Raising the Stakes:
Physician Facility Investments and Provider Agency

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Principal-agent problems often extend beyond what can be directly addressed through conventional incentive arrangements. We examine a context where physicians are likely under-incentivized to minimize total medical costs until their private financial interests align with those of patients. Leveraging novel data on physician ownership of ambulatory surgery centers—i.e., same-day facilities––we show that these equity holdings cause a substitution away from higher cost, rival settings that lowers Medicare spending by 10-40% per physician. We find no clear evidence of perverse behavior following these investments. Instead, our findings demonstrate how entrepreneurial activity can indirectly limit principal-agent problems and improve efficiency. (*JEL* I11, I18, L84)

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In many markets, suppliers provide both diagnostic assessments and services to address any identified problems. When consumers rely on professional assessments and recommendations from suppliers that are not disinterested parties, information gaps may create misaligned incentives.[1] For example, consumers in need of automobile repairs would prefer the mechanic to order the most efficient replacement parts. But if the mechanic's compensation is solely dependent on her labor contribution—and therefore independent of the selected replacement parts—she may underweight the automobile owner's interests in the choice of parts. Existing contracts and incentive schemes could be broadened or redesigned to incorporate a wider set of potential actions by agents and thereby improve principal-agent alignment.[2] However, doing so may not always be feasible and could introduce other agency concerns. Incomplete contracts and information asymmetries often leave some agent behavior outside of direct incentive arrangements.

In this paper, we use a common source of medical market transactions to explore the importance of such missing incentives for agents' actions, which ultimately shape the total cost of care. We specifically examine how changes in indirect financial incentives impact a physician's decision over the location of procedural service delivery. Because US medical care is typically reimbursed through separate payments to different production factors (e.g., a treating physician, a clinical facility, a pharmacy, etc.) and substitutable inputs are often paid different amounts, the choice of treatment *location* substantively shapes the total medical spend for patients and payers. An area where such payment differences are particularly relevant is the market for outpatient

[1] For examples across several different market transaction settings, see Chevalier and Ellison (1997), Hubbard (1998), Afendulis and Kessler (2007), Levitt and Syverson (2008), and Iizuka (2007, 2012).

[2] Some examples include designs to increase agent effort and output (Prendergast 1999; Lazear 2000; Lazear and Oyer 2010), encourage the selection of productive workers (Besley and Ghatak 2005; Bandiera et al. 2015), or profitably manage a company (Abowd 1990; Gibbons and Murphy 1990; Jensen and Murphy 1990; Aggarwal and Samwick 1999).

procedures—a growing segment of the healthcare sector, partly in response to concerns over rising costs. The two most prominent settings for outpatient procedures are hospital outpatient departments (HOPDs) and ambulatory surgery centers (ASCs). ASCs are standalone surgical facilities that compete with hospitals for a variety of profitable "same-day" services and are commonly the lower priced option for publicly as well as privately insured consumers. Consequently, the use of a hospital setting in lieu of an ASC for the exact same procedure performed by the exact same physician will generally translate to higher spending. However, the patient's focal agent (i.e., her physician) wields significant influence over most medical decisions, including the selection of treatment setting (Arrow 1963; Dranove and White 1987; McGuire 2000).

Within the context of outpatient surgeries and procedures, physicians' professional service payments are identical across treatment settings—meaning that standard payment systems do not explicitly incentivize physicians to seek out the lowest-cost facility environment.[3] An ASC may be a clinically appropriate and readily available option for a given patient-procedure pair, and even the setting that the patient (i.e., the principal) would prefer in order to minimize her total out-of-pocket spending obligations. Yet, the physician's own inertia, preferences, and/or cost considerations (e.g., the added administrative, transportation, and time costs from providing care in multiple locations) may receive greater weight in the treatment setting referral decision than the financial implications for the patient. If true, physicians could exhibit an overreliance on hospital-

[3] As an example, in 2023, Medicare's professional (physician) reimbursement for a colonoscopy was $199 regardless of whether the case was performed in an ASC or a hospital. In contrast, for this procedure the facility was reimbursed $610 if the case was performed in an ASC and $1,026 if the case was performed in a hospital. Reimbursement rates obtained from the Centers for Medicare and Medicaid Procedure Price Lookup tool: https://www.medicare.gov/procedure-price-lookup/cost/45380/. We also note that while it is uniformly the case that physicians' professional fees are identical across the two settings for a given service paid by Medicare (our analytic setting), it is possible that some commercial contracts allow for some variation in the professional fee based on setting choice.

based delivery that would be inefficient, with the additional spending burden falling on patients and their insurers.

We empirically investigate the presence and consequences of this broader principal-agent problem using a 100% sample of Medicare fee-for-service transaction data from 2013 through 2019. A key characteristic of the ASC industry is that physician ownership is the prevailing norm.[4] Holding an ownership stake entitles physicians to a share of profits from the facility fees that are tied to medical services that they personally deliver as well as those performed by other physicians. This profit-sharing arrangement creates an explicit financial incentive for the invested physician to favor the ASC over a competing hospital. In this way, the equity investment has the potential to indirectly correct a previous misalignment between the physician's and patient's interests with respect to the selected outpatient surgical treatment setting. However, ASC ownership may create perverse incentives that distort treatment behavior. Direct ownership beyond the physician's own medical practice encourages steering more business to the owned assets based on private financial interests. Affected physicians could oversupply care (i.e., exhibit supplier induced demand) or make suboptimal treatment setting allocations across their patient mix (i.e., make inappropriate patient-facility matches). Either behavior represents a potential agency issue that could offset the financial benefits from increased ASC utilization. Patients are also unlikely to be aware of underlying physician investments in complementary services, which limits the ability of market discipline to mitigate any undesired behaviors stemming from these opaque business arrangements and could suggest a role for regulatory intervention (Wolinsky 1993).

[4] Approximately 70 percent of ASCs are standalone facilities under physician ownership. In addition to financial incentives, physicians commonly take ownership stakes in ASCs to improve autonomy: https://www.beckersasc.com/asc-news/ascs-are-vying-to-maintain-independence-heres-why.html.

Our analyses of the potential benefits and drawbacks of these equity holdings are made feasible through detailed physician-level ASC ownership information obtained through a Freedom of Information Act (FOIA) request to the Centers for Medicare and Medicaid Services (CMS). These novel data allow us to combine individual physicians' ownership stakes over time with their comprehensive clinical care delivery within the Medicare outpatient procedure market. The effects of ASC ownership are identified using a "stacked" differences-in-differences (DD) and event study framework (Section III) spanning multiple quarter-years before and after a given investment.

We find that physicians favor ASC settings following formal ownership stakes with these facilities. However, there is substantial heterogeneity across two types of new ASC investors: those with versus without previous ASC experience. Physicians that utilized ASCs prior to becoming an owner increase their ASC volumes by approximately 15 to 20%, but their HOPD volumes fall by comparatively less—leaving their total Medicare procedure output nearly 10% higher overall. In contrast, new ASC equity holders lacking previous ASC experience exchange HOPD for ASC treatments settings in an almost one-for-one fashion. Their aggregate supply of procedural care to Medicare beneficiaries is therefore unchanged; though, the setting substitution impacts between one-third to one-half of their total Medicare cases. These physicians are also 5 to 6% less likely to use a HOPD setting at all within one year after becoming an owner—revealing a substantive extensive margin effect. Both classifications of new physician owners save the Medicare program money following their ASC equity stakes. The former generates 13% lower Medicare payments in total—despite performing more cases for more Medicare beneficiaries—while the latter group's average Medicare total payments fall by roughly 40%. The spending reductions are not driven by changes in procedural case mix, and neither quality of care or appropriateness of patient-facility matches seems to suffer once these physicians become ASC investors.

Our findings suggest that physicians under-utilize ASCs when they lack an explicit incentive to do so. This pattern is consistent with physicians behaving as imperfect agents and underweighting the financial burden for patients and payers from alternative care delivery options until the physicians' interests are better aligned through an indirect incentive. Our paper also extends an important literature (Section IIB) investigating the impacts of physicians' controversial ownership of complementary medical inputs. However, the existing literature lacks the rich and extensive data that we leverage, which limits both the applicability and precision of previous findings. We also newly contribute to an understanding of how providers' medical setting substitution can be a mechanism to enhance patient convenience while lowering the total financial outlays for care. Such substitution behavior generates positive externalities for purchasers of private insurance as well as taxpayers that support the public insurance programs.

I. Background

A. *Features of the Outpatient Procedure Market*

US medical services have experienced a long-running trend toward outpatient (i.e., "same day"), as opposed to inpatient (i.e., "overnight"), delivery (Munnich and Parente 2014; Baker, Bundorf, and Kessler 2019)—with nearly 2 billion outpatient procedures and $170 billion in associated spending for Medicare beneficiaries in 2018 alone.[5] The outpatient surgery market is effectively divided between ASCs and hospitals.[6] ASCs are overwhelmingly for-profit (94%) firms and located in urban metropolitan areas (MedPAC 2019). In contrast, over 70% of hospitals are not-

[5] Authors' calculations from the 100% national sample of Medicare claims data.

[6] Some outpatient procedures can be performed within physician offices, but this is a small share of the market and is restricted to just a subset of procedures that are of low complexity.

for-profit (Lakdawalla and Philipson 2006).[7] ASCs also tend to be small, with just three operating rooms per facility, on average (MedPAC 2019). In 2017, 5,630 Medicare certified ASCs were operational across the US and accounted for 6.5 million outpatient Medicare procedures and $4.6 billion in associated payments during that year (MedPAC 2019). ASCs are believed to improve consumer welfare through greater convenience and lower service prices (Paquette *et al*. 2008; Grisel *et al*. 2009; Munnich and Parente 2014; Weber 2014; Munnich and Parente 2018; Aouad, Brown, and Whaley 2019; Sood and Whaley 2019). Estimates also suggest that ASCs have lower cost structures than their rival HOPDs due to greater procedure specialization and economies of scale (Carey and Mitchell 2019; MedPAC 2019). Hospitals, however, argue that ASCs enjoy unfair cost advantages derived from their healthier patient mix, more restricted (i.e., profitable) service lines, and lighter regulatory burden (Casalino, Devers, and Brewster 2003). Further, HOPDs exposed to ASC entry suffer outpatient procedure volume losses and weaker financial performance (Bian and Morrisey 2007; Courtemanche and Plotzke 2010; Carey, Burgess, and Young 2011; Koenig and Gu 2013; Hollenbeck *et al*. 2015). ASCs also appear to place downward pressure on HOPDs' service prices, which is at least consistent with consumer gains from more competition between rival suppliers (Carey 2017; Whaley and Brown 2018; Baker, Bundorf, and Kessler 2019).[8]

B. *ASC Physician Ownership and Regulation*

[7] Related statistics on US hospital characteristics from the American Hospital Association (AHA) can be found here: https://www.aha.org/statistics/fast-facts-us-hospitals.

[8] Of note, since ASCs are overwhelmingly for-profit firms, they consequently bear state and federal tax liabilities on their earnings. Conversely, not-for-profit hospitals, which dominate the industry, receive billions of dollars in tax exemptions per year (Rosenbaum *et al*. 2015). Though, reallocating high-margin procedures from hospitals to ASCs can weaken hospitals' earnings. A worsening earnings profile can negatively influence hospitals' downstream investments in technology or quality (Garthwaite, Ody, and Starc 2022).

Increased physician engagement in outpatient care entrepreneurship is not inherently problematic. Physicians may benefit from the high degree of specialization, the lower organizational complexity (and hence greater physician control of the firm's conduct), fewer scheduling disruptions (e.g., elective procedures being cancelled to accommodate emergent cases within hospitals), and better optimization of their procedure schedule overall when relying on ASCs instead of hospitals.[9] Each of these features can positively impact a physician's core income stream (i.e., the reimbursements from his or her own clinical effort) and suggests much closer incentive alignment with ASCs when compared to hospitals, which are broader in clinical scope and more layered in terms of management. Consumers could likewise benefit from physicians' ASC ownership if their physicians do not subsequently change their clinical decision-making but are able to steer procedures to more desirable and/or efficient settings.

Although Medicare has reimbursed for services performed at ASCs since 1982, the legality—and hence risks—associated with physician ASC investments have not always been clear. It was not until 1999 that physician owners received "safe harbor" protections from prevailing US regulatory statutes that otherwise could have applied to ASC financial stakes and diminished their value (Becker and Biala 2000; Dyrda 2017; MedPAC 2019).[10] This federal policy decision was consequential and not without criticism because it shielded physicians from laws explicitly intended to prevent financial interests from undermining their agency functions for

[9] These and other related benefits of ASC ownership for physicians are commonly asserted within the industry and trade presses. They can also be found in materials from the Ambulatory Surgery Center Association. For an example, see https://www.ascassociation.org/advancingsurgicalcare/asc/benefitsofphysicianownership.

[10] This means that federal regulations (i.e., the "Stark Laws") do not prohibit physicians from referring patients to ASCs where they have existing facility ownership investments.

patients.[11] Others have remarked that the favorable regulatory position adopted in 1999 likely spurred greater interest in ASC ownership among physicians (Carey and Mitchell 2019).

The stylized and descriptive evidence in Figure 1 aligns with such an assertion. Among the ASC firms we observe (data fully described in Section II), the number of first-time physician ASC equity owners grows steadily between 1987 and 1998 and then rapidly accelerates in the following decade when the safe harbor rules are in place. By 2007, new ownership stakes in that year outnumber those observed in 1998 by nearly 500%. The annual number of new ASC owners peaks in 2008, which is also when industry-wide ASC supply growth becomes sharply more restrained following changes to Medicare payment policy for ASCs (Munnich and Richards 2022). However, even after the reductions in 2009 and beyond, hundreds of new ownership stakes still take place each year. While little systematic data exist, trade press articles often quote ASC ownership share prices starting at $100,000 and climbing to over $500,000 in some circumstances. Expectedly, such outlays generally require physicians to first seek a willing lender in order to make the requisite ASC equity investment.[12]

C. *Existing Studies on ASC Ownership*

[11] For example, some have warned that ASC ownership could foster an oversupply of procedures and economically wasteful care (Casalino, Devers, and Brewster 2003; MedPAC 2019). Various state legislatures have since pursued their own regulations to slow further growth in physician-owned ASCs and to partially undo the permissive regulatory stance taken by the federal government (e.g., see Blesch 2008). Similarly, though targeting a different investment type (and a much smaller number of firms), Section 6001 of the Affordable Care Act (ACA) effectively prohibited future expansions of physician-owned hospitals across the US—an action championed and still supported by hospital lobby groups. Specific information from CMS on this regulatory action can be found here: https://www.cms.gov/Medicare/Fraud-and-Abuse/PhysicianSelfReferral/Physician_Owned_Hospitals. The American Hospital Association (AHA) advocacy points on the matter can be found here: https://www.aha.org/system/files/2018-03/fact-sheet-self-referral-2018.pdf. Other work has discussed similar issues related to Accountable Care Organizations and patient steering (Handel 2015; Kanter and Pauly 2019).

[12] A recent example from the Nashville Medical News blog can be found here: https://nashvillemedicalnews.blog/2017/11/16/what-is-a-fair-price-and-value-of-an-asc-investment/.

As previously noted, physician ownership is highly common among ASC firms and has attracted considerable research and policy attention. Yet, our economic understanding around whether, and to what degree, ASC investments influence individual physician behavior is limited to date. Specifically, physician-level ASC ownership has often been poorly measured or not measured at all, and *changes* in physician behavior following *changes* in ASC ownership status have typically not been captured in previous analyses. For these reasons, the existing findings may motivate closer scrutiny of physicians' ASC equity holdings, but they ultimately leave many policy-relevant questions unanswered.

Existing research demonstrates that ASC firm entry positively correlates with local outpatient procedure market expansion (Lynk and Longley 2002; Hollenbeck *et al*. 2014, 2015; Hollingsworth *et al*. 2011; Koenig and Gu 2013).[13] Studies at the physician-level reach similar conclusions when documenting positive associations between ASC ownership proxy measures and individual surgical output (e.g., Strope *et al*. 2009; Mitchell 2010; Yee 2011). Additionally, other work suggests that the availability of ASCs as well as underlying ASC ownership relationships may encourage selective (i.e., financially attractive) referrals to ASC settings and perhaps blunt physicians' incentives to adopt new evidence-based treatment protocols when doing so would be at odds with profit-maximization (Gabel *et al*. 2008; David and Neuman 2011; Plotzke and Courtemanche 2011; Howard, David, and Hockenberry 2017).

Gabel *et al*. (2008) claim to be the first study to explicitly investigate the role of ASC ownership within procedure referral patterns—namely, whether care is diverted to ASCs rather than HOPD settings. However, the authors are restricted to two geographic markets (Pittsburgh

[13] Of note, Lynk and Longley (2002) offer compelling and detailed time series data, which include precise information on ownership status at the physician-level. However, the authors are restricted to two cases studies (one from Louisiana and one from South Dakota) that materialized from formal legal disputes in the late 1990s. Thus, generalizations are limited.

and Philadelphia) in a single year (2003) and rely on an ASC referral volume threshold to serve as a proxy for actual physician ownership status. The use of arbitrary volume thresholds linked to individual physicians' ASC use has also been a common limitation in the most closely related literature (e.g., see Hollingsworth *et al*. 2009, 2010; Strope *et al*. 2009). Beyond the inability to clearly classify physicians as ASC owners or nonowners, many studies have narrowly examined select physician specializations and procedures (e.g., see Hollingsworth *et al*. 2009, 2010; Strope *et al*. 2009; Mitchell 2010; Aouad 2022), which challenges the formation of generalizable inferences as well as policy recommendations. Furthermore, and as remarked above, rarely has a change in ownership status entered into the empirical analyses.

Hollingsworth *et al*. (2010) implemented a version of a difference-in-differences design, though the authors were limited to data from just a three-year period, with only one year of ownership status changes and no precise information on actual ownership status at the physician level. Yee (2011) is the most similar to our study in intent and analytic setup. Yet, the author analyzes the effect of ASC board membership, rather than acquiring an ASC ownership stake. As Yee (2011) correctly points out, these two forms of financial interests are meaningfully different. Board positions tend to be of limited duration (e.g., two-year rotating assignments), and board membership status does not necessarily reflect a change in ownership status since new board members may have been selected from existing investors in the relevant ASC. Additionally, many of the ASC's owners will not serve as board members. Yee (2011) ultimately finds greater procedure volume, a larger share of cases performed within ASCs, and selective steering of patients to ASCs once a physician becomes an ASC board member. The corresponding estimates are arguably more informative than prior research in this area since the author benefits from more detailed data and uses physician fixed effects specifications to identify off of changes in board

membership status from 1997 through 2004. That said, the empirical implementation did not demonstrate how the outcomes evolved over time, and crucially, if they were behaving similarly across treatment and comparison groups prior to the board membership events. Unaccounted for pre-period divergence across physician groups could lead to a biased estimate of the true board membership effect. And again, a board membership effect is not synonymous with an ASC ownership effect, with the latter being more relevant to the plurality of physician outpatient care investors and consequently of greater significance for public payer and regulatory policy.

II. Data

A. *Physician-Level Ownership Status*

One of our most important empirical contributions is to acquire and apply detailed ASC ownership information at the individual physician-level. As previously described, these data were obtained through a FOIA request to the federal agency CMS. The original FOIA request was made in March of 2018, and the data were delivered by CMS in April 2019.

The data contain identifying information for physician owners, including their National Provider Identification (NPI) number, at every Medicare-certified ASC. We also observe the precise date the ownership stake is acquired and if (and when) it is ever terminated. We restrict to individual ASC investors with valid NPI information and a reported ownership stake relevant to our study. Specifically, we keep observations with the categories: "5% or more ownership interest," "partner," "sole owner," or "sole proprietor" reported to CMS.[14] We do not observe the

[14] These are the verbatim categories captured by CMS record keeping. This excludes observations reporting administrative roles, such as "director" or "authorized representative." Note, many physicians reporting administrative roles, such as directorships, also have an additional ownership entry with the categories listed above for the same ASC facility.

exact size of the physician's ownership stake, however—unless it is 100% (i.e., "sole") ownership, which is rare in the data. While a subset of physicians reports ownership relationships with more than one ASC, the overwhelming majority of physician owners own a stake in a single ASC. For our analytic purposes, we consider a given NPI (i.e., unique physician) to be an owner within a given point in time if that physician has an active ownership stake in at least one ASC. Accordingly, we longitudinally represent individual physician ownership as beginning when the first ASC investment is made and not concluding (for the minority that return to nonowner status at some point) until the latest observed termination date for that same physician.[15] Of note, in our analytic sample (described in Section III), we exclude the small minority (34 in total) of new physician owners that terminate their ownership stake prior to the end of the observed analytic window for estimation.

The FOIA data are not a complete historical record of all ASC firms ever operating or Medicare-certified in the US. We observe firms that are in the market and certified at least by January 1, 2005 or later and consequently do not capture ASC information for those that closed prior to 2005. However, for all ASCs with an active Medicare certification by 2005 or later, we observe their complete physician ownership history, including exact start and end dates, irrespective of when the physician ownership transitions occurred. Moreover, as demonstrated in Appendix Figure A1, market exits (i.e., losses of ASC Medicare certifications) are a rare event, especially when compared to the number of Medicare-certified ASCs in operation in a given year. Thus, among all historical ASC ownership events, only a small subset is not included in our data

[15] In this way, an ownership stake that concludes earlier than the latest termination date would be ignored since at least one other ownership stake would persist for the physician. Only a minority of ownership stakes are ever terminated within the database, however.

(i.e., those occurring for firms that closed prior to 2005). Importantly, these unobserved events play no role in our empirical estimations or interpretations.

B. *National Medicare Claims Data*

Our primary analytic data capturing physician behavior changes are from a 100% national sample of fee-for-service Medicare claims (CMS). This universe of physician services data from the Medicare market span 2013 to 2019 and are aggregated at the physician-quarter level for those practicing within the 50 US states or Washington DC. We use these data to examine physicians' outpatient procedure setting choices and total productivity.[16] We create quarterly measures of overall procedure complexity and patient mix that are independent of outpatient surgical setting choices. The former takes the average Relative Value Units (RVUs) across all performed outpatient cases while the latter averages over the hierarchical condition category (HCC) risk scores belonging to the corresponding Medicare patients. We also leverage the ability to track all care utilization at the Medicare beneficiary level to construct measures of adverse health events immediately following the receipt of an outpatient procedure. Specifically, we focus on emergency department visits within 30 days of an outpatient procedure. This measure is consistent with related economic studies of outpatient procedure markets (e.g., Munnich and Parente 2018) and provide reasonable proxies for the general quality of outpatient procedural care belonging to a given physician in a given quarter. We also use the transaction information contained within the complete Medicare claims data to assess changes in the public insurer's total spending for outpatient services

[16] Of note, we are necessarily limiting to physicians that perform outpatient procedures and surgeries since they are relevant to our empirical context. Large swathes of physicians (e.g., primary care fields of medicine) have no involvement in outpatient procedural care. We also restrict to all the procedures with a Berenson-Eggers Type of Service (BETOS) code falling in the procedure category (i.e., starting with "P") but not in the oncology (starting with "P7") nor in the dialysis service (starting with "P9") categories.

attached to a given physician after the physician becomes an ASC equity owner. Our spending measure reflects the combination of professional and facility payments and is irrespective of the mix of outpatient facility settings ultimately chosen by the physician in a particular quarter. Thus, it captures the full, direct spending burden born by the public insurance program—and hence taxpayers—for all Medicare enrollees treated by each unique physician during each three-month time horizon.

III. Empirical Strategy

A. *Stacked Difference-in-Differences*

We employ a difference-in-differences (DD) design at the physician-quarterly level. All physicians in the Medicare claims are identified via their unique National Provider Identifier (NPI)—a requirement for billing the public insurance program. For each NPI in each quarter, we observe the number of all Medicare-paid outpatient procedures performed (including true zeros) within ASCs, HOPDs, and overall. We then merge our quarterly physician-level procedure volume panels with our ASC investor information from CMS using the common NPIs across the two databases. We translate the month and year of initial ownership to identify the exact quarter-year of the ASC ownership transition within a given physician's panel of Medicare procedural activity. These are the physician investment actions that ultimately underlie our DD estimations

Because we rely on market events that occur with differential timing—similar to other recent economics studies (e.g., Eliason *et al*. 2019; Prager and Schmitt 2021)—additional care is necessary for implementing the DD design to yield appropriate inferences from the resulting estimates (e.g., see Goodman-Bacon 2021). We do so by adopting a "stacked" DD design.[17] We

[17] Similar estimation approaches have been used in other recent economics research (e.g., Cengiz et al. 2019; Deshpande and Li 2019; Chen *et al*. 2023; Lin *et al*. 2023).

first exclude 'already owners' so that the analytic sample is solely composed of never treated units (i.e., 'never owners') and physicians that become a first-time ASC owner during our analytic window (2013-2019). We then retain ten quarters before and after the ASC ownership event among our treatment group physicians and impose a balanced panel requirement for analytic sample inclusion. Quarterly data for over two years prior to ASC investment event allows us to assess any pre-ownership differential trending behavior. At the same time, narrowing our focus to the time periods +/– 2.5 years around the ownership stake allows us to exploit the sharp, differential change in financial incentives among the subset of physicians that newly become an ASC equity holder to test if there are concomitant sharp changes in physician treatment behavior. This timing restriction necessarily excludes treatment group observations that became new owners during the first two years or last two years of our analytic window since they cannot contribute data over the entire five-year time span belonging to the analytic sample. However, as a robustness check, we also relax this requirement to ascertain that our main findings are not materially affected by this restriction (fully described and discussed in Section IV).

We observe 741 unique physicians across the full US healthcare system whose new ownership events satisfy these inclusion criteria. To construct the control comparison group, we randomly assign a quarter-year 'anchor date' from all possible quarters in 2013 to 2019 to each potential control group observation. This process is akin to assigning placebo ownership dates to control group physicians. We apply the same analytic sample restriction to the observed time periods for a potential control group observation based on the randomly assigned anchor date (i.e., keeping the [–10, +10] quarters surrounding the anchor date for an included control group

physician). The control group subsequently captures the outpatient procedural behavior of 17,069 unique physicians, which can then be combined with our treatment group physicians.

Our resulting analytic sample is therefore aligned (i.e., "stacked") around the zero-time point, which reflects the time of actual ownership for the treated physicians or the randomly assigned placebo date for controls. The constructed stacked sample lends itself to the use of standard DD estimating regressions that are both transparent and easy to interpret. This particular method also guards against the known issues of differential timing in treatment while not requiring a weighting strategy to be imposed on the data. In short, it returns the analytic context to the familiar and canonical "2x2" DD setup where pre-period and post-period data contributions are identical across all observations used in the estimation.

Before diagramming our DD specifications, we first characterize the treatment and control groups comprising our stacked DD analytic data since physicians' financial investments in ASCs are non-random. Table 1 displays these specific physician groups and summarizes their outpatient procedure output within our Medicare claims data as well as the physicians' overall patient mix and quality of care proxy measures. Unsurprisingly, physicians that will eventually become ASC owners rely more heavily on ASC facilities and less on HOPDs. However, their broad productivity measures (i.e., total Medicare volume, unique Medicare beneficiaries treated, and procedure mix complexity) are, on average, similar to the never owners control group physicians. Additionally, the average physician generates approximately $343,000 and $498,000 in quarterly aggregate Medicare revenue among the treated and control groups, respectively. The middle panel of Table 1 describes the average patient mix across the physician groups, which are virtually identical on almost every metric. This similarity suggests that eventual ASC owners are not serving an unusual subset of Medicare beneficiaries and/or operating in healthcare markets distinct from the never

owner subgroup. Lastly, in the bottom portion of Table 1, we can see that the rate of Medicare patients presenting to an emergency department (ED) within the first 30 days after receiving an outpatient procedure is low (2-3%, on average), and if anything, lower among the treatment group physicians in the stacked analytic sample.[18]

Our first stacked DD estimating equation is the simple two-way fixed effects model that averages the ASC investment effects over the entire (2.5-year) post-period. The specification is as follows:

$$y_{pt} = \delta\left[\mathbf{1}\left(Treated_p\right) \times \mathbf{1}(Post_t)\right] + \lambda_p + \eta_t + \varepsilon_{pt} \quad (1)$$

Our outcomes (y) are at the physician (p) and quarterly (t) levels, and we accordingly have full vectors of physician (λ) and quarterly time (η) fixed effects.[19] The physician-specific indicator variable (*Treated*) is equal to one for those with at least one active ASC investment during the analytic period and zero otherwise. The time-specific variable (*Post*) is equal to one starting in the eleventh quarter (i.e., $t = 0$) for each physician's respective panel. Our first-order outcomes concerning physicians' treatment settings are: aggregate volume of procedures performed in ASCs, aggregate volume of outpatient procedures performed within HOPDs, and a binary

[18] Appendix Table A1 displays corresponding summary statistics for the stacked DD treatment group against those belonging to the full analytic sample of new ASC physician owners 2013-2019 (i.e., no restrictions on stacked sample inclusion) as well as those with at least one ownership stake by 2013 (i.e., "always owners'). Again, there is similarity across all three outpatient procedural physician subgroups in terms of their Medicare market activity, patient mix, rates of adverse health events post-procedure, and physician specialty. The exceptions are that 'always owners' use ASCs more, on average, and have little representation by cardiologists among the most common physician specialties to hold ASC investments. This is unsurprising since cardiology-focused ASCs are a recent growth area within the industry (Lubell 2019).

[19] Recall, the quarterly fixed effects are relative to the data periods surrounding the true treatment or false treatment time point for each physician included in the stacked DD analytic sample.

extensive margin measure for the use of any HOPD facilities in a given quarter. Assessing changes in physicians' reliance on HOPDs, specifically, after becoming an ASC owner allows us to understand and separate reallocation effects from productivity effects in the context of increasing cases devoted to ASCs. We then complement our primary outcomes with setting-agnostic measures that capture changes in overall procedure volume, number of unique Medicare patients treated, case complexity as measured by average RVUs per case, and total Medicare revenues (professional plus facility fees for all outpatient procedures performed). [20]

Consistent with standard DD empirical practice, we adapt Equation (1) to an event study approach. The only modification is the interaction of the *Treated* binary indicator variable with each quarterly time period belonging to the stacked data. The resulting specification is:

$$y_{pt} = \sum_{\substack{j=-10 \\ j\neq -4}}^{10} \theta_j[(Time_t = j)] + \sum_{\substack{j=-10 \\ j\neq -4}}^{10} \delta_j \left[\mathbf{1}\left(Treated_p\right) \times (Time_t = j)\right] + \lambda_p + \varepsilon_{pt} \qquad (2)$$

The omitted reference time point is one year prior to the ownership event. We maintain the physician fixed effects (λ_p) from Equation (1), and the *Time* variable in Equation (2) corresponds to the quarterly time dummies (η_t) from Equation (1) which reflect the corresponding quarterly periods before and after the key ($t = 0$) quarter for a given physician (i.e., the quarter of actual ASC ownership acquisition or the randomly assigned anchor quarter for treatment and control physicians, respectively). The $[\delta_{-10}, \delta_{-1}]$ treatment-time interaction coefficients allow us to examine pre-ownership trending behavior for treated physicians, and in particular, if it diverges

[20] We do not include patient characteristics as covariates because we use these variables as outcomes in patient selection models, discussed in Section V. However, our results are robust to their inclusion (available upon request).

from the control group physicians. An absence of pre-period differential trending supports the DD research design—though evidence of behavior changes in the immediate lead up to the ownership stake (e.g., the four quarters prior to the ASC investment) can reveal important and economically relevant anticipatory behavior by eventual owners. This approach also underscores the value of our more granular analytic data, including along the time dimension. The series of $[\delta_0, \delta_{10}]$ coefficients reveal the time path for any change in physician behavior (relative to one year prior the equity stake) once they become an ASC owner—namely the short- as well as long-run effects. We cluster our standard errors at the physician level throughout.

B. *Analytic Sample Stratification*

Before implementing our DD empirical strategy, we make one final adjustment to the analytic data. Physicians commonly make use of ASC treatment settings without possessing an equity stake in the facility—a known industry feature that is also directly observable in our combined data. Previous experience with ASC-delivered care could additionally be a contributing factor in the physician's decision to eventually pursue an ASC ownership stake. As evident in Figure 2, the plurality of physicians belonging to our treatment group do have prior clinical experience with ASCs (i.e., they performed at least one Medicare case within an ASC before ever becoming an ASC investor). However, a nontrivial minority (27%) have no previous experience in ASCs prior to obtaining an ownership stake. In other words, their first experience providing care in an ASC treatment environment coincides with their newly held facility investment. Disparate pre-ownership experience with ASCs suggests potential heterogeneity in the physician behavioral response to the new financial incentives tied to their equity positions.

To avoid masking such heterogeneity, we stratify our treatment and control group physicians according to their pre-period experience with ASC facilities and consequently estimate Equation (1) and Equation (2) separately for the two subgroups (i.e., those with and those without previous ASC clinical activity, respectively) and present two sets of corresponding DD and event study estimates for our Medicare market outcomes of interest. This analytic sample stratification has the additional benefit of transparently displaying pre-period trending behavior and any effect dynamics (via the event study specification) for each treatment subgroup relative to the corresponding control subgroup—something that triple differences estimation could otherwise obscure. It also underscores the value of a substantive look-back period prior to the ownership event in order to more accurately classify physicians based on their level of experience working in ASCs prior to becoming an ASC owner.

IV. ASC Ownership Effects on Physician Behavior

A. *Procedure Volumes, Complexity, and Spending*

Table 2 reports our "2x2" DD estimates for outpatient procedure case allocations across facility types among the ASC pre-period experienced (Panel A) and pre-period inexperienced (Panel B) analytic samples, respectively. Physicians with prior ASC experience increase their ASC procedure volumes by 16% and decrease their HOPD volumes by 10% after becoming an ASC investor. These same physicians are also 2-percentage points (3% relative change) less likely to perform any cases within a HOPD once they hold an ASC equity stake. Within Panel B, we observe stronger effects for new physician owners lacking prior experience with ASC-delivered care. Specifically, these physicians newly allocate 6.7 procedures or surgeries to ASC settings per quarter after becoming an owner. They demonstrate a nearly reciprocal drop in HOPD cases, with

5.5 fewer cases performed in these settings—a decline of 26% relative to their pre-period average HOPD procedural activity. We find a negative extensive margin HOPD effect for these physician investors as well, with a reduction of 4-percentage points (Panel B, column 3) in the likelihood of using a HOPD—an effect approximately twice as large in level terms as what is observed for the ASC experienced group of new owners (Panel A, column 3).

Figures 3 and 4 offer the supporting event study results corresponding to Table 2 Panel A and Panel B DD estimates, respectively. New ASC investors, already working in ASC settings, begin to increase their ASC procedure volumes six months before completing their formal investment and then largely stabilize at a higher volume in the six months immediately following their ASC equity stake. Their HOPD activity displays two downward level shifts in the mid-panel of Figure 3. In the 1.5 years before the ASC investment, their HOPD volumes fall and remain on a stable trend until they become a facility owner when they decline again by approximately one procedure per quarter and remain that way during the subsequent two years of ownership. The extensive margin (any HOPD use) reduction is less pronounced and suggestive of a longer run change in physician behavior for this specific (i.e., ASC-experienced) group of ASC owners.

The patterns are generally sharper and comparatively larger in Figure 4 when examining the ASC-inexperienced new owners. There are strong dynamics related to their ASC case allocations, with a nearly linear increase between the time of becoming an owner and two years following the equity stake. By 2.5 years out from the start of the ASC investment, these physicians perform approximately 12 Medicare procedures or surgeries within ASC settings per quarter, on average. The decline in HOPD volumes mirrors much of the changes observed for ASC volumes (mid-panel in Figure 4). Lower HOPD volumes begin during the first year of ownership and accelerate until reaching a stably lower level two years after becoming an ASC owner. The bottom

panel in Figure 4 shows a similar trajectory for the negative extensive margin effect for HOPD use, which is sharper and larger than that observed for the group of new owners with a history of ASC-delivered care prior to becoming an ASC investor (bottom panel in Figure 3).

When relaxing our stacked DD sample inclusion criteria to allow for an analytic window of just five quarters following the ownership event, rather than ten, we increase the number of unique physicians within our two treatment groups by 59% and 62%, respectively. However, the resulting event study findings in Appendix Figures A2 and A3 align with those belonging to our preferred analytic samples in Figures 3 and 4. Moreover, a clear shortcoming for the truncated post-period is being blinded to longer run dynamics in the effects of ownership, as evident in Figures 3 and 4 from our preferred estimations. Taken together, trading off treatment group size for a wider pre- and post-ownership time horizon does not lead to qualitatively different findings or conclusions and benefits from more completely capturing the evolution of the post-ownership physician behavior changes.

Table 3 shifts to our outcomes that reflect a physician's overall Medicare market activity– i.e., those that are not specific to a given facility type. Regarding total procedure/surgical volume, there is a clear increase among physicians with previous ASC experience (Panel A, column 1). Their total output rises by almost three cases per quarter—a 7% relative increase compared to their pre-ownership level. The DD estimate in Panel B (column 1) for physicians whose ASC ownership coincides with their first ASC activity is directionally the same as their treatment group counterparts in Panel A. However, the estimate lacks sufficient statistical precision at conventional levels. This pattern of findings was also foreshadowed in Table 2, where the former group increases ASC output with only a modest reduction in HOPD output. The latter group of new ASC investors (i.e., those without previous ASC experience) demonstrated behavior change closer to a

one-for-one substitution of ASC settings for HOPD settings following the ownership stake. For both treated physician groups, the number of unique Medicare beneficiaries receiving procedural/surgical care increases accordingly—though again the DD estimate is imprecise for those without previous ASC experience (Panel B, column 2). The DD estimate in Panel A (column 2) reveals an 8% increase in unique patients, which is suggestive of greater physician-level throughput after the ASC ownership transition. More specifically, the close correspondence between the increase in total procedure volume and number of unique patients is at least consistent with relaxed capacity constraints (e.g., via greater and/or preferential schedule time allotments) after becoming an ASC owner. The findings in columns 3 and 4 for Panel A also demonstrate a slight reduction (3%) in average case complexity and an approximately 13% decline in total Medicare payments tied to the physician's overall outpatient procedure activity.[21] Lower average case complexity is unsurprising since the physicians' greater output is driven by ASC-delivered care, which is generally lower complexity, all else equal. The fall (13%) in aggregate Medicare revenues is particularly striking because these physicians' volume of Medicare cases is 8% *higher* after obtaining an ASC ownership stake. Thus, modest substitution away from HOPD settings can generate meaningful savings for the Medicare program—even in the presence of greater supply of outpatient procedural care to the Medicare market overall. The final noteworthy finding in Table 3 is present in column 4 of Panel B. Physicians without ASC experience are responsible for 37% *less* Medicare spending once they become ASC investors. Their sharp reallocation of cases from HOPD settings to ASC settings (Table 2, Figure 4) results in considerable savings for the public insurance program—and hence taxpayers.

[21] The percent change in Medicare revenues is calculated from exponentiating the reported DD coefficient in Table 3.

Figures 5 and 6 offer the event study estimates that correspond to the DD results belonging to Table 3. For physicians with ASC experience at baseline (Figure 5), the dynamics in effects for total output, unique Medicare patients, and case complexity tightly align with what was observed in Figure 3 for ASC procedure volume. As these physicians shift out their supply of outpatient procedural care via the ASC channel, the marginal cases are less complex (consistent with being ASC appropriate), on average, and they are more productive in a given quarter overall. Likewise, the growing decline in aggregate Medicare spending tracks with their shrinking use of HOPDs. Consistent with Panel B of Table 3, Figure 6 shows suggestive increases in total procedure volumes and Medicare beneficiaries treated, with sharp and large decreases in total Medicare spending following their ASC investment event. Within two years of obtaining ASC equity stakes, Medicare's total payments for outpatient procedural care tied to these specific physicians have fallen by more than half—again reflecting the affected physicians' strong substitution away from HOPD-delivered care.

B. *Disentangling ASC Ownership Effects from ASC Entry Effects*

The pronounced heterogeneity revealed in Section IVA demonstrates the importance of considering previous reliance on ASC settings for physicians' clinical work when assessing the influence of ASC ownership incentives. Those with ASC experience preceding their facility investments have more muted setting substitution behavior for their surgical care in comparison to the large and rapid reallocations of cases observed among new physician owners that are simultaneously utilizing ASC facilities for the first time. The contrast in behavior change across the two types of new ASC owners also encourages further exploration, with respect to the type of ASCs the members of each subgroup commonly invest in. Recall, ASCs are generally small and

specialized firms with tighter capacity constraints than their HOPD rivals. Industry-wide entry has also slowed in recent years (Munnich and Richards 2022), so availability of scheduling space (as well as ownership opportunities) could be limited, especially among incumbent firms.

In Figure 7, we diagram the type of ASC where our analytic sample physicians ultimately hold their ownership stakes. We divide the corresponding ASCs into three mutually exclusive groups based on the timing of the relevant physician's investment and the facilities official Medicare certification date.[22] The corresponding ASC subgroups are those that opened in tandem with the relevant physician's ownership stake, those that had been in the market for 1-3 years prior to the physician's ownership stake, and those whose market debut was at least four years before the physician's ownership stake. Interestingly, almost 75% of our treatment group physicians with pre-ownership ASC experience become investors in well-established ASCs (i.e., those with at least four years of market presence). Conversely, approximately 60% of our treatment group physicians with no prior ASC experience hold ownership stakes in ASCs just entering the market. The divergent patterns across the two physician subgroups are consistent with binding operational constraints for established ASCs, which could indirectly limit ownership opportunities for physicians not already performing surgeries at the facility. The depiction in Figure 7 also raises the prospect of ASC entry as a potential contributor, if not the driver, of the sharp substitution between settings demonstrated in Section IVA, among physicians concurrently experiencing new incentives via ASC ownership *and* new surgical space availability via ASC entry.

To disentangle the relative contributions of personal ASC ownership from local ASC entry, we conduct two additional empirical exercises. The first returns to our DD approach underlying

[22] The respective ASC ages are derived from the same data underlying Appendix Figure A1 (discussed in Section IIA).

Table 2 Panel B. The modification is simply stratifying the treatment group physicians according to the length of ASC market presence among the ASCs where their investments are made. Given the distribution in Figure 7, we define the two treated physician subgroups as either taking an ownership stake in a new ASC (i.e., opened the same year) or an established ASC (i.e., already open for at least one year). We then re-estimate that DD specification among the stacked analytic sample twice—once for each treated subgroup—to assess if the findings in Panel B of Table 2 are driven by the former subgroup (i.e., physicians experiencing ownership and entry concurrently). The results are reported in Table 4, and the DD estimates are qualitatively similar in magnitude and statistical precision across both panels of novel ASC owners and utilizers. Put differently, Table 4 does not indicate that physician behavior change is weaker or absent among physicians without previous ASC experience that ultimately invest in more established ASCs. Ownership effects are substantive among this subgroup *not* exposed to simultaneous ASC entry.

Notwithstanding the findings belonging to Table 4, it remains a possibility that entry could have a yet-to-be-quantified effect on the subgroup of physician owners taking stakes in new firms, which creates ambiguity for interpreting their specific subset of DD estimates. We consequently leverage an additional empirical approach to provide indirect evidence on the presence and magnitude of any entry effect germane to this subgroup of new physician owners.

Our approach closely follows our previous estimations. We retain our stacked DD analytic sample and empirical strategy but redefine what it means to be a member of the treatment group. Specifically, we identify a set of never-ASC-owner physician peers that work in the same geographic area (i.e., county) at the same time as one of our main analysis physicians becoming a new ASC investor in a new (less than one year old) ASC. We then construct a balanced panel of procedural output over the relevant time frame for these never-ASC-owner physician peers. We

further require that these never-owners practice within the same medical specialty as the matched main analysis treatment group physician. The latter inclusion criterion ensures that the corresponding ASC entering their local market is relevant to their domain of outpatient surgical care.[23] These physicians comprise a new treatment group and number 277 in total. We then re-estimate Equation (1) and Equation (2) using this subset of physicians who were exposed to newly entering ASCs but did not become owners as a new analytic treatment group in our DD models while preserving the same set of control group never-owners underlying the results from Tables 2-4.[24] Doing so allows us to quantify the procedure volume effects of ASC entry when the ownership incentives channel is shut down since these are, by definition, physicians that never invest in an ASC over our study period. Under the assumption that these physicians can provide a reasonable counterfactual for our main analysis physicians that acquire ownership stakes in ASCs new to the market, we can use the resulting estimates to benchmark against the DD estimates in Panel A of Table 4. In doing so, we can assess how much of the observed setting substitution is plausibly attributable to ASC entry effects, independent of ownership incentives.

Table 5 displays these findings—again, exclusively focused on a never-owner subsample of physicians. The DD estimates for the ASC procedure volume and HOPD procedure volume outcomes are both small in magnitude and not statistically significant at conventional levels. Thus, the findings in Table 5 fail to reject the null that ASC entry has no influence on care delivery choices for non-owner physicians. Moreover, when considering the resulting confidence intervals in Table 5, we can rule out any entry effect contribution greater than 0.6% and 18.5% to the Table

[23] For example, entry of a gastroenterology-focused ASC would not be relevant to an ophthalmologist's care setting options and therefore not constitute a plausible entry shock for any ophthalmologist practicing in the area at that time.

[24] We also purge from the control group any physicians that are now part of the newly created never-owner, entry-exposed treatment group.

4 (Panel A) DD estimates for ownership impacts on ASC volumes and HOPD volumes, respectively. In other words, our indirect counterfactual estimates further suggest that the overwhelming majority of behavior change is the consequence of incentive changes tied to personal facility ownership, rather than simply increased local ASC accessibility, even for the subgroup of physicians with new ownership stakes in ASCs that are also new to the market. These findings also reveal that the estimated ASC entry effects on hospitals from previous studies (Section IA) should likely not be interpreted as entry alone but entry in the presence of physician ASC ownership—i.e., it is the combination of physician access *and* physician incentives that leads to business stealing from hospitals.

V. Quality of Care and Risk Selection

After establishing the ownership effects on physicians' surgical setting preferences, productivity, and Medicare payments, we investigate downstream consequences for quality of care and patient risk selection, which could each suffer from agency issues in the presence of ASC ownership incentives. Table 6 applies Equation (1) to our three constructed rates of emergency department (ED) visits during the 30-day interval immediately following a procedure by the focal physician. Columns 1, 2, and 3 capture same-day, first week post-procedure, and 8-30 days post-procedure ED visits, respectively. The pre-period means reveal that these rates are relatively low across treatment and control group physicians—typically between 3-6% of a given physician's patients will present to an ED during the first month after outpatient surgery when looking across Panel A and Panel B in Table 6. However, the DD estimates for those with pre-period ASC experience (Panel A) as well as those lacking pre-period ASC experience (Panel B) show no indication that

ASC ownership affects these rates. The coefficients are uniformly small in Table 6 and are negatively signed more often than positively signed.

Within Table 7, we shift our focus to changes in physicians' patient mix among HOPD cases after becoming an ASC investor. We specifically examine HOPD patients to investigate any changes that could be consistent with "cream skimming" behavior—i.e., retaining higher risk beneficiaries in HOPD settings while shifting those with more favorable health risk profiles to ASC-delivered care.[25] Panel A of Table 7 reveals that the HOPD patient mix among new ASC investors with prior ASC experience is not materially different after the rival facility ownership event. Panel B of Table 7 offers some suggestive evidence that HOPD cases are relatively riskier for physicians with no prior ASC experience after taking on an ASC equity stake. The share of Medicare beneficiaries receiving HOPD procedures and surgeries that are dual eligible (i.e., qualifying for Medicaid supplemental coverage) or qualify for low-income subsidies for Part D prescription drug plans increases by approximately 10% following the ASC investment (Table 7, Panel B). Likewise, the beneficiaries' composite risk score (HCC) is differentially 4% higher, on average, for treatment group physicians during the post-period. However, the estimates in Appendix Figure A4 caution against strong interpretations of ASC ownership effects along these margins. The event study results do not reveal sharp and clear changes in these outcomes, which contrasts with previous findings for these physicians (Figure 4). Additionally, the DD estimates in Panel B of Table 2, along with the corresponding event study findings in Figure 4, make clear that this particular subgroup of treated physicians engages in substantive reallocations of HOPD cases

[25] This analysis inherently restricts to physicians with nonzero HOPD cases in each of the 21 quarters belonging to the stacked DD sample. Appendix Table A2 removes the setting restriction to capture the full analytic sample belonging to our previous estimations (i.e., Tables 1-3).

to ASC settings after holding ASC equity.[26] A rational reallocation, where the relatively lowest risk—and hence most appropriate—Medicare beneficiaries are the first to be shifted to ASC treatment delivery, would mechanically lead to modest changes in remaining HOPD patients' risk profiles, without any perverse strategic behavior (e.g., "cream skimming") on the part of the involved physicians. Thus, a conservative interpretation of the findings in Panel B of Table 7 indicates no definitive evidence of strategic risk selection for ASC patients, and at most, a slight preference for lower risk patients when performing the surgery in an ASC. This change could be in the patients' best interests and create an optimal matching of treatment setting to patient health risks and needs.

Of note, Appendix Table A2 provides analogous DD estimates for patient mix changes when placing no restrictions on treatment setting for a given physician. Panels A and B consequently capture any changes to the *overall* Medicare market patient mix for physicians becoming ASC owners. There is no clear evidence that the aggregate risk profile (irrespective of treatment setting choices) responds to the abrupt change in financial incentives following the ASC equity investment.

VI. Supplementary Results from All-Payer Data in Florida Markets

A. *Brief Data Description*

Nationally, more than 80% of ambulatory surgeries are estimated to have either commercial insurance or Medicare as the main payer (Hall *et al*. 2017). Our previous analyses and findings in Sections IV and V are therefore focused on a large and relevant market for physicians performing

[26] Recall from Section IVA, these physicians demonstrated a relative decline of 27% when averaging over the full post-period.

these cases. Yet, the Medicare claims data cannot speak to physician behavior change for patients originating from other payer groups.

To overcome this limitation, we supplement our primary encounter-level data (Section III) with the universe of outpatient (ambulatory) procedure discharge records from the state of Florida, which we obtained from the Florida Agency for Health Care Administration—i.e., the Florida AHCA (Florida).[27] Here, we trade off geographic scope for the ability to observe physician activity across all payer markets. We also note that Florida has an accommodating regulatory environment toward ASCs (e.g., ASCs are not bound by any existing certificate of need laws), and in terms of ASCs per 100,000 Medicare beneficiaries, Florida falls in the middle of the national distribution (MedPAC 2019). The state also offers a relatively rare opportunity to observe the universe of outpatient procedural activity over long time horizons.

Our available discharge records begin in the first quarter of 2010 and continue through the fourth quarter of 2019.[28] The detailed records include a rich set of variables, such as diagnosis and procedure codes, type of insurance, patient demographic information, the specific facility (e.g., ASC versus HOPD) where the procedure was performed, and the specific physician (i.e., NPI) performing the outpatient procedure. We then use these data to perform a stacked DD event study analysis that follows our main approach detailed in Section III. Our pre-ASC experience treatment group includes 237 unique physicians, with 2,045 physicians comprising the corresponding control group. We are also able to include 45 unique physicians that become ASC owners but lack previous

[27] The discharge data we use differs from other commonly used medical claims data (e.g., Marketscan or Health Care Cost Institute claims) by including all patients and procedures, rather than procedures for specific patient populations or patients covered by particular insurers. However, while we are able to link physicians across cases, unlike some medical claims data, we are unable to observe patients longitudinally.

[28] During the first quarter of 2010, AHCA began collecting and reporting physician NPIs belonging to the relevant discharge record—allowing us to link these data with our ownership information in a straightforward fashion.

ASC experience prior to becoming an owner. 2,472 physicians satisfy the inclusion criteria to serve as controls for this physician treatment group.

B. *Findings*

We first assess the procedure activity outcomes (across all payers, not just Medicare) from our main findings tied to the national sample (Section IV), with respect to ASC, HOPD, and total outpatient procedure volumes. Doing so ensures that the Florida subgroup is a reasonably representative subsample of the national data. Appendix Figures B1 and B2 capture these results for our treatment physicians with prior ASC experience and those lacking such treatment setting experience, respectively. The general patterns of outpatient surgery activity, irrespective of payer type, for these Florida-specific physicians align with our main results in Section IV. Again, the sharpest and most pronounced changes are found among the smaller subgroup of physicians that newly perform cases in ASCs after becoming ASC investors (Appendix Figure B2). As observed among the national sample (Section IV), these physicians engage in a strong treatment setting substitution whereby they move cases into ASCs at the expense of HOPD facility options. However, the intended contribution of these supplementary data is to use the stacked DD estimation from Equation (2) to examine any changes in *payer mix* following the ownership event. Appendix Figures B3 and B4 offer no compelling evidence of payer mix shifts over the first 2.5 years of ASC ownership for either treatment group. Thus, we find no indication that investing in ASCs leads physicians to adjust their payer mix in a manner that would suggest some patients being disadvantaged by the physicians' change in financial incentives.

VII. Conclusions

Conflicting interests can lead agents to make decisions that impose unnecessary costs on principals in the presence of informational asymmetries. Healthcare is a prime example since physicians both routinely decide which interventions patients will receive and where medical care delivery will take place. While the "where" decision may not always have direct financial ramifications for physicians, it can burden patients and their insurers with higher than necessary costs.

We test for the presence of suboptimal agency on the part of physicians with respect to treatment setting choices by leveraging the sharp incentive change that takes place when these providers invest in ASC facilities. Becoming a residual claimant on the facility's profits generates a new and salient consideration for subsequent referrals. Our DD estimates confirm that new ASC equity holders favor ASCs going forward, especially among the subset of new owners lacking clinical work experience in ASCs prior to becoming an ASC investor.[29] This latter group reallocates as much as half of their outpatient surgery caseloads to ASC settings and are 4 to 6 percentage points less likely to use a HOPD at all following their equity stakes. Substitution along the intensive or extensive margins for hospital-delivered care will meaningfully lower the accompanying medical spend. For Medicare specifically, we find that the public insurance program's payments fall by approximately 10 to 20% and 30 to 50% across our ASC-experienced and ASC-inexperienced new owners, respectively. Although physicians are not necessarily internalizing the cost differences across settings from the perspective of patients and payers, their shift in private incentives is able to better align their referral choices with the interests of principals.

In sum, our paper benefits from a comprehensive and highly relevant set of results that can quantify a nuanced but not uncommon principal-agent problem, especially within the $4.5 trillion

[29] The degree of setting substitution we find in response to providers' private incentives is on par with the magnitude of effects tied to large-scale consumer-focused interventions (e.g., reference pricing) that aim to encourage patients to choose lower cost (i.e., ASC) care settings (Robinson, Brown, and Whaley 2017).

US healthcare sector. The ASC investments allow physicians to receive an indirect earning stream from the overall financial performance of these facilities. Importantly, these equity stakes additionally provide an indirect incentive that encourages them to substitute ASC settings for hospital settings, which at least partially solves the principal-agent problem tied to treatment setting choice. Direct incentives to encourage physicians to refer to the efficient facility option are also possible (e.g., bundled payment models) and likely warranted, given the reallocation effects we identify in our context.[30] The findings also have direct relevance to existing policy debates from the tax-financed, public payer (i.e., Medicare) perspective as well as the regulatory perspective.[31] Since regulations may distort supplier behavior and sacrifice efficiencies, evidence-based policy is needed to appropriately balance the tradeoffs from weaker versus stronger regulatory frameworks. Our analyses demonstrate that ASC facility investments alter physician behavior without clear evidence of perverse effects or care quality erosion. Moreover, reducing the total medical spend through setting substitution has positive spillover effects onto private insurance market participants (insofar as lower average medical costs translate to premium reductions) as well as public insurance program underwriters (i.e., taxpayers).[32] These patient-specific and population-specific implications underscore the consumer and social welfare benefits

[30] Such incentives may become increasingly important as a counterweight to hospitals recapturing lost referral streams to lower cost options through acquisitions (e.g., Whaley *et al*. 2021; Richards, Seward, and Whaley 2022) as well as hospital efforts to move into the ASC industry (MedPAC 2019; Castellucci 2020).

[31] An example of such a contemporary policy debate where physician and hospital industry stakeholders can be found on opposing sides is described here: https://www.fiercehealthcare.com/providers/hospital-groups-aim-blunt-effort-reverse-aca-ban-physician-owned-hospitals.

[32] Recent research demonstrates treatment setting complementarities across payers as well as across procedures when performing more services within ASCs (e.g., see Geruso and Richards 2022). Thus, it is reasonable to assume that what we observe in the national Medicare data would largely hold for the commercially insured markets across the US. The Florida-specific all-payer results in Appendix B further support this assumption.

from this specific type of physician entrepreneurial activity and caution against greater regulatory interference aiming to correct a presupposed market failure.

REFERENCES

Abowd, John M. 1990. "Does Performance-Based Managerial Compensation Affect Corporate Performance?" *Industrial Labor Relations Review*, 43(3): 52s-73s.

Aggarwal, Rajesh K., and Andrew A. Samwick. 1999. "The Other Side of the Trade-off: The Impact of Risk on Executive Compensation." *Journal of Political Economy*, 107(1): 65-105.

Aouad, Marion. 2022. "Is Physician Location Sensitive to Changes in Patients' Financial Responsibility?" *Journal of Applied Economics* 25 (1): 280–99.

Aouad, Marion, Timothy T. Brown, and Christopher M. Whaley. 2019. "Reference Pricing: The Case of Screening Colonoscopies." *Journal of Health Economics*, 65, 246-259.

Afendulis, Christopher C., and Daniel P. Kessler. 2007. "Tradeoffs from Integrating Diagnosis and Treatment in Markets for Health Care." *American Economic Review*, 97 (3): 1013-1020.

Arrow, Kenneth. 1963. "Uncertainty and the Welfare Economics of Medical Care." *American Economic Review*, 53 (5): 941-973.

Baker, George P., and Thomas N. Hubbard. 2004. "Contractibility and asset ownership: On-board computers and governance in US trucking." *Quarterly Journal of Economics*, 119(4): 1443-1479.

Baker, Laurence C., M. Kate Bundorf, and Daniel P. Kessler. 2019. "Competition in Outpatient Procedure Markets." *Medical Care*, 57 (1): 36-41.

Bandiera, Oriana, Luigi Guiso, Andrea Prat, and Raffaella Sadun. 2015. "Matching firms, managers, and incentives." *Journal of Labor Economics*, 33(3): 623-681.

Becker, Scott, and Marcy Biala. 2000. "Ambulatory Surgery Centers—Current Business and Legal Issues." *Journal of Health Care Finance*, 27 (2): 1-7.

Besley, Timothy, and Maitreesh Ghatak. 2005. "Competition and Incentives with Motivated Agents." *American Economic Review*, 95 (3): 616-636.

Besley, Timothy, and Maitreesh Ghatak. 2005. "Competition and Incentives with Motivated Agents." *American Economic Review*, 95 (3): 616-636.

Bian, John, and Michael A. Morrisey. 2007. "Free-Standing Ambulatory Surgery Centers and Hospital Surgery Volume." *Inquiry*, 44: 200-210.

Blesch, Gregg. 2008. "Doctors Battle Hospitals over ASC Ownership Restrictions." Modern Healthcare. December 8, 2008. Crains Communications Inc. Available here: https://www.modernhealthcare.com/article/20081208/MODERNPHYSICIAN/311309995/doctors-battle-hospitals-over-asc-ownership-restrictions.

Carey, Kathleen, James F. Burgess Jr., and Gary J. Young. 2011. "Hospital Competition and Financial Performance: The Effects of Ambulatory Surgery Centers." *Health Economics*, 20: 571-581.

Carey, Kathleen. 2017. "Ambulatory Surgery Centers and Prices in Hospital Outpatient Departments." *Medical Care Research and Review*, 74 (2): 236-248.

Carey, Kathleen, and Jean. M. Mitchell. 2019. "Specialization as an Organizing Principle: The Case of Ambulatory Surgery Centers." *Medical Care Research and Review*, 76 (4): 386-402.

Casalino, Lawrence P., Kelly J. Devers, and Linda R. Brewster. 2003. "Focused Factories? Physician-Owned Specialty Facilities." *Health Affairs*, 22 (6): 56-67.

Castellucci, Maria. 2020. "Tenet to Pay $1B for up to 45 Ambulatory Surgery Centers." Modern Healthcare, December 10, 2020. Crains Communications Inc. https://www.modernhealthcare.com/mergers-acquisitions/tenet-pay-1b-up-45-ambulatory-surgery-centers.

Cengiz, Doruk, Arindrajit Dube, Attila Lindner, and Ben Zipperer. 2019. "The Effect of Minimum Wages on Low-Wage Jobs." *Quarterly Journal of Economics*, 134 (3): 1405-1454.

Centers for Medicare and Medicaid Services. 2013-2019. Research Identifiable Dataset. ResDAC.

Chevalier, Judith, and Glenn Ellison. 1997. "Risk Taking by Mutual Funds as a Response to Incentives." *Journal of Political Economy*, 105 (6): 1167-1200.

Chen, Alice J., Elizabeth L. Munnich, Stephen T. Parente, and Michael R. Richards. 2023. "Provider Turf Wars and Medicare Payment Rules." *Journal of Public Economics*, 218 (February): 104812.

Courtemanche, Charles and Michael Plotzke. 2010. "Does Competition from Ambulatory Surgical Centers Affect Hospital Surgical Output?" *Journal of Health Economics*, 29: 765-773.

David, Guy and Mark D. Neuman. 2011. "Physician Division of Labor and Patient Selection for Outpatient Procedures." *Journal of Health Economics*, 30(2): 381–391.

Deshpande, Manasi and Yue Li. 2019. "Who Is Screened Out? Application Costs and the Targeting of Disability Programs." *American Economic Journal: Economic Policy*, 11 (4): 213-248.

Dranove, David, and William D. White. 1987. "Agency and the Organization of Health Care Delivery." *Inquiry*, 24 (4): 405-415.

Dyrda, Laura. 2017. "39% of ASCs are 15+ years old, 92% have physician ownership: 14 statistics on ASCs." Becker's ASC Review, October 9. Available at https://www.beckersasc.com/benchmarking/39-of-ascs-are-15-years-old-92-have-physician-ownership-14-statistics-on-ascs.html.

Eliason, Paul J., Benjamin Heebsh, Ryan C. McDevitt, and James W. Roberts. 2019. "How Acquisitions Affect Firm Behavior and Performance: Evidence from the Dialysis Industry." *Quarterly Journal of Economics*: 221-267.

Florida Agency for Health Care Administration. Hospital Discharge Data. Tallahassee Florida.

Gabel, Jon R., Cheryl Fahlman, Ray Kang, Gregroy Wozniak, Phil Kletke, and Joel W. Hay. 2008. "Where Do I Send Thee? Does Physician-Ownership Affect Referral Patterns to Ambulatory Surgery Centers?" *Health Affairs*, 27 (3): 165-174.

Garthwaite, Craig, Christopher Ody, and Amanda Starc. 2022. "Endogenous quality investments in the US hospital market." *Journal of Health Economics*, 84: 102636.

Geruso, Michael, and Michael R. Richards. 2022. "Trading Spaces: Medicare's Regulatory Spillovers on Treatment Setting for Non-Medicare Patients." *Journal of Health Economics*, 84 (July): 102624.

Gibbons Robert, and Kevin J. Murphy. 1990. “Relative Performance Evaluation for Chief Executive Officers.” *Industrial Labor Relations Review*, 43(3): 30s-51s.

Goodman-Bacon, Andrew. 2021. “Difference-in-Differences with Variation in Treatment Timing.” *Journal of Econometrics*, 225 (2): 254-277.

Grisel, Jedidiah and Ellis Arjmand. 2009. “Comparing Quality at an Ambulatory Surgery Center and a Hospital-Based Facility.” *Otolaryngology-Head and Neck Surgery*, 141(6): 701-709.

Handel, Benjamin R. 2015. “Commentary—Accountable Care Organizations and Narrow Network Insurance Plans.” *Journal of Health Politics Policy and Law*, 40 (4): 705-710.

Hall, Margaret J., Alexander Schwartzman, Jin Zhang, Xiang Liu, and Division of Health Care Statistics. 2017. “Ambulatory Surgery Data from Hospitals and Ambulatory Surgery Centers: United States, 2010.” National Health Statistics Reports, No. 102, 28 February 2017, Centers for Disease Control and Prevention; US Department of Health and Human Services.

Hollenbeck, Brent K., Rodney L. Dunn, Anne M. Suskind, Yun Zhang, John M. Hollingsworth, and John D. Birkmeyer. 2014. “Ambulatory Surgery Centers and Outpatient Procedure Use among Medicare Beneficiaries.” *Medical Care*, 52 (10): 926-931.

Hollenbeck, Brent K., Rodney L. Dunn, Anne M. Suskind, Seth A. Strope, Yun Zhang, and John Hollingsworth. 2015. “Ambulatory Surgery Centers and Their Intended Effects on Outpatient Surgery.” *Health Services Research*, 50 (5): 1491-1507.

Hollingsworth, John M., Zaojun Ye, Seth A. Strop, Sarah L. Krein, Ann T. Hollenbeck, and Brent K. Hollenbeck. 2009. “Urologist Ownership of Ambulatory Surgery Centers and Urinary Stone Surgery.” *Health Services Research*, 44 (4): 1370-1384.

Hollingsworth, John M., Zaojun Ye, Seth A. Strope, Sarah L. Krein, Ann T. Hollenbeck, and Brent K. Hollenbeck. 2010. "Physician-Ownership of Ambulatory Surgery Centers Linked to Higher Volume of Surgeries." *Health Affairs*, 29 (4): 683-689.

Hollingsworth, John M., Sarah L. Krein, Zaojun Ye, Hyungjin Myra Kim, and Brent K. Hollenbeck. 2011. "Opening of Ambulatory Surgery Centers and Procedure Use in Elderly Patients." *Archives of Surgery*, 146 (2): 187-193.

Howard, David H., Guy David, and Jason Hockenberry. 2017. "Selective Hearing: Physician-Ownership and Physicians' Response to New Evidence." *Journal of Economics & Management Strategy*, 26 (1): 152-168.

Hubbard, Thomas N. 1998. "An Empirical Examination of Moral Hazard in the Vehicle Inspection Market." *RAND Journal of Economics*, 29 (2): 406-426.

Iizuka, Toshiaki. 2007. "Experts' Agency Problems: Evidence from the Prescription Drug Market in Japan." *RAND Journal of Economics*, 38 (3): 844-862.

Iizuka, Toshiaki. 2012. "Physician Agency and Adoption of Generic Pharmaceuticals." *American Economic Review*, 102 (6): 2826-2858.

Jensen, Michael C., and Kevin J. Murphy. 1990. "Performance Pay and Top-Management Incentives." *Journal of Political Economy*, 98(2): 225-264.

Kanter, Genevieve P., and Mark V. Pauly. 2019. "Coordination of Care or Conflict of Interest? Exempting ACOs from the Stark Law." *New England Journal of Medicine*, 380 (5): 410-411.

Koenig, Lane, and Qian Gu. 2013. "Growth of Ambulatory Surgical Centers, Surgery Volume, and Savings to Medicare." *Journal of Gastroenterology*, 108 (1): 10-15.

Lakdawalla, Darius, and Tomas Philipson. 2006. “The Nonprofit Sector and Industry Performance.” *Journal of Public Economics*, 90 (8-9): 1681-1698.

Lazear, Edward P. 2000. “Performance pay and productivity.” *American Economic Review*, 90(5): 1346-1361.

Lazear, Edward P. and Paul Oyer. 2010. “Personnel Economics”, in R. Gibbons and J. Roberts (eds), Handbook of Organizational Economics, North-Holland, Amsterdam.

Levitt, Steven D., and Chad Syverson. 2008. “Market Distortions When Agents Are Better Informed: The Value of Information in Real Estate Transactions.” *Review of Economics and Statistics*, 90 (4): 599-611.

Lin, Haizhen, Elizabeth L. Munnich, Michael R. Richards, Christopher M. Whaley, and Xiaoxi Zhao. 2023. “Private Equity and Healthcare Firm Behavior: Evidence from Ambulatory Surgery Centers.” *Journal of Health Economics*, 91 (September): 102801.

Lubell, Jennifer. “Cardiology Services: The Next Wave in ASCs?” OR Manager, 17 May 2019, available here: https://www.ormanager.com/cardiology-services-next-wave-ascs/.

Lynk, William J., and Carina S. Longley. 2002. "The effect of physician-owned surgicenters on hospital outpatient surgery." *Health Affairs*, *21*(4): 215-221.

McGuire, Thomas G. 2000. “Physician agency.” In Handbook of Health Economics, vol. 1, pp. 461-536. Elsevier.

MedPAC. 2019. “Ambulatory Surgical Center Services.” Medicare Payment Advisory Commission. Report to Congress: Medicare Payment Policy, Chapter 5: 127-151.

Mitchell, Jean M. 2010. “Effect of Physician Ownership of Specialty Hospitals and Ambulatory Surgery Centers on Frequency of Use of Outpatient Orthopedic Surgery.” *Archives of Surgery*, 145 (8): 732-738.

Munnich, Elizabeth L., and Stephen T. Parente. 2014. “Procedures Take Less Time at Ambulatory Surgery Centers, Keeping Costs Down and Ability to Meet Demand Up.” *Health Affairs*, 33(5): 764-769.

Munnich, Elizabeth L., and Stephen T. Parente. 2018. “Returns to Specialization: Evidence from the Outpatient Surgery Market.” *Journal of Health Economics*, 57: 147-167.

Munnich, Elizabeth L., and Michael R. Richards. 2022. “Long-Run Growth of Ambulatory Surgery Centers 1990-2015 and Medicare Payment Policy.” *Health Services Research*, 57 (1): 66-71.

Oyer, Paul, and Scott Schaefer. 2005. “Why do some firms give stock options to all employees? An empirical examination of alternative theories.” *Journal of Financial Economics*, 76(1): 99-133.

Paquette, Ian M., Douglas Smink, and Samuel R.G. Finlayson. 2008. “Outpatient Cholecystectomy at Hospitals Versus Freestanding Ambulatory Surgical Centers.” *Journal of the American College of Surgeons*, 206(2): 301-305.

Plotzke, Michael and Charles Courtemanche. 2011. “Does Procedure Profitability Impact Whether an Outpatient Surgery is Performed at an Ambulatory Surgery Center or Hospital?” *Health Economics*, 20(7): 817-830.

Prager, Elena, and Matt Schmitt. 2021. “Employer Consolidation and Wages: Evidence from Hospitals.” *American Economic Review*, 111(2): 397-427.

Prendergast, Canice. 1999. "The provision of incentives in firms." *Journal of Economic Literature*, 37(1): 7-63.

Richards, Michael R., Jonathan Seward, and Christopher Whaley. 2022. "Treatment Consolidation after Vertical Integration: Evidence from Outpatient Procedure Markets." *Journal of Health Economics*, 81 (January): 102569.

Robinson, James C., Timothy T. Brown, and Christopher Whaley. 2017. "Reference Pricing Changes the 'Choice Architecture' of Health Care for Consumers." *Health Affairs*, 36 (3): 524-530.

Rosenbaum, Sara, David A. Kindig, Jie Bao, Maureen K. Byrnes, and Colin O'Laughlin. 2015. "The Value of the Nonprofit Hospital Tax Exemption Was $24.6 Billion in 2011." *Health Affairs*, 34 (7): 1225-1233.

Sood, Neeraj and Chistopher M. Whaley. 2019. "Reverse Reference Pricing: Rewarding Patients for Reducing Medicare Costs." *Health Affairs* Blog, June 7, 2019. https://www.healthaffairs.org/do/10.1377/hblog20190604.509495/full/.

Strope, Seth A., Stephanie Daignault, John M. Hollingsworth, Zaujun Ze, John T. Wei, and Brent K. Hollenbeck. 2009. "Physician Ownership of Ambulatory Surgery Centers and Practice Patterns for Urologic Surgery: Evidence from the State of Florida." *Medical Care*, 47 (4): 403-410.

Weber, Ellerie. 2014. "Measuring Welfare from Ambulatory Surgery Centers: A Spatial Analysis of Demand for Healthcare Facilities." *The Journal of Industrial Economics*, 62(4): 591-631.

Whaley, Christopher M., and Timothy T. Brown. 2018. "Firm Responses to Targeted Consumer Incentives: Evidence from Reference Pricing for Surgical Services." *Journal of Health Economics*, 61: 111-133.

Whaley, Christopher M., Xiaoxi Zhao, Michael Richards, and Cheryl L. Damberg. 2021. "Higher Medicare Spending on Imaging And Lab Services After Primary Care Physician Group Vertical Integration." *Health Affairs*, 40 (5): 702–709.

Wolinsky, Asher. 1993. "Competition in a Market for Informed Experts' Services." *RAND Journal of Economics*, 24 (3): 380-398.

Yee, Christine A. 2011. "Physicians on Board: An Examination of Physician Financial Interests in ASCs Using Longitudinal Data." *Journal of Health Economics*, 30: 904-918.

MAIN RESULTS

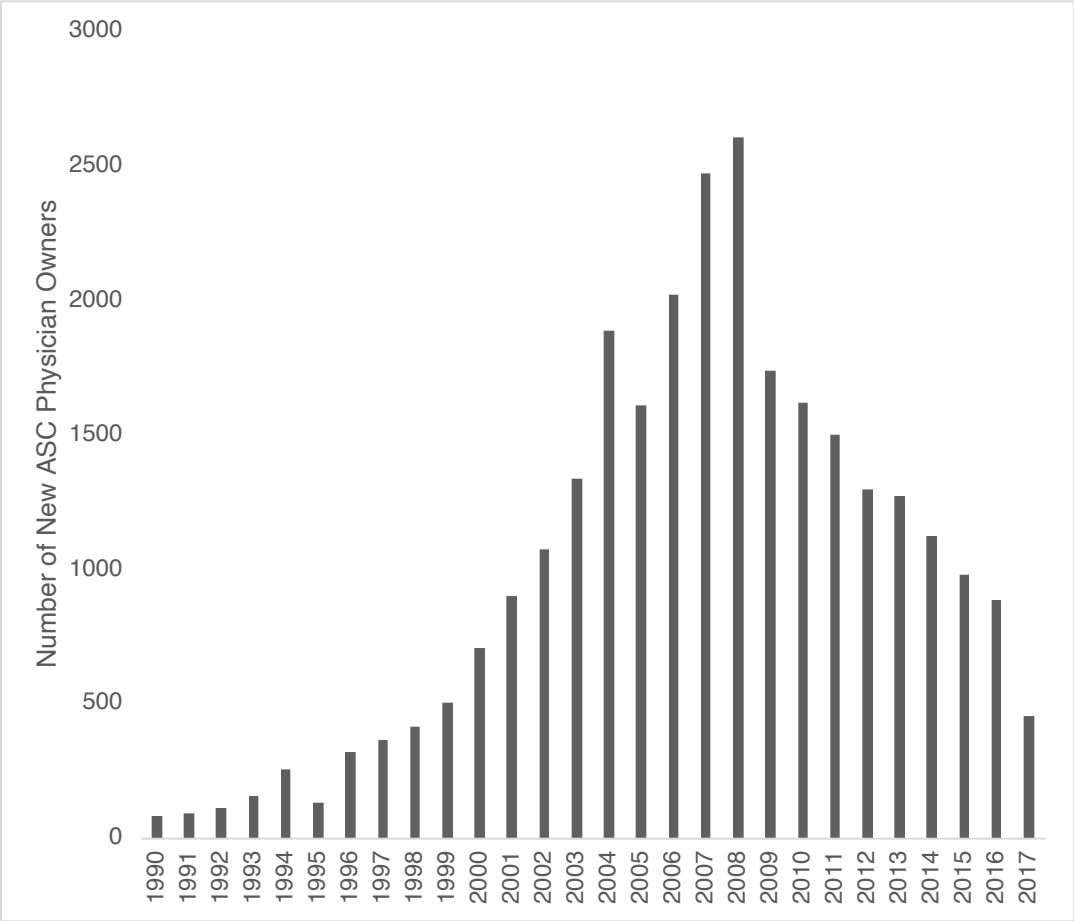


FIGURE 1. NATIONAL TREND IN PHYSICIAN-LEVEL FIRST-TIME ASC OWNERSHIP STAKES, 1990-2017

Notes: Data are from a CMS FOIA request and are described in Section II. The count captures the total number of first-time (i.e., novel) physician ASC owners in a given year; therefore, the counts are cross-sectional, rather than cumulative. We are only able to observe ASC firms that Medicare certified at least by January 1, 2005 or later. Those losing their certification prior to 2005 are not observed. Of note, in 1999, physician ASC owners were granted safe harbor status with respect to federal anti-kickback statutes.

TABLE 1—SUMMARY STATISTICS FOR STACKED ANALYTIC SAMPLE

	Treated ('New Owners')	Controls ('Never Owners')
ASC Volume	22.41 (37.90)	15.86 (68.32)
HOPD Volume	13.33 (20.00)	22.39 (32.75)
Total Volume	35.75 (40.70)	38.25 (71.66)
Unique Medicare Patients	29.50 (30.46)	31.28 (58.03)
Average Work RVUs per Case	14.00 (7.63)	11.22 (7.63)
Total Medicare Revenues	343,444 (665,721)	498,407 (930,936)
Patient Characteristics		
Age	74.44 (2.52)	74.75 (2.77)
Share Female	0.54 (0.19)	0.54 (0.22)
Share White	0.68 (0.22)	0.69 (0.23)
Share Low-income subsidy eligible	0.12 (0.14)	0.15 (0.17)
Share Dual eligible	0.11 (0.14)	0.13 (0.16)
HCC Risk score	1.35 (0.53)	1.66 (0.78)
Share of Patients Same-Day ED Visit	0.00 (0.02)	0.00 (0.02)
Share of Patients ED Visit 1-7 Days	0.01 (0.04)	0.02 (0.05)
Share of Patients Visit 8-30 Days	0.02 (0.05)	0.03 (0.06)
Unique Physicians (N)	741	17,069

Notes: Each physician is observed for 21 consecutive quarters in total. Measures are derived from the 100% Medicare claims, 2013-2019.

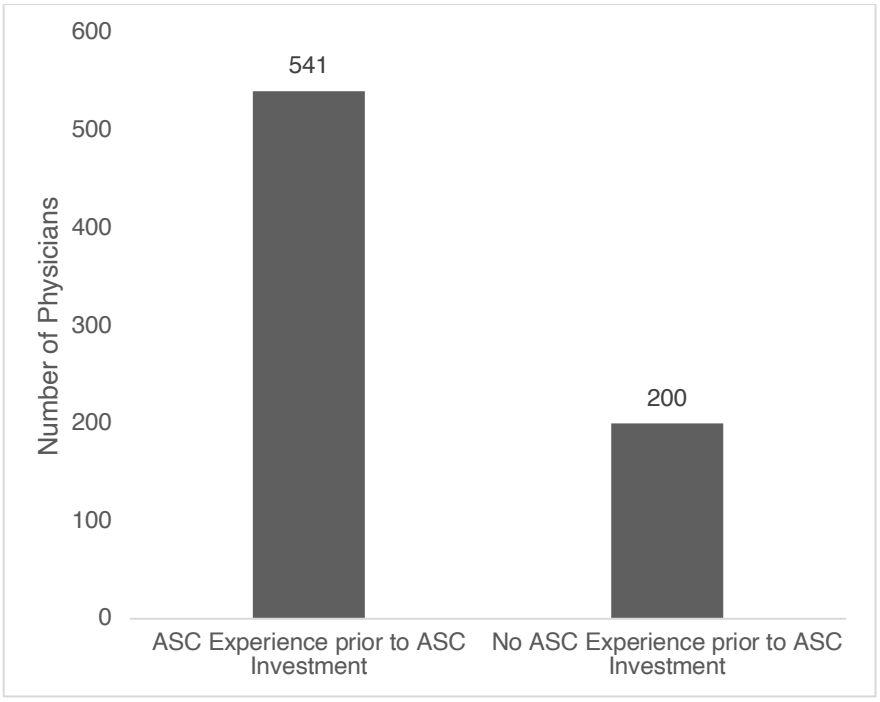


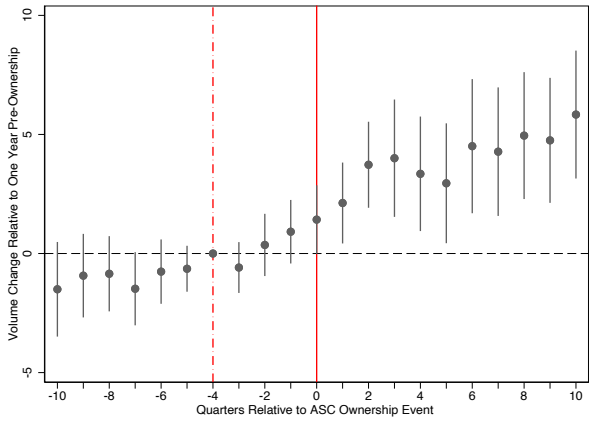
FIGURE 2. PRE-OWNERSHIP ASC EXPOSURE AMONG NEW OWNERS IN STACKED ANALYTIC SAMPLE

Notes: Restricts to the 741 physicians comprising treated group in 'stacked' difference-in-differences analytic sample.

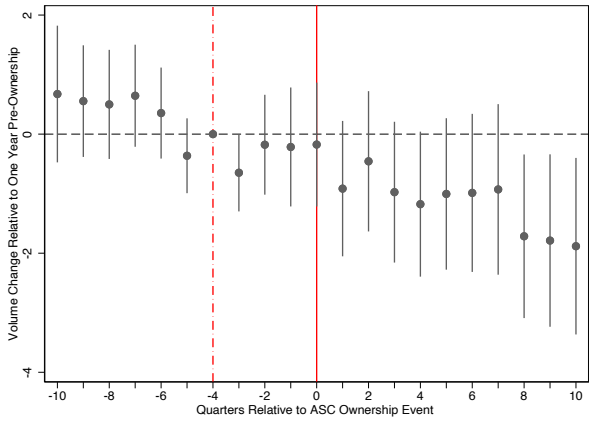
TABLE 2— DIFFERENCE-IN-DIFFERENCES ESTIMATES FOR ASC OWNERSHIP EFFECTS ON PHYSICAN CASELOAD ALLOCATIONS USING STACKED ANALYTIC SAMPLE

PANEL A: Pre-Period ASC Experience	ASC Procedure Volume	HOPD Procedure Volume	Any HOPD Use
	(1)	(2)	(3)
1[Treated x Post]	4.203***	–1.134**	–0.024***
	(1.002)	(0.518)	(0.008)
Physician Fixed Effects	Yes	Yes	Yes
Qtr-Year Fixed Effects	Yes	Yes	Yes
Unique Physicians	5,882	5,882	5,882
Observations (N)	123,522	123,522	123,522
Pre-Period Mean: Treated	25.75	11.72	0.75
Pre-Period Mean: Control	49.09	12.66	0.68
PANEL B: No Pre-Period ASC Experience	ASC Procedure Volume	HOPD Procedure Volume	Any HOPD Use
	(1)	(2)	(3)
1[Treated x Post]	6.675***	–5.498***	–0.040***
	(1.005)	(0.970)	(0.009)
Physician Fixed Effects	Yes	Yes	Yes
Qtr-Year Fixed Effects	Yes	Yes	Yes
Unique Physicians	11,928	11,928	11,928
Observations (N)	250,488	250,488	250,488
Pre-Period Mean: Treated	0.00	20.92	1.00
Pre-Period Mean: Control	0.00	25.92	1.00

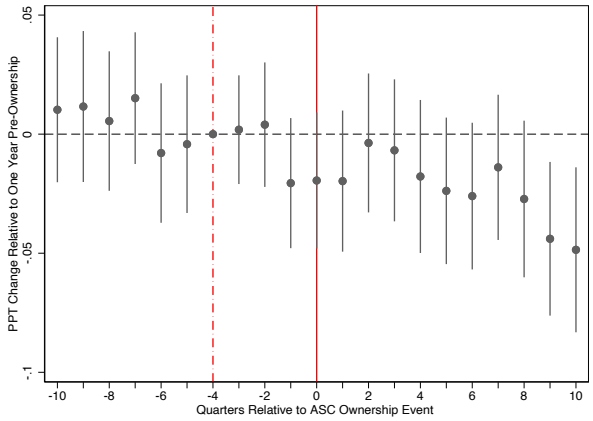
Notes: Analytic data are from 100% Medicare claims 2013-2019 and restricted to a balanced panel of physicians constructed for the 'stacked' difference-in-differences estimation (Section III). Standard errors clustered at the physician level, *** P value at 0.01, ** P value at 0.05.



ASC Procedure Volume



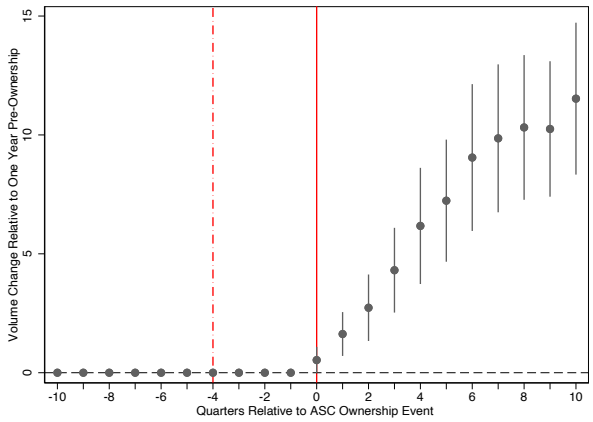
HOPD Procedure Volume



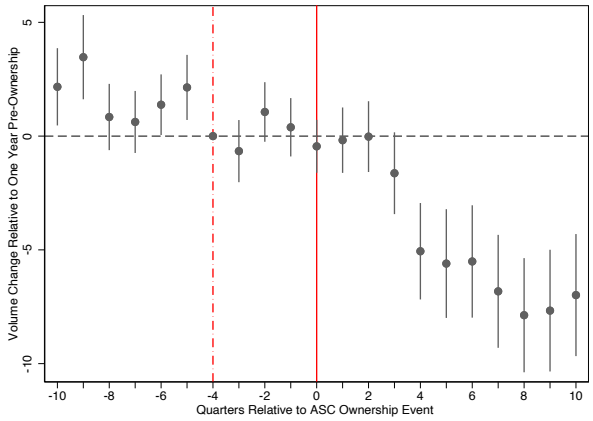
Any HOPD Use

FIGURE 3. STACKED DIFFERENCE-IN-DIFFERENCES EVENT STUDY RESULTS FOR NEW OWNERSHIP EFFECTS ON PHYSICAN CASELOAD ALLOCATIONS AMONG THOSE WITH PRE-OWNERSHIP ASC EXPERIENCE

Notes: Treatment and control group physicians are restricted to those with non-zero ASC procedures prior to the quarter of new ASC ownership (treatment) or randomly assigned anchor date (control). Regression is at the physician level and uses specification from Equation 2. "PPT" indicates percentage point change.



ASC Procedure Volume



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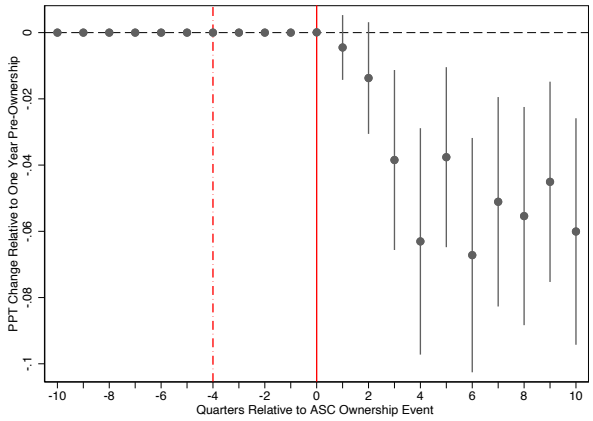

Any HOPD Use

FIGURE 4. STACKED DIFFERENCE-IN-DIFFERENCES EVENT STUDY RESULTS FOR NEW OWNERSHIP EFFECTS ON PHYSICAN CASELOAD ALLOCATIONS AMONG THOSE WITH NO PRE-OWNERSHIP ASC EXPERIENCE

Notes: Treatment and control group physicians are restricted to those with zero ASC procedures prior to the quarter of new ASC ownership (treatment) or randomly assigned anchor date (control). Regression is at the physician level and uses specification from Equation 2. "PPT" indicates percentage point change.

TABLE 3— DIFFERENCE-IN-DIFFERENCES ESTIMATES FOR ASC OWNERSHIP EFFECTS ON OVERALL MEDICARE MARKET ACTIVITY USING STACKED ANALYTIC SAMPLE

PANEL A: Pre-Period ASC Experience	Total Procedure Volume	Number of Patients	Avg. RVU per Case	Total Medicare Revenues (in logs)
	(1)	(2)	(3)	(4)
1[Treated x Post]	3.069***	2.392***	–0.341***	–0.120***
	(1.001)	(0.749)	(0.096)	(0.035)
Physician Fixed Effects	Yes	Yes	Yes	Yes
Qtr-Year Fixed Effects	Yes	Yes	Yes	Yes
Unique Physicians	5,882	5,882	5,882	5,882
Observations (N)	123,522	123,522	123,522	123,522
Pre-Period Mean: Treated	37.47	30.66	13.92	11.29
Pre-Period Mean: Control	61.74	51.43	12.62	11.41
PANEL B: No Pre-Period ASC Experience	Total Procedure Volume	Number of Patients	Avg. RVU per Case	Total Medicare Revenues (in logs)
	(1)	(2)	(3)	(4)
1[Treated x Post]	1.176	0.987	–0.353**	–0.312***
	(0.681)	(0.552)	(0.180)	(0.059)
Physician Fixed Effects	Yes	Yes	Yes	Yes
Qtr-Year Fixed Effects	Yes	Yes	Yes	Yes
Unique Physicians	11,928	11,928	11,928	11,928
Observations (N)	250,488	250,488	250,488	250,488
Pre-Period Mean: Treated	20.92	17.75	15.19	12.51
Pre-Period Mean: Control	25.92	20.58	10.68	12.32

Notes: Analytic data are from 100% Medicare claims 2013-2019 and restricted to a balanced panel of physicians constructed for the 'stacked' difference-in-differences estimation (Section III). Standard errors clustered at the physician level, *** P value at 0.01, ** P value at 0.05.

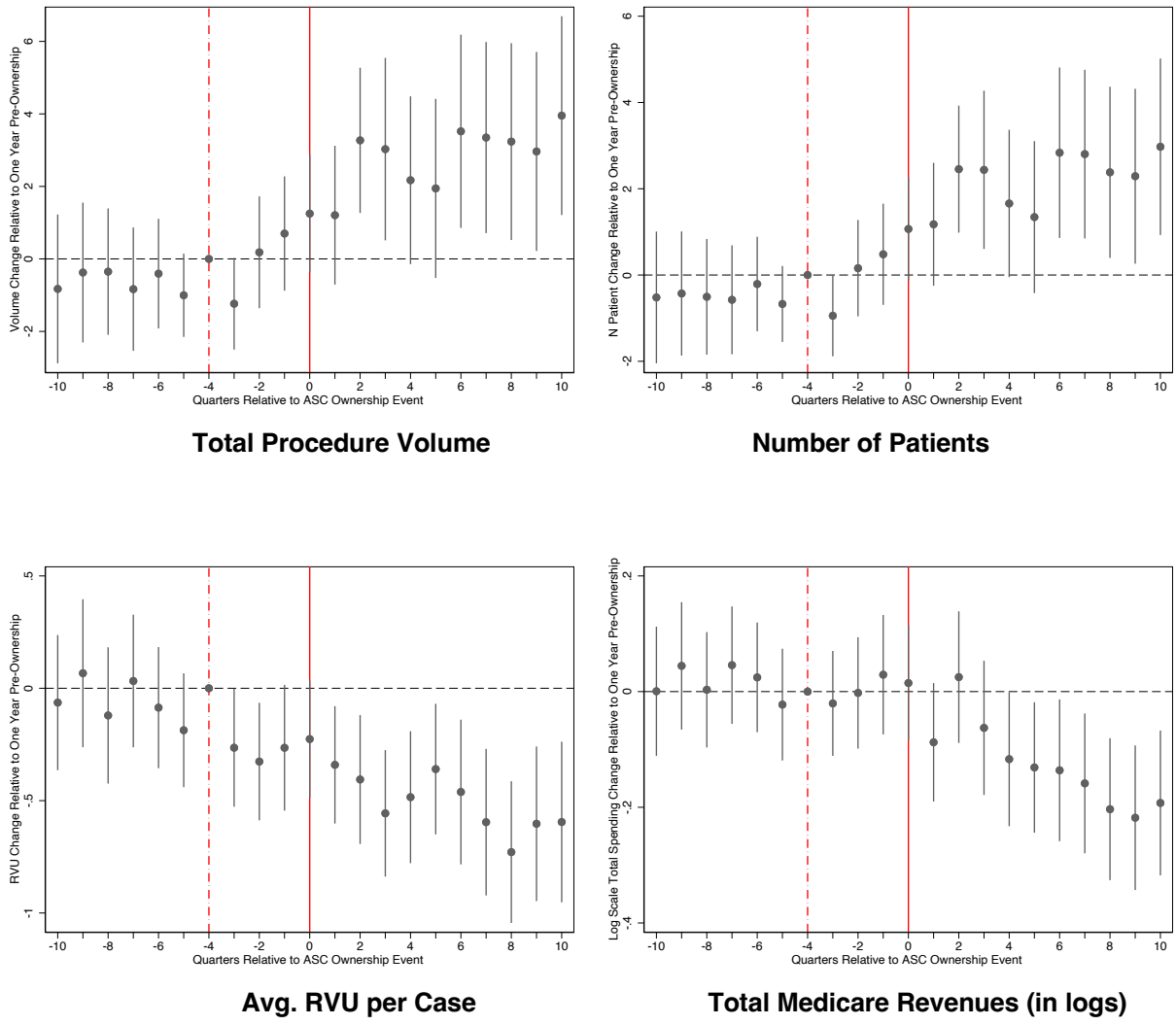

FIGURE 5. STACKED DIFFERENCE-IN-DIFFERENCES EVENT STUDY RESULTS FOR NEW OWNERSHIP EFFECTS ON MEDICARE MARKET ACTIVITY AMONG THOSE WITH PRE-OWNERSHIP ASC EXPERIENCE

Notes: Treatment and control group physicians are restricted to those with non-zero ASC procedures prior to the quarter of new ASC ownership (treatment) or randomly assigned anchor date (control). Regression is at the physician level and uses specification from Equation 2.

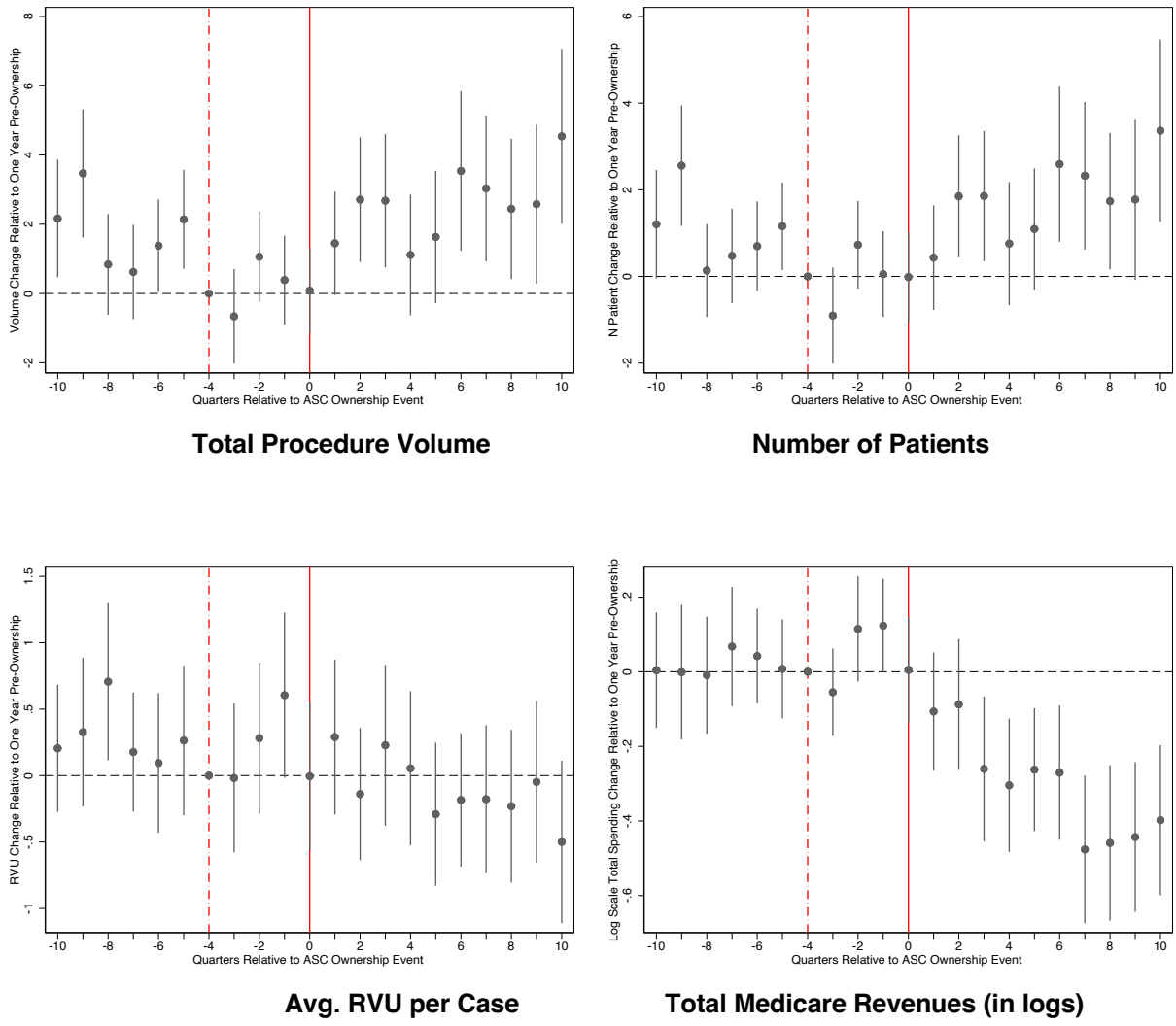

FIGURE 6. STACKED DIFFERENCE-IN-DIFFERENCES EVENT STUDY RESULTS FOR NEW OWNERSHIP EFFECTS ON MEDICARE MARKET ACTIVITY AMONG THOSE WITH NO PRE-OWNERSHIP ASC EXPERIENCE

Notes: Treatment and control group physicians are restricted to those with zero ASC procedures prior to the quarter of new ASC ownership (treatment) or randomly assigned anchor date (control). Regression is at the physician level and uses specification from Equation 2.

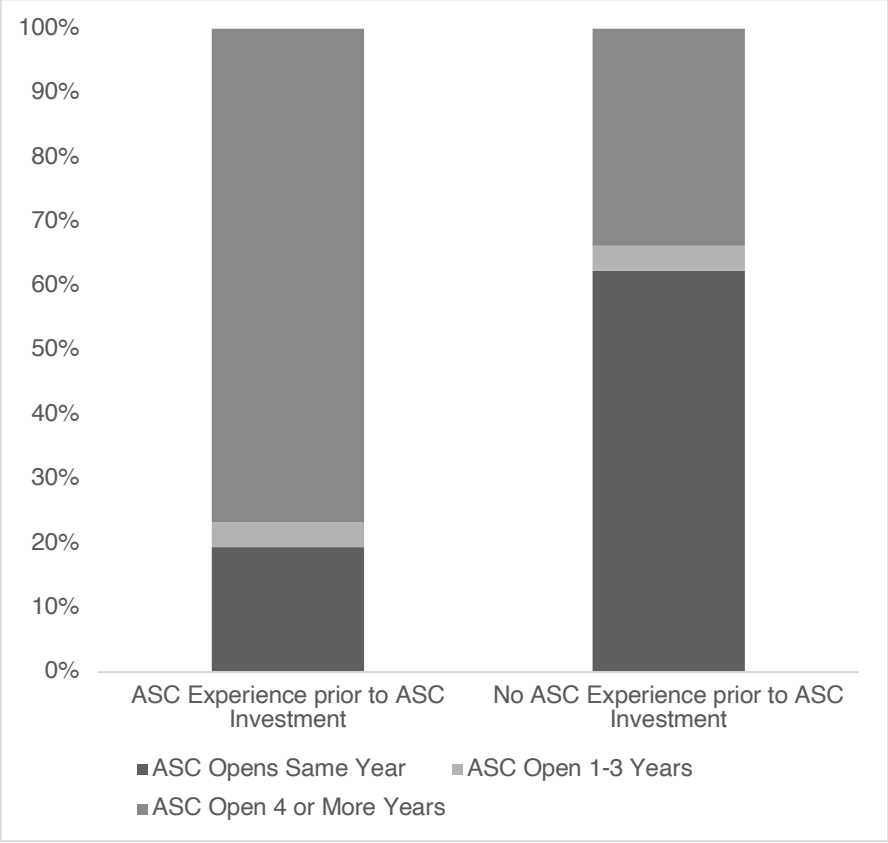

FIGURE 7. ASC OPERATIONAL TIME FOR FACILITIES WHERE OWNERSHIP STAKES ARE MADE AMONG THE TWO TREATMENT PHYSICIAN SUBGROUPS

Notes: The treatment samples include 571 NPIs and 200 NPIs, respectively, which correspond to our main 'stacked' difference-in-differences analyses (e.g., Tables 2-4). The specific ASC for each treatment group physician is listed in the FOIA data. PECOS ownership information is coupled with Medicare Provider of Services files to recover how long the facility has been open prior to the physician becoming a partial owner of the facility.

TABLE 4— DIFFERENCE-IN-DIFFERENCES ESTIMATES FOR ASC OWNERSHIP EFFECTS USING STACKED ANALYTIC SAMPLE WITH NO PRE-OWNERSHIP EXPERIENCE TREATMENT GROUP STRATIFIED BY ASC OPERATIONAL TIME

PANEL A: No Pre-Period ASC Experience + New ASC	ASC Procedure Volume	HOPD Procedure Volume	Any HOPD Use
	(1)	(2)	(3)
1[Treated x Post]	6.601***	–6.372***	–0.026***
	(1.521)	(1.562)	(0.010)
Physician Fixed Effects	Yes	Yes	Yes
Qtr-Year Fixed Effects	Yes	Yes	Yes
Unique Physicians	11,839	11,839	11,839
Observations (N)	248,619	248,619	248,619
Pre-Period Mean: Treated	0.00	24.09	1.00
Pre-Period Mean: Control	0.00	25.92	1.00

PANEL B: No Pre-Period ASC Experience + Established ASC	ASC Procedure Volume	HOPD Procedure Volume	Any HOPD Use
	(1)	(2)	(3)
1[Treated x Post]	7.744***	–5.880***	–0.065***
	(1.482)	(0.948)	(0.020)
Physician Fixed Effects	Yes	Yes	Yes
Qtr-Year Fixed Effects	Yes	Yes	Yes
Unique Physicians	11,800	11,800	11,800
Observations (N)	247,800	247,800	247,800
Pre-Period Mean: Treated	0.00	16.67	1.00
Pre-Period Mean: Control	0.00	25.92	1.00

Notes: Analytic data are from 100% Medicare claims 2013-2019 and restricted to a balanced panel of physicians constructed for the 'stacked' difference-in-differences estimation (Section III). Panel A restricts the treatment group to physicians with no ASC exposure prior to their ownership investments and with an ownership stake in an ASC that is Medicare certified in the same year (i.e., newly opened). Panel B restricts the treatment group to the no prior ASC exposure subgroup where the ASC with reported ownership stake has been open for at least one year (i.e., established ASCs). Standard errors clustered at the physician level, *** P value at 0.01, ** P value at 0.05.

TABLE 5—TESTING FOR ASC MARKET ENTRY EFFECTS AMONG NEVER ASC OWNERS USING STACKED ANALYTIC SAMPLE

	ASC Procedure Volume	HOPD Procedure Volume
	(1)	(2)
1[Treated x Post]	–0.124	0.933
	(0.086)	(1.010)
Physician Fixed Effects	Yes	Yes
Qtr-Year Fixed Effects	Yes	Yes
Unique Physicians	11,730	11,730
Observations (N)	246,330	246,330
Pre-Period Mean: Treated	0.00	15.34
Pre-Period Mean: Control	0.00	25.99

Notes: Analytic data are from 100% Medicare claims 2013-2019 and restricted to a balanced panel of physicians constructed for the 'stacked' difference-in-differences estimation (Section III). The analytic sample is restricted to physicians never holding an ASC ownership stake. The treatment group is comprised of physicians in the same specialty and practicing in the same geography (i.e., county) at the same time as the ASC owners with no prior ASC experience having ownership in facilities becoming Medicare certified in the same year as the ownership stake. Standard errors clustered at the physician level, *** P value at 0.01, ** P value at 0.05.

TABLE 6— DIFFERENCE-IN-DIFFERENCES ESTIMATES FOR ASC OWNERSHIP EFFECTS ON QUALITY OF CARE USING STACKED ANALYTIC SAMPLE

PANEL A: Pre-Period ASC Experience	Share of Patients with Same-Day ED Visit	Share of Patients with ED Visit 1-7 Days	Share of Patients with ED Visit 8-30 Days
	(1)	(2)	(3)
1[Treated x Post]	0.000196	–0.000018	0.000367
	(0.000281)	(0.000660)	(0.000841)
Physician Fixed Effects	Yes	Yes	Yes
Qtr-Year Fixed Effects	Yes	Yes	Yes
Unique Physicians	5,882	5,882	5,882
Observations (N)	123,522	123,522	123,522
Pre-Period Mean: Treated	0.003	0.01	0.02
Pre-Period Mean: Control	0.003	0.01	0.02

PANEL B: No Pre-Period ASC Experience	Share of Patients with Same-Day ED Visit	Share of Patients with ED Visit 1-7 Days	Share of Patients with ED Visit 8-30 Days
	(1)	(2)	(3)
1[Treated x Post]	–0.00110	–0.00106	–0.000474
	(0.000631)	(0.00174)	(0.00178)
Physician Fixed Effects	Yes	Yes	Yes
Qtr-Year Fixed Effects	Yes	Yes	Yes
Unique Physicians	11,928	11,928	11,928
Observations (N)	250,488	250,488	250,488
Pre-Period Mean: Treated	0.005	0.02	0.03
Pre-Period Mean: Control	0.004	0.02	0.04

Notes: Analytic data are from 100% Medicare claims 2013-2019 and restricted to a balanced panel of physicians constructed for the 'stacked' difference-in-differences estimation (Section III). Standard errors clustered at the physician level, *** P value at 0.01, ** P value at 0.05.

TABLE 7— DIFFERENCE-IN-DIFFERENCES ESTIMATES FOR ASC OWNERSHIP EFFECTS ON HOPD PATIENT SELECTION USING STACKED ANALYTIC SAMPLE

PANEL A:
Pre-Period ASC Experience

	Avg. Age	Share Dual Eligible	Share Female	Avg. HCC Risk Score	Share Qualifying for Low-Income Subsidies	Share White
	(1)	(2)	(3)	(4)	(5)	(6)
1[Treated x Post]	0.0281	0.00141	0.00975	0.0299	0.00155	0.00304
	(0.0879)	(0.00399)	(0.00611)	(0.0201)	(0.00432)	(0.00595)
Physician Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Qtr-Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Unique Physicians	4,662	4,662	4,662	4,660	4,662	4,662
Observations (N)	83,794	83,794	83,794	83,737	83,794	83,794
Pre-Period Mean: Treated	74.95	0.13	0.55	1.59	0.15	0.69
Pre-Period Mean: Control	74.94	0.13	0.54	1.63	0.15	0.68

PANEL B:
No Pre-Period ASC Experience

	Avg. Age	Share Dual Eligible	Share Female	Avg. HCC Risk Score	Share Qualifying for Low-Income Subsidies	Share White
	(1)	(2)	(3)	(4)	(5)	(6)
1[Treated x Post]	0.0755	0.00920**	–0.00423	0.0588***	0.0114**	0.000173
	(0.102)	(0.00432)	(0.00596)	(0.0211)	(0.00475)	(0.00607)
Physician Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Qtr-Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Unique Physicians	11,928	11,928	11,932	11,932	11,928	11,928
Observations (N)	250,055	250,055	250,138	250,102	250,055	250,055
Pre-Period Mean: Treated	74.91	0.11	0.49	1.55	0.13	0.707
Pre-Period Mean: Control	74.94	0.14	0.53	1.81	0.16	0.68

Notes: Analytic data are from 100% Medicare claims 2013-2019 and restricted to a balanced panel of physicians constructed for the 'stacked' difference-in-differences estimation (Section III). All outcomes are relevant to the physician's HOPD patients only. Difference-in-differences estimations therefore capture changes in HOPD patient mix following ASC ownership stake. Standard errors clustered at the physician level, *** P value at 0.01, ** P value at 0.05.