population.

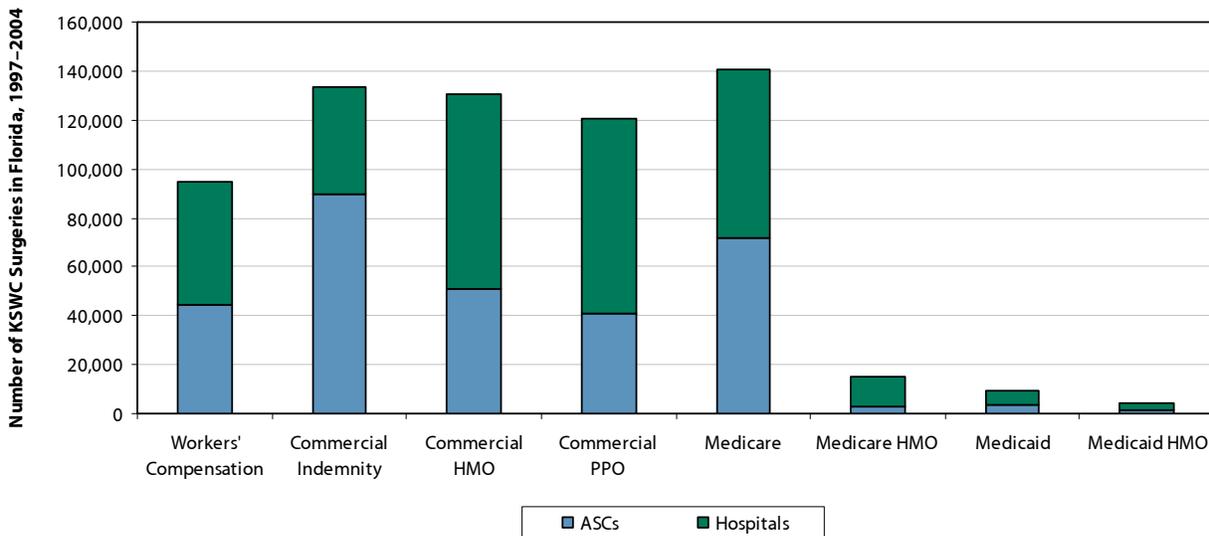
Table 3.2 Impact of Ownership of ASCs on Payor and Plan Type

	Ownership Measure					
	Board Owner		Frequent User Owner		Threshold Owner	
Workers' compensation						
Average annual surgery volume covered by payor before ASC ownership	17.1		16.7		13.1	
Estimated % change in surgery volume due to ASC ownership	19.7%	***	17.4%	***	23.4%	***
Commercial indemnity insurance						
Average annual surgery volume covered by payor before ASC ownership	25.0		22.5		12.7	
Estimated % change in surgery volume due to ASC ownership	50.7%	***	19.7%	***	46.2%	***
Commercial insurance HMO						
Average annual surgery volume covered by payor before ASC ownership	23.4		21.4		17.1	
Estimated % change in surgery volume due to ASC ownership	-11.3%	***	3.0%		3.0%	*
Commercial insurance PPO						
Average annual surgery volume covered by payor before ASC ownership	17.5		16.6		15.8	
Estimated % change in surgery volume due to ASC ownership	-24.4%	***	13.9%	***	-5.8%	***
Medicare						
Average annual surgery volume covered by payor before ASC ownership	23.0		20.1		15.1	
Estimated % change in surgery volume due to ASC ownership	23.4%	***	27.1%	***	25.9%	***
Medicare HMO						
Average annual surgery volume covered by payor before ASC ownership	3.4		2.8		2.3	
Estimated % change in surgery volume due to ASC ownership	-42.9%	***	7.3%		-28.1%	***
Medicaid						
Average annual surgery volume covered by payor before ASC ownership	1.2		1.7		1.0	
Estimated % change in surgery volume due to ASC ownership	-24.4%	***	-4.9%		-2.0%	
Medicaid HMO						
Average annual surgery volume covered by payor before ASC ownership	0.5		0.7		0.3	
Estimated % change in surgery volume due to ASC ownership	-1.0%		-3.0%		-1.0%	

Notes: Data are based on Florida administrative ASC and hospital outpatient records for KSWC surgeries that occurred between 1997 and 2004 and Florida Division of Corporations annual corporate filings between 1997 and 2004. The sample includes orthopedic surgeons in Florida between 1997 and 2004. * signifies that the coefficient is significant at the 10 percent level, ** signifies that the coefficient is significant at the 5 percent level, and *** signifies that the coefficient is significant at the 1 percent level. A surgeon's surgery volume is the number of KSWC surgeries he or she performed in an ASC or HOPD in the specified time period.

Key: ASC: ambulatory surgical center; HMO: health maintenance organization; HOPD: hospital outpatient department or facility; KSWC surgery: a knee, shoulder, or wrist arthroscopy, or carpal tunnel surgery; PPO: preferred provider organization.

Figure 3.5 Number of Surgeries by Primary Payors and Facility Type



Notes: Data are based on Florida administrative ASC and hospital outpatient records for KSWC surgeries that occurred between 1997 and 2004 and Florida Division of Corporations annual corporate filings between 1997 and 2004. The sample includes orthopedic surgeons in Florida between 1997 and 2004.

Key: ASC: ambulatory surgical center; HMO: health maintenance organization; PPO: preferred provider organization; KSWC surgery: a knee, shoulder, or wrist arthroscopy, or carpal tunnel surgery.

The findings may reinforce access to care concerns for payors that set lower than typical rates. Previous studies have shown that with price increases for certain services, physicians substitute the higher-revenue services for the lower-revenue ones (see, for example, Mitchell, Hadley, and Gaskin, 2000). By the same logic, it is plausible that financially-incentivized physicians substitute services covered by payors that reimburse at lower levels with those covered by payors that reimburse at higher levels, especially as their revenue for certain procedures may be tied not only to professional fees but also to facility fees.

4

DISCUSSION AND POLICY CONSIDERATIONS

In summary, surgeon owners performed 52 to 111 percent more surgeries each year than non-owners. There were many reasons for this, the most important of which we call the entrepreneurial/recruitment effect—that is, ASCs tend to recruit higher-volume surgeons to be owners and higher-volume surgeons are more likely to initiate development of new ASCs. The entrepreneurial/recruitment effect explained roughly one- to three-quarters of the additional surgeries done by owners compared with non-owners. Another important factor was that surgeon owners had financial incentives to do more surgeries than non-owners. The financial incentive effect explained about 14 to 21 additional surgeries per year done by owners compared with non-owner surgeons. These estimates are lower than other studies that do not isolate the financial incentive effect from ASC efficiency gains, entrepreneurial/recruitment effects, and other effects that explain the overall owner/non-owner differential in the number of surgeries performed.

Other reasons explored in this study explained only small amounts of the owner/non-owner differential—diversifying or consolidating a surgeon’s facility network, increased efficiency by using ASCs, and trends in technology and market phenomena. While these factors affected a surgeon’s surgery volume in significant ways, they did not explain much of the difference between owners and non-owners because often both owners and non-owners were impacted by each. For every 10 percent of their (outpatient) caseload that surgeons shifted from hospitals to ASCs, they were able to do, on average, 1.3 to 3.5 more surgeries per year. Surgeons also increased the number of surgeries that they performed when they added a facility to their network. An addition of an ASC or HOPD was associated with an increase in capacity of 11 to 12 surgeries per year. The impact of technology and market trends was also significant, attributing to an increase of 36 to 42 surgeries per surgeon by 2004 when compared with 1997. These trends captured phenomena like improved scope technology, shifting from inpatient to outpatient surgery, and the growth in the number of ASCs and facilities where surgeons can practice.

We also found that ownership affected other aspects of a surgeon’s practice other than surgery volume. It led to a very large shift in the surgeon owners’ cases to the affiliated ASC, often surgeries that previously would have been performed in a hospital.

We found that surgeon owners increased the number of patients covered by commercial insurance (group health), workers’ compensation, and Medicare, relative to prior to ownership; however, they did not change, or sometimes decreased, the number of patients covered by Medicaid, Medicaid HMO, and Medicare HMO.

The impact of surgeon ownership of ASCs is likely to be larger than what we report. Because data on physician ownership is not readily available, we used proxies for ownership that were used in previous studies. In using proxies for ownership, our estimates will underestimate the effect of ownership. The time frame of the data also leads us to suspect that the impact of ownership may be larger today. The prevalence of physician ownership has likely grown since the end of our study period. Since 2004, the number of ASCs and their market share of services provided have continued to grow. In addition, some articles suggest that ownership incentives may also affect other treatment decisions, such as which hardware or implants to use (Carreyrou and McGinty, 2010), or to which physical therapy

clinics (Mitchell and Sass, 1995; Mitchell and Scott, 1991) or MRI facilities to send patients (Baker, 2010).

This study did not address whether any of the additional surgeries (due to financial incentives, increased capacity from expanding one's network, or ASC efficiency gains) were necessary or not. We also did not address whether they were cost-effective or not. If medically necessary and cost-effective, then increasing surgeon ownership would have improved access to surgical care for those who previously did not have access, in particular, those covered by workers' compensation, commercial indemnity insurance, and Medicare. If the surgeries were not all necessary, then increasing surgeon ownership would be a cost driver and merit increased regulatory attention. This question deserves additional research using data on patient outcomes.

The findings have implications for several policy issues: containing medical costs, regulating physician ownership, improving access to care, the societal need and/or desire for hospitals and ASCs, optimizing reimbursement rates, and trends for workers' compensation systems.

Medical cost containment and finding ways to make the delivery and payment of medical services more efficient is one of the most discussed topics in health care today. The discussion involves determining what is most cost-effective. ASCs are lower-cost facilities, relative to hospitals. Certainly if a standard outpatient surgery is inevitably going to be delivered, providing it at an ASC will likely be less expensive than at alternative facilities. However, the findings suggest that the use of ASCs by surgeons and surgeon ownership of ASCs lead to more surgeries being delivered, due to either financial incentives or efficiency gains. These surgeries may be necessary and cost-effective, i.e., the benefits outweigh the costs; they may be necessary but not cost-effective; or they may be unnecessary. If all are necessary and cost-effective, surgeon ownership and use of ASCs lead to substantial savings. If any are unnecessary or not cost-effective, then surgeon ownership and use of ASCs may contribute to unnecessary cost, which of course, may be offset by the savings from the necessary and cost-effective surgeries.

Currently, some state and federal legislators and regulators have passed rules that prohibit self-referrals and require physicians to disclose their ownership to patients. However, federal rules apply mainly to the treatment of Medicare and Medicaid patients. State rules, particularly ones involving prohibition, often exempt ASCs from restrictions because ASCs can be considered as a group practice, which is a classification that is not regulated. A few states, including California and Texas, have workers' compensation regulations covering ASCs. This study finds that surgeon owners of ASCs performed 14 to 22 percent more KSWC surgeries per year than they did when they were not owners—and that these additional surgeries are attributable to the financial incentives attendant to ownership.

It is difficult to say whether current policies will achieve desired results. Disclosure can help identify physician owners, but strategies on how to use this information to mitigate adverse effects may prove difficult to design. It is possible that if surgeons disclose their ownership to patients, patients will seek second opinions about whether to have surgery. But there is little data showing whether or not this is the case. It is also possible that patients may think that physician owners supply higher quality of care because they are financially invested in the ASC; thus, disclosure would not mitigate the adverse effects of financial incentives.

Prohibiting physicians from referring to affiliated entities, such as ASCs, may curtail the large shift in surgeries (or procedures) to affiliated facilities and prevent the occurrence of additional surgeries brought on by ownership; however, in the ASC case, performing surgeries at these less costly settings may be cost saving. ASCs are also thought to have other positive effects, such as amenities and convenience for patients and doctors. It is unclear whether prohibiting all surgeries at affiliated ASCs targets the appropriate surgeries—the surgeries that are brought on by ownership and that are either unnecessary or not cost-effective. Finally, prohibition is difficult to enforce. Although physician referral of diagnostic imaging services to owned entities is prohibited in some instances, studies still find effects of ownership on the use of these services. To date, there has been very little research on the efficacy of these regulations.

Another approach is creating financial incentives or structures that could counteract or eliminate ownership financial incentives. These policies would be less targeted at physician ownership, but potentially may be more effective approaches that aim to lower medical costs and improve the delivery and payment of necessary care. For example, accountable care organizations would encourage physicians to incorporate health costs into their objectives. Another financial vehicle is setting reimbursement rates. It is common for there to be different reimbursement rates for ASCs and HOPDs for the facility portion of costs associated with a medical service. However, it is not common for different fees to be paid to the operating surgeon if the surgery is done in an ASC or done in a HOPD. We find that ASCs allow surgeons to use their time more efficiently and to do more surgery. The “cost” to the surgeon is lower for surgeries done in an ASC than for those done in a HOPD. Extending the logic of an RBRVS system, lower cost to surgeons per procedure implies lower reimbursement.¹ This raises the possibility that payors might consider the advantages and disadvantages of having lower professional reimbursement rates for surgeries done in an ASC.

Current policies on physician ownership assume that ownership causes more surgeries to happen and that this does not improve access to care. Surgeons do more surgery at ASCs. Surgeons do more surgery when they become owners. If the additional surgeries either due to ASC efficiency gains or due to financial incentives are medically necessary, however, it should be recognized that ASCs and physician ownership can improve access to care. Of course, to the extent that some of these surgeries are unnecessary, they do not improve patient care. As indicated previously, this study does not address the extent to which additional surgeries are medically necessary.

Moreover, physician ownership of ASCs may improve access to care for some groups of patients more than others. This study finds that when surgeons became owners of ASCs, on average, they increased their caseload of patients covered by payors with higher reimbursement rates (e.g., commercial indemnity insurance and workers’ compensation) and did not increase their caseload of patients covered by payors with lower reimbursement rates (e.g., Medicaid). In this sense, patients covered by more generous plans may have improved access to care due to physician ownership. Policymakers will need to decide whether these populations are indeed the ones that need improved access.

Another policy issue is society’s need for hospital institutions. Many hospitals provide medical training, research, and substantial uncompensated care to low income populations, all of which require additional fixed and variable costs. These hospitals need a broad base of paying patients to amortize these costs. The evidence indicates that ASCs recruit high-volume surgeons and that these surgeons shift a substantial number of patients from hospitals to ASCs when they become owners. These patients also may be the more profitable ones (covered by more generous insurance plans) and precisely the ones hospitals may need to keep them financially secure. Approximately 21 to 60 KSWC surgeries per surgeon owner per year would have been performed in non-surgeon-owned facilities (such as hospitals) had the owner not been financially incentivized to shift patients to his or her affiliated ASC.² If hospitals are not closing down today, then perhaps they are learning to compete with ASCs, possibly by acquiring them or by using similar strategies, such as aligning the financial interests of physicians with the hospitals.

Hospitals also provide backup for ASCs in case of complications at the ASC. This could be profitable for hospitals if the emergency-like services are profitable, when accounting for the cost of medical technology, capital, and labor in the provision of these more serious services. If providing these emergency-like procedures produces

¹ This report neither supports nor opposes a RBRVS system concept. Furthermore, the calculation of the differential rate would have to be carefully designed so as not to create perverse incentives.

² The number of surgeries that would have been performed in non-affiliated ASCs per surgeon per year is the number of surgeries performed in an affiliated ASC during ownership (59–92) less the new surgeries due to ownership (15–25) less the surgeries already performed in affiliated ASC prior to ownership (15–36).

more profit for the hospitals than would have been received from the care of patients whose treatment moved to ASCs, hospitals benefit from sharing the market with ASCs. If the services are not ultimately profitable for hospitals, one can imagine a solution in which ASCs help finance their hospital backup via a revenue- and cost-sharing contract.

We speculate that physician ownership and the role of ASCs will become a bigger issue for injured workers and workers' compensation payors in the next decade. The use of ASCs for orthopedic services and pain management services is growing rapidly (Koenig et al., 2009). ASCs may become as dominant a setting for services treating musculoskeletal and nervous system conditions as they are for eye surgery and gastroenterology today. Management companies of ASCs indicate orthopedics as the most desirable medical specialty in which to do business (Fields, 2011). Since many injured workers today are treated with these types of services, we may expect the issue regarding physician ownership of ASCs to receive more attention by regulators that oversee workers' compensation systems in the future.

The efficacy of current policies intended to counteract adverse effects of physician ownership has not been determined. The optimal policy would curtail any adverse effects, while encouraging medical innovation focused on producing high quality and cost-effective care.

TECHNICAL APPENDIX A:

DATA

We use data from Florida's Agency for Health Care Administration (AHCA) and Division of Corporations,¹ which contain all outpatient discharge records in Florida and ASC corporate filings, respectively. The outpatient discharge records were used to study a surgeon's medical decisions and practice patterns and to identify *owners* according to previous proxies for ownership. The Division of Corporations corporate filings were used to identify board members of ASCs, our third proxy for ASC owners. A discussion of the benefits and limitations of each proxy is in Technical Appendix B.

The outpatient discharge records include all outpatient procedures performed in ASCs and HOPDs. We studied patients covered by all payors, including workers' compensation, Medicare, and commercial insurance.

Using the AHCA data, we identified what the AHCA calls the *attending/referring physicians* of KSWC surgeries that were performed in Florida between 1997 and 2004. Many of these physicians were orthopedic surgeons who likely performed the surgery for which they were the attending/referring physician. Some physicians were non-surgeons who referred cases to surgeons. The AHCA discharge records describe all visits to ASCs and hospitals. This means that we were able to observe all patients that a physician referred or treated in an ASC or hospital and all physicians who were coded as the referring physician of KSWC surgeries. The data include information on patient diagnoses and procedures received, as well as facility identifiers which indicate where the patient received procedures.

The Current Procedural Terminology (CPT) codes used to identify KSWC surgeries were based on the American Medical Association (AMA) CPT handbook (2006). We also asked several physicians and medical coding specialists to list the CPT codes that they thought would be relevant to the study.²

Board owners were identified using Florida's Division of Corporations annual reports. All businesses that provide services to Floridians must provide corporate filings to the Division, specifying the members of their boards, such as officers and directors. Information on ASC board members allowed us to determine which physicians had financial interests in ASCs.

SAMPLE OF ORTHOPEDIC SURGEONS

In the data, several types of physicians were coded as the referring physician of a KSWC surgery, as listed by the primary procedure CPT code. Based on their observed practice patterns and the types of procedures that they performed or referred, we identified physicians who practiced how one would expect an orthopedic surgeon to practice.³

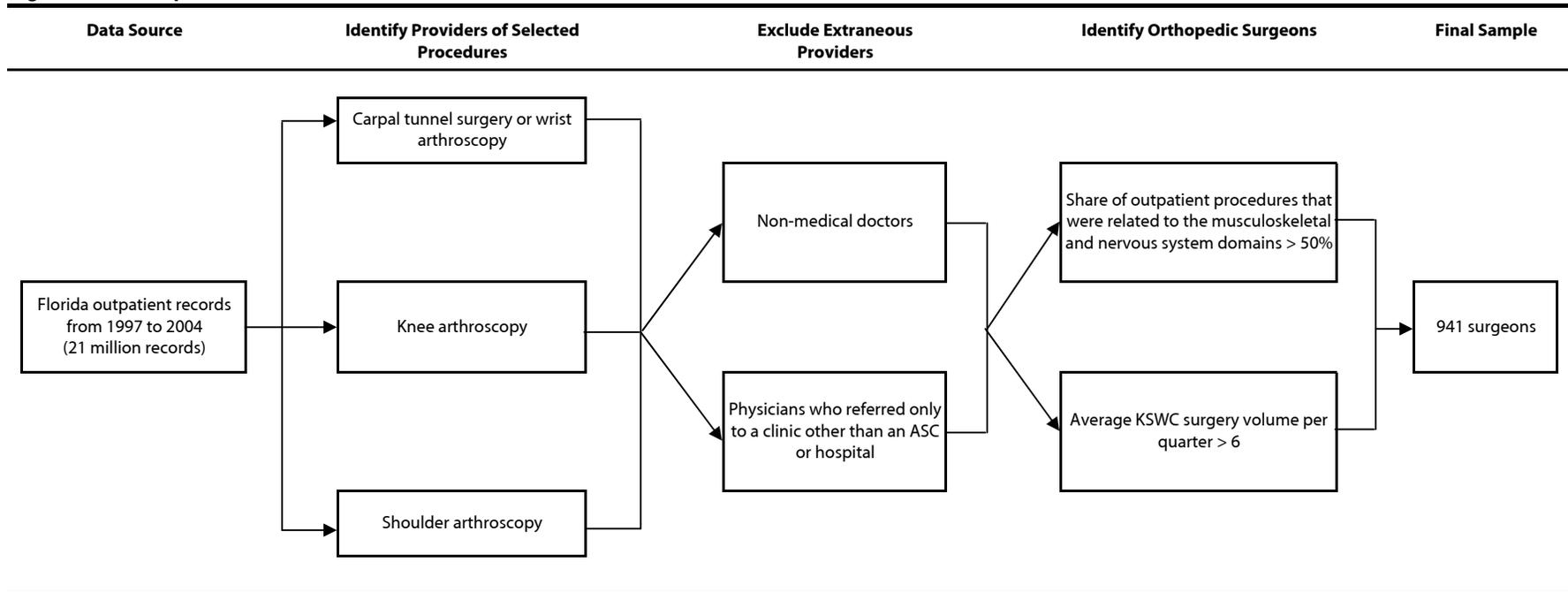
The sample of physicians that we refer to as orthopedic surgeons is defined in Figure TA.A1. We began by including any provider who was the referring/attending physician of a KSWC surgery. We excluded providers who

¹ Data were retrieved from <http://www.sunbiz.org>.

² The codes used were: 29805, 29806, 29807, 29815, 29819, 29820, 29821, 29822, 29823, 29824, 29825, 29826, 29827, 29828, 29840, 29843, 29844, 29845, 29846, 29847, 29848, 29850, 29851, 29870, 29871, 29873, 29874, 29875, 29876, 29877, 29879, 29880, 29881, 29882, 29883, 29884, 29885, 29886, 29887, 29888, 29889, 29999, G0289, S2112, S2113, S2114, S2300, 64721, 29866, 29909, 0012T, 29867, 0013T, 29868, 0014T, 29893, 64718, 27425, and 64719.

³ We also performed analyses on the entire set of physicians, as well as on a set of physicians who were likely primary care physicians, physiatrists, neurologists, and other physicians. The findings indicated that there was little to no significant effect of financial interests on the KSWC surgery volume of this set of physicians, which was expected since these physicians did not specialize in these orthopedic surgeries. These findings are available from the author upon request.

Figure TA.A1 Sample Construction



Note: The Area Resource File and the AMA survey identified 953 orthopedic surgeons who were likely to be practicing in 2005. See the Glossary for a definition of surgery volume.

Key: ASC: ambulatory surgical center; KSWC surgery: a knee, shoulder, or wrist arthroscopy, or carpal tunnel surgery.

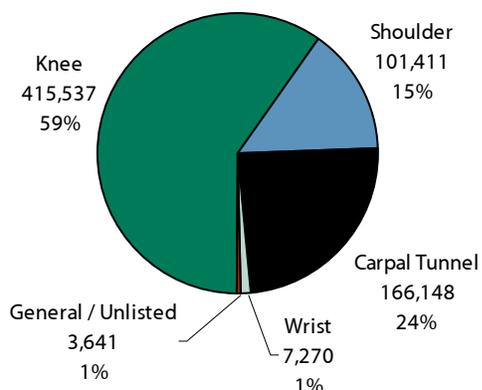
were not medical doctors, such as nurse practitioners, and providers who did not refer patients to an ASC or hospital in each of the periods in which they were observed. In other words, physicians who referred patients only to a radiation therapy clinic or similar non-ASC or hospital facility, in a given period, were excluded. The orthopedic surgeon group also includes only those who referred or performed more than six KSWC surgeries per quarter on average throughout the study period and who concentrated in neuromuscular procedures. We determined these thresholds by validating the physician counts in each group with counts provided by the Area Resource File (ARF).⁴ The ARF is a widely used data source that provides information on the counts of physicians by medical specialty in Florida and other states. It is based on the AMA Physician Survey.

We acknowledge that our group of surgeons may include some non-surgeons and it may not include all orthopedic surgeons. We validated the count as much as possible using external surveys. We analyzed 941 physicians who were likely orthopedic surgeons. According to the ARF, 1,273 physicians specialized in orthopedic surgery in Florida in 2005, with 953 likely to be practicing.⁵ The count of orthopedic surgeons that we analyzed is smaller than the ARF count, which reflects the possibility that some orthopedic surgeons in our data had licenses in Florida but did not practice there, some orthopedic surgeons practiced only in inpatient settings and physician offices, and others were retired.

DESCRIPTIVE STATISTICS

Figure TA.A2 describes the distribution of KSWC surgeries in the sample studied. Knee arthroscopies capture the majority of the surgeries, or 59 percent. Carpal tunnel surgeries capture 24 percent, and shoulder arthroscopies capture 15 percent. The remaining 2 percent are comprised of non-carpal-tunnel-related wrist arthroscopies and general codes for unlisted arthroscopies.

Figure TA.A2 Distribution of KSWC Surgeries in the Sample



Notes: Data are based on Florida administrative ASC and hospital outpatient records for KSWC surgeries that occurred between 1997 and 2004. The sample includes orthopedic surgeons in Florida between 1997 and 2004.

Key: ASC: ambulatory surgical center; KSWC surgery: a knee, shoulder, or wrist arthroscopy, or carpal tunnel surgery.

⁴ The Health Resources and Services Administration of the U.S. Department of Health and Human Services produces the Area Resource File. The 2010 version was used in this study. It provided information from the AMA Physician Survey up to 2008.

⁵ We defined the 953 physicians as *likely to be practicing* because the ARF data indicate that they are between the ages of 35 and 64.

Table TA.A1 describes the patients who received these orthopedic surgeries. It shows that the sample was equally split between male and female, and that patients predominantly fell into the 46- to 55-year-old category, relative to other age categories. Patients receiving surgery were predominantly Caucasians.

Table TA.A1 Patient Characteristics

	Number of All Patients	Percentage of Patients
Patient's gender		
Female	352,786	50.8%
Male	341,221	49.2%
Patient's age		
Less than 25	57,246	8.2%
Between 25 and 35	75,201	10.8%
Between 36 and 45	138,965	20.0%
Between 46 and 55	155,350	22.4%
Between 56 and 65	118,188	17.0%
Between 66 and 75	96,643	13.9%
Between 76 and 85	46,631	6.7%
Greater than 85	5,783	0.8%
Patient's primary payor		
Medicare	140,513	20.2%
Commercial indemnity	133,492	19.2%
Commercial HMO	130,846	18.9%
Commercial PPO	120,393	17.3%
Workers' compensation	94,552	13.6%
Unidentified insurance	19,059	2.7%
Medicare HMO	15,410	2.2%
Self insured	12,036	1.7%
Medicaid	9,373	1.4%
CHAMPUS	7,377	1.1%
Medicaid HMO	4,587	0.7%
Other state/local government	4,527	0.7%
Charity	1,527	0.2%
Veterans Affairs	167	0.0%
Kid Care	148	0.0%
Patient's race		
Caucasian	529,519	76.3%
African American	49,270	7.1%
Caucasian Hispanic	49,103	7.1%
No response	38,787	5.6%
Other race	15,816	2.3%
Asian	6,010	0.9%
American Indian	4,143	0.6%
African American Hispanic	1,359	0.2%

Notes: Data are based on Florida administrative ASC and hospital outpatient records for KSWC surgeries that occurred between 1997 and 2004. The sample includes orthopedic surgeons in Florida between 1997 and 2004.

Key: ASC: ambulatory surgical center; KSWC surgery: a knee, shoulder, or wrist arthroscopy, or carpal tunnel surgery; HMO: health maintenance organization; PPO: preferred provider organization.

TECHNICAL APPENDIX B: COMPARISONS OF “OWNERSHIP” MEASURES

In this report, we used three physician owner identification techniques that have been used in previous studies:

- a surgeon who served on the board of directors of a particular ASC (*board owner*),
- a surgeon who is one of the most frequent users of a particular ASC (*frequent user owner*), and
- a surgeon who performs above a minimum threshold percentage of his or her procedures at a particular ASC (*threshold owner*).

This appendix evaluates each ownership measure and shows how the owners that are identified by each measure are similar and different to owners identified by the other measures. We compare the prevalence of surgeon ownership among the different measures, and evaluate them based on the stability of ownership tenures and the number of ASCs that surgeons are identified as “owning” during the time frame of the data.

In the main text, we used three owner measures: board owner, frequent user owner with a cutoff level of 50 percent of an ASC’s procedure volume (which we shall refer to in this appendix as *frequent user owner-50*), and threshold owner with a 30 percent threshold for a surgeon’s procedure volume (which we shall refer to in this appendix as *threshold owner-30*). In this appendix, we additionally compare frequent user owners with a 75 percent cutoff level (which we refer to as *frequent user owner-75*), threshold owners with a 50 percent cutoff level (which we refer to as *threshold owner-50*), and threshold owners with a 30 percent cutoff level but using quarterly procedure volume rather than annual procedure volume (which we refer to as *threshold owner-30-Q*). Table TA.B1 defines the six ownership measures.

Figure TA.B1 illustrates two points: the prevalence of physician ownership and the growth of ownership that results when applying each ownership measure. In any given year, threshold owners are the most prevalent. At the end of the time frame, they represented approximately 40 to 60 percent of orthopedic surgeons. Frequent ASC users were the next prevalent, representing 10 to 30 percent of orthopedic surgeons by the last quarter in 2004. Board owners are the least prevalent or most selective group of surgeon owners, around 9 percent by 2004.

Since data that identify physician owners is not readily available, we must rely on external surveys to evaluate whether the ownership measures are over or under inclusive. Unfortunately, these surveys are also scarce. There are several surveys that inquire about physician ownership. However, they often do not survey whether a physician is an owner of an ASC specifically. An extensive review of the literature located only one such survey: the MedScape 2011 survey, performed by a division of WebMD (WebMD, 2011). This survey indicated that 29 percent of orthopedic surgeons in 2011 were owners of ASCs and 12 percent were considering ownership. It is likely that ownership has grown between 2004 and 2011. Thus, if the surgeons who responded to the survey by MedScape in 2011 were representative for the purposes of measuring ownership and they did not underreport their ownership, we would expect the prevalence of ownership between 1997 and 2004 to be lower than 29 percent.

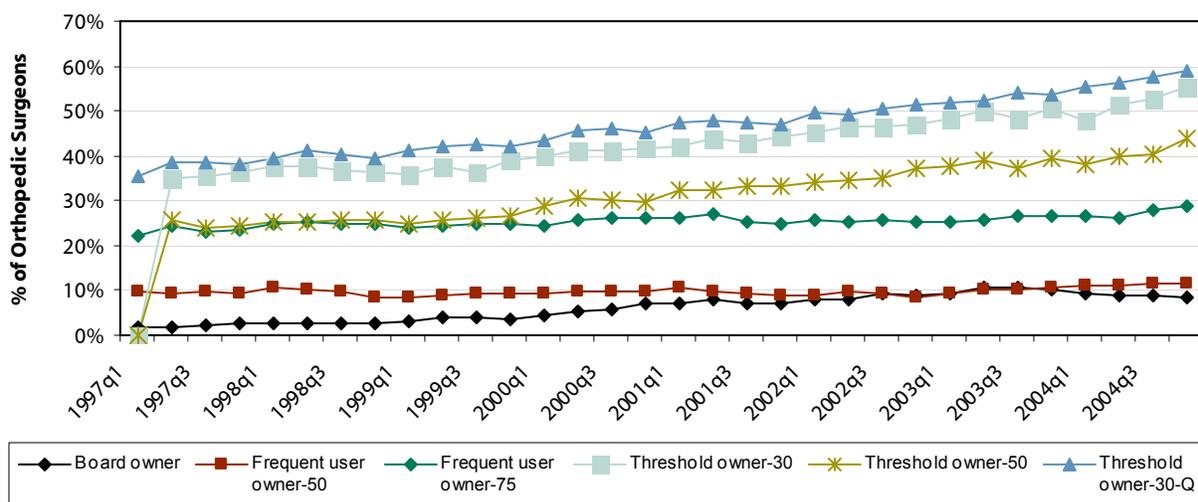
Table TA.B1 Variables Identifying Surgeon Owners

Short-hand Name	Reference	Variable Description	Variable Definition
Board owner	Yee (2011)	Identifies a surgeon serving on an ASC's board of directors in time period <i>t</i> .	Binary indicator that equals one if a surgeon served on an ASC's board in a particular quarter and zero otherwise.
Frequent user owner-50	Gabel et al. (2008)	Identifies a surgeon who was a frequent user of an ASC and who collectively with all frequent users accounted for 50 percent of procedures performed at the ASC within the past year from time period <i>t</i> .	Binary indicator that equals one if a surgeon, when ranked by his procedure volume among all surgeons who performed procedures at an ASC, was among the top surgeons who accounted for at most 50 percent of the ASC's procedure volume in the past year from time period <i>t</i> . It is zero otherwise.
Frequent user owner-75	Variants of Gabel et al. (2008)	Identifies a surgeon who was a frequent user of an ASC and who collectively with all frequent users accounted for 75 percent of procedures performed at the ASC within the past year from time period <i>t</i> .	Binary indicator that equals one if a surgeon, when ranked by his procedure volume among all surgeons who performed procedures at an ASC, was among the top surgeons who accounted for at most 75 percent of the ASC's procedure volume. It is zero otherwise.
Threshold owner-30	Hollingsworth et al. (2010)	Identifies a surgeon who did more than 30 percent of his or her procedure volume in the previous 12 months before time period <i>t</i> at a single ASC.	Binary indicator that equals one if a surgeon performed more than 30 percent of his or her procedures in the previous 12 months prior to a particular quarter at a single ASC and zero otherwise.
Threshold owner-50	Variants of Hollingsworth et al. (2010)	Identifies a surgeon who did more than 50 percent of his or her procedure volume in the previous 12 months before time period <i>t</i> at a single ASC.	Binary indicator that equals one if a surgeon performed more than 50 percent of his or her procedures in the previous 12 months prior to a particular quarter at a single ASC and zero otherwise.
Threshold owner-30-Q	Variants of Hollingsworth et al. (2010)	Identifies a surgeon who did more than 30 percent of his or her procedure volume in time period <i>t</i> at a single ASC.	Binary indicator that equals one if a surgeon performed more than 30 percent of his or her procedures at a single ASC in a particular quarter and zero otherwise.

Note: See the Glossary for definitions of a surgeon's procedure volume, a surgeon's surgery volume, and an ASC's procedure volume.

Key: ASC: ambulatory surgical center.

Figure TA.B1 Prevalence of Surgeon Ownership, by Ownership Measure



Notes: Data are based on Florida administrative ASC and hospital outpatient records for KSWC surgeries that occurred between 1997 and 2004 and Florida Division of Corporations annual corporate filings between 1997 and 2004. The sample includes orthopedic surgeons in Florida between 1997 and 2004. For a definition of the ownership measures, see Table TA.B1.

Key: ASC: ambulatory surgical center; KSWC surgery: a knee, shoulder, or wrist arthroscopy, or carpal tunnel surgery.

Comparing the MedScape 2011 percentages to previously used ownership measures, we can see that threshold owners represented more than 29 percent of orthopedic surgeons in 2004. The prevalence of frequent ASC users who accounted for 75 percent of an ASC's volume was just shy of 29 percent. Board owners of ASCs and surgeons who accounted for the top 50 percent of an ASC's volume represented below 29 percent of orthopedic surgeons.

Each measure shows that physician ownership grew from 1997 to 2004 in Florida. However, some measures show ownership growing faster than others. Surgeon board owners grew from approximately 2 percent of orthopedic surgeons in 1997 to 9 percent in 2004, or in other words quadrupled in eight years. The number of surgeons who performed more than 30 percent of their procedures at a single ASC, based on either the previous 12 months (threshold owner-30) or the current quarter (threshold owner-30-Q), grew from around 35 percent of orthopedic surgeons to over 55 percent. Surgeons who performed more than 50 percent of their procedures (threshold owner-50) grew from around 25 to around 45 percent of orthopedic surgeons. The prevalence of frequent user owners, who accounted for 50 percent or 75 percent of a single ASC's volume, grew less substantially than the other owner measures. Surgeons defined by frequent user owner-50 represented 10 percent of surgeons in 1997 and grew to 12 percent by 2004; surgeons defined by frequent user owner-75 represented 22 percent of surgeons in 1997 and grew to 29 percent by 2004. Meanwhile, the number of orthopedic surgeons in Florida grew roughly seven percent between 1997 and 2004.

Table TA.B2 shows how the ownership measures overlap. The table demonstrates that surgeon board owners of ASCs were a subset of surgeons who performed above 30 or 50 percent of their procedures at ASCs (threshold owners). Of the 108 surgeon board owners, 101 were owners according to the threshold owner-30 measure and 96 were owners according to the threshold owner-50. Approximately 82 percent of board owners were surgeons who accounted for the top 75 percent of an ASC's volume, and approximately 54 percent accounted for the top 50 percent of an ASC's volume.

The Pearson and the tetrachoric correlations among ownership measures are in Table TA.B3. The Pearson correlations are provided as a rudimentary benchmark. The reason for using tetrachoric correlations rather than other concordance measures (e.g., kappa statistic) is that the measures are approximately subsets or supersets of each other. For example, almost all board members and frequent users are threshold owners. While other statistics do not deal well with these types of measures, tetrachoric correlation does in the sense that it relies on a single underlying distribution upon which all measures are dependent.¹ In the case of surgeon ownership measures, the tetrachoric correlation between two binary measures assumes that the measures are based on the distribution of a continuous latent variable that determines whether a surgeon becomes an owner or not. Values of the latent variable above a cutoff value determine that a surgeon is an owner and values below that cutoff value determine that a surgeon is not an owner. Each of the three ownership measures used in this report use their own imprecise measures of the true cutoff value.

¹ For example, the kappa statistic does not do well with extreme base-rate probabilities, e.g., the probability that a randomly selected doctor was a board member was very low, and a threshold owner very high. It also compares the observed probability of agreement between two owner measures with the agreement based on the assumption that the owner measures randomly "guess" whether each doctor is an owner. Because the owner measures are approximately subsets or supersets of one another it would not be appropriate to "subtract out" the probability of agreement as if we randomly assigned doctors to be owners, as the kappa statistic does.

Table TA.B2 Overlap of Ownership Measures

Number of Orthopedic Surgeons	Board Owner	Frequent User Owner-50	Frequent User Owner-75	Threshold Owner-30	Threshold Owner-50	Threshold Owner-30-Q
	Number and Percentage of Board Owners	Number and Percentage of Frequent User Owner-50	Number and Percentage of Frequent User Owner-75	Number and Percentage of Threshold Owner-30	Number and Percentage of Threshold Owner-50	Number and Percentage of Threshold Owner-30-Q
Board owner	108	58	89	101	96	106
	100%	22%	19%	16%	18%	15%
Frequent user owner-50	58	262	262	254	238	258
	54%	100%	55%	40%	44%	37%
Frequent user owner-75	89	262	476	447	408	461
	82%	100%	100%	71%	75%	66%
Threshold owner-30	101	254	447	632	545	632
	94%	97%	94%	100%	100%	91%
Threshold owner-50	96	238	408	545	545	545
	89%	91%	86%	86%	100%	79%
Threshold owner-30-Q	106	258	461	632	545	694
	98%	98%	97%	100%	100%	100%
Number of orthopedic surgeons	941	941	941	941	941	941
	11%	28%	51%	67%	58%	74%

Notes: The sample includes 941 orthopedic surgeons that were practicing in Florida between 1997 and 2004. The counts are the number of these surgeons who were identified as an owner according to the owner measure defined in the column and row headings. The percentages are the percentages of surgeons identified by the owner measure in the column head who are also identified by the owner measure in the row label. For example, in the column for board owners, and row for frequent user owner-50, 54 percent indicates that 54 percent of surgeons identified as board owners are also identified as frequent user owner-50 in our data. Cells are shaded to highlight the total number of surgeons identified by each measure. For a definition of the ownership measures, see Table TA.B1.

Table TA.B3 Tetrachoric and Pearson Correlations among Ownership Measures

	Board Owner	Frequent User Owner-50	Frequent User Owner-75	Threshold Owner-30	Threshold Owner-50	Threshold Owner-30-Q
Tetrachoric Correlations						
Board owner	1.00					
Frequent user owner-50	0.37	1.00				
Frequent user owner-75	0.42	1.00	1.00			
Threshold owner-30	0.60	0.68	0.81	1.00		
Threshold owner-50	0.59	0.59	0.73	1.00	1.00	
Threshold owner-30-Q	0.72	0.75	0.85	0.96	0.96	1.00
Pearson Correlations						
Board owner	1.00					
Frequent user owner-50	0.15	1.00				
Frequent user owner-75	0.19	0.56	1.00			
Threshold owner-30	0.24	0.32	0.54	1.00		
Threshold owner-50	0.27	0.31	0.50	0.79	1.00	
Threshold owner-30-Q	0.26	0.33	0.55	0.81	0.70	1.00

Table TA.B2 and Figure TA.B1 suggest that the threshold owner measures were the most inclusive ownership measure, classifying the greatest number of surgeons as owners relative to the other measures. Frequent ASC user owners were the next most inclusive, and board owners of ASCs were the least inclusive. Similar to surgeon board owners, over 90 percent of the frequent ASC user owners were threshold owners. But only 37 to 44 percent of the threshold owners were surgeons who accounted for the top 50 percent of an ASC's referrals.

Next we turn to the stability of each ownership measure. We define stability in two ways: 1) by whether physicians who were labeled as *owners* had at least one complete year of being an owner, and 2) by the number of times a physician cycles in and out of ownership. Our expectation is that most physician owners have equity for at least one year. Some owners may stay an owner once they have become an owner. Others may become an owner for a while, take a break, and then become an owner again either at the same ASC or a different one. We would not expect that surgeons repeatedly cycled between being owners and non-owners during our study period.

To see how each ownership measure compared to our expectations, we measured the stability of the identification of surgeons as owners by each measure. Figure TA.B2 shows, for each owner definition, the percentage of owners who were and were not considered owners for at least one complete year. Some of these owners did not have a complete year of ownership because their ownership tenure started before 1997 and ended in 1997 or their ownership tenure started in 2004 and ended after 2004—in other words, their period of ownership was *left- or right-censored*. For these censored owners, we would not be able to capture the entire duration of their ownership. Figure TA.B2 divides owners (as defined by ownership measure) into three categories: owners who had more than 1 year of continuous ownership, censored owners who had less than 1 year of continuous ownership, and owners who had less than 1 year of continuous ownership but were not censored.

More than 95 percent of surgeon board owners had ownership periods that were either more than one complete year or censored. Between 90 and 94 percent of threshold owners had either more than one complete year of ownership or were censored. Between 73 and 84 percent of frequent ASC users had ownership durations of more than one year or were censored.

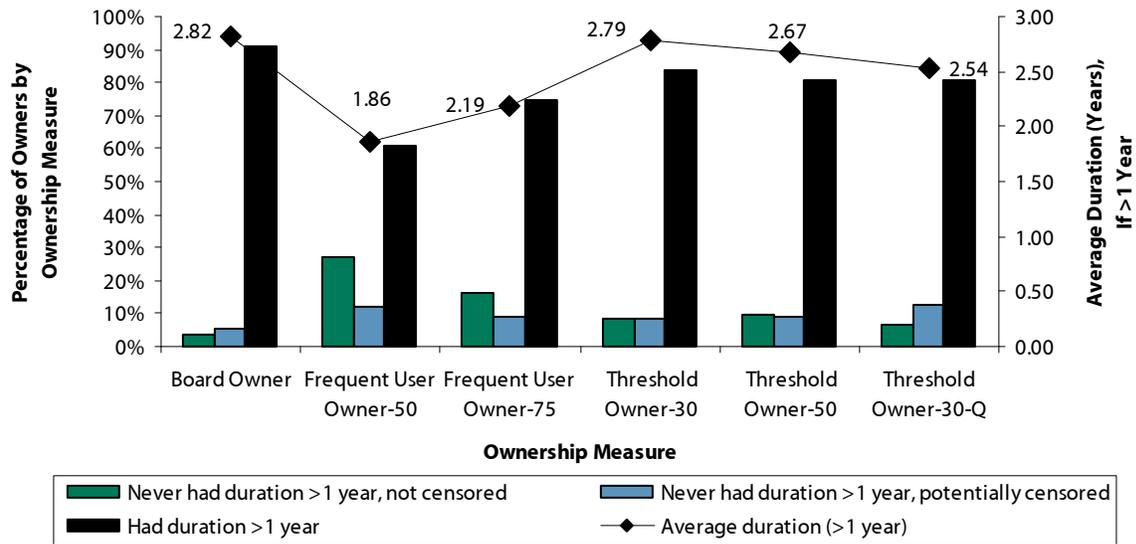
Among ownership tenures that were longer than one year, the average duration was highest for surgeon board owners, at 2.82 years. It was slightly smaller for all threshold owner measures. Duration was the smallest among frequent ASC user owners, at 1.86 to 2.19 years, or 22 to 34 percent less than board ownership tenures.

Figure TA.B3 shows the number of times a surgeon cycled in and out of ownership, among surgeon owners who had at least one ownership period that lasted at least one year. It is reasonable to expect some surgeons have two distinct ownership periods in eight or fewer years. It is less plausible that they would have had three or more distinct periods of ownership in the course of eight or fewer years.

Board ownership appears to be most stable, with 89 percent having only one ownership period. The other measures are less stable, with approximately 10 to 23 percent of the owners having 3 or more ownership periods. However, we must also account for the prevalence of each group as well. Twenty-two percent of surgeons identified as threshold owner-30-Q with one continuous year of ownership, or 121 orthopedic surgeons, had three or more distinct ownership periods. Twenty-three percent of surgeons identified as frequent user owner-50, or 37 orthopedic surgeons, had three or more distinct ownership periods. Similarly, 82 of 357 surgeons identified as frequent user owner-75 had three or more distinct ownership periods.

The comparisons indicated that surgeons who performed 30 percent or 50 percent of their procedures at an ASC were likely to keep performing above these same thresholds. In contrast, it may prove to be more difficult to continue to be the most frequent referrer or performer at an ASC. As new owners enter among the surgeons who work at ASCs and as individual ASCs grow in capacity, being a top referrer or performer may be difficult to maintain. The findings also suggest that frequent user owner definitions were more sensitive to their cutoff levels.

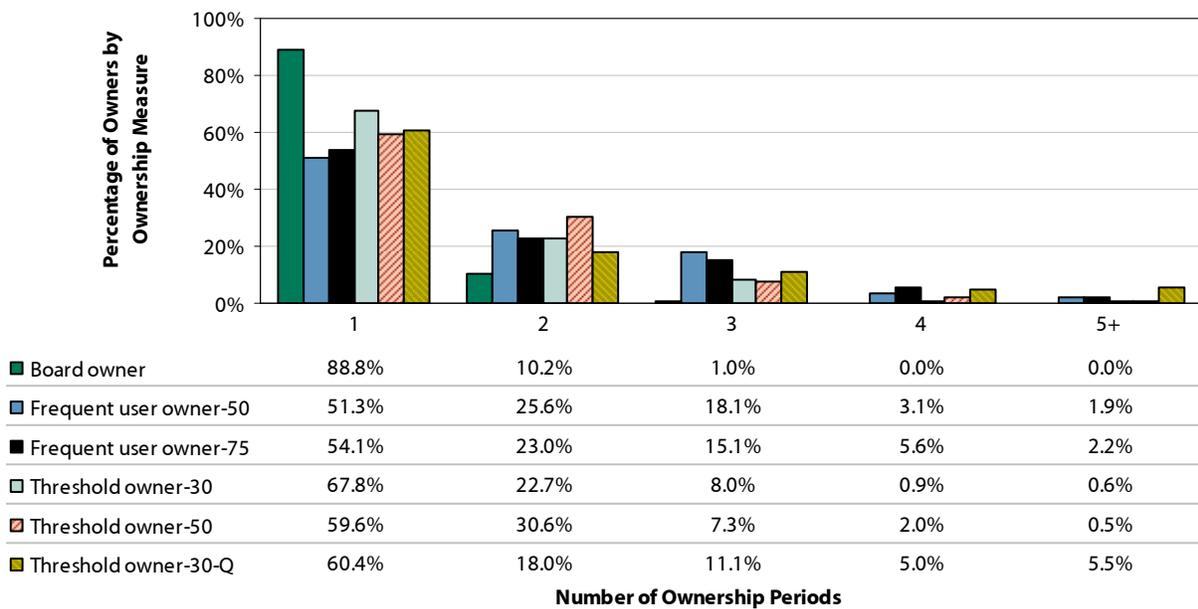
Figure TA.B2 Stability of Ownership: Ownership Duration, by Ownership Measure



Notes: Data are based on Florida administrative ASC and hospital outpatient records for KSWC surgeries that occurred between 1997 and 2004 and Florida Division of Corporations annual corporate filings between 1997 and 2004. The sample includes orthopedic surgeons in Florida between 1997 and 2004. For a definition of the ownership measures, see Table TA.B1.

Key: ASC: ambulatory surgical center; KSWC surgery: a knee, shoulder, or wrist arthroscopy, or carpal tunnel surgery.

Figure TA.B3 Stability of Ownership: Number of Distinct Ownership Periods among Owners with at Least One Complete Year of Ownership, by Ownership Measure



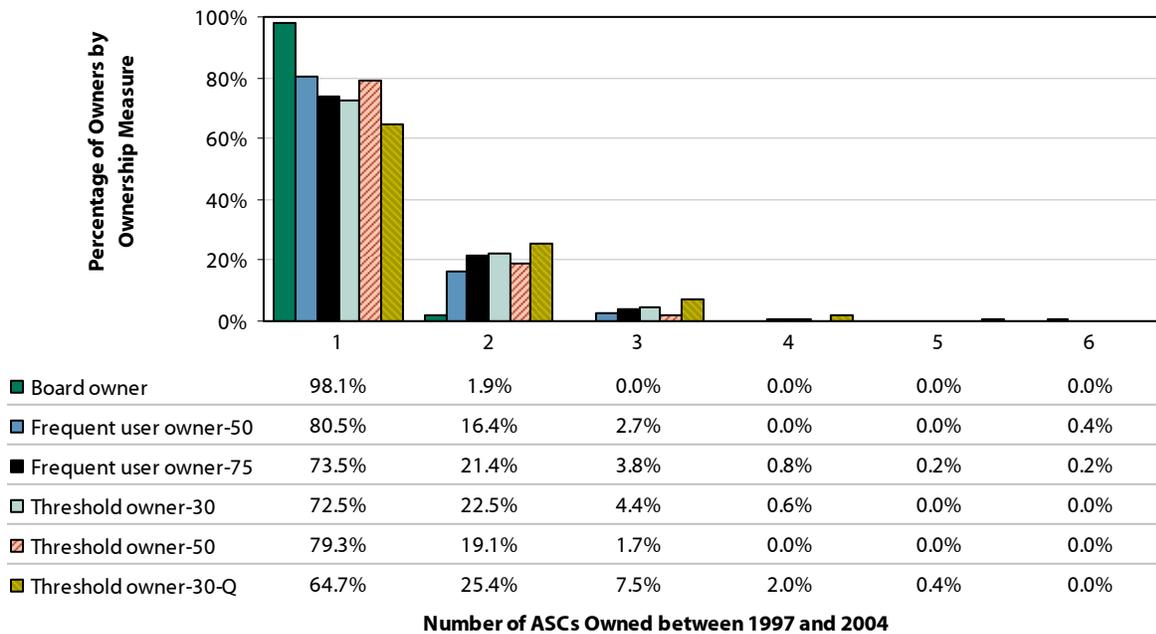
Notes: Data are based on Florida administrative ASC and hospital outpatient records for KSWC surgeries that occurred between 1997 and 2004 and Florida Division of Corporations annual corporate filings between 1997 and 2004. The sample includes orthopedic surgeons in Florida between 1997 and 2004, who owned ASCs as defined by the measures for at least one complete year. For a definition of the owner measures, see Table TA.B1.

Key: ASC: ambulatory surgical center; KSWC surgery: a knee, shoulder, or wrist arthroscopy, or carpal tunnel surgery.

We also investigated the number of ASCs that surgeon owners were considered to have owned, according to each owner measure. Although external numbers do not exist on how many ASCs a surgeon typically owns, we would expect that it may be difficult to be an owner of many ASCs.

Figure TA.B4 illustrates this point: more surgeons were owners of one ASC than two ASCs, of two ASCs than three ASCs, and so on. Board owners, frequent user owner-50, and threshold owner-50 were the most likely to only “own” one ASC. Ninety-eight percent of surgeon board owners were board owners of only one ASC between 1997 and 2004. Eighty percent of surgeons identified as frequent user owner-50 were frequent users of only one ASC. Eighty percent of surgeons who performed more than 50 percent of their case load from the previous 12 months at a single ASC were threshold owners of only one ASC. Only 65 percent of surgeons who performed more than 30 percent of their case load at a single ASC in a given quarter were threshold owners-30-Q for only one ASC, and 35 percent were threshold owners-30-Q for two or more. Aggregating surgery volume to an annual level, 73 percent of surgeons identified as threshold owners-30 were threshold owners of a single ASC.

Figure TA.B4 Multiple ASC Ownership: Percentage of Owners Who Owned Multiple ASCs, by Ownership Measure

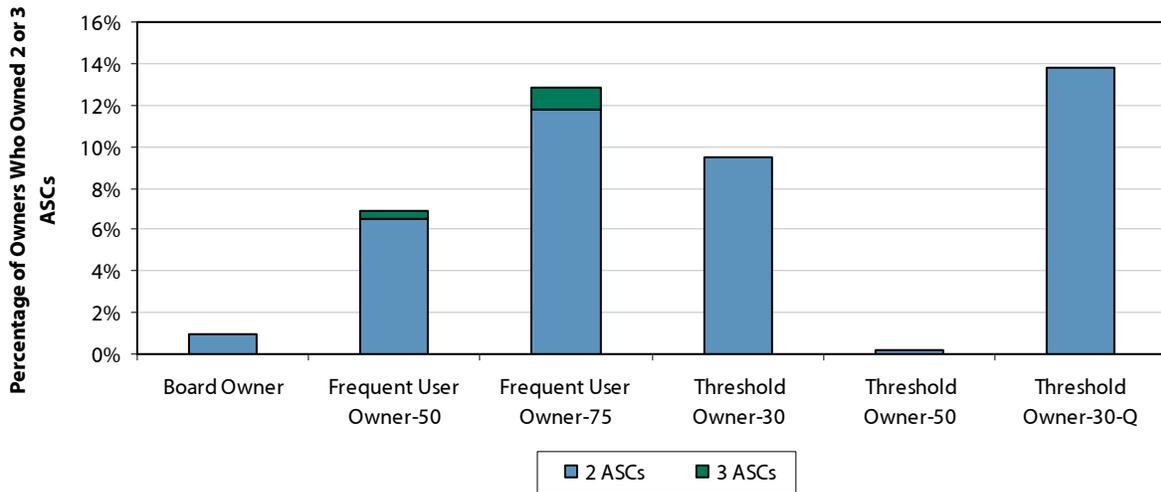


Notes: Data are based on Florida administrative ASC and hospital outpatient records for KSWC surgeries that occurred between 1997 and 2004 and Florida Division of Corporations annual corporate filings between 1997 and 2004. The sample includes orthopedic surgeons in Florida between 1997 and 2004, who owned ASCs. For a definition of the ownership measures, see Table TA.B1.

Key: ASC: ambulatory surgical center; KSWC surgery: a knee, shoulder, or wrist arthroscopy, or carpal tunnel surgery.

Figure TA.B5 shows that surgeon board owners and surgeons who performed more than 50 percent of their case load from the previous 12 months at an ASC rarely owned more than one ASC at the same time. In fact, for threshold owners-50, this would be impossible unless the surgeon referred exactly 50 percent to one ASC and 50 percent to another ASC. The other measures indicate that between 7 and 14 percent of owners (as measured by the corresponding ownership measure) owned 2 or 3 ASCs at the same time.

Figure TA.B5 Multiple ASC Ownership: Percentage of Owners Who Owned 2 or 3 ASCs at the Same Time



Notes: Data are based on Florida administrative ASC and hospital outpatient records for KSWC surgeries that occurred between 1997 and 2004 and Florida Division of Corporations annual corporate filings between 1997 and 2004. The sample includes orthopedic surgeons in Florida between 1997 and 2004. For a definition of the ownership measures, see Table TA.B1.

Key: ASC: ambulatory surgical center; KSWC surgery: a knee, shoulder, or wrist arthroscopy, or carpal tunnel surgery.

TECHNICAL APPENDIX C: METHODOLOGY AND FULL ESTIMATES

This appendix describes the models used in the report to decompose the owner/non-owner differential in the number of surgeries performed. It also describes the models used to estimate the shift in surgeries to surgeon-owned ASCs and the shift in payor mix. We additionally show how the models used in the report differ from the commonly used difference-in-differences approach. Finally, we briefly describe the organization of the tables and figures of this appendix.

The language and terminology used in this appendix is likely most familiar to economists and public policy analysts. The author expects that although researchers with expertise in other areas may not be as familiar with this terminology, using it allows the clearest explanation of this subject matter.

ECONOMICS FRAMEWORK

A surgeon, similar to any worker, chooses between the hours that he or she works, or conversely leisure hours, and how much he or she can consume. The level of consumption is dependent on income, and income is dependent on the number of surgeries and the income received per surgery. Figure TA.C1 is a standard economics graph of labor supply that depicts the optimal number of hours worked and income received for a given budget constraint. Financial incentives attendant to ownership increase the income per surgery. For every hour worked, the income is larger, which is exhibited by a shift in the budget constraint. Depending on a surgeon's utility curve, he or she may decrease, increase, or maintain the number of hours worked. Figure TA.C1 shows an example of a case in which the *substitution effect* (desire to work more because each hour yields a higher return) is larger than the *income effect* (desire to work less because a higher income is already achieved), and a surgeon increases the hours worked by $h - h'$.

Likewise, if ASCs provide an efficiency gain and surgeons shift to working at ASCs rather than hospitals, a surgeon will be able to earn more income per each hour worked (assuming no decreasing marginal ability to perform surgeries as surgery volume increases). The efficiency effect is similar to the financial incentives effect in that it shifts a surgeon's budget constraint in a similar way, as depicted in Figure TA.C1. To keep the same number of surgeries performed per year (i.e., effort is held constant), a surgeon could work fewer hours. Alternatively, a surgeon could work similar hours and receive a higher income.

This report determines, through the models described below, whether the average surgeon 'worked more' or performed more surgery in a given quarter when he or she became an owner. As an owner, a surgeon experienced a higher wage both due to financial incentives and efficiency gains. The findings indicate that the average surgeon performed more surgery as a result of financial incentives and as a result of increased efficiency. The substitution effect was larger than the income effect.

EMPIRICAL METHODOLOGY

The average difference in surgery volume (y) between surgeon owners and non-owners is represented by $\beta^{(1)}$ in the following model:

$$y_{i,t} = C^{(1)} + \beta^{(1)} FI_{i,t} + \varepsilon_{i,t}^{(1)} \tag{1}$$

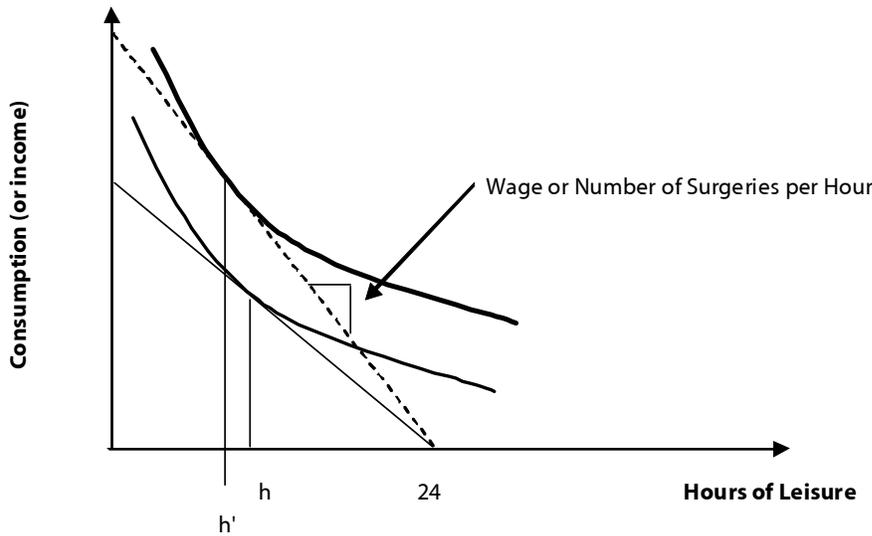
where $y_{i,t}$ is the surgery volume of surgeon i in period t , $C^{(1)}$ is the average surgery volume of non-owners, $FI_{i,t}$ is an indicator of whether surgeon i in period t has a financial interest in an ASC, as defined by the six proxies for physician ownership described in Technical Appendix B and in the text.

The average difference in surgery volume between surgeon owners and non-owners, controlling for underlying trends in the use of surgery, such as technology improvements over time or seasonal changes in the use of surgery in Florida, is represented by $\beta^{(2)}$ in the following model:

$$y_{i,t} = C^{(2)} + \bar{\delta}_t^{(2)} + \beta^{(2)} FI_{i,t} + \varepsilon_{i,t}^{(2)} \tag{2}$$

where $\bar{\delta}_t^{(2)}$ is a vector of the coefficients on year and quarter binary indicators that define period t .

Figure TA.C1 A Surgeon's Response to Ownership and ASC Efficiency



Notes: The y axis can be thought of as either income or consumption, products and services purchased by income. The dotted line shows a higher wage rate than the solid line. An owner may experience higher wages either due to efficiency gains, personal efficiency, or financial incentives. An owner's wage rate is exemplified by the dotted line, and a non-owner's wage rate is exemplified by the solid line. The figure shows an example of an owner choosing to work more hours, or to have less leisure time (h'), than a non-owner (h).

These coefficients measure how much the average surgeon's surgery volume in period t is different from (more than) the first quarter of the year 1997. The coefficients on annual indicators measure trends in the supply and demand of orthopedic surgery due to a variety of reasons, such as technology trends, shifting of procedures from inpatient settings to outpatient ones, changes in surgeon or patient preferences to have surgery, price changes, and statewide legislative changes. Inclusion of variables to isolate seasonal trends is particularly important because Florida experiences an influx of people during the winter, which can lead to higher utilization. Also, since the orthopedic surgeries that are studied in this report are typically non-emergency, people can schedule them at their

convenience. Seasonal effects also account for jobs that are seasonal, which might affect the use of surgeries that are covered by workers' compensation.

While the trend variables control for trends in the use of surgery, they also affect how one interprets the owner to non-owner differential $\beta^{(2)}$. The difference between $\beta^{(1)}$ and $\beta^{(2)}$ is the part of the owner to non-owner differential that is due to trends that coincide with trends in surgeon ownership. It is likely that surgeon ownership in Florida grew between 1997 and 2004. It is also known that there were technology improvements in the use of surgery. The surgery volumes of owners therefore are more likely to be higher in later periods, when there was higher utilization of surgery.

The average difference in surgery volume between surgeon owners and non-owners, controlling for underlying trends in the use of surgery and the recruitment of higher-volume surgeons by ASCs or self-selection of higher-volume surgeons into ownership, is represented by $\beta^{(3)}$ in the following model:

$$y_{i,t} = C^{(3)} + \bar{\delta}_t^{(3)} + \beta^{(3)} FI_{i,t} + \bar{\alpha}_i^{(3)} + \varepsilon_{i,t}^{(3)} \quad (3)$$

where $\alpha_i^{(3)}$ is a vector of coefficients on individual surgeon binary identifiers. These coefficients represent the average surgery volume of surgeon i (relative to an arbitrarily assigned surgeon for the constant C) across time periods, when $FI_{i,t} = 0$ and it is the first quarter of 1997. In other words, for surgeons who were owners at some point in the time frame of the data, $\alpha_i^{(3)}$ is their average surgery volume before and after their ownership period (relative to an arbitrarily assigned surgeon). The difference between $\beta^{(3)}$ and $\beta^{(2)}$ is the part of the owner to non-owner differential that is due the recruitment or self-selection effect.

With the inclusion of surgeon fixed effects, or indicators for each surgeon, $\beta^{(3)}$ captures within-surgeon variation. It is the average change in surgery volume when an individual surgeon became an owner, and it is no longer the difference between one group of surgeons (owners) and another group (non-owners).

In a similar way to Models (2) and (3), we controlled for increases in surgeon i 's surgery volume due to diversifying (or consolidating) his or her facility referral network, by including a measure for the size of surgeon i 's network, or

$$y_{i,t} = C^{(4)} + \bar{\delta}_t^{(4)} + \gamma^{(4)} N_{i,t} + \beta^{(4)} FI_{i,t} + \bar{\alpha}_i^{(4)} + \varepsilon_{i,t}^{(4)} \quad (4)$$

where $N_{i,t}$ is the number of facilities (ASCs and hospitals) where surgeon i referred and treated patients. $\gamma^{(4)}$ identifies how many more surgeries surgeons, on average, performed when they practiced at an additional facility, or increased their capacity by one facility. This variable controls for the phenomenon that surgeons add a new facility to their network when they want to increase their capacity (without regard to causality). Adding a facility provides one more place to schedule surgeries. It may also lead to access to more patients.¹ This addition likely occurs when a surgeon wants to increase his patient load. Thus, we should expect that a surgeon's facility network size is associated with higher surgery volumes. Conversely, consolidating one's network may lead to a reduction in the number of patients. When surgeons become owners, they may expand or contract their networks—for example, add an ASC or subtract a hospital. The difference between $\beta^{(4)}$ and $\beta^{(3)}$ is the part of the owner to non-owner differential that is due to surgeons increasing capacity through network expansion or decreasing it through consolidation.

Surgeon owners of ASCs may experience an increase in capacity by working more with ASCs, which are hypothesized to be more efficient and allow surgeons to schedule more surgeries within a certain amount of time

¹ Surgeons who want access to more patients or to have a more convenient location for their patients may decide to expand their facility network. Adding a facility to one's network may also indicate which physicians were in such high demand for surgeries that they needed to add a facility to the number of locations where they can perform surgeries.

relative to hospitals. However, because surgeon owners experience both efficiency gains and ownership effects, teasing out the efficiency gains among surgeon owners is difficult. Thus, we implemented a two-step process that uses non-owners and their efficiency gains to inform us about the gains among owners. A necessary assumption is that non-owners experience similar efficiency gains as owners do when they begin to work more at ASCs, rather than hospitals. The two-step process to control for the increase in surgery volume due to scheduling efficiency gains is as follows.

In the first step, we estimated the relationship between the amount a non-owner surgeon works with an ASC and his or her surgery volume. The amount a surgeon works with an ASC is measured by the percentage of his or her procedures that are performed in any ASC, rather than a hospital. The hypothesis states that as a surgeon works more with an ASC, he or she is able to schedule more surgeries and have larger surgery volumes. We then predicted, for each surgeon owner and non-owner, the number of surgeries that he or she would have performed in a given quarter based on how much he or she worked with ASCs. This prediction is based on the behavior of a sample of surgeons who were non-owners. To be precise, the sample of non-owner surgeons included in the estimated model contained those who were not frequent user owners-75 and not board owners. We included all observation periods of those who were never these types of owners (between 1997 and 2004) and only pre-ownership periods of those who eventually became one of these owners. For sensitivity purposes, we additionally excluded from the sample surgeons who were *employed* by a hospital or ASC, defined as those that referred over 95 percent of their procedures to either a single ASC or hospital.

Using this sample of surgeons, who did not have financial incentives to do more surgery, we determined how much their surgery volumes increased as they shifted more of their caseloads to ASCs from hospitals by estimating:

$$y_{i,t} = C^{(5a)} + \bar{\delta}_t^{(5a)} + \bar{\varphi}^{(5a)} \cdot F(\%ASC_{i,t}) + \bar{\alpha}_i^{(5a)} + \varepsilon_{i,t}^{(5a)} \quad (5a)$$

where $\%ASC_{i,t}$ is the percentage of surgeon i 's procedures in period t that he or she performed at ASCs (not a single ASC), and $F(\cdot)$ is a third order polynomial of $\%ASC_{i,t}$ to account for decreasing returns to working more with ASCs and non-linearities of surgeons who do not work frequently with ASCs. The dot product $\bar{\varphi}^{(5a)} \cdot F(\%ASC_{i,t})$ represents the relationship between working more with ASCs and surgery volume. The logic is that if there were efficiency gains due to improved scheduling at ASCs (as opposed to hospitals), then non-owners, like owners, should experience these gains.

Using the relationship between ASC use and surgery volume among non-owners, we extrapolated that relationship for owners. We predicted what owners' surgery volumes would have been had they not been owners, but yet still experienced working with ASCs the same amount as they did, i.e., $E[y_{i,t} | \%ASC_{i,t}]$, with all other variables in (5a) set to zero. The first step yields the efficiency gains from working at ASCs rather than hospitals.

The second step identifies how much of the owner/non-owner differential was due to efficiency gains and separates them from the financial incentives effect. In the second step, for each surgeon, we subtracted the predicted number of surgeries due to the efficiency gains from a surgeon's surgery volume. In essence, we constrained the coefficient of the predicted values of $E[y_{i,t} | \%ASC_{i,t}]$, or $\hat{y}_{i,t}^{ASC}$, to 1, as the following model indicates:

$$y_{i,t} = C^{(5b)} + \bar{\delta}_t^{(5b)} + \gamma^{(5b)} N_{i,t} + \hat{y}_{i,t}^{ASC} + \beta^{(5b)} FI_{i,t} + \bar{\alpha}_i^{(5b)} + \varepsilon_{i,t}^{(5b)} \quad (5b)$$

To implement this for ordinary least squares estimation (using STATA), we used $y_{i,t} - \hat{y}_{i,t}^{ASC}$ as the dependent variable. For negative binomial estimation (using STATA), we constrained the coefficient on the natural log of $\hat{y}_{i,t}^{ASC}$ to 1, in order to match the negative binomial implicit transformation of the dependent variable to a natural log form.

Model (5b) allows identification of the financial incentives effect under the assumption that the timing of when

a surgeon becomes an owner is not correlated with any time-varying phenomena that affect his or her procedure volume, other than those under the umbrella of ownership, such as exposure to new financial incentives. Surgeon fixed effects capture the heterogeneity among surgeon practice patterns. They control for differences in overall ability, experience, reputation, and geographical location. Even if surgeon owners typically have higher procedure volumes, the estimate of financial interest impact should not be biased as long as their procedure volumes (detrended from increases in the use of medical services, seasonal trends, changes due to growing referral networks, and efficiency gains) do not change significantly with the timing of each of their ownership assignments from a reason other than owner financial incentives. Model (1) and the fact that surgeons become owners at different times reduce potential biases from reverse causality.

Due to limited data availability, much of the previous literature has been constrained to cross-sectional comparisons, which treats α_i as unobservable. Without expansive information on surgeon characteristics, this omission is likely to bias the coefficient β positively. High-volume surgeons are more likely to be sought after by ASC managers to become financially contracted with their facility. Moreover, some high-volume surgeons could seek out investment opportunities, such as part-ownership of ASCs. Thus, by omitting α_i , β would include any selection or entrepreneurial/recruitment effects in addition to the impact of financial interests.

Likewise, previous studies have omitted a control for effects due to increased capacity, either through ASC efficiency gains or diversifying one's facility referral network. Without controlling for these aspects, β may have a positive bias.

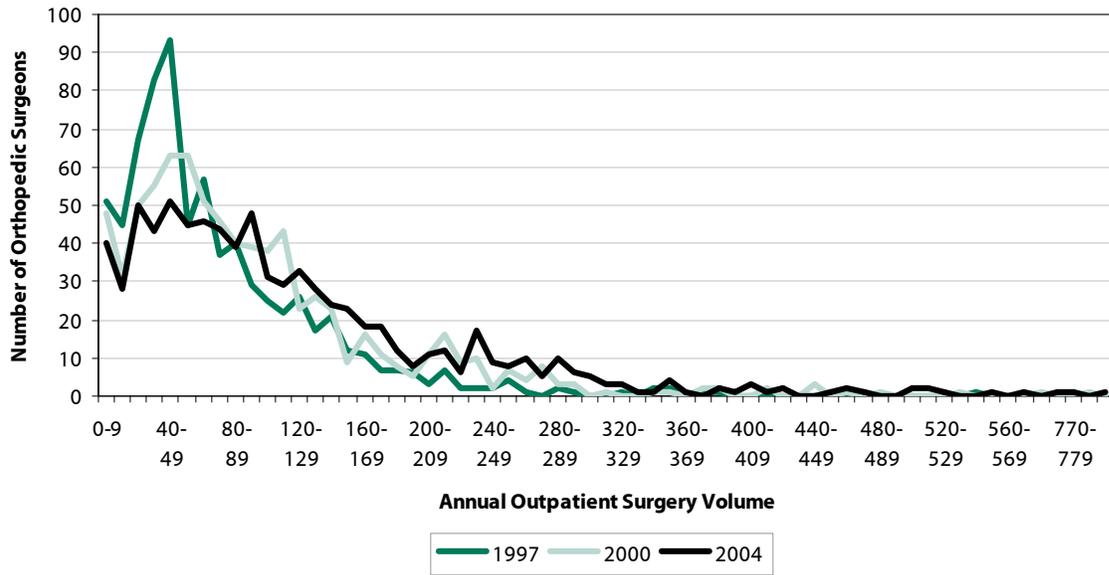
To estimate Models (1) through (5) and ascertain how each of the five factors contributes to the owner/non-owner differential, we used negative binomial regressions. These results are summarized in the main text of this report. The dependent variable—surgery volume—is a count variable. The dispersion of the distribution of surgeon surgery volumes was large relative to the mean, supporting the use of a negative binomial regression over ordinary least squares (OLS). Surgery volumes were not as normal as one would like in order to use OLS (see Figure TA.C2). OLS estimation was performed, however, and the results are available upon request.

Tables TA.C1 to TA.C3 present results from negative binomial estimation of Models (1) through (4) and (5b) using board owner, frequent user owner, and threshold owner measures, respectively. In order to estimate Model (5b) using a negative binomial regression, the natural log of surgery volumes predicted by Model (5a), or $\hat{y}_{i,t}^{ASC}$, were used instead of the linear form. As exhibited in the tables, the coefficient was constrained to 1.

Estimates for Model (5a) are in Table TA.C4. The table shows negative binomial estimates using first order and third order polynomial specifications of $\%ASC_{i,t}$.

Figure TA.C3 shows the distribution of $\%ASC_{i,t}$ across the sample of non-owners and surgeons who did not have strong incentives to refer to either ASCs or hospitals—the sample used to estimate Model (5a). If $\%ASC_{i,t}$ were sparse and concentrated only in the left side of the distribution, we would not be able to use this method as a control for ASC efficiency. In other words, if only non-owners did not perform many surgeries at ASCs and only owners performed surgery at ASCs, we would not be able to disentangle the ASC efficiency effect from the ownership effect. We caution readers to interpret the threshold owner measure of ownership carefully, as this measure is more susceptible to the collinearity issue.

Figure TA.C2 Distribution of Surgeons' Outpatient Surgery Volume



Notes: Data are based on Florida administrative ASC and hospital outpatient records, provided by the Florida Agency for Health Care Administration, for KSWC surgeries that occurred between 1997 and 2004.

Table TA.C1 Relationship between a Surgeon's Surgery Volume and Five Explanatory Factors, Using Board Owner Measure (negative binomial regressions)

Outcome Variable:	[1]		[2]		[3]		[4]		[5]		
Surgeon's Quarterly Surgery Volume	Coefficient (standard error)										
Surgeon owner of an ASC in period <i>t</i>	0.57	*** (0.08)	0.52	*** (0.08)	0.22	*** (0.02)	0.18	*** (0.02)	0.13	*** (0.02)	
Predicted surgery volume from working with ASCs (natural log form)										1.00	
Surgeon's facility network size										0.12	*** (0.00)
										0.11	*** (0.00)
Year relative to 1997											
1998			0.08	*** (0.02)	0.09	*** (0.01)	0.07	*** (0.01)	0.07	*** (0.01)	
1999			0.18	*** (0.02)	0.18	*** (0.01)	0.17	*** (0.01)	0.17	*** (0.01)	
2000			0.24	*** (0.02)	0.24	*** (0.01)	0.23	*** (0.01)	0.23	*** (0.01)	
2001			0.29	*** (0.03)	0.30	*** (0.01)	0.30	*** (0.01)	0.30	*** (0.01)	
2002			0.32	*** (0.03)	0.32	*** (0.01)	0.34	*** (0.01)	0.32	*** (0.01)	
2003			0.37	*** (0.03)	0.36	*** (0.01)	0.39	*** (0.01)	0.37	*** (0.01)	
2004			0.41	*** (0.03)	0.40	*** (0.01)	0.44	*** (0.01)	0.42	*** (0.01)	
Quarter relative to quarter 1											
Quarter 2			0.03	*** (0.01)	0.03	*** (0.01)	0.03	*** (0.01)	0.03	*** (0.01)	
Quarter 3			-0.04	*** (0.01)	-0.06	*** (0.01)	-0.05	*** (0.01)	-0.05	*** (0.01)	
Quarter 4			-0.02	*** (0.01)	-0.03	*** (0.01)	-0.02	*** (0.01)	-0.03	*** (0.01)	
Constant	3.20	*** (0.03)	2.96	*** (0.03)	1.51	*** (0.02)	1.19	*** (0.02)	0.93	*** (0.02)	
Number of surgeon-quarters	23,729		23,729		23,721		23,721		23,721		
Number of surgeons					933		933		933		
Log-likelihood	-100,000.7		-99,687.0		-82,532.3		-81,850.8		-81,646.4		
Chi-squared	55.0		594.6		2,025.4		3,542.7		3,964.0		

Notes:

Specification [1] estimates the owner to non-owner differential.

Specification [2] separates technology and market trends from the owner to non-owner differential.

Specification [3] separates the entrepreneurial/recruitment effect and technology and market trends from the owner to non-owner differential.

Specification [4] separates capacity changes, the entrepreneurial/recruitment effect, and technology and market trends from the owner to non-owner differential.

Specification [5] separates the efficiency effect, the entrepreneurial/recruitment effect, and technology and market trends from the owner to non-owner differential.

Data are based on Florida administrative ASC and hospital outpatient records for KSWC surgeries that occurred between 1997 and 2004 and Florida Division of Corporations annual corporate filings between 1997 and 2004. The sample includes orthopedic surgeons in Florida between 1997 and 2004. For a definition of the ownership measures, see Table TA.B1. See the Glossary for a definition of surgery volume. For a definition of the five explanatory factors, see Table 2.3. + signifies that the coefficient is significant at the 20 percent level; * signifies that the coefficient is significant at the 10 percent level; ** signifies that the coefficient is significant at the 5 percent level; and *** signifies that the coefficient is significant at the 1 percent level.

Key: ASC: ambulatory surgical center; KSWC surgery: a knee, shoulder, or wrist arthroscopy, or carpal tunnel surgery; n/a: not applicable.

Table TA.C2 Relationship between a Surgeon's Surgery Volume and Five Explanatory Factors, Using Frequent User Owner-50 Measure (negative binomial regressions)

Outcome Variable:	[1]		[2]		[3]		[4]		[5]		
Surgeon's Quarterly Surgery Volume	Coefficient (standard error)										
Surgeon owner of an ASC in period <i>t</i>	0.75	*** (0.05)	0.75	*** (0.06)	0.27	*** (0.01)	0.24	*** (0.01)	0.20	*** (0.01)	
Predicted surgery volume from working with ASCs (natural log form)										1.00	n/a
Surgeon's facility network size										0.12	*** (0.00)
Year relative to 1997											
1998			0.10	*** (0.02)	0.09	*** (0.01)	0.07	*** (0.01)	0.07	*** (0.01)	
1999			0.21	*** (0.02)	0.19	*** (0.01)	0.17	*** (0.01)	0.17	*** (0.01)	
2000			0.27	*** (0.02)	0.24	*** (0.01)	0.24	*** (0.01)	0.23	*** (0.01)	
2001			0.34	*** (0.03)	0.31	*** (0.01)	0.32	*** (0.01)	0.30	*** (0.01)	
2002			0.38	*** (0.03)	0.34	*** (0.01)	0.35	*** (0.01)	0.33	*** (0.01)	
2003			0.43	*** (0.03)	0.38	*** (0.01)	0.40	*** (0.01)	0.38	*** (0.01)	
2004			0.45	*** (0.03)	0.41	*** (0.01)	0.45	*** (0.01)	0.43	*** (0.01)	
Quarter relative to quarter 1											
Quarter 2			0.03	*** (0.01)	0.03	*** (0.01)	0.03	*** (0.01)	0.03	*** (0.01)	
Quarter 3			-0.04	*** (0.01)	-0.05	*** (0.01)	-0.05	*** (0.01)	-0.05	*** (0.01)	
Quarter 4			-0.01	* (0.01)	-0.03	*** (0.01)	-0.02	** (0.01)	-0.02	*** (0.01)	
Constant	3.15	*** (0.02)	2.86	*** (0.03)	1.50	*** (0.02)	1.19	*** (0.02)	0.93	*** (0.02)	
Number of surgeon-quarters	23,729		23,729		23,721		23,721		23,721		
Number of surgeons					933		933		933		
Log-likelihood	-99,322.9		-98,909.2		-82,394.3		-81,726.4		-81,547.6		
Chi-squared	184.7		704.6		2,350.1		3,844.1		4,211.1		

Notes:

Specification [1] estimates the owner to non-owner differential.

Specification [2] separates technology and market trends from the owner to non-owner differential.

Specification [3] separates the entrepreneurial/recruitment effect and technology and market trends from the owner to non-owner differential.

Specification [4] separates capacity changes, the entrepreneurial/recruitment effect, and technology and market trends from the owner to non-owner differential.

Specification [5] separates the efficiency effect, the entrepreneurial/recruitment effect, and technology and market trends from the owner to non-owner differential.

Data are based on Florida administrative ASC and hospital outpatient records for KSWC surgeries that occurred between 1997 and 2004 and Florida Division of Corporations annual corporate filings between 1997 and 2004. The sample includes orthopedic surgeons in Florida between 1997 and 2004. For a definition of the ownership measures, see Table TA.B1. See the Glossary for a definition of surgery volume. For a definition of the five explanatory factors, see Table 2.3. + signifies that the coefficient is significant at the 20 percent level; * signifies that the coefficient is significant at the 10 percent level; ** signifies that the coefficient is significant at the 5 percent level; and *** signifies that the coefficient is significant at the 1 percent level.

Key: ASC: ambulatory surgical center; KSWC surgery: a knee, shoulder, or wrist arthroscopy, or carpal tunnel surgery; n/a: not applicable.

Table TA.C3 Relationship between a Surgeon's Surgery Volume and Five Explanatory Factors, Using Threshold Owner-30 Measure (negative binomial regressions)

Outcome Variable:	[1]		[2]		[3]		[4]		[5]	
Surgeon's Quarterly Surgery Volume	Coefficient (standard error)									
Surgeon owner of an ASC in period t	0.42	***	0.38	***	0.29	***	0.24	***	0.16	***
	(0.04)		(0.04)		(0.01)		(0.01)		(0.01)	
Predicted surgery volume from working with ASCs (natural log form)									1.00	
									n/a	
Surgeon's facility network size							0.11	***	0.10	***
							(0.00)		(0.00)	
Year relative to 1997										
1998			0.04	**	0.06	***	0.05	***	0.06	***
			(0.02)		(0.01)		(0.01)		(0.01)	
1999			0.15	***	0.15	***	0.15	***	0.15	***
			(0.02)		(0.01)		(0.01)		(0.01)	
2000			0.20	***	0.20	***	0.21	***	0.21	***
			(0.02)		(0.01)		(0.01)		(0.01)	
2001			0.26	***	0.26	***	0.27	***	0.28	***
			(0.03)		(0.01)		(0.01)		(0.01)	
2002			0.29	***	0.27	***	0.30	***	0.30	***
			(0.03)		(0.01)		(0.01)		(0.01)	
2003			0.32	***	0.31	***	0.34	***	0.34	***
			(0.03)		(0.01)		(0.01)		(0.01)	
2004			0.36	***	0.34	***	0.39	***	0.38	***
			(0.03)		(0.01)		(0.01)		(0.01)	
Quarter relative to quarter 1										
Quarter 2			0.01	*	0.01	*	0.02	**	0.02	**
			(0.01)		(0.01)		(0.01)		(0.01)	
Quarter 3			-0.06	***	-0.07	***	-0.06	***	-0.06	***
			(0.01)		(0.01)		(0.01)		(0.01)	
Quarter 4			-0.04	***	-0.05	***	-0.04	***	-0.04	***
			(0.01)		(0.01)		(0.01)		(0.01)	
Constant	3.05	***	2.88	***	1.47	***	1.20	***	0.93	***
	(0.03)		(0.03)		(0.02)		(0.02)		(0.02)	
Number of surgeon-quarters	23,729		23,729		23,721		23,721		23,721	
Number of surgeons					933		933		933	
Log-likelihood	-99,645.6		-99,376.9		-82,152.6		-81,595.9		-81,537.4	
Chi-squared	94.3		653.7		2,818.4		4,087.2		4,206.4	

Notes:

Specification [1] estimates the owner to non-owner differential.

Specification [2] separates technology and market trends from the owner to non-owner differential.

Specification [3] separates the entrepreneurial/recruitment effect and technology and market trends from the owner to non-owner differential.

Specification [4] separates capacity changes, the entrepreneurial/recruitment effect, and technology and market trends from the owner to non-owner differential.

Specification [5] separates the efficiency effect, the entrepreneurial/recruitment effect, and technology and market trends from the owner to non-owner differential.

Data are based on Florida administrative ASC and hospital outpatient records for KSWC surgeries that occurred between 1997 and 2004 and Florida Division of Corporations annual corporate filings between 1997 and 2004. The sample includes orthopedic surgeons in Florida between 1997 and 2004. For a definition of the ownership measures, see Table TA.B1. See the Glossary for a definition of surgery volume. For a definition of the five explanatory factors, see Table 2.3. + signifies that the coefficient is significant at the 20 percent level; * signifies that the coefficient is significant at the 10 percent level; ** signifies that the coefficient is significant at the 5 percent level; and *** signifies that the coefficient is significant at the 1 percent level.

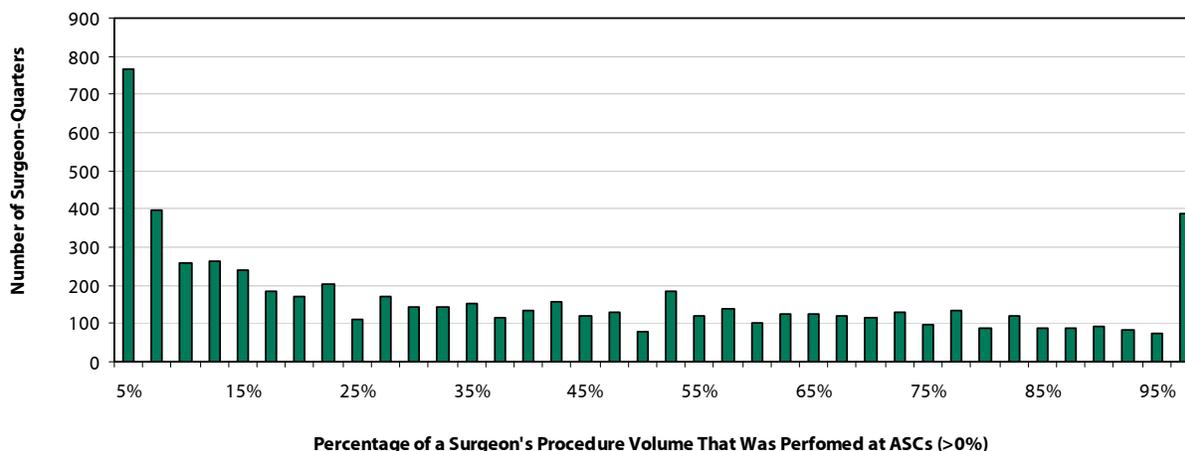
Key: ASC: ambulatory surgical center; KSWC surgery: a knee, shoulder, or wrist arthroscopy, or carpal tunnel surgery; n/a: not applicable.

Table TA.C4 Relationship between Percentage of a Surgeon's Total Procedure Volume Performed at an ASC and a Surgeon's KSWC Surgery Volume

Outcome Variable: Surgeon's Quarterly Surgery Volume	OLS Results								Negative Binomial Results							
	Entire Sample of Non-Owners				Exclude Hospital-only and ASC-only				Entire Sample of Non-Owners				Exclude Hospital-only and ASC-only			
	Polynomial Degree 1		Polynomial Degree 3		Polynomial Degree 1		Polynomial Degree 3		Polynomial Degree 1		Polynomial Degree 3		Polynomial Degree 1		Polynomial Degree 3	
	Coefficient (standard error)		Coefficient (standard error)		Coefficient (standard error)		Coefficient (standard error)		Coefficient (standard error)		Coefficient (standard error)		Coefficient (standard error)		Coefficient (standard error)	
% of surgeries a surgeon performed at ASCs	3.31 (1.27)	***	-2.48 (5.07)		3.43 (1.29)	***	-21.62 (9.29)	**	0.30 (0.03)	***	0.39 (0.15)	***	0.24 (0.04)	***	-0.96 (0.30)	***
% of surgeries a surgeon performed at ASCs, squared			25.40 (12.80)	**			56.57 (20.57)	***			0.86 (0.43)	**			2.45 (0.73)	***
% of surgeries a surgeon performed at ASCs, cubed			-22.09 (9.17)	**			-35.39 (13.68)	***			-1.19 (0.32)	***			-1.38 (0.50)	***
Year relative to 1997																
1998	1.64 (0.31)	***	1.65 (0.31)	***	1.24 (0.56)	**	1.20 (0.55)	**	0.10 (0.02)	***	0.10 (0.02)	***	0.08 (0.03)	***	0.08 (0.03)	***
1999	4.11 (0.44)	***	4.13 (0.44)	***	5.27 (0.84)	***	5.24 (0.83)	***	0.22 (0.02)	***	0.23 (0.02)	***	0.31 (0.03)	***	0.30 (0.03)	***
2000	4.65 (0.55)	***	4.67 (0.55)	***	5.65 (1.07)	***	5.59 (1.05)	***	0.23 (0.02)	***	0.23 (0.02)	***	0.30 (0.03)	***	0.29 (0.03)	***
2001	5.77 (0.62)	***	5.79 (0.62)	***	6.88 (1.16)	***	6.83 (1.14)	***	0.28 (0.02)	***	0.29 (0.02)	***	0.38 (0.03)	***	0.38 (0.03)	***
2002	6.79 (0.68)	***	6.77 (0.69)	***	7.41 (1.14)	***	7.41 (1.13)	***	0.33 (0.02)	***	0.33 (0.02)	***	0.41 (0.03)	***	0.41 (0.03)	***
2003	7.75 (0.78)	***	7.74 (0.78)	***	8.83 (1.26)	***	8.77 (1.24)	***	0.36 (0.02)	***	0.36 (0.02)	***	0.48 (0.03)	***	0.47 (0.03)	***
2004	9.62 (0.95)	***	9.60 (0.95)	***	9.83 (1.30)	***	9.72 (1.27)	***	0.43 (0.02)	***	0.43 (0.02)	***	0.52 (0.03)	***	0.52 (0.03)	***
Quarter relative to quarter 1																
Quarter 2	0.60 (0.15)	***	0.58 (0.16)	***	0.52 (0.24)	**	0.55 (0.24)	**	0.03 (0.01)	**	0.03 (0.01)	**	0.02 (0.02)	+	0.03 (0.02)	+
Quarter 3	-0.85 (0.19)	***	-0.86 (0.19)	***	-1.08 (0.30)	***	-1.07 (0.30)	***	-0.06 (0.01)	***	-0.06 (0.01)	***	-0.07 (0.02)	***	-0.07 (0.02)	***
Quarter 4	-0.54 (0.17)	***	-0.55 (0.17)	***	-0.87 (0.26)	***	-0.87 (0.26)	***	-0.05 (0.01)	***	-0.05 (0.01)	***	-0.07 (0.02)	***	-0.07 (0.02)	***
Constant	13.80 (0.42)	***	13.84 (0.43)	***	12.15 (0.73)	***	14.69 (1.00)	***	1.30 (0.02)	***	1.29 (0.02)	***	1.81 (0.04)	***	1.95 (0.05)	***
Number of surgeon-quarters	13,745		13,745		4,908		4,908		13,699		13,699		4,822		4,822	
Log-likelihood									-44,291		-44,249		-13,858		-13,847	
Chi-squared									949		1042.3		568.1		595.6	
R-squared	0.084		0.085		0.115		0.119									

Notes: Data are based on Florida administrative ASC and hospital outpatient records for KSWC surgeries that occurred between 1997 and 2004 and Florida Division of Corporations annual corporate filings between 1997 and 2004. The sample includes non-owner orthopedic surgeons in Florida between 1997 and 2004. The non-owner measures used were the frequent-user-75 (75 percent cutoff level rather than 50 percent) and board owner. The threshold owner measures were not used because there was not enough variation among non-threshold owners in the shares of procedures surgeons performed at ASCs—almost all shares were below 30 percent. For a definition of the owner measures, see Table TA.B1. See the Glossary for a definition of a surgeon's procedure and surgery volume. + signifies that the coefficient is significant at the 20 percent level, * signifies that the coefficient is significant at the 10 percent level, ** signifies that the coefficient is significant at the 5 percent level, and *** signifies that the coefficient is significant at the 1 percent level.

Key: ASC: ambulatory surgical center; KSWC surgery: a knee, shoulder, or wrist arthroscopy, or carpal tunnel surgery.

Figure TA.C3 Distribution of the Percentage of a Surgeon's Procedure Volume That Was Performed at ASCs

Notes: Data are based on Florida administrative ASC and hospital outpatient records for KSWC surgeries that occurred between 1997 and 2004 and Florida Division of Corporations annual corporate filings between 1997 and 2004. The sample includes non-owner orthopedic surgeons in Florida between 1997 and 2004. Surgeon quarters are the number of quarters that surgeons are observed. The non-owner measures used were frequent user-75 (75 percent cutoff level rather than 50 percent) and board owner. Threshold owner measures were not used because there was not enough variation among non-threshold owners in the shares of procedures surgeons performed at ASCs—almost all shares were below 30 percent. The figure excludes those who performed 100 percent of their procedures in a hospital outpatient department. The number of surgeon-quarters for which surgeons performed 100 percent in a hospital outpatient department was 7,714, which was approximately 55 percent of all surgeon-quarters. Although these surgeons were included in the analysis, they are not shown in the figure in order to show the variation in percentage of procedure volume performed in ASCs among other surgeons. For a definition of the ownership measures, see Table TA.B1. See the Glossary for a definition of a surgeon's procedure volume.

Key: ASC: ambulatory surgical center; KSWC surgery: a knee, shoulder, or wrist arthroscopy, or carpal tunnel surgery.

ESTIMATING THE SHIFT IN SURGERIES TO SURGEON-OWNED ASCS

We used a model similar to Model (4) above to estimate the impact of financial incentives attendant to ownership on the shift in surgeries to surgeon-owned ASCs. This model includes surgeon fixed effects, annual and seasonal trend variables, a surgeon's facility network size, and the ownership variable.

The model is different from Model (4) in that the dependent variable or response variable is different—instead of a surgeon's surgery volume, it is the percentage of a surgeon's surgeries (or procedures) that he or she performed in his or her affiliate or owned ASC. Because the dependent variable is different, the interpretation of the coefficients is different. In particular, all variables besides the ownership variable are labeled as control variables, since this section only reports the financial incentives effect on the shift in site of surgery. Please see the main text for more description.

Tables TA.C5 and TA.C6 present estimates for the shift in surgeries and procedures, respectively, to a surgeon owner's affiliated ASC. These estimates are obtained by using OLS estimation on Model (4), except with different dependent variables.

Table TA.C5 Impact of Ownership of ASC on Site of Service for KSWC Surgery (OLS regressions)

Outcome Variable: Share of a Surgeon's Quarterly KSWC Surgery Volume Performed in the Affiliate ASC	Ownership Measure					
	Board Owner		Frequent User Owner-50		Threshold Owner-30	
	Coefficient (standard error)		Coefficient (standard error)		Coefficient (standard error)	
Surgeon owner of an ASC in period <i>t</i>	0.54 (0.03)	***	0.28 (0.02)	***	0.39 (0.01)	***
Surgeon's facility network size	0.00 (0.00)		0.00 (0.00)		0.01 (0.00)	**
Year relative to 1997						
1998	0.01 (0.00)	***	0.01 (0.00)	**	-0.03 (0.01)	***
1999	0.01 (0.00)	***	0.02 (0.01)	***	-0.02 (0.01)	**
2000	0.01 (0.00)	***	0.03 (0.01)	***	0.00 (0.01)	
2001	0.01 (0.00)	***	0.04 (0.01)	***	0.02 (0.01)	*
2002	0.02 (0.00)	***	0.05 (0.01)	***	0.03 (0.01)	***
2003	0.03 (0.00)	***	0.06 (0.01)	***	0.04 (0.01)	***
2004	0.04 (0.01)	***	0.07 (0.01)	***	0.06 (0.01)	***
Year relative to quarter 1						
Quarter 2	0.00 (0.00)		0.00 (0.00)	***	-0.01 (0.00)	***
Quarter 3	0.00 (0.00)	+	0.01 (0.00)	***	-0.01 (0.00)	***
Quarter 4	0.00 (0.00)	***	0.01 (0.00)	***	-0.02 (0.00)	***
Constant	0.02 (0.01)	***	0.11 (0.01)	***	0.20 (0.01)	***
R-squared	0.879		0.831		0.818	
Number of surgeon-quarters	23,204		23,204		23,204	

Notes: Data are based on Florida administrative ASC and hospital outpatient records for KSWC surgeries that occurred between 1997 and 2004 and Florida Division of Corporations annual corporate filings between 1997 and 2004. The sample includes orthopedic surgeons in Florida between 1997 and 2004. For a definition of the ownership measures, see Table TA.B1. See the Glossary for a definition of a surgeon's surgery volume. + signifies that the coefficient is significant at the 20 percent level; * signifies that the coefficient is significant at the 10 percent level; ** signifies that the coefficient is significant at the 5 percent level; and *** signifies that the coefficient is significant at the 1 percent level.

Key: ASC: ambulatory surgical center; KSWC surgery: a knee, shoulder, or wrist arthroscopy, or carpal tunnel surgery; OLS: ordinary least squares.

Table TA.C6 Impact of Ownership of ASC on Site of Service for All Procedures (OLS regressions)

Outcome Variable: Share of a Surgeon's Quarterly Total Procedure Volume Performed in the Affiliate ASC	Ownership Measure					
	Board Owner		Frequent User Owner-50		Threshold Owner-30	
	Coefficient (standard error)		Coefficient (standard error)		Coefficient (standard error)	
Surgeon owner of an ASC in period <i>t</i>	0.49 (0.03)	***	0.28 (0.02)	***	0.37 (0.01)	***
Surgeon's facility network size	0.00 (0.00)	*	0.00 (0.00)		0.00 (0.00)	
Year relative to 1997						
1998	0.01 (0.00)	***	0.01 (0.00)	***	-0.02 (0.00)	***
1999	0.01 (0.00)	***	0.02 (0.01)	***	0.00 (0.01)	
2000	0.01 (0.00)	***	0.04 (0.01)	***	0.01 (0.01)	**
2001	0.02 (0.00)	***	0.04 (0.01)	***	0.03 (0.01)	***
2002	0.02 (0.00)	***	0.05 (0.01)	***	0.04 (0.01)	***
2003	0.03 (0.00)	***	0.06 (0.01)	***	0.06 (0.01)	***
2004	0.03 (0.01)	***	0.07 (0.01)	***	0.07 (0.01)	***
Year relative to quarter 1						
Quarter 2	0.00 (0.00)		0.00 (0.00)	***	-0.01 (0.00)	***
Quarter 3	0.00 (0.00)	*	0.00 (0.00)	***	-0.01 (0.00)	***
Quarter 4	0.00 (0.00)	***	0.01 (0.00)	***	-0.01 (0.00)	***
Constant	0.02 (0.00)	***	0.09 (0.01)	***	0.16 (0.01)	***
R-squared	0.879		0.828		0.83	
Number of surgeon-quarters	23,729		23,729		23,729	

Notes: Data are based on Florida administrative ASC and hospital outpatient records for KSWC surgeries that occurred between 1997 and 2004 and Florida Division of Corporations annual corporate filings between 1997 and 2004. The sample includes orthopedic surgeons in Florida between 1997 and 2004. For a definition of the ownership measures, see Table TA.B1. See the Glossary for a definition of a surgeon's surgery volume. + signifies that the coefficient is significant at the 20 percent level; * signifies that the coefficient is significant at the 10 percent level; ** signifies that the coefficient is significant at the 5 percent level; and *** signifies that the coefficient is significant at the 1 percent level.

Key: ASC: ambulatory surgical center; KSWC surgery: a knee, shoulder, or wrist arthroscopy, or carpal tunnel surgery; OLS: ordinary least squares.

ESTIMATING THE SHIFT IN PAYOR MIX

To estimate changes in the payor mix of a surgeon's practice in response to ownership, we used a model similar to Model (4). This model includes surgeon fixed effects, annual and seasonal trend variables, a surgeon's facility network size, and the ownership variable.

The model is different from Model (4) in that the dependent variable or response variable is the number of surgeries a surgeon performed that were reimbursed by a particular payor. In other words, Model (4) was estimated for each payor separately. The main difference in interpretation is that the control variables control for payor-specific issues. For example, when estimating the increase in surgeries covered by workers' compensation, the annual trend variables control for the trends in workers' compensation. The trends may be a result of the same technology improvements and market trends that affected a surgeon's total surgery volume. However, they may also be a result of workers' compensation trends, such as the growing or shrinking price of surgery paid by workers' compensation relative to other payors. Please see the main text for more description.

Tables TA.C7 to TA.C14 present payor-specific estimates, obtained by using negative binomial estimation on Model (4). Each table represents a different payor, in which the dependent variable is a surgeon's quarterly number of surgeries that are covered by a specific payor group, such as workers' compensation payors.

Table TA.C7 Impact of Ownership of an ASC on a Surgeon's Surgery Volume Covered by Workers' Compensation

Outcome Variable: Surgeon's Quarterly Surgery Volume Covered by Workers' Compensation	Ownership Measure					
	Board Owner		Frequent User Owner-50		Threshold Owner-30	
	Coefficient (standard error)		Coefficient (standard error)		Coefficient (standard error)	
Surgeon owner of an ASC in period <i>t</i>	0.18	***	0.16	***	0.21	***
	(0.03)		(0.02)		(0.02)	
Surgeon's facility network size	0.10	***	0.10	***	0.09	***
	(0.01)		(0.01)		(0.01)	
Year relative to 1997						
1998	0.02		0.02		0.00	
	(0.02)		(0.02)		(0.02)	
1999	0.18	***	0.19	***	0.16	***
	(0.02)		(0.02)		(0.02)	
2000	0.32	***	0.33	***	0.30	***
	(0.02)		(0.02)		(0.02)	
2001	0.36	***	0.37	***	0.33	***
	(0.02)		(0.02)		(0.02)	
2002	0.29	***	0.31	***	0.26	***
	(0.02)		(0.02)		(0.02)	
2003	0.31	***	0.33	***	0.28	***
	(0.02)		(0.02)		(0.02)	
2004	0.30	***	0.31	***	0.25	***
	(0.02)		(0.02)		(0.02)	
Quarter relative to quarter 1						
Quarter 2	0.05	***	0.05	***	0.04	**
	(0.01)		(0.01)		(0.01)	
Quarter 3	0.02	+	0.02	+	0.01	
	(0.02)		(0.02)		(0.02)	
Quarter 4	-0.06	***	-0.05	***	-0.07	***
	(0.02)		(0.02)		(0.02)	
Constant	0.71	***	0.69	***	0.69	***
	(0.04)		(0.04)		(0.04)	
Number of surgeon-quarters	23,287		23,287		23,287	
Log-likelihood	-41,731.1		-41,718.8		-41,674.8	
Chi-squared	907.4		931.3		1,016.0	

Notes: Data are based on Florida administrative ASC and hospital outpatient records for KSWC surgeries that occurred between 1997 and 2004 and Florida Division of Corporations annual corporate filings between 1997 and 2004. The sample includes orthopedic surgeons in Florida between 1997 and 2004. For a definition of the ownership measures, see Table TA.B1. See the Glossary for a definition of a surgeon's surgery volume. + signifies that the coefficient is significant at the 20 percent level; * signifies that the coefficient is significant at the 10 percent level; ** signifies that the coefficient is significant at the 5 percent level; and *** signifies that the coefficient is significant at the 1 percent level.

Key: ASC: ambulatory surgical center; KSWC surgery: a knee, shoulder, or wrist arthroscopy, or carpal tunnel surgery.

Table TA.C8 Impact of Ownership of an ASC on a Surgeon's Surgery Volume Covered by Commercial Indemnity

Outcome Variable: Surgeon's Quarterly Surgery Volume Covered by Commercial Indemnity	Ownership Measure					
	Board Owner		Frequent User Owner-50		Threshold Owner-30	
	Coefficient (standard error)		Coefficient (standard error)		Coefficient (standard error)	
Surgeon owner of an ASC in period <i>t</i>	0.41	***	0.18	***	0.38	***
	(0.03)		(0.02)		(0.02)	
Surgeon's facility network size	0.11	***	0.11	***	0.10	***
	(0.01)		(0.01)		(0.01)	
Year relative to 1997						
1998	0.02		0.02		-0.02	
	(0.03)		(0.03)		(0.03)	
1999	0.26	***	0.28	***	0.24	***
	(0.02)		(0.02)		(0.02)	
2000	0.23	***	0.25	***	0.19	***
	(0.02)		(0.02)		(0.02)	
2001	0.28	***	0.31	***	0.25	***
	(0.02)		(0.02)		(0.02)	
2002	0.39	***	0.43	***	0.36	***
	(0.02)		(0.02)		(0.02)	
2003	0.33	***	0.38	***	0.29	***
	(0.02)		(0.02)		(0.02)	
2004	0.35	***	0.39	***	0.29	***
	(0.02)		(0.02)		(0.02)	
Quarter relative to quarter 1						
Quarter 2	0.05	***	0.06	***	0.04	**
	(0.02)		(0.02)		(0.02)	
Quarter 3	0.00		0.00		-0.02	+
	(0.02)		(0.02)		(0.02)	
Quarter 4	0.02	+	0.03	*	0.00	
	(0.02)		(0.02)		(0.02)	
Constant	0.11	***	0.08	**	0.07	**
	(0.03)		(0.03)		(0.03)	
Number of surgeon-quarters	23,648		23,648		23,648	
Log-likelihood	-49,789.9		-49,851.6		-49,640.4	
Chi-squared	1,202.3		1,028.8		1,460.4	

Notes: Data are based on Florida administrative ASC and hospital outpatient records for KSWC surgeries that occurred between 1997 and 2004 and Florida Division of Corporations annual corporate filings between 1997 and 2004. The sample includes orthopedic surgeons in Florida between 1997 and 2004. For a definition of the ownership measures, see Table TA.B1. See the Glossary for a definition of a surgeon's surgery volume. + signifies that the coefficient is significant at the 20 percent level; * signifies that the coefficient is significant at the 10 percent level; ** signifies that the coefficient is significant at the 5 percent level; and *** signifies that the coefficient is significant at the 1 percent level.

Key: ASC: ambulatory surgical center; KSWC surgery: a knee, shoulder, or wrist arthroscopy, or carpal tunnel surgery.

Table TA.C9 Impact of Ownership of an ASC on a Surgeon's Surgery Volume Covered by Commercial HMO

Outcome Variable: Surgeon's Quarterly Surgery Volume Covered by Commercial HMO	Ownership Measure					
	Board Owner		Frequent User Owner-50		Threshold Owner-30	
	Coefficient (standard error)		Coefficient (standard error)		Coefficient (standard error)	
Surgeon owner of an ASC in period <i>t</i>	-0.12 (0.03)	***	0.03 (0.02)	+	0.03 (0.02)	*
Surgeon's facility network size	0.11 (0.01)	***	0.11 (0.01)	***	0.11 (0.01)	***
Year relative to 1997						
1998	0.20 (0.03)	***	0.20 (0.03)	***	0.20 (0.03)	***
1999	0.44 (0.03)	***	0.44 (0.03)	***	0.43 (0.03)	***
2000	0.60 (0.03)	***	0.59 (0.03)	***	0.59 (0.03)	***
2001	0.70 (0.03)	***	0.69 (0.03)	***	0.68 (0.03)	***
2002	0.69 (0.03)	***	0.68 (0.03)	***	0.67 (0.03)	***
2003	0.72 (0.03)	***	0.70 (0.03)	***	0.70 (0.03)	***
2004	0.83 (0.03)	***	0.81 (0.03)	***	0.80 (0.03)	***
Quarter relative to quarter 1						
Quarter 2	0.10 (0.02)	***	0.10 (0.02)	***	0.10 (0.02)	***
Quarter 3	0.05 (0.02)	***	0.05 (0.02)	***	0.05 (0.02)	***
Quarter 4	0.07 (0.02)	***	0.07 (0.02)	***	0.06 (0.02)	***
Constant	-0.06 (0.03)	*	-0.06 (0.03)	*	-0.06 (0.03)	*
Number of surgeon-quarters	22,787		22,787		22,787	
Log-likelihood	-46,495.1		-46,500.9		-46,500.2	
Chi-squared	1,865.8		1,854.7		1,855.5	

Notes: Data are based on Florida administrative ASC and hospital outpatient records for KSWC surgeries that occurred between 1997 and 2004 and Florida Division of Corporations annual corporate filings between 1997 and 2004. The sample includes orthopedic surgeons in Florida between 1997 and 2004. For a definition of the ownership measures, see Table TA.B1. See the Glossary for a definition of a surgeon's surgery volume. + signifies that the coefficient is significant at the 20 percent level; * signifies that the coefficient is significant at the 10 percent level; ** signifies that the coefficient is significant at the 5 percent level; and *** signifies that the coefficient is significant at the 1 percent level.

Key: ASC: ambulatory surgical center; HMO: health maintenance organization; KSWC surgery: a knee, shoulder, or wrist arthroscopy, or carpal tunnel surgery.

Table TA.C10 Impact of Ownership of an ASC on a Surgeon's Surgery Volume Covered by Commercial PPO

Outcome Variable: Surgeon's Quarterly Surgery Volume Covered by Commercial PPO	Ownership Measure					
	Board Owner		Frequent User Owner-50		Threshold Owner-30	
	Coefficient (standard error)		Coefficient (standard error)		Coefficient (standard error)	
Surgeon owner of an ASC in period <i>t</i>	-0.28	***	0.13	***	-0.06	***
	(0.03)		(0.02)		(0.02)	
Surgeon's facility network size	0.10	***	0.10	***	0.10	***
	(0.01)		(0.01)		(0.01)	
Year relative to 1997						
1998	0.09	***	0.08	***	0.09	***
	(0.03)		(0.03)		(0.03)	
1999	0.26	***	0.25	***	0.25	***
	(0.03)		(0.03)		(0.03)	
2000	0.40	***	0.39	***	0.40	***
	(0.02)		(0.02)		(0.02)	
2001	0.50	***	0.48	***	0.49	***
	(0.02)		(0.02)		(0.02)	
2002	0.53	***	0.51	***	0.52	***
	(0.02)		(0.02)		(0.02)	
2003	0.68	***	0.65	***	0.66	***
	(0.02)		(0.02)		(0.02)	
2004	0.70	***	0.67	***	0.69	***
	(0.02)		(0.02)		(0.02)	
Quarter relative to quarter 1						
Quarter 2	0.07	***	0.07	***	0.07	***
	(0.02)		(0.02)		(0.02)	
Quarter 3	0.04	**	0.03	**	0.04	**
	(0.02)		(0.02)		(0.02)	
Quarter 4	0.09	***	0.09	***	0.09	***
	(0.02)		(0.02)		(0.02)	
Constant	0.13	***	0.13	***	0.14	***
	(0.03)		(0.03)		(0.03)	
Number of surgeon-quarters	23,331		23,331		23,331	
Log-likelihood	-47,189.0		-47,208.5		-47,217.5	
Chi-squared	1,696.8		1,656.9		1,634.9	

Notes: Data are based on Florida administrative ASC and hospital outpatient records for KSWC surgeries that occurred between 1997 and 2004 and Florida Division of Corporations annual corporate filings between 1997 and 2004. The sample includes orthopedic surgeons in Florida between 1997 and 2004. For a definition of the ownership measures, see Table TA.B1. See the Glossary for a definition of a surgeon's surgery volume. + signifies that the coefficient is significant at the 20 percent level; * signifies that the coefficient is significant at the 10 percent level; ** signifies that the coefficient is significant at the 5 percent level; and *** signifies that the coefficient is significant at the 1 percent level.

Key: ASC: ambulatory surgical center; KSWC surgery: a knee, shoulder, or wrist arthroscopy, or carpal tunnel surgery; PPO: preferred provider organization.

Table TA.C11 Impact of Ownership of an ASC on a Surgeon's Surgery Volume Covered by Medicare

Outcome Variable: Surgeon's Quarterly Surgery Volume Covered by Medicare	Ownership Measure					
	Board Owner		Frequent User Owner-50		Threshold Owner-30	
	Coefficient (standard error)		Coefficient (standard error)		Coefficient (standard error)	
Surgeon owner of an ASC in period <i>t</i>	0.21	***	0.24	***	0.23	***
	(0.02)		(0.02)		(0.01)	
Surgeon's facility network size	0.09	***	0.09	***	0.08	***
	(0.00)		(0.00)		(0.01)	
Year relative to 1997						
1998	0.02		0.02		-0.01	
	(0.02)		(0.02)		(0.02)	
1999	0.18	***	0.19	***	0.15	***
	(0.02)		(0.02)		(0.02)	
2000	0.27	***	0.28	***	0.23	***
	(0.02)		(0.02)		(0.02)	
2001	0.37	***	0.38	***	0.34	***
	(0.02)		(0.02)		(0.02)	
2002	0.46	***	0.48	***	0.42	***
	(0.02)		(0.02)		(0.02)	
2003	0.54	***	0.57	***	0.51	***
	(0.02)		(0.02)		(0.02)	
2004	0.64	***	0.66	***	0.59	***
	(0.02)		(0.02)		(0.02)	
Quarter relative to quarter 1						
Quarter 2	-0.10	***	-0.10	***	-0.11	***
	(0.01)		(0.01)		(0.01)	
Quarter 3	-0.26	***	-0.26	***	-0.27	***
	(0.01)		(0.01)		(0.01)	
Quarter 4	-0.19	***	-0.19	***	-0.20	***
	(0.01)		(0.01)		(0.01)	
Constant	1.22	***	1.20	***	1.21	***
	(0.03)		(0.03)		(0.03)	
Number of surgeon-quarters	23,603		23,603		23,603	
Log-likelihood	-48,820.6		-48,765.2		-48,724.9	
Chi-squared	3,214.9		3,333.1		3,412.4	

Notes: Data are based on Florida administrative ASC and hospital outpatient records for KSWC surgeries that occurred between 1997 and 2004 and Florida Division of Corporations annual corporate filings between 1997 and 2004. The sample includes orthopedic surgeons in Florida between 1997 and 2004. For a definition of the ownership measures, see Table TA.B1. See the Glossary for a definition of a surgeon's surgery volume. + signifies that the coefficient is significant at the 20 percent level; * signifies that the coefficient is significant at the 10 percent level; ** signifies that the coefficient is significant at the 5 percent level; and *** signifies that the coefficient is significant at the 1 percent level.

Key: ASC: ambulatory surgical center; KSWC surgery: a knee, shoulder, or wrist arthroscopy, or carpal tunnel surgery.

Table TA.C12 Impact of Ownership of an ASC on a Surgeon's Surgery Volume Covered by Medicare HMO

Outcome Variable: Surgeon's Quarterly Surgery Volume Covered by Medicare HMO	Ownership Measure					
	Board Owner		Frequent User Owner-50		Threshold Owner-30	
	Coefficient (standard error)		Coefficient (standard error)		Coefficient (standard error)	
Surgeon owner of an ASC in period <i>t</i>	-0.56 (0.08)	***	0.07 (0.05)	+	-0.33 (0.04)	***
Surgeon's facility network size	0.09 (0.01)	***	0.08 (0.01)	***	0.10 (0.01)	***
Year relative to 1997						
1998	0.55 (0.05)	***	0.55 (0.05)	***	0.57 (0.05)	***
1999	0.72 (0.05)	***	0.70 (0.05)	***	0.73 (0.05)	***
2000	0.51 (0.05)	***	0.48 (0.05)	***	0.53 (0.05)	***
2001	0.43 (0.05)	***	0.39 (0.05)	***	0.45 (0.05)	***
2002	0.11 (0.06)	*	0.06 (0.06)		0.14 (0.06)	**
2003	0.09 (0.06)	+	0.03 (0.06)		0.12 (0.06)	**
2004	0.11 (0.06)	*	0.05 (0.06)		0.16 (0.06)	***
Quarter relative to quarter 1						
Quarter 2	0.06 (0.03)	+	0.05 (0.03)	+	0.07 (0.03)	*
Quarter 3	-0.02 (0.04)		-0.02 (0.04)		-0.01 (0.04)	
Quarter 4	-0.01 (0.04)		-0.01 (0.04)		0.01 (0.04)	
Constant	-0.63 (0.07)	***	-0.61 (0.07)	***	-0.61 (0.07)	***
Number of surgeon-quarters	17,525		17,525		17,525	
Log-likelihood	-14,730.8		-14,754.5		-14,722.5	
Chi-squared	553		512.6		575.9	

Notes: Data are based on Florida administrative ASC and hospital outpatient records for KSWC surgeries that occurred between 1997 and 2004 and Florida Division of Corporations annual corporate filings between 1997 and 2004. The sample includes orthopedic surgeons in Florida between 1997 and 2004. For a definition of the ownership measures, see Table TA.B1. See the Glossary for a definition of a surgeon's surgery volume. + signifies that the coefficient is significant at the 20 percent level; * signifies that the coefficient is significant at the 10 percent level; ** signifies that the coefficient is significant at the 5 percent level; and *** signifies that the coefficient is significant at the 1 percent level.

Key: ASC: ambulatory surgical center; HMO: health maintenance organization; KSWC surgery: a knee, shoulder, or wrist arthroscopy, or carpal tunnel surgery.

Table TA.C13 Impact of Ownership of an ASC on a Surgeon's Surgery Volume Covered by Medicaid

Outcome Variable: Surgeon's Quarterly Surgery Volume Covered by Medicaid	Ownership Measure					
	Board Owner		Frequent User Owner-50		Threshold Owner-30	
	Coefficient (standard error)		Coefficient (standard error)		Coefficient (standard error)	
Surgeon owner of an ASC in period <i>t</i>	-0.28	***	-0.05		-0.02	
	(0.08)		(0.06)		(0.04)	
Surgeon's facility network size	0.12	***	0.12	***	0.12	***
	(0.02)		(0.02)		(0.02)	
Year relative to 1997						
1998	-0.02		-0.03		-0.02	
	(0.06)		(0.06)		(0.06)	
1999	0.06		0.05		0.05	
	(0.06)		(0.06)		(0.06)	
2000	0.13	**	0.11	*	0.12	**
	(0.06)		(0.06)		(0.06)	
2001	0.09	+	0.07		0.07	
	(0.06)		(0.06)		(0.06)	
2002	0.25	***	0.23	***	0.23	***
	(0.06)		(0.06)		(0.06)	
2003	0.24	***	0.21	***	0.22	***
	(0.06)		(0.06)		(0.06)	
2004	0.20	***	0.18	***	0.19	***
	(0.06)		(0.06)		(0.06)	
Quarter relative to quarter 1						
Quarter 2	-0.02		-0.02		-0.02	
	(0.04)		(0.04)		(0.04)	
Quarter 3	0.01		0.01		0.01	
	(0.04)		(0.04)		(0.04)	
Quarter 4	-0.06	+	-0.06	+	-0.06	+
	(0.04)		(0.04)		(0.04)	
Constant	0.21	**	0.20	**	0.20	**
	(0.09)		(0.09)		(0.09)	
Number of surgeon-quarters	18,240		18,240		18,240	
Log-likelihood	-10,767.1		-10,772.6		-10,772.8	
Chi-squared	103.8		92.5		92.1	

Notes: Data are based on Florida administrative ASC and hospital outpatient records for KSWC surgeries that occurred between 1997 and 2004 and Florida Division of Corporations annual corporate filings between 1997 and 2004. The sample includes orthopedic surgeons in Florida between 1997 and 2004. For a definition of the ownership measures, see Table TA.B1. See the Glossary for a definition of a surgeon's surgery volume. + signifies that the coefficient is significant at the 20 percent level; * signifies that the coefficient is significant at the 10 percent level; ** signifies that the coefficient is significant at the 5 percent level; and *** signifies that the coefficient is significant at the 1 percent level.

Key: ASC: ambulatory surgical center; KSWC surgery: a knee, shoulder, or wrist arthroscopy, or carpal tunnel surgery.

Table TA.C14 Impact of Ownership of an ASC on a Surgeon's Surgery Volume Covered by Medicaid HMO

Outcome Variable: Surgeon's Quarterly Surgery Volume Covered by Medicaid HMO	Ownership Measure					
	Board Owner		Frequent User Owner-50		Threshold Owner-30	
	Coefficient (standard error)		Coefficient (standard error)		Coefficient (standard error)	
Surgeon owner of an ASC in period <i>t</i>	-0.01		-0.03		-0.01	
	(0.16)		(0.10)		(0.07)	
Surgeon's facility network size	0.07	***	0.07	***	0.07	***
	(0.02)		(0.02)		(0.02)	
Year relative to 1997						
1998	0.02		0.02		0.02	
	(0.12)		(0.12)		(0.12)	
1999	0.53	***	0.53	***	0.53	***
	(0.11)		(0.11)		(0.11)	
2000	0.89	***	0.89	***	0.89	***
	(0.10)		(0.10)		(0.10)	
2001	1.00	***	1.00	***	1.00	***
	(0.10)		(0.10)		(0.10)	
2002	1.08	***	1.08	***	1.08	***
	(0.10)		(0.10)		(0.10)	
2003	0.84	***	0.84	***	0.85	***
	(0.10)		(0.10)		(0.10)	
2004	0.68	***	0.68	***	0.68	***
	(0.11)		(0.11)		(0.11)	
Quarter relative to quarter 1						
Quarter 2	0.11	*	0.11	*	0.11	*
	(0.06)		(0.06)		(0.06)	
Quarter 3	0.00		0.00		0.00	
	(0.06)		(0.06)		(0.06)	
Quarter 4	-0.05		-0.05		-0.05	
	(0.06)		(0.06)		(0.06)	
Constant	-1.21	***	-1.21	***	-1.21	***
	(0.13)		(0.13)		(0.13)	
Number of surgeon-quarters	13,071		13,071		13,071	
Log-likelihood	-5,881.5		-5,881.5		-5,881.5	
Chi-squared	243		243.1		243	

Notes: Data are based on Florida administrative ASC and hospital outpatient records for KSWC surgeries that occurred between 1997 and 2004 and Florida Division of Corporations annual corporate filings between 1997 and 2004. The sample includes orthopedic surgeons in Florida between 1997 and 2004. For a definition of the ownership measures, see Table TA.B1. See the Glossary for a definition of a surgeon's surgery volume. + signifies that the coefficient is significant at the 20 percent level; * signifies that the coefficient is significant at the 10 percent level; ** signifies that the coefficient is significant at the 5 percent level; and *** signifies that the coefficient is significant at the 1 percent level.

Key: ASC: ambulatory surgical center; HMO: health maintenance organization; KSWC surgery: a knee, shoulder, or wrist arthroscopy, or carpal tunnel surgery.

OUR MODELS VERSUS A DIFFERENCE-IN-DIFFERENCES APPROACH

Some readers may ask why we did not use a difference-in-differences model instead. Models (3) through (5b), which include surgeon fixed effects and time trend controls, are similar to a difference-in-differences (D-in-D) approach. Like a D-in-D approach, there are two groups from which we estimate “differences,” and the ownership effect can be thought of as the difference between the two groups’ differences. However, the surgeon fixed effects with trend controls approach improves upon the D-in-D approach in two ways: first, it controls for more heterogeneity among surgeons by allowing each surgeon to represent his or her own group, and second, it allows differential timing in ownership among surgeons.

Since surgeons become owners at different points in time and since non-owners do not have a point in time that creates a “before and after” scenario, a D-in-D approach probably should not be used to study ownership. A model with surgeon fixed effects and time trend controls, however, accounts for differential timing in ownership, and compares owners’ surgery volumes during their ownership periods to their volumes when they were not owners, differencing out underlying (annual) trends in the use of surgery among non-owners. Further, among owners, some may be higher volume than others, and some may have more administrative duties than others. In a D-in-D approach, all owners would be in one group, and, therefore, this approach would not account for differences within the owner group, similarly within the non-owner group.

Below illustrates the differences and similarities between a D-in-D approach and a model with surgeon fixed effects and time controls using equations. Simply comparing owners (surgeons with financial interests) to non-owners (without financial interests), we would calculate:

$$\bar{y}_{i,t}^{FI} - \bar{y}_{i,t}^{no-FI}$$

where $\bar{y}_{i,t}^{FI}$ is the average surgery volume (y) of surgeon owners (i) in time periods (t), and $\bar{y}_{i,t}^{no-FI}$ is the average for non-owners. The regression analog is:

$$y_{i,t} = C + \beta FI_{i,t} + \epsilon_{i,t}$$

A D-in-D approach can be written as:

$$\left(\bar{y}_{i,t>T}^{FI} - \bar{y}_{i,t \leq T}^{FI} \right) - \left(\bar{y}_{i,t>T}^{no-FI} - \bar{y}_{i,t \leq T}^{no-FI} \right)$$

where T is the point in time in which all individuals in the treatment group (owners) get treated (become owners). The regression analog is:

$$\begin{aligned} y_{i,t} &= C + \eta FIgroup_i + 1[t > T] + \beta FIgroup_i \times 1[t > T] + \epsilon_{i,t} \\ &= C + \eta FIgroup_i + 1[t > T] + \beta FIgroup_i \times FI_{i,t>T} + \epsilon_{i,t} \end{aligned}$$

where $FIgroup_i$ represents the group of surgeons who were owners at some point in the time frame of the data, and $t > T$ symbolizes all time periods after the period in which surgeons in the $FIgroup_i$ became owners.

A near-fixed-effects model with time controls (as used in the report) that keeps the idea of two groups as in the D-in-D model is:

$$y_{i,t} = C + \eta FIgroup_i + \delta_i + \beta FIgroup_i \times FI_{i,t} + \epsilon_{i,t}$$

where $FI_{i,t}$ is an indicator that equals 1 for the time periods t in which surgeon i is an owner. The variable allows differential timing in ownership. This model, through $FIgroup_i$, bundles the heterogeneity among surgeons into

two groups: owners and non-owners.

The model used in the report, which includes surgeon fixed effects and time trend controls, is:

$$y_{i,t} = C + \alpha_i + \delta_t + \beta FIgroup_i \times FI_{i,t} + \varepsilon_{i,t}$$

where α_i controls for more of the heterogeneity among surgeons by allowing each surgeon to be his or her own “group.”

TECHNICAL APPENDIX D: SUPPLEMENTAL AND SENSITIVITY ANALYSES

Tables TA.D1 to TA.D3 show negative binomial estimation results for Models (1) through (4) and (5b) using ownership measures: frequent user owner-75, threshold owner-50, and threshold owner-30Q, respectively. OLS results are available upon request.

Table TA.D1 Relationship between a Surgeon's Surgery Volume and Five Explanatory Factors, Using Frequent User Owner-75 Measure (negative binomial regressions)

Outcome Variable:	[1]		[2]		[3]		[4]		[5]	
Surgeon's Quarterly Surgery Volume	Coefficient (standard error)									
Surgeon owner of an ASC in period <i>t</i>	0.69	*** (0.05)	0.68	*** (0.05)	0.35	*** (0.01)	0.31	*** (0.01)	0.25	*** (0.01)
Predicted surgery volume from working with ASCs (natural log form)									1.00	n/a
Surgeon's facility network size							0.11	*** (0.00)	0.10	*** (0.00)
Year relative to 1997										
1998			0.08	*** (0.02)	0.08	*** (0.01)	0.07	*** (0.01)	0.07	*** (0.01)
1999			0.19	*** (0.02)	0.18	*** (0.01)	0.17	*** (0.01)	0.17	*** (0.01)
2000			0.25	*** (0.02)	0.23	*** (0.01)	0.23	*** (0.01)	0.23	*** (0.01)
2001			0.32	*** (0.03)	0.29	*** (0.01)	0.30	*** (0.01)	0.29	*** (0.01)
2002			0.35	*** (0.03)	0.32	*** (0.01)	0.34	*** (0.01)	0.32	*** (0.01)
2003			0.40	*** (0.03)	0.36	*** (0.01)	0.39	*** (0.01)	0.37	*** (0.01)
2004			0.43	*** (0.03)	0.39	*** (0.01)	0.43	*** (0.01)	0.41	*** (0.01)
Quarter relative to quarter 1										
Quarter 2			0.03	*** (0.01)	0.03	*** (0.01)	0.03	*** (0.01)	0.02	*** (0.01)
Quarter 3			-0.05	*** (0.01)	-0.06	*** (0.01)	-0.05	*** (0.01)	-0.05	*** (0.01)
Quarter 4			-0.02	*** (0.01)	-0.03	*** (0.01)	-0.03	*** (0.01)	-0.03	*** (0.01)
Constant	3.03	*** (0.02)	2.77	*** (0.03)	1.48	*** (0.02)	1.21	*** (0.02)	0.93	*** (0.02)
Number of surgeon-quarters	23,729		23,729		23,721		23,721		23,721	
Number of surgeons					933		933		933	
Log-likelihood	-98,596.5		-98,196.6		-81,956.3		-81,389.6		-81,312.8	
Chi-squared	228.9		721.8		3,358.8		4,662.9		4,807.6	

Notes:

Specification [1] estimates the owner to non-owner differential.

Specification [2] separates technology and market trends from the owner to non-owner differential.

Specification [3] separates the entrepreneurial/recruitment effect and technology and market trends from the owner to non-owner differential.

Specification [4] separates capacity changes, the entrepreneurial/recruitment effect, and technology and market trends from the owner to non-owner differential.

Specification [5] separates the efficiency effect, the entrepreneurial/recruitment effect, and technology and market trends from the owner to non-owner differential.

Data are based on Florida administrative ASC and hospital outpatient records for KSWC surgeries that occurred between 1997 and 2004 and Florida Division of Corporations annual corporate filings between 1997 and 2004. The sample includes orthopedic surgeons in Florida between 1997 and 2004. For a definition of the ownership measures, see Table TA.B1. See the Glossary for a definition of surgery volume. For a definition of the five explanatory factors, see Table 2.3. + signifies that the coefficient is significant at the 20 percent level; * signifies that the coefficient is significant at the 10 percent level; ** signifies that the coefficient is significant at the 5 percent level; and *** signifies that the coefficient is significant at the 1 percent level.

Key: ASC: ambulatory surgical center; KSWC surgery: a knee, shoulder, or wrist arthroscopy, or carpal tunnel surgery; n/a: not applicable.

Table TA.D2 Relationship between a Surgeon's Surgery Volume and Five Explanatory Factors, Using Threshold Owner-50 Measure (negative binomial regressions)

Outcome Variable:	[1]		[2]		[3]		[4]		[5]	
Surgeon's Quarterly Surgery Volume	Coefficient (standard error)									
Surgeon owner of an ASC in period <i>t</i>	0.39	*** (0.04)	0.35	*** (0.04)	0.23	*** (0.01)	0.20	*** (0.01)	0.15	*** (0.01)
Predicted surgery volume from working with ASCs (natural log form)									1.00	
Surgeon's facility network size							0.12	*** (0.00)	0.10	*** (0.00)
Year relative to 1997										
1998			0.06	*** (0.02)	0.07	*** (0.01)	0.06	*** (0.01)	0.06	*** (0.01)
1999			0.17	*** (0.02)	0.17	*** (0.01)	0.16	*** (0.01)	0.16	*** (0.01)
2000			0.22	*** (0.02)	0.21	*** (0.01)	0.21	*** (0.01)	0.22	*** (0.01)
2001			0.28	*** (0.03)	0.27	*** (0.01)	0.28	*** (0.01)	0.28	*** (0.01)
2002			0.31	*** (0.03)	0.29	*** (0.01)	0.31	*** (0.01)	0.30	*** (0.01)
2003			0.35	*** (0.03)	0.33	*** (0.01)	0.36	*** (0.01)	0.35	*** (0.01)
2004			0.38	*** (0.03)	0.36	*** (0.01)	0.40	*** (0.01)	0.39	*** (0.01)
Quarter relative to quarter 1										
Quarter 2			0.02	*** (0.01)	0.02	*** (0.01)	0.02	*** (0.01)	0.02	*** (0.01)
Quarter 3			-0.05	*** (0.01)	-0.06	*** (0.01)	-0.05	*** (0.01)	-0.06	*** (0.01)
Quarter 4			-0.04	*** (0.01)	-0.04	*** (0.01)	-0.03	*** (0.01)	-0.03	*** (0.01)
Constant	3.11	*** (0.03)	2.91	*** (0.03)	1.49	*** (0.02)	1.19	*** (0.02)	0.93	*** (0.02)
Number of surgeon-quarters	23,729		23,729		23,721		23,721		23,721	
Number of surgeons					933		933		933	
Log-likelihood	-99,806.4		-99,526.5		-82,321.9		-81,676.5		-81,558.3	
Chi-squared	78.0		629.4		2,482.6		3,937.5		4,176.5	

Notes:

Specification [1] estimates the owner to non-owner differential.

Specification [2] separates technology and market trends from the owner to non-owner differential.

Specification [3] separates the entrepreneurial/recruitment effect and technology and market trends from the owner to non-owner differential.

Specification [4] separates capacity changes, the entrepreneurial/recruitment effect, and technology and market trends from the owner to non-owner differential.

Specification [5] separates the efficiency effect, the entrepreneurial/recruitment effect, and technology and market trends from the owner to non-owner differential.

Data are based on Florida administrative ASC and hospital outpatient records for KSWC surgeries that occurred between 1997 and 2004 and Florida Division of Corporations annual corporate filings between 1997 and 2004. The sample includes orthopedic surgeons in Florida between 1997 and 2004. For a definition of the ownership measures, see Table TA.B1. See the Glossary for a definition of surgery volume. For a definition of the five explanatory factors, see Table 2.3. + signifies that the coefficient is significant at the 20 percent level; * signifies that the coefficient is significant at the 10 percent level; ** signifies that the coefficient is significant at the 5 percent level; and *** signifies that the coefficient is significant at the 1 percent level.

Key: ASC: ambulatory surgical center; KSWC surgery: a knee, shoulder, or wrist arthroscopy, or carpal tunnel surgery; n/a: not applicable.

Table TA.D3 Relationship between a Surgeon's Surgery Volume and Five Explanatory Factors, Using Threshold Owner-30-Q Measure (negative binomial regressions)

Outcome Variable:	[1]		[2]		[3]		[4]		[5]	
Surgeon's Quarterly Surgery Volume	Coefficient (standard error)									
Surgeon owner of an ASC in period <i>t</i>	0.41	***	0.38	***	0.28	***	0.23	***	0.10	***
	(0.04)		(0.04)		(0.01)		(0.01)		(0.01)	
Predicted surgery volume from working with ASCs (natural log form)									1.00	
									n/a	
Surgeon's facility network size							0.11	***	0.10	***
							(0.00)		(0.00)	
Year relative to 1997										
1998			0.08	***	0.08	***	0.07	***	0.07	***
			(0.02)		(0.01)		(0.01)		(0.01)	
1999			0.18	***	0.17	***	0.16	***	0.17	***
			(0.02)		(0.01)		(0.01)		(0.01)	
2000			0.23	***	0.22	***	0.22	***	0.23	***
			(0.02)		(0.01)		(0.01)		(0.01)	
2001			0.29	***	0.28	***	0.29	***	0.29	***
			(0.02)		(0.01)		(0.01)		(0.01)	
2002			0.32	***	0.30	***	0.32	***	0.32	***
			(0.03)		(0.01)		(0.01)		(0.01)	
2003			0.36	***	0.34	***	0.37	***	0.37	***
			(0.03)		(0.01)		(0.01)		(0.01)	
2004			0.38	***	0.36	***	0.41	***	0.41	***
			(0.03)		(0.01)		(0.01)		(0.01)	
Quarter relative to quarter 1										
Quarter 2			0.03	***	0.03	***	0.03	***	0.02	***
			(0.01)		(0.01)		(0.01)		(0.01)	
Quarter 3			-0.04	***	-0.06	***	-0.05	***	-0.05	***
			(0.01)		(0.01)		(0.01)		(0.01)	
Quarter 4			-0.02	***	-0.03	***	-0.03	***	-0.03	***
			(0.01)		(0.01)		(0.01)		(0.01)	
Constant	3.04	***	2.82	***	1.44	***	1.16	***	0.91	***
	(0.03)		(0.03)		(0.02)		(0.02)		(0.02)	
Number of surgeon-quarters	23,729		23,729		23,721		23,721		23,721	
Number of surgeons					933		933		933	
Log-likelihood	-99,662.9		-99,376.5		-82,190.4		-81,616.0		-81,606.8	
Chi-squared	87.7		634.3		2,731.4		4,040.2		4,050.0	

Notes:

Specification [1] estimates the owner to non-owner differential.

Specification [2] separates technology and market trends from the owner to non-owner differential.

Specification [3] separates the entrepreneurial/recruitment effect and technology and market trends from the owner to non-owner differential.

Specification [4] separates capacity changes, the entrepreneurial/recruitment effect, and technology and market trends from the owner to non-owner differential.

Specification [5] separates the efficiency effect, the entrepreneurial/recruitment effect, and technology and market trends from the owner to non-owner differential.

Data are based on Florida administrative ASC and hospital outpatient records for KSWC surgeries that occurred between 1997 and 2004 and Florida Division of Corporations annual corporate filings between 1997 and 2004. The sample includes orthopedic surgeons in Florida between 1997 and 2004. For a definition of the ownership measures, see Table TA.B1. See the Glossary for a definition of surgery volume. For a definition of the five explanatory factors, see Table 2.3. + signifies that the coefficient is significant at the 20 percent level; * signifies that the coefficient is significant at the 10 percent level; ** signifies that the coefficient is significant at the 5 percent level; and *** signifies that the coefficient is significant at the 1 percent level.

Key: ASC: ambulatory surgical center; KSWC surgery: a knee, shoulder, or wrist arthroscopy, or carpal tunnel surgery; n/a: not applicable.

GLOSSARY

Financial interests are characterized by a relationship in which the monetary interests of separate entities (the ASC and surgeon) are aligned. Typically these interests are based on contracts that align incentives through financial means, e.g., the surgeon is given equity in an ASC, office space, or payment for providing consulting advice to the ASC. Ownership in this report may therefore be a more inclusive definition of having an ownership stake in an ASC.

KSWC surgery—A knee, shoulder, or wrist arthroscopy, or a carpal tunnel surgery.

Owner/non-owner differential or *disparity* describes the average surgery volume of surgeon owners during their ownership periods less the following: the average surgery volume of surgeons who were never owners throughout the time frame of the data, of surgeon owners before ownership, and of surgeon owners after ownership ends (if applicable).

Ownership vs. financial incentives that arise from ownership—When a surgeon becomes an owner, many factors may be influencing his or her surgery volume, besides additional financial incentives. Wherever possible, to prevent confusion, we reserve *ownership* to describe all that happens in the time period when a surgeon is an owner of an ASC and *financial incentives that arise from ownership* to describe the incentive structure that a surgeon faces when he or she is an owner, or the financial aspect of being an owner of an ASC (as proxied by our ownership measures). Similar to previous studies, we compare probable surgeon owners with probable non-owners. In these previous studies, this is called the *ownership effect*, although it also includes the entrepreneurial/recruitment effect and efficiency gains that owners may experience when becoming an owner. In this study, we isolate the effect of the financial aspect of ownership, which provides clearer policy applications.

Ownership describes the period in which a surgeon is considered to have financial interests in an ASC.

Physician ownership vs. surgeon ownership—We use the phrase *physician ownership* when discussing the generality of ownership among any type of physician, and *surgeon ownership* when discussing the findings of this report.

Procedure volume of an ASC—The number of outpatient procedures that were performed in the ASC in a given quarter or time period, if specified.

Procedure volume of a surgeon—The number of outpatient procedures the surgeon referred or performed in an ASC or HOPD in a given quarter or time period, if specified.

Surgeons is used to describe the physicians in our sample. They include those who referred or performed a certain minimum number of musculoskeletal and orthopedic services per quarter. For more information, see Technical Appendix A. Our measure of surgeons may include some non-surgeons who referred a patient to an orthopedic surgeon.

Surgeon owner describes a surgeon who was considered an owner at any point in our data. A surgeon who became an owner in 2000 and had ownership in an ASC between 2000 and 2002 is referred to as a surgeon owner, although ownership may only have lasted for two years.

Surgeries performed is used to describe the KSWC surgeries that our orthopedic surgeons referred or performed. In the Florida administrative data, there are two ways a physician can be associated with a surgery: as an *attending/referring physician* or an *operating physician*. The surgeons we studied are the ones identified as attending/referring physicians. We found that for 98 percent of the surgeries in our data, the attending/referring physician is the same as the operating physician.

Surgery volume of a surgeon—The number of outpatient KSWC surgeries the surgeon referred or performed in an ASC or HOPD in a given quarter or time period, if specified.

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