Stress Testing Cardiac Care Markets through Deregulation

By Daniel Arnold, Michael R. Richards, Yashaswini Singh, and Christopher M. Whaley*

The diffusion of technological innovation depends on incentives, regulations, and firms' strategic behaviors. We study these intersections within cardiac procedure markets following Medicare's expansion of non-hospital facility options for treatment, enabled by clinical advancements. State-level regulations restrain federal pro-competition policy. Where market entry occurs, business stealing is concentrated among the lowest cost treatment settings, rather than high-cost hospitals—increasing Medicare spending by approximately $2.5 million. Medicare policy also generates externalities for untargeted procedures and other payers, except when hospitals and physicians are vertically integrated. Federal rulemaking interacts with and is mitigated by complex market dynamics—including in potentially unanticipated ways. (*JEL* H44, H51, H75, I11, I18)

* Arnold: Brown University, Email: daniel_arnold@brown.edu; Richards: Cornell University and NBER, Email: michael.richards@cornell.edu; Singh: Brown University, Email: yashaswini_singh@brown.edu; Whaley: Brown University, Email: christopher_whaley@brown.edu.

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Technological innovation is a known source of economic progress and consumer welfare gains. However, the diffusion and ultimate impact of a given innovation will crucially depend on prevailing price signals and regulations facing private firms, as well as the strategic behavior of firms within the relevant industry. Weak financial incentives and/or an unaccommodating regulatory environment can suppress, if not prevent, the spread of a technological advancement to market suppliers as well as end-consumers. Conversely, strong incentives and favorable policies can spur the adoption and accessibility of new innovations. However, in either scenario, pre-existing as well as reactive strategies by affected firms can amplify or undermine any changes to incentives or policy.

While these factors can be influential for a host of goods and services, the over $5 trillion US healthcare sector offers a salient example of where these forces collide. Technological advancement in medical care delivery can dramatically improve patient experiences and outcomes as well as shape spending trajectories (Smith, Newhouse, and Freeland 2009; Chandra and Skinner 2012; Cutler and Klarnet 2026; Glied and Lui 2026). However, the mixed economy structure allows public sector pricing and policy—especially rulemaking by the large federal public insurance program (i.e., Medicare)—to strongly influence the incentives for intervention discovery and the adoption of new treatment delivery models (e.g., see Finkelstein 2004; Acemoglu *et al*. 2006; Acemoglu and Finkelstein 2008; Blume-Kohout and Sood 2013; Budish, Roin, and Williams 2015; Freedman, Lin, and Simon 2015; Yurukoglu, Liebman, and Ridley 2017; Horn, Sacarny, and Zhou 2022). The downstream consequences of such pricing and policy decisions are also not confined to the Medicare market. The size of the program, coupled with providers' own preferences and time constraints, can cause a Medicare-specific decision to spillover onto the care delivery experience and spending for non-Medicare patients (e.g., Yip 1998; Finkelstein 2007; Baicker, Chernew, and Robbins 2013; Clemens and Gottlieb 2017; Einav *et al*. 2020; Richards, Seward, and Whaley 2021; Chen *et al*. 2022; Geruso and Richards 2022; Barnett, Olenski, and Sacarny 2023).[1] Even within the Medicare program, a targeted policy can extend to untargeted procedures received by other Medicare beneficiaries.

[1] Of note, private insurers with sufficient market dominance can likewise generate externalities for the public insurance segments (e.g., see Richards and Tello-Trillo 2019).

The effects of Medicare rulemaking are further complicated by the joint production of care delivery between provider clinicians (e.g., physicians) and provider facilities (e.g., hospitals), which typically have separate financial incentives and regulations. Policy decisions for the latter (facilities) can therefore expand or constrain the treatment options available to the former (clinicians). Regulations also occur at both the federal and state levels—perhaps leading to policy interactions and potentially conflicts. Moreover, the net effects of a healthcare rule change for facilities are inevitably shaped by the behavior of incumbent firms and the availability of new market entrants, which downstream clinical providers and patients tend not to control.

An area with some of the most active regulatory changes influencing patients' access to treatment innovations is outpatient procedural and surgical care. Due to new medical technologies and clinical process improvements (e.g., minimally invasive surgical techniques and in-home recovery options), a growing share of procedural care is now safely performed in non-hospital-based outpatient settings—with freestanding ambulatory surgery centers (ASCs) being a common destination. Alternative (non-hospital) settings, such as ASCs, typically promote superior patient experience at lower costs for insurers and their enrollees. But that does not mean that treatment setting substitution is without friction. Policy can create barriers for non-hospital options in response to perceived patient safety concerns and/or regulatory capture. Affected physicians may consequently lack full setting flexibility when planning treatment, at least not until a deregulation event occurs.

Medicare is a prominent source of this type of regulatory restriction and frequently policy reversal as well. We can see this concretely in the cardiac procedure space. Cardiac disease remains one of the leading causes of death in the US, but over time, providers have accumulated more clinical tools and options to intervene for these patients.[2] However, Medicare regulatory permissions have not always kept pace with these evolutions in clinical capabilities. As a key example, starting in January 2019, the Centers for Medicare & Medicaid Services (CMS) expanded the list of cardiovascular procedures that can be reimbursed in ASC settings. The eleven newly approved procedures for ASCs reflect clinical variations of cardiac catheterization—a set of procedures to visualize blood flow through the heart, identify and diagnosis issues, and facilitate

[2] National mortality statistics are available from the Center for Disease Control and Prevention (CDC) and can be found here: https://www.cdc.gov/nchs/fastats/leading-causes-of-death.htm.

intervention to improve flow and cardiac function (CMS 2019).[3] These specific cardiac procedures accounted for 900,000 Medicare outpatient cases and nearly $180 million in Medicare physician payments in 2018 alone.[4]

While cardiac catheterization is common and relevant to an elderly patient population, the public insurer's rules prior to 2019 significantly lagged recent technological advancements for these interventions (described in Section IB). Changing federal policy was therefore of interest to cardiac physicians and the ASC industry. Importantly, removing the barrier in 2019 represented a sizable shift in Medicare's view of what is permissible for cardiac care delivery outside of a hospital setting and presented an opportunity for greater efficiency for the public insurance program—a common rationale given by federal policymakers and program administrators in support of such deregulations. Yet, the direct and indirect market ramifications of this policy decision are currently unknown.

In this paper, we use the 2019 Medicare deregulation policy change to study the complex intersection between provider incentives, federal and state policy, and firms' strategic market behavior via a series of difference-in-differences analyses. We comprehensively assess the policy change's impact on physicians' cardiac catheterization treatment setting choices and spending implications as well as spillover effects onto other Medicare outpatient procedures and non-Medicare outpatient care. We do so by first leveraging national Medicare claims data, which we then complement with all-payer discharge records from Florida—home to a sizable Medicare population and aggressive ASC entry into cardiac care markets following the Medicare rule change.

Our first DD estimations with the national Medicare claims data test for a mediating effect of state-level Certificate of Need (CON) regulations.[5] We find that these barriers to entry heavily

[3] The eleven specific Healthcare Common Procedure Coding System (HCPCS) codes ranged from 93451 to 93461. HCPCS codes are a type of code used by providers and insurers to bill for individual services and procedures. Other related codes include Current Procedural Terminology (CPT) codes and, for inpatient care, Diagnosis Related Group (DRG) codes.

[4] Authors' calculations from 20% traditional Medicare Part B claims data (fully described in Section II).

[5] Certificate of Need (CON) policies require state regulatory approval to build or expand health care facility capacity. CON policies are in effect in approximately half of US states and vary in scope of facilities (e.g., hospitals, specialty hospitals, ASCs, imaging centers, etc.) and regulatory approval. CON laws and related economics research are described in Section III.

restrain the ASC industry's movement into the cardiac catheterization market—revealing the importance of state policy in shaping the downstream impact of a federal health policy intervention. We then leverage the observed ASC entry into cardiac catheterization delivery to study its direct effects on healthcare providers' outpatient treatment choices. Firm entry is important in this context because ASCs are highly specialized and the technical inputs for cardiac catheterization are also highly specialized, so few incumbent ASCs would likely be equipped to begin offering the procedure.[6]

We quantify the effects of local market entry shock using a 'stacked' differences-in-differences (DD) design that exploits the variation in the timing and location of entry. We find that markets exposed to ASC entry sharply increase their use of ASCs to perform the targeted procedures for Medicare beneficiaries once the option becomes available. However, this first-order effect does not result in a clear substitution away from hospital-based outpatient settings. Understanding this empirical pattern requires incorporating a key market feature. Physicians performing cardiac catheterization are able to do so across *three eligible sites*: ASCs, hospital outpatient departments (HOPDs), *and* office-based labs (OBLs). Physicians were only permitted to rely on HOPD and OBL settings for these Medicare procedures prior to 2019. Following the Medicare rule change, case losses are concentrated among OBLs—not HOPDs. The built-in reimbursement disparities (high-to-low) between HOPDs, ASCs, and OBLs means that each cardiac catheterization case migrating from an OBL to an ASC leads to higher per procedure spending (~$550) by Medicare. Moreover, approximately half of the market entry we observe appears to reflect OBL-to-ASC conversions, rather than *de novo* facility creation. This strategic behavior can leave local competition and care access unchanged while allowing providers to extract higher (ASC) payments for the same care previously delivered in an OBL.[7] Subsequent

[6] Recent descriptions of the ASC industry, including the breakdown of specialization, can be found within recent MedPAC reporting. Available here: https://www.medpac.gov/wp-content/uploads/2026/03/Mar26_Ch11_MedPAC_Report_To_Congress_SEC.pdf. Various industry and consulting reports detail the extensive specialty equipment required as well, e.g., see here: https://blog.cmecorp.com/essential-healthcare-equipment-for-cath-labs.

[7] In theory, OBL-to-ASC substitution could improve quality, but we find no strong evidence that it does so over the initial post-policy years (Section IVC).

calculations suggest that Medicare expenditures increased by roughly $2.5 million per year due to these either unanticipated or underestimated policy responses.

After documenting the first-order deregulation effects, we next examine potential spillovers within and beyond the Medicare market. We again exploit ASC market entry shocks to implement stacked DD estimations. We show that cardiac care physicians exposed to ASC market entry increase their use of ASC settings for Medicare procedures not targeted by the policy change as well. They tend to do so without reducing volumes in other settings (i.e., HOPDs or OBLs), which implies a higher Medicare procedure volume overall—though the aggregate increase is small (approximately 0.5% over baseline levels). Our all-payer data from Florida further demonstrate spillovers onto affected physicians' non-Medicare outpatient procedure volumes (i.e., the Medicare Advantage and commercially insured markets). We additionally find that the direct and indirect effects on cardiac specialists' treatment setting decisions are largely driven by an extensive margin behavior change following ASC market entry. These physicians are roughly 5 to 10 percentage-points more likely to perform any procedure for a given payer in an ASC immediately after an ASC setting becomes available.

We conclude our empirics by examining mediating roles for hospital-physician consolidation. The share of physicians employed by a hospital or health systems has more than doubled over the past two decades and generated concerns over physician agency.[8] The contemporary trend toward vertical integration in healthcare markets could align previously disparate incentives between facilities and clinicians; however, such business strategies may be at odds with other policymaker objectives. In the cardiac catheterization context, local hospital ownership of physician practices (via direct employment) could weaken incentives for ASC entry, and even in the presence of ASC entry, restrain employed physicians' willingness to exercise new ASC options.

Physician-level triple differences (DDD) analyses leveraging pre-policy vertical integration status reveal that hospital-employed physicians do not take up the new opportunity to perform targeted or untargeted cases within the rival (ASC) industry. Their non-response to the

[8] For example, see Richards and Whaley (2026) for a review of and citations linked to vertical integration trends in US healthcare.

deregulatory action is true for traditional Medicare, Medicare Advantage, and commercially insured patients alike. Supplementary analyses demonstrate that newly becoming vertically integrated reduces cardiac specialists' use of ASC settings on the intensive and extensive margins as well—consistent with Richards, Seward, and Whaley (2022)—and there is suggestive evidence that post-deregulation ASC entry encourages competing hospitals to employ more cardiac care physicians over time.

Taken together, our comprehensive collection of findings makes several important contributions. Our empirics demonstrate that Medicare rulemaking for procedural and surgical care is binding and has wide-reaching influence. Physicians' outpatient treatment setting choices are impacted not only for care targeted by a given Medicare policy but also for other Medicare as well as non-Medicare patients—aligning with recent research in this emerging area (e.g., Richards, Seward, and Whaley 2021; Geruso and Richards 2022) and broader work on Medicare spillover effects (e.g., Yip 1998; Finkelstein 2007; Baicker, Chernew, and Robbins 2013; Clemens and Gottlieb 2017; Einav *et al*. 2020; Chen *et al*. 2022; Barnett, Olenski, and Sacarny 2023). In our analytic setting, these Medicare policy externalities appear large enough to prevent the affected physicians from ever utilizing an ASC treatment setting option for any of their patients until Medicare permits the change. These empirical patterns add to the economic understanding of physician practice variation (e.g., see Newhouse and Marquis 1978; Glied and Graff Zivin 2002; Frank and Zeckhauser 2007; Epstein and Nicholson 2009; Molitor 2018; Cutler *et al*. 2019; Richards and Tello-Trillo 2019, among others). From a policy perspective, allowing greater market entry for cardiac catheterization has mixed implications for the Medicare program. Efficient setting substitution for care delivery (i.e., HOPD-to-ASC) is not clearly evident in the short-run. Instead, Medicare spending is higher as these procedures predominantly move out of OBLs and into ASCs. Elevated Medicare outlays would need to be coupled with downstream health or care quality improvements to justify a greater tax burden tied to the public insurer. We do not find evidence of such offsetting benefits. The presence of multiple substitution margins, with opposite Medicare spending implications, also underscores how site-neutral reimbursements could better incentivize optimal care delivery when the treatment facility choice set expands. And finally, the extent and speed of Medicare policy impact is mediated by state-level regulations as well as organizational dynamics (e.g., vertical integration) within and across provider industries. Federal policymakers

and public insurer administrators will need to keep such complexity in mind, as both state healthcare policy and provider ownership structures continue to evolve.

The remainder of the paper begins with an overview of our specific healthcare market context (Section I) and corresponding analytic data (Section II). Section III describes and tests the influence of state-level CON regulations on the downstream impact of the federal Medicare rule change for cardiac catheterization delivery. Within Sections IV through VI, we systematically examine the direct effects of ASC entry into cardiac care markets. Section VII concludes.

I. Outpatient Surgical Markets

A. *Industry Rivals*

More medical services are shifting outside of the inpatient setting over time, especially with respect to low-to-medium risk ("same day") procedures that do not require an overnight hospital stay (Munnich and Parente 2014; Baker, Bundorf, and Kessler 2019). This long-running trend poses a challenge for much of the "brick-and-mortar" hospital industry since inpatient delivery of care tends to generate more revenue per case, and the outpatient market landscape is becoming more crowded with competing hospital and non-hospital treatment setting options. Currently, outpatient procedural and surgical care commonly take place in one of three key facility settings: hospital outpatient departments (HOPDs), ambulatory surgery centers (ASCs), or physician office-based labs (OBLs)—with the scope of eligible procedures narrowing when moving from HOPD to ASC to OBL settings. While joint ventures and common ownership structures can occur (e.g., see Richards and Whaley 2026), firms from each industry often compete against each other with respect to their overlapping service offerings.

ASCs main value proposition when competing with HOPDs is improved consumer experience and generally less expensive care for payers and patients (Paquette *et al*. 2008; Grisel and Arjmand 2009; Munnich and Parente 2014; Weber 2014; Munnich and Parente 2018; Aouad, Brown, and Whaley 2019; Carey and Mitchell 2019; Sood and Whaley 2019; Maughan *et al*. 2025). Relative to ASCs, HOPDs can often handle more complex care and utilize more advanced medical technology but may also have a higher price point for a given service common to both treatment settings. Over time, hospitals have been facing increasing competition with ASCs,

specifically (e.g., see Munnich and Richards 2022), and are known to lose market share and revenue to these rival firms (Bian and Morrisey 2007; Courtemanche and Plotzke 2010; Carey, Burgess, and Young 2011; Hollenbeck *et al*. 2015). Evidence suggests that HOPDs may even be forced to lower their procedural prices in response to greater ASC competitive pressure (Carey 2017; Whaley and Brown 2018; Baker, Bundorf, and Kessler 2019).

Beyond intensifying competition over time, outpatient surgery markets are also characterized by a principal-agent relationship (e.g., see Munnich *et al*. 2026). Physicians hold considerable sway over medical treatment decisions, including treatment setting, which can have profound impacts on overall medical spend (Arrow 1963; Dranove and White 1987; McGuire 2000; Gabel *et al*. 2008; Hollingsworth *et al*. 2010; Mitchell 2010; David and Neuman 2011; Plotazke and Courtemanche 2011; Yee 2011; Howard, David, and Hockenberry 2017; Munnich *et al*. 2026). Incentive structures directly facing physicians can tilt their medical decision-making in favor of a particular outpatient facility option (e.g., Richards, Seward, and Whaley 2022; Munnich *et al*. 2026), but even in the absence of private incentives or organizational pressure, physicians' options are often constrained by payer-specific rulemaking that prohibits a particular option for certain patients. And in the presence of common treatment styles across similar patients belonging to other payers—due to physician preferences, switching costs, and/or other constraints—such payer-generated rules can spillover to other patient-payer combinations.

B. *Clinical Advancements for Cardiac Catheterization*

Cardiac catheterization is a minimally invasive procedure in which a physician threads a catheter through a blood vessel up to the arteries surrounding the heart. Once in place, the catheter allows the physician to inject contrast dye and capture real-time x-ray images ("angiography") that reveal blockages or other abnormalities in blood flow to the heart. If diagnostic catheterization reveals a blockage, the physician can often address it during the same procedure using percutaneous coronary intervention (PCI), commonly known as "angioplasty" or "stenting".

Two recent clinical developments make it possible to move cardiac catheterization out of the traditional hospital setting and eventually into outpatient ASC settings. The first development concerns the surgical-backup requirement. Early angioplasty carried a meaningful risk that a

patient would need emergency coronary artery bypass graft (CABG) surgery if the procedure went wrong, so clinical guideline committees required that elective procedures be performed only in facilities with an on-site cardiac surgery program standing by. By the late 2000s, improvements in stent technology and drug regimens drove down the rate of emergency CABG, and by the late 2000s, large registry studies found no meaningful difference in outcomes between hospitals with and without on-site surgical backup, for either primary or elective procedures, once case-mix differences were accounted for (Kutcher *et al*. 2009). Accordingly, in 2014, guideline formation bodies concluded that PCI performed at hospitals lacking on-site surgical backup carried no increased risk of mortality or emergency bypass surgery (Dehmer *et al*. 2014).

The second development was the "*wrist revolution*" in surgical techniques. This clinical innovation entailed a shift from traditional femoral (groin) to radial (wrist) artery access, which enabled same-day patient discharge—a key prerequisite for performing cardiac catheterizations in ASCs or OBLs. Femoral access historically necessitated extended bed rest due to risk of post-procedure bleeding and vascular complications. Radial access, by contrast, relies on a smaller artery for the entry point, allowing patients to sit up, walk, and often go home on the same day as receiving the cardiac catheterization. Follow-on research demonstrated that radial access reduced vascular complications and local bleeding relative to femoral access while maintaining similar procedural success (Ferrante *et al*. 2016).

In combination, these care delivery developments cleared the primary objections to performing cardiac catheterization outside a traditional hospital setting, leaving payment policy, rather than clinical capabilities, as the binding constraint on where these procedures could be performed.

C. *Medicare Rules and Reimbursements for Cardiac Catheterization*

Medicare payment policy has lagged well behind advancements in clinical capabilities described in Section IB. Prior to 2019, CMS reimbursed cardiac catheterization only in HOPDs and OBLs. Medicare's Ambulatory Surgical Center Covered Procedures List contained no cardiac catheterization codes. Starting in January 2019, CMS added 11 diagnostic catheterization codes to

the ASC list of reimbursable codes. CMS also extended reimbursement to PCI procedures in ASC settings in 2020—effectively a follow-on deregulation policy.

HOPDs and ASCs are both paid under the Outpatient Prospective Payment System (OPPS), with both facility types receiving a facility fee intended to cover overhead on top of the professional fee that the rendering physician bills separately. Because they are considered part of a physician's office rather than a licensed surgical facility, OBLs receive no separate facility fee. OBLs are consequently paid solely through the Physician Fee Schedule. This distinction matters for our analysis, since it means a procedure moving from an OBL to an ASC does more than relocate setting choice. It adds a facility fee component that did not previously exist for that procedure and therefore mechanically raising what Medicare pays without necessarily changing the underlying quality or complexity of the clinical care delivered.

Within Figure 1, we can see the Medicare spending implications from shifting a relevant cardiac catheterization procedure from one outpatient setting type to another according to the 2025 fee schedule. Substituting an ASC for a HOPD can reduce Medicare's obligations by approximately half. Likewise, moving from an ASC to an OBL can again cut Medicare's per-procedure expense by roughly 50%.

II. Data

A. *National Medicare Claims Data*

Our national data come from a 20% sample of traditional Medicare Part B claims data covering 2017-2023 and spanning all 50 US states and Washington DC. These transaction data allow us to observe the facility location, procedure(s) delivered to patients, rendering physician, and the specific outpatient facility of interest: ASC, HOPD, or OBL. Besides offering national scope to the analyses, we benefit from the Medicare claims data that specifically allow us to capture procedural activity within OBLs—which is unobserved in the Florida discharge data (discussed next) and other discharge database sources, as far as we are aware. We also primarily aggregate our Medicare transaction data to the county-level to approximate a 'market-level' analyses for these outpatient procedural services, with the exception in Section III when we focus on mediating roles for state-

level policy and Section VI when we explore the roles of physician-level vertical integration status on ASC use.[9]

We identify cardiac catheterization procedures using eleven HCPCS codes: 93451–93461. In 2018, these codes accounted for 179,927 procedures and $35.7 million in Medicare physician/professional payments in our 20% sample, implying approximately 900,000 procedures and $179 million in Medicare physician/professional payments nationwide after scaling to the full traditional Medicare fee-for-service population. We identify PCI procedures using HCPCS codes 92920, 92921, 92928, 92929, C9600, and C9601. To capture broader procedural activity among cardiologists and interventional cardiologists, we also construct a measure of other cardiology procedure encounters using BETOS procedure codes. Specifically, we define these as beneficiary-date-county-setting encounters with at least one BETOS "P" procedure line but no cardiac catheterization or PCI code on the same encounter. This definition allows us to distinguish cardiac catheterization and PCI procedure volume from broader non-catheterization, non-PCI procedural encounters.

B. *Florida All-Payer Discharge Data*

Our second source of analytic data comes from the Florida Agency for Health Care Administration (AHCA). These quarterly data provide the universe of outpatient procedural and surgical care episodes within HOPDs and ASCs from 2018 through 2023 across all payers. The latter attribute is key to formally test for causal Medicare policy effects on other (non-Medicare) patient-payer combinations. Florida is also a populous state that is home to a large number of Medicare beneficiaries and robust healthcare industries. Each outpatient procedural discharge record (i.e., case) includes the facility type (ASC or HOPD), the facility location, and the clinical provider (in our analytic context: physician cardiac specialist) that is primarily responsible for delivering and overseeing the patient's care. We therefore know what services were provided, where, and by whom. We leverage this detailed information to construct our differences-in-differences (DD)

[9] Unsurprisingly, patients tend not to travel far in order to receive "same-day" procedural and surgical services, which allows for the county boundary to be a reasonable proxy for the relevant market, and importantly, in cases where county boundaries are smaller than the actual market then our results would be understated (i.e., biased against finding an effect).

analyses for traditional Medicare, Medicare Advantage, and the commercially insured payer markets, as discussed in Sections V and VI.

C. *Physician-Level Vertical Integration Status*

We measure physician-level vertical integration status using the Agency for Healthcare Research and Quality (AHRQ) Compendium of US Health Systems.[10] The Compendium identifies physicians who are affiliated with, or integrated into, hospital and health system organizations. We link the Compendium to MD-PPAS by Tax ID Number (TIN) name and then link to rendering physician National Provider Identifiers (NPIs) in the Medicare Carrier claims. This allows us to classify each cardiologist or interventional cardiologist observed in the claims as vertically integrated or non-integrated in a given year. Because Compendium releases are not available for every calendar year in our claims period, we assign integration status using the closest prior available Compendium year when necessary. Specifically, we use the 2016 Compendium for 2017 claims, the 2018 Compendium for 2018 and 2019 claims, the 2020 Compendium for 2020 claims, the 2021 Compendium for 2021 claims, and the 2022 Compendium for 2022 and 2023 claims. A physician is classified as vertically integrated if the Compendium identifies the physician as integrated with a hospital or health system in the relevant year.

III. State CON Law Effects

A. *Estimation Approach*

As previously noted, US healthcare markets are often shaped by state-level policy choices. More specifically, "Certificate of Need" (CON) laws represent longstanding and controversial policies implemented by states that, in their most extreme form, can block entry of new healthcare businesses within the relevant healthcare industry or industries.[11] Although Medicare approved reimbursement for cardiac catheterization services in outpatient settings in 2019, restrictions in

[10] A similar approach is found within Singh *et al*. (2026).

[11] Less extreme versions of CON laws delay firm entry (ranging from months to years) or restrict the number of new entrants below the level that free market entry would otherwise yield.

state CON laws and state licensure laws for ASCs can still limit the provision of cardiovascular services in ASC settings by restraining or prohibiting ASC market entry. Put differently, state CON laws determine whether physicians can actually provide cardiac catheterization services in ASC settings after Medicare made its rule change.

While studies have examined CON regulations and provider supply as well as patients' use of services, they often do not employ causal research designs—see Cutler, Huckman, and Kolstad (2010), Chiu (2021), Melo *et al*. (2024), Bjoerkheim and Melad (2025), and Cantor *et al*. (2025) as recent work aiming for causal identification. CON-related studies can also be limited by imprecise legal data that only account for whether a state has any CON requirement for medical services, rather than a CON requirement specifically applying to key services subject to a policy change, such as cardiac catheterization in ASCs. We avoid these shortcomings by using broad measures of CON policies.

We begin by compiling information on state-specific restrictions on the provision of the eleven cardiac catheterization procedures of interest in ASC settings using data from the National Conference of State Legislatures. We first identify and flag states *without* any CON restrictions as of 2019.[12] We determine 28 states lack any CON restrictions for the provision of cardiac catheterization services in ASCs.[13] These states are shaded in gray within Figure 2. We next shade states in red in Figure 2 that have active CON restrictions. States with dots or diagonal line patterns in Figure 2 reflect special cases with nuanced policies aimed at ASC provision of cardiac catheterizations. To set up a cleaner test of a CON effect (described next), we ultimately exclude California, Michigan, Mississippi, New Jersey, New York, and Pennsylvania due to their respective 'CON-adjacent' regulatory restrictions that affect the ASC industry's provision of cardiac catheterization.

[12] Of note, some states have updated their CON since 2019. For example, Pennsylvania enacted a law (SB 818) in 2022 allowing ASCs to perform cardiac catheterization procedures.

[13] States without CON restrictions for the relevant procedures include Arizona, Arkansas, California, Colorado, Florida, Idaho, Indiana, Kansas, Louisiana, Michigan, Minnesota, Missouri, Montana, Nebraska, New Hampshire, New Mexico, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, Texas, Utah, Wisconsin, and Wyoming.

We subsequently implement a standard DD event study framework as well as a "2x2" (i.e., pre-post) DD version since we rely on binary CON status and a single time point for treatment (i.e., the beginning of 2019). We leverage our national analytic data (see Section IIA) from Medicare over the 2017-2023 period to estimate straightforward DD specifications:

$$Y_{st} = \psi_s + \gamma_t + \delta(Treated_s \times Post_t) + \varepsilon_{st} \quad (1)$$

$$Y_{st} = \psi_s + \gamma_t + \sum_{\substack{j=2017Q1 \\ j \neq 2018Q4}}^{2023Q4} \delta_j \, (Treated_s \times time = j) + \varepsilon_{st} \quad (2)$$

We include state fixed effects (ψ) and calendar quarter-year fixed effects (γ). *Treated* is equal to one for non-CON states and zero otherwise. *Post* is equal to one beginning in the first quarter of 2019 and continuing through the fourth quarter of 2023. Our three state-by-time outcomes of interest provide a full decomposition of facility setting location for the eleven cardiac catheterization procedure volumes impacted by the 2019 Medicare rule change. The standard errors are clustered at the state level, and each DD specification is ultimately testing for a differential effect of the 2019 federal deregulation event based on pre-existing state-level CON policy.

B. *Results*

Figure 3 displays the event study findings for aggregate cardiac catheterization procedure volumes by setting type. Non-CON and CON-restricted states' cardiac catheterization Medicare volumes closely track each other across settings in the lead up to 2019. However, beginning at the start of 2019 (i.e., when the deregulation event is in effect) and persisting through 2023, a divergence emerges. Specifically, states lacking CON barriers to ASC market entry for these cardiac services demonstrate a sharp and growing use of ASCs as the treatment setting (Panel A, Figure 3). This divergence indicates that state-level impediments to firm entry curtail ASC industry growth for these medical services, despite the change in federal policy tied to the Medicare program. Panels

B and C of Figure 3 show corresponding cardiac catheterization volumes for HOPD and OBL settings, respectively.

There is no clear evidence that HOPD volumes suffer in non-CON states as ASCs capture market share. Instead, Panel C of Figure 3 reveals that it is the lowest cost facility option (i.e., OBLs) that are the source of setting substitution. Cardiac catheterizations differentially decline immediately after the 2019 deregulation event and continue to fall over the remaining years. The estimates in Figure 3 suggest an approximately 1:1 substitution away from OBLs and toward the newly available ASC settings. The 2x2 DD results in Table 1 align with the patterns observed in Figure 3 and further indicate that the setting substitution translates to roughly half of the pre-policy OBL case volumes shifting over to ASCs.

IV. ASC Entry Effects

A. *Estimation Approach*

We next explore the direct effects of ASC cardiac market entry on local procedure volumes and setting allocation. For the eleven cardiac catheterization codes affected by the 2019 Medicare rule change, we again aggregate the quantity of procedures together but now at the county-quarter-year level across the three eligible setting types: ASCs, HOPDs, and OBLs.

Our analyses begin by characterizing the ASC entry pattern for cardiac catheterization across the US, which provides the underlying source of variation for our identification strategy. We consider a county to experience ASC entry at the first quarter-year instance of 10 or more of the 2019 policy relevant cardiac catheterization procedures being performed within an ASC facility. The threshold of 10 procedures aims to minimize reporting errors in the claims data (e.g., one-off inaccurate place-of-service coding issues) to avoid misclassifying a given county in terms of experiencing ASC entry. Interestingly, only 36 counties are exposed to ASC entry for this procedure market over the 2019 to 2023 period, with just two of the counties located in a CON active state (one in Mississippi and one in Nevada). This further indicates that Medicare's previous regulations were binding and created a meaningful barrier to entry for the ASC industry. Yet, entry was also not aggressive during the first five years post-deregulation, and a more accommodating regulatory environment at the state level appears influential.

Moving to our DD framework, the location and spread of what become our treatment and control counties is shown in Figure 4. The dark blue counties comprise our treatment group and represent 33 counties in total—three counties experienced entry too late in our analytic window to provide sufficient post-period data and were excluded. The pale green counties (763 in total) are those with at least 10 HOPD or OBL policy-relevant cardiac catheterization procedures in 2018. All other counties either did not experience ASC entry into this procedure market or lacked the minimum outpatient cardiac catheterization volume preceding the Medicare deregulation policy shock.

The corresponding 2018 procedure volume and patient complexity summary statistics for treatment and control counties, respectively, are provided in Table 2. The patient mix is virtually identical across the two groups, but perhaps unsurprisingly, ASC entry is concentrated in counties with high procedure volumes and presumably high patient demand at baseline. The contrast with respect to baseline procedure output motivates our sensitivity checks described below.

Given the differential timing in ASC entry exposure, we operationalize our DD estimation using a 'stacked DD' strategy—akin to other recent economics work (e.g., see Chen *et al*. 2023; Lin *et al*. 2023; Munnich *et al*. 2026). For the treatment group counties, we incorporate their aggregate cardiac catheterization activity (i.e., the eleven procedure codes affected by the 2019 Medicare rule change) by facility type six quarters before the ASC entry event and the four quarters following entry. Since the control group counties, by definition, do not possess a date to demarcate a pre- and post-entry period, we randomly assign a placebo date that serves as the anchor for their panel of cardiac catheterization care delivery volumes. The potential placebo dates are drawn from the range observed among the treatment group, and we again restrict to the six quarters prior to the randomly assigned quarter-year and the following four quarters to align with the treatment group stacked analytic sample. All treatment and control group counties consequently provide a balanced panel of data spanning 10 quarters in total.

Our first specification adapts an event study estimation to our stacked analytic data:

$$Y_{ct} = \alpha_c + \tau_t + \sum_{\substack{j=-6 \\ j\neq -4}}^{3} \delta_j \left(Treated_c \times time = j\right) + \varepsilon_{ct} \tag{3}$$

We also estimate a "2x2" (i.e., pre-post) version of the DD specification that pools the post-period estimates into a singular average policy effect parameter:

$$Y_{ct} = \alpha_c + \tau_t + \delta(Treated \times Post)_{ct} + \varepsilon_{ct} \quad (4)$$

Common to both specifications, we have a binary treatment group variable (*Treated*) equal to one for counties experiencing true ASC entry and zero otherwise. We also include county (α) and stacked quarter-time (τ) fixed effects. The standard errors are clustered at the county level.

B. *Results*

Figure 5 shows the ASC entry effects on cardiac catheterization procedure volumes by facility setting. Counties exposed to ASC entry newly experience approximately 15 of the Medicare policy-impacted procedures performed within an ASC per quarter. The increase is immediate and sustained over the entire post-period (Panel A, Figure 5). The pattern is also unsurprising, given how the treatment and control groups are constructed.[14] The subsequent two panels of Figure 5 offer the more informative tests for any setting substitution for counties experiencing ASC entry relative to counties that do not. In Panel B of Figure 5, we see, at most, a noisy decline in case volumes performed in HOPD facilities—arguably where substitution was intended and anticipated by policymakers and industry stakeholders. The strong and sharp (negative) change following ASC entry actually localizes to the lower cost OBL facilities, which also aligns with the pattern of CON-focused findings reported in Section III.

Table 3 contains the accompanying 2x2 DD estimates while also exploring the estimates' sensitivity to control group composition. For the latter, we first examine if restricting to control

[14] In other words, Panel A of Figure 5 acts as a face validity test for our underlying stacked DD analytic data. Recall, treatment is defined by the first instance of the 2019 Medicare eligible cardiac catheterization procedures within an ASC, so if our data construction and empirical execution is correct, we should observe a differential increase in ASC volumes across the treatment (experienced entry) and control (did not experience entry) counties.

counties within the same state—and hence the same policy environments—influences the DD results. As a second robustness check, we impose a higher minimum baseline procedure volume threshold at baseline for included control counties—recall, ASC entry occurred in disproportionately higher volume areas (Table 2). More specifically, this sensitivity test requires all control counties to be within at least one-half standard deviation of the treatment group mean cardiac catheterization volume in 2018 (Table 2) in order to be included in the DD estimation. We subsequently compare the DD findings across the three control group options for each facility setting type in Table 3.[15]

Expectedly, and irrespective of control group composition, the DD estimate for policy-relevant cardiac catheterization procedures performed within an ASC increase remains stable at approximately 14 procedures per quarter following the ASC entry event (columns 1-3, Table 3). The more relevant sensitivity checks belong to columns 4-9 in Table 3. Importantly, the loss of case volumes among HOPDs is not robust to our various control group compositions. When excluding the lowest volume—and arguably least comparable—counties from the control group, the DD coefficient size shrinks by more than half and is no longer statistically significant at conventional levels (columns 4-6, Table 3). A similar pattern does not emerge for the OBL case volume reductions. Across all three DD estimations, OBLs lose approximately 7 cardiac catheterization cases per quarter, on average, once ASCs are contesting the local market.

For additional context, we explore heterogenous ASC entry effects in Appendix Tables A1 and A2. Appendix Table A1 stratifies our treatment group into counties that experience exactly one ASC facility entering the cardiac catheterization market (two-thirds of the overall treatment group) versus counties exposed to two or more ASC entrants over time (one-third of the overall treatment group). Both single and multiple entry ASC entry markets show comparable increases in cardiac catheterization volumes newly taking place in ASCs. However, the reductions in OBL cases are much more pronounced (and precisely estimated) within multiple ASC entry markets, which largely offset the increases observed for ASC facilities. The DD results for single ASC entry counties are consistent with market expansion—i.e., an increased supply of cardiac

[15] Of note, we also explored restricting control group counties to be drawn only from CON-active states. The resulting DD estimates were very close to those from the "Same State" restriction, so for conciseness, we do not report them here (results available by request).

catheterizations for local Medicare beneficiaries overall. Appendix Table A2 stratifies the treatment group in an alternative way based on the presence of an OBL-to-ASC conversion. Only half of the treatment group counties experience de novo ASC entry exclusively, meaning that no OBL was performing cardiac catheterizations at the same facility address prior to the ASC being established. Conversely, the rest of the treatment group counties are home to one or more instances of a previous OBL now operating as an ASC following the Medicare policy change. Despite the differences in entry definition—and corresponding spending implications for the Medicare program—the pattern of procedure volume changes is quite similar across the two panels in Appendix Table A2.

C. *Supplementary Results*

Table 4 and Table 5 offer additional results for the direct ASC entry effects. The DD estimations and analytic samples are identical to those in Table 3. The only differences are the constructed outcome variables. For Table 4, we first use a proxy measure for quality of care—following Munnich *et al*. (2026). Specifically, we create a county-quarter-year count of emergency department (ED) visits within thirty days of receiving a cardiac catheterization, regardless of facility setting. We then turn to the Medicare inpatient data to construct an analogous measure of cardiac-related hospitalizations at the county-quarter-year level. This latter variable is intended to capture any downstream population health changes following ASC entry into the cardiac catheterization market. Neither outcome demonstrates a clear and statistically significant post-entry change across the three control group versions. The DD estimates for post-cardiac catheterization ED visits are negative across all three columns in Table 4—though insufficiently precise in column 3. While we cannot infer from these results that OBL-to-ASC substitution leads to better care quality, it does at least indicate that ASC entry is not worsening cardiac catheterization outcomes.

Table 5 supplements our findings for cardiac catheterization procedures by examining procedure volumes for percutaneous coronary intervention (PCI) across our three outpatient facilities of interest.[16] Recall from Section IB and IC, PCI is a common follow-on procedure for

[16] The corresponding event study results can be found in Appendix Figure A1.

cardiac catheterization in order to alleviate cardiovascular vessel blockage that poses risks of a harmful cardiac event. Additionally, in 2020 the Medicare program newly permitted six specific PCI procedure codes to be billed for within ASC settings, paralleling the rule change for the eleven cardiac catheterization codes implemented one year prior. While there is the expected increase in PCI volumes performed within ASCs, OBLs experience no change (rare at baseline—Table 2) and HOPDs show, at most, a noisy decline in case volumes across the different DD estimations in Table 5—potentially indicative of some degree of local Medicare market expansion for PCI procedures, specifically.

V. Medicare Deregulation Spillover Effects

The third portion of our empirics tests for spillover effects onto untargeted Medicare cardiac procedures as well as *non-Medicare* cardiac procedure volumes (i.e., non-Medicare cardiac services common to the Medicare 2019 rule change as well as those outside of the 2019 rule change) performed within ASC facilities. Doing so reveals if Medicare rulemaking indirectly impacts the use of an alternative treatment setting option for a wider swath of care, and hence, the full extent of externalities tied to Medicare's regulatory stance toward these specialized cardiac services and the ASC industry prior to 2019.

A. *Medicare Claims Estimation and Results*

The empirical approach using the Medicare claims data closely follows what was described in Section IV. The only departure is the set of procedures underlying the aggregate volumes measured by outpatient setting type. Specifically, we restrict to outpatient encounters performed by cardiac specialists that do not include the eleven cardiac catheterization procedures impacted by the 2019 Medicare rule change or the six PCI procedures impacted by the 2020 Medicare rule change. We consider all other medical services from these cardiac specialists to be 'untargeted' procedures in terms of Medicare regulatory policy.

Figure 6 shows that ASC entry for cardiac catheterization sharply leads to more untargeted procedures performed in ASCs as well. There is no evidence of business stealing from either HOPDs or OBLs in the surrounding area. The event study results consequently reveal externalities from targeted Medicare rules on other procedure-patient combinations within the Medicare market as well as an increase in the supply of untargeted cardiac services following Medicare permission granting for cardiac catheterizations, specifically, to be delivered in ASC facilities. However, the size of the market expansion is comparatively small (Table 2)—suggesting a 0.5% effect, on average.

B. *Florida Discharge Data Estimation and Results – County Level*

To expand the analyses beyond the Medicare market, we turn to the Florida all-payer discharge data. We exploit the fact that while ASC entry does occur in Florida, it occurs unevenly throughout the state. Specifically, we observe that six ASC firms located within six unique counties demonstrate entry behavior for cardiac catheterization after the 2019 Medicare policy change.[17] The setup and empirical execution for the Florida data otherwise closely follow Section IV and Section VA using the national Medicare claims data to conduct a county-level 'stacked' event study estimation.[18] We specifically examine untargeted cardiac procedure volumes within ASCs and HOPDs over time for traditional Medicare, Medicare Advantage, and commercially insured patients, respectively. Recall, OBLs are not available in the discharge data records (Section II).

Figure 7 presents the payer-specific results from the Florida county-level stacked DD event study estimation for untargeted procedures. The findings align well with Figure 6 using the national Medicare claims data.[19] For these key Florida markets, ASC entry corresponds to a sharp

[17] We also restrict our entry events of interest to those in 2022 through the start of 2023 in order to leverage the aggressive entry during that time in the state and to avoid the peak of the COVID-19 pandemic while still preserving sufficient post-period observations.

[18] For classifying the 'untargeted' ASC procedures at the county level in the Florida discharge data, we leverage the International Classification of Disease (ICD-10) information belonging to each discharge record in order to exclusively restrict to outpatient procedural encounters where the patient's principal diagnosis code falls within the ICD-10 range for circulatory medical problems.

[19] Recall, the Medicare claims analytic data are derived from a 20% sample. The 2-3 untargeted procedures in ASC shown in Figure 6 (Panel A) consequently represents a 10-15 increase, on average, when scaled to the full Medicare population. A 30-procedure increase when just examining Florida markets is a plausible change, given the size of the

increase in Medicare as well as non-Medicare untargeted procedure case volumes within ASC settings. The effect size is approximately 30 procedures per quarter for the traditional Medicare market and roughly 10-25 procedures per quarter for the Medicare Advantage and commercially insured markets. Taken together, there is strong evidence that all key payer segments experience a spillover effect for untargeted cardiac-related case volumes performed in ASCs following the Medicare rule change and subsequent ASC market entry. There is also no offsetting decrease within HOPD settings for any of the three payer groups (Appendix Figure A2), which corresponds to the pattern observed in the national data as well (Figure 6).[20]

C. *Florida Discharge Data Estimation – Physician Level*

With the all-payer data, we can extend the spillovers investigation to better understand what drives the aggregate increase in ASC use for each of the key insurance markets. To do so, we exploit the timing and location of ASC entry in Florida as an exposure shock to relevant physicians performing these cardiac procedures at baseline in the same counties where entry takes place. We then compare their outpatient surgical care activity to similar physicians that work elsewhere around the state of Florida that have not been exposed to ASC cardiac catheterization entry.[21]

For each physician, we calculate the volume of ASC cases for each of the three payer groups: traditional Medicare, Medicare Advantage, and commercial insurance. We also generate a payer-specific extensive margin outcome that captures the physician's use of an ASC at all for any patient belonging to a given payer in each quarter-year. We create a 'stacked' analytic data set by incorporating treatment group physicians' market activity six quarters before the ASC entry exposure and the four quarters during entry exposure. We again randomly assign a placebo date

state's healthcare industries and Medicare beneficiary population (i.e., we would expect the volumes to be on the high-end of the national distribution).

[20] Of note, a modest strand of economics literature finds that public insurance size and incentives can impact physician labor supply (e.g., Garthwaite 2012; Chen, Lo Sasso, and Richards 2018). The results in Figures 6 and 7 are at least consistent with the Medicare deregulation decision and subsequent facility option expansion facilitating greater output among local physicians.

[21] We identify relevant physicians by using the publicly available Physician Compare data from CMS in order to restrict to physicians with cardiology, interventional cardiology, or vascular surgery as their primary specialty in order to ascertain that they are appropriately trained to perform the cardiac procedures of interest.

that serves as the anchor for control group physicians' panel of care delivery. The potential placebo dates are drawn from the range observed among the treatment group physicians, and we likewise restrict to the six quarters prior to the randomly assigned anchor date and the following four quarters. Consequently, all treatment and control group physicians provide a balanced panel of data over the 10 quarters of DD analytic data.

The event study framework applied to our stacked analytic data closely mirrors the previous estimations:

$$Y_{pt} = \phi_p + \tau_t + \sum_{\substack{j=-6 \\ j\neq -4}}^{3} \delta_j \left(Treated_p \times time = j \right) + \varepsilon_{pt} \tag{5}$$

Similarly, we implement a "2x2" version of the DD specification, just as before:

$$Y_{pt} = \phi_p + \tau_t + \delta(Treated \times Post)_{pt} + \varepsilon_{pt} \tag{6}$$

Common to our prior estimations at the county-level, we have a binary treatment group variable (*Treated*) that is equal to one only for physicians working in ASC entry exposed counties, but instead of county fixed effects, we use physician (ϕ) fixed effects, along with the stacked quarter-time (τ) fixed effects. The standard errors are clustered at the physician level throughout.

D. *Florida Discharge Data Results – Physician Level*

The physician-level stacked DD results across payers in Florida are presented in Figure 8 and Figure 9. In terms of total ASC volume, there is sharp and sustained uptick for the relevant physicians providing care in the same counties where an ASC entry shock occurs. The pattern is qualitatively similar across all three payer markets (Figure 8). Furthermore, the results in Figure 9 make clear that the aggregate entry exposure effects are driven by an extensive margin impact at

the physician-level. For traditional Medicare, Medicare Advantage, and commercially insured patients, affected physicians are roughly 5-10 percentage-points more likely to perform any treatments in an ASC immediately after an ASC enters the cardiac catheterization market in their area. Given the low baseline ASC utilization rates (1-3%) for both the treatment and control group physicians, the differential increases among the ASC entry-exposed cardiac specialists represents an approximately 300-500% relative increase in extensive margin ASC use.

VI. Hospital-Physician Integration Effects

Given the recent wave of hospital-physician integration and known consequences for referral patterns (e.g., Richards, Seward, and Whaley 2022; Whaley and Zhao (2024); Cooper *et al*. (2025) Lin *et al*. 2025), we conclude our empirics by formally testing for a heterogeneous response by physicians' vertical integration (i.e., employment) status with respect to local hospitals and health systems. We do so by implementing simple extensions of our previous analyses to understand whether hospitals influence the treatment setting decisions by their physician employees in a manner that differentially retains their case volumes in the HOPD setting at the expense of local ASCs. We then explore the direct effects of vertical integration on cardiac care physicians' use of ASCs across payers. And our final set of DD analyses examines hospital-physician consolidation as a strategic response to the 2019 deregulation event by Medicare.

A. *Mediating Physician Response to ASC Entry*

We first examine physician level heterogeneity in the 2019 policy response using our national Medicare data by adapting our DD setup from Section IV. A balanced panel of cardiac physicians are allocated to treatment or control status based on the geographic location of their practice and hence exposure to ASC entry (Figure 4). We employ DD and triple differences (DDD) estimations. The former simply applies Equation (6) to the physician-level analytic data using the national Medicare claims data. The latter expands the specification to capture any heterogeneous response for those vertically integrated (i.e., the 'VI' term):

$$Y_{pt} = \phi_p + \tau_t + \delta(Treated \times Post)_{pt} + \lambda_1(Post \times VI)_{pt} +$$
$$\lambda_2(Treated \times Post \times VI)_{pt} + \varepsilon_{pt} \quad (7)$$

We use the physician-level intensive and extensive margin measures of procedures performed within ASC facilities, and the standard errors are clustered at the physician level throughout.

Using the Florida all-payer data at the physician level (Section VC), we perform analogous analytic exercises by payer (Medicare, Medicare Advantage, and commercial insurance)—again relying on Equation (6) and Equation (7) for these estimations. Treatment and control status within Florida markets are defined by ASC entry exposure, just as before.

Within Table 6 (national Medicare data) and Table 7 (Florida all-payer data), we provide the physician-level "2x2" estimates for the cardiac procedure volumes in ASCs and extensive margin use by payer type, which are then juxtaposed to the triple differences estimation results. The DDD estimates are almost perfectly offsetting and precisely estimated when compared to the DD coefficients in Table 6 and Table 7. The triple differences findings are therefore consistent with hospitals being able to exert pressure on their physician employees to retain their case volumes in the (higher cost) HOPD setting after the ASC industry newly enters the cardiac outpatient procedure market.

B. *Direct Effects on Physician ASC Utilization*

We also leverage our national Medicare data to explore the direct effects of vertical integration (i.e., newly becoming employed by a hospital or health system) on cardiac care physicians' reliance on ASC settings. Our empirical strategy mirrors our prior approaches and relies on a stacked DD analytic sample and estimation to quantify physician-level changes in ASC use. We construct two outcomes at the physician-quarter level: the share of a physician's outpatient cardiac procedure volume performed in ASCs and an extensive-margin indicator for whether the physician performs any outpatient cardiac procedure in an ASC during the quarter. Treatment "turns on" in the first quarter in which a physician becomes newly vertically integrated with a hospital or health system. Control group physicians are those that remain independent from hospitals or health systems and

receive a placebo anchor date drawn from the distribution of treatment dates. We then construct balanced event-time panels around these treatment and placebo dates, capturing ASC use eight quarters before 'VI' and the six quarters after, including the quarter of vertical alignment. The stacked design therefore compares changes in ASC use around newly integrated physicians' integration events to contemporaneous changes among physicians who remain independent. The event study specification is as follows:

$$Y_{pt} = \phi_p + \tau_t + \sum_{\substack{j=-8 \\ j\neq -4}}^{5} \delta_j \left(Treated_p \times time = j \right) + \varepsilon_{pt} \tag{8}$$

Figure 10 provides the event study results for our two outcomes of interest. Affected cardiac physicians' share of procedures performed in an ASC setting is stable (and trending with the control group) during the two years leading up to the 'VI' event. However, it begins to differentially decline one quarter before and further diverges over the next year (Panel A). A similar pattern emerges for the extensive margin outcome in Panel B—though divergence begins even earlier during the year immediately prior to formal hospital employment. This aligns with related work also finding foreclosure effects for ASCs following hospital and health system acquisitions of physician practices in outpatient surgery and procedural markets (Richards, Seward, and Whaley 2022). Interestingly, the pre- and post-VI outcome averages across the treatment and control groups (Figure 10) indicate that the observed differential change for the treatment group is driven by arresting growth in the use of ASCs relative to the control group cardiac physicians, rather than outright lowering existing use.

C. *Strategic Response to New ASC Competition*

Finally, we return to our ASC entry effects setup (Section IV), but now construct a county-quarter-year measure of the number of cardiac care physicians that are vertically integrated with local hospitals and health systems. The stacked analytic data and DD estimation is otherwise identical to Equation (3) in Section IV, with the exception that we also impose the baseline cardiac

catheterization minimum volume requirement (Section IVC) since our prior sensitivity checks revealed that doing so provides better comparability for HOPD post-policy experiences between the treated and control counties.

Figure 11 offers the resulting event study estimates. There is suggestive evidence of an increase in the level of vertically integrated cardiac physicians following ASC entry into this market; however, the post-period estimates lack sufficient precision to draw strong inferences. Similarly, defining the outcome as a share of all cardiac physicians does not yield a tightly estimated result (Appendix Table A3). It is therefore possible that local hospitals strategically respond in this manner, but the data are not conclusive—at least not over the short-run.

VII. Conclusions

There is longstanding economic interest in the causes and consequences of physician treatment style variation (e.g., see Newhouse and Marquis 1978; Glied and Graff Zivin 2002; Frank and Zeckhauser 2007; Epstein and Nicholson 2009; Molitor 2018; Cutler *et al*. 2019; Richards and Tello-Trillo 2019; Einav *et al*. (2020); Richards, Seward, and Whaley 2021; Chen *et al*. 2022; Geruso and Richards 2022; Barnett, Olenski, and Sacarny 2023), including which facilities they choose to utilize for care and at what cost to payers and patients. Physician preferences tend to evolve alongside technological advancements and clinical innovation, but regulation can play a substantive and lagging role. Abrupt changes to rulemaking can consequently generate sharp shifts in their treatment approaches, and when policy decisions emanate from the large and influential Medicare program, the impact can reverberate throughout the entire market.

We show that a seemingly narrow Medicare policy change impacting eleven cardiac procedural services (all tied to cardiac catheterization care, specifically) has wide-ranging implications. The previously excluded industry (i.e., ASCs) newly enters the market, and local cardiac specialists begin using ASCs for these policy-targeted *and* non-targeted procedures for their Medicare and non-Medicare patients alike. The reach of Medicare regulations is therefore well-beyond just the Medicare program, which can distort clinical decision-making and care delivery for a variety of patients. That said, Medicare's deregulation event in 2019 not only invited market entry by ASCs but also led to setting substitution that appears less anticipated by advocates

of the policy change. Namely, the strongest evidence of business stealing belongs to the low-cost OBL facilities, rather than high-cost hospitals.

Using the pricing differentials by setting from 2019 (Appendix Figure A3) and weighted by the 2018 OBL volumes per cardiac catheterization HCPCS code, the Medicare cost increase for each procedure shifted out of an OBL and into an ASC translates to roughly $550. With an average of seven procedures affected by this setting substitution among the treatment group counties per quarter (Table 3) and scaling the 20% Medicare sample to the full population in the 33 affected counties, a simple back-of-the-envelope calculation implies approximately $2.5 million in additional spending annually by Medicare, at least over the short-run—which contrasts with policymaker and industry forecasts of public insurer cost-savings.[22] With longer time horizons, care quality and other health improvements are possible, and ASCs may eventually compete away cardiac care business from hospitals as well. But during the immediate aftermath of the Medicare rule change, these more desirable effects did not obviously materialize.

Importantly, the deregulation action taken by the federal Medicare program had its downstream implications mitigated by state-level policy and cross-industry provider integration. Unaccommodating state-level laws and misaligned physician incentives can blunt the impact of newly allowing ASCs to compete with hospitals. These findings underscore the multiple and sometimes conflicting forces shaping whether and to what degree new treatment options are taken up by front-line clinicians. To achieve optimal treatment setting choices, greater policy concordance between the federal and state levels can be necessary, and prevailing incentive structures need to encourage physicians to select the most efficient setting option for a given procedure-patient combination—as opposed to simply "trading up" for higher reimbursements when site-specific payment rules allow. These issues are likely to only become more salient and influential as Medicare continues to deregulate care delivery, such as its current three-year phase

[22] For example, the US Governmental Accountability Organization (GAO) posited that 5% of cardiac catheterizations in 2019 could shift from HOPDs to ASCs across the country and lower Medicare expenditures by $36 million and beneficiary copayments by $14 million in that year (see https://www.govinfo.gov/content/pkg/FR-2018-11-21/pdf/2018-24243.pdf). Of note, the GAO projection did not appear to consider relevant CON frictions, OBL substitution potential, or hospital-physician integration.

out of the Inpatient Only ("IPO") procedural list.[23] Sweeping forecasts of greater patient access and public insurer savings may prove inaccurate unless local market frictions and provider incentive structures are carefully integrated into any policy impact projections.

[23] Recent industry commentary on the Medicare IPO list decision can be found here: https://www.beckersasc.com/asc-coding-billing-and-collections/what-does-cms-ipo-phase-out-mean-for-surgical-care/.

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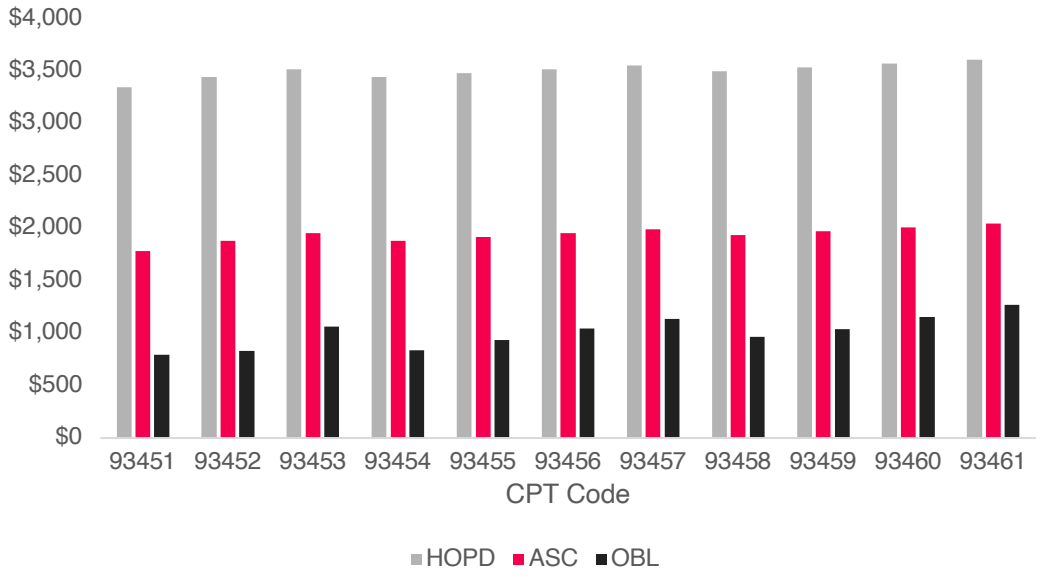


FIG 1. CARDIAC CATHETERIZATION MEDICARE REIMBURSEMENT BY SETTING, 2025

Notes: The figure shows the national average Medicare rate in 2025 for the 11 cardiac catheterization procedures affected by the 2019 policy change. Sources: Medicare Procedure Price Lookup (HOPD & ASC) https://www.medicare.gov/procedure-price-lookup/ and Physician Fee Schedule (OBL) https://www.cms.gov/medicare/payment/fee-schedules/physician

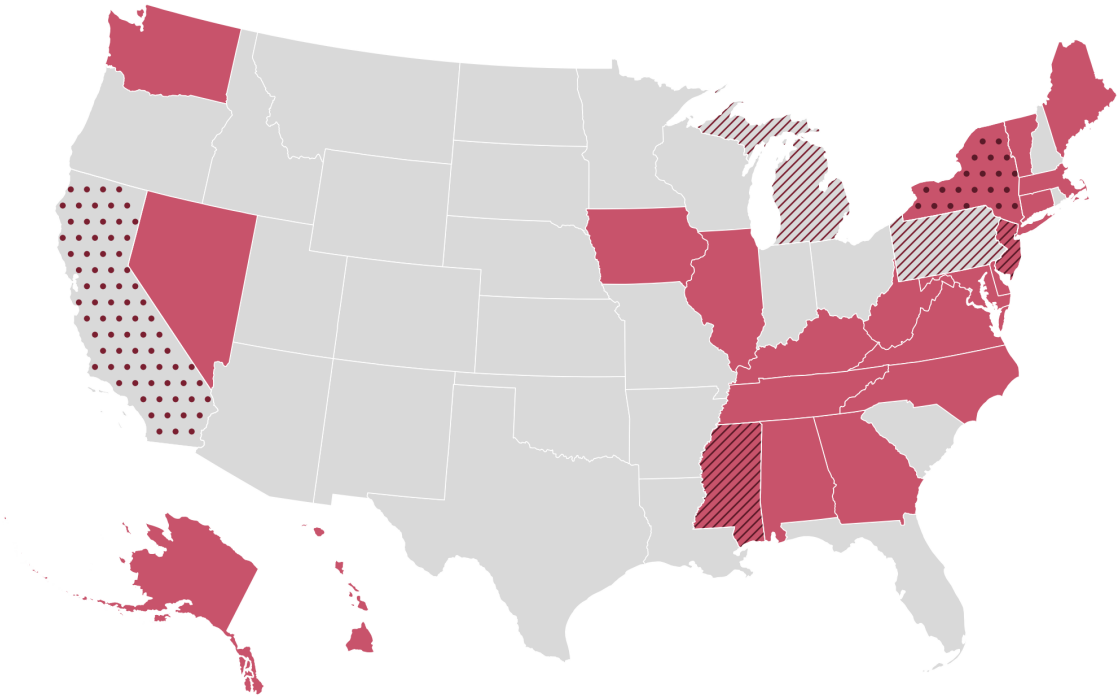
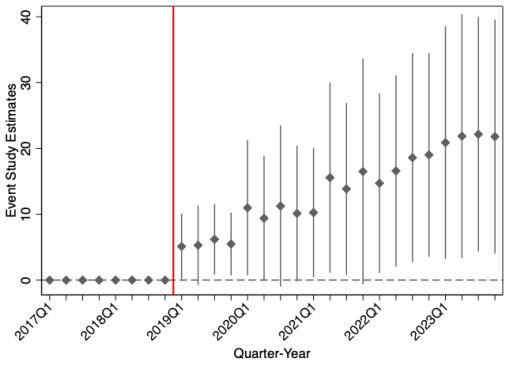
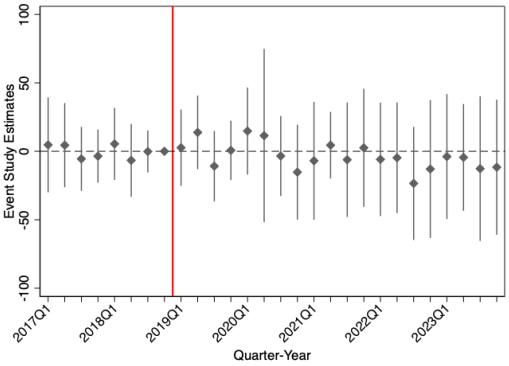


FIG 2. STATE LEVEL CERTIFICATE OF NEED EXPOSURE

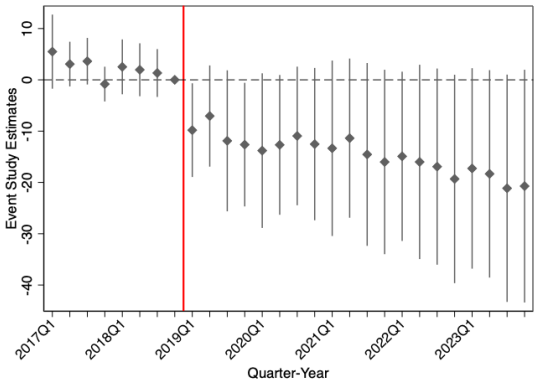
Notes: The 22 states with CON programs as of 2019 plus the District of Columbia are shown in red. This includes Delaware which calls it program Certificate of Public Review (COPR). Michigan, Mississippi, New Jersey, and Pennsylvania (stripes) had rule changes that facilitated cardiac catheterization in ASCs after 2019. California and New York (dots) strictly prohibit cardiac catheterization in ASCs. Nevada was the only CON state that did not specifically facilitate cardiac catheterization in ASCs where we observed entry (one county).



(a) ASC Facilities



(b) HOPD Facilities



(c) OBL Facilities

FIG 3. STATE CERTIFICATE OF NEED REGIME AND CARDIAC CATHETERIZATION VOLUME BY OUTPATIENT SETTING

Notes: State-level event-study difference-in-difference estimates of operating in a non–Certificate of Need (CON) regime on cardiac catheterization procedure volume, by outpatient setting (ASC, HOPD, OBL). The observation level is state × quarter-year over 2017Q1–2023Q4, using the 11 cardiac catheterization procedures affected by the 2019 Medicare policy change (see Figure 2) aggregated to the state-quarter-year. Specifications include state and quarter-year fixed effects, with standard errors clustered at the state level. The omitted reference period is 2018Q4, and the solid red vertical line marks 2019Q1, the first post-policy quarter. Treated states are the non-CON ("gray")

TABLE 1—STATE-LEVEL CARDIAC CATHETERIZATION PROCEDURE VOLUME DIFF-IN-DIFF ESTIMATES BY CON REGULATION STATUS

	ASC Facilities	**HOPD Facilities**	**OBL Facilities**
	(1)	(2)	(3)
DD Estimate	13.78**	–3.44	–16.71*
	(5.97)		
		(18.71)	(9.19)
State FE	Yes	Yes	Yes
Qtr-Year FE	Yes	Yes	Yes
Observations (N)	1,260	1,260	1,260
Unique States + DC	45	45	45
Pre-Period Mean (Treated)	0.0	430.5	32.3

Notes: Two-way fixed-effects difference-in-difference estimates at the state × quarter-year level, 2017Q1–2023Q4, with the post-period beginning 2019Q1. The outcome is the volume of the 11 cardiac catheterization procedures affected by the 2019 Medicare policy change (see Figure 2) performed in the indicated setting. Treated states are the non–Certificate of Need (CON) states in Figure 2; control states are the CON states in Figure 2. We exclude the identified states with adjacent and interacting rules impacting cardiac catheterization provision within ASCs (California, Michigan, Mississippi, New Jersey, New York, and Pennsylvania). The District of Columbia is included as a CON jurisdiction. All specifications include state and quarter-year fixed effects. Standard errors clustered at the state level in parentheses. *** P value at 0.01 ** P value at 0.05 * P value at 0.10

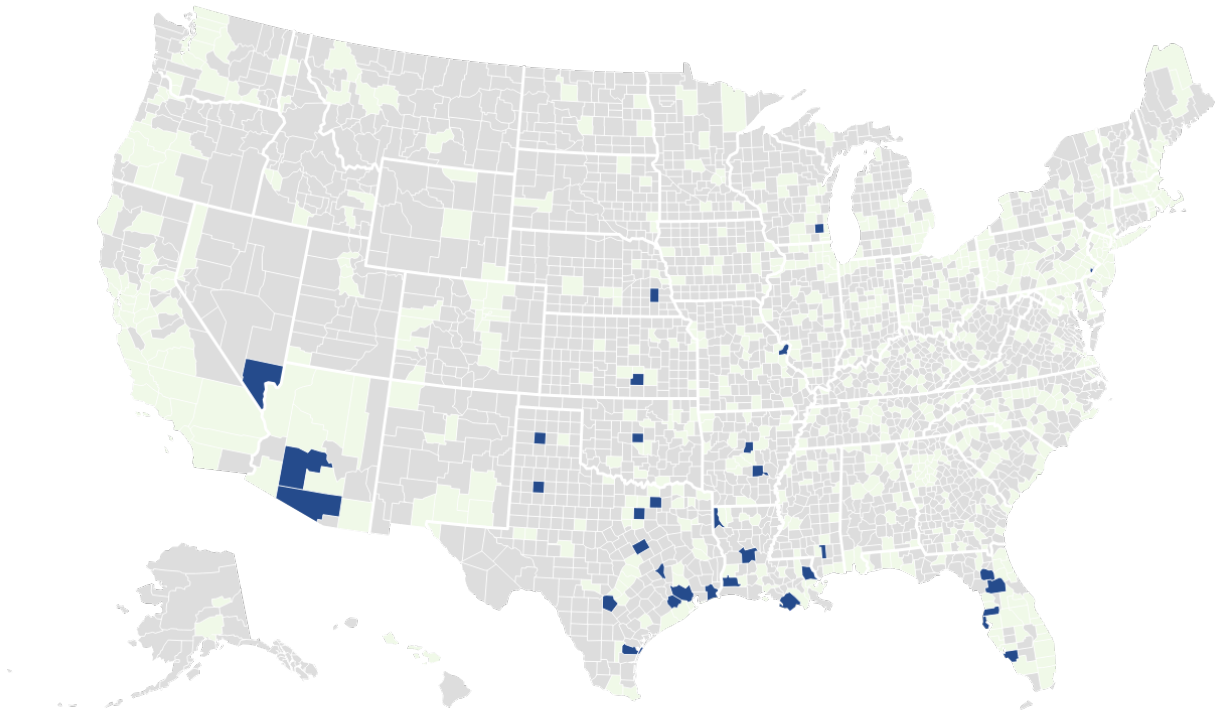


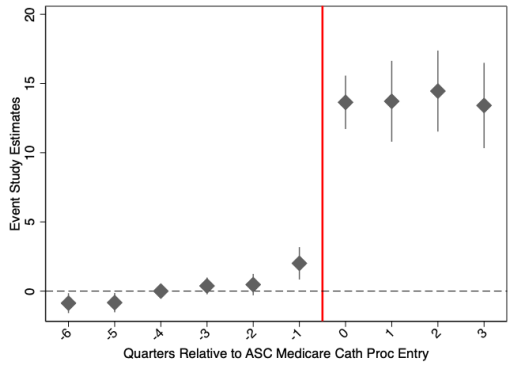
FIG 4. COUNTIES EXPOSED TO ASC CARDIAC CATHETERIZATION ENTRY FOLLOWING MEDICARE DEREGULATION POLICY AND CONTROL GROUP COUNTIES

Notes: The 33 treated counties in our analytic sample are shown in blue. The 763 control counties in our sample are shown in light green. Two additional counties would have been treated if not for the HOPD/OBL 10 or more cardiac catheterization procedures volume requirement at baseline. Three counties that had entry at the end of study period (i.e., 2023Q2 or later) were excluded due to limited post-period observations. Except for one county in Nevada and one county in Mississippi, all entry occurred in states without CON restrictions.

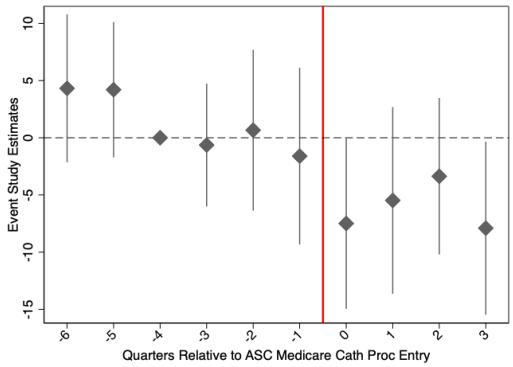
TABLE 2—SUMMARY STATISTICS FOR TREATED AND CONTROL COUNTIES IN 2018

	Treated counties Mean (SD)	Control counties Mean (SD)
Total volume	1,620 (2,400)	311 (536)
Unique patients	677 (989)	151 (260)
Cardiac Cath		
HOPD volume	337 (320)	109 (134)
OBL volume	64 (72)	1.91 (10.95)
ASC volume	--	--
PCI		
HOPD volume	118 (106)	32 (42)
OBL volume	0.91 (1.44)	0.15 (0.99)
ASC volume	--	--
Untargeted		
HOPD volume	189 (250)	58 (73)
OBL volume	900 (2,169)	110 (379)
ASC volume	10.79 (14.33)	0.40 (2.96)
Patient characteristics		
Age	73.42 (1.28)	73.12 (1.88)
Share female	0.44 (0.04)	0.44 (0.06)
Share white	0.87 (0.08)	0.89 (0.11)
Share dual eligible	0.17 (0.06)	0.19 (0.10)
HCC risk score	2.55 (0.29)	2.56 (0.33)
Counties (N)	33	763

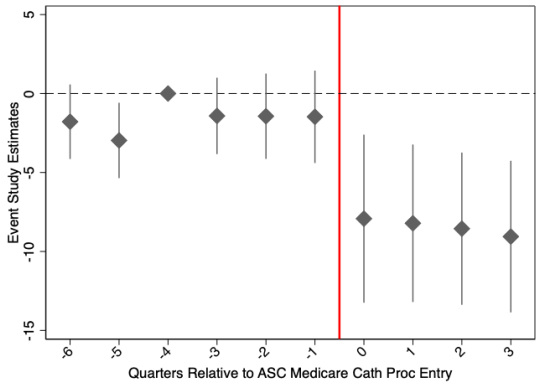
Notes: Data are from the Medicare carrier file 20% sample and Master Beneficiary Summary File for 2018. Analytic counties are required to have 10 or more policy relevant cardiac catheterization outpatient procedures performed in a HOPD or OBL in 2018. Treated counties are those that then experience at least one ASC entry event from 2019Q1 and onward (i.e., after the Medicare deregulation change) related to these specific cardiac catheterization procedures. "Untargeted procedures are encounters that do not include a cardiac catheterization or PCI claim line relevant to the 2019 or 2020 Medicare rules changes.



(a) ASC Facilities



(b) HOPD Facilities



(c) OBL Facilities

FIG 5. ASC ENTRY EFFECTS ON CARDIAC PROCEDURE VOLUME BY OUTPATIENT SETTING TYPE

Notes: Event study estimates using national Medicare claims data and stacked DD analytic sample (see Section IV). Treated counties are those that experience ASC entry, defined as counties with 10 or more relevant procedures performed within an ASC. Procedure volume includes the 11 cardiac catheterization procedures affected by the 2019 policy change.

TABLE 3—CARDIAC CATHETERIZATION PROCEDURE VOLUME DIFF-IN-DIFF ESTIMATES FOR STACKED ANALYTIC DATA AND SENSITIVITY TO CONTROL GROUP RESTRICTIONS

	ASC Facilities			**HOPD Facilities**			**OBL Facilities**		
	All Controls	Same State Controls	Volume Min Controls	All Controls	Same State Controls	Volume Min Controls	All Controls	Same State Controls	Volume Min Controls
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
DD Estimate	13.61***	13.60***	13.60***	–7.22***	–7.59***	–3.47	–6.92***	–6.92***	–6.71***
	(1.12)	(1.12)	(1.13)	(2.70)	(2.71)	(2.92)	(2.02)	(2.02)	(2.03)
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Stacked Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations (N)	7,960	2,630	1,760	7,960	2,630	1,760	7,960	2,630	1,760
Unique Counties	796	263	176	796	263	176	796	263	176

Notes: Of note, restricting the control counties to CON restricted states (see Figure 2) generates results very similar to the "All Controls" and "Same State Controls" versions. Standard errors clustered at the county level. *** P value at 0.01 ** P value at 0.05 * P value at 0.10

TABLE 4—DIFF-IN-DIFF ESTIMATES FOR MEDICARE BENEFICIARY POPULATION HEALTH POST-ASC ENTRY

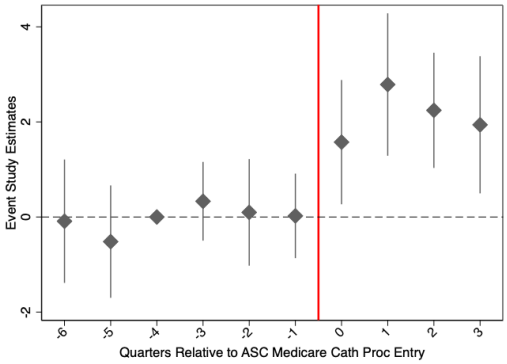
	30-Day ED Visits Post-Cardiac Cath			**Cardiac-Related Hospitalizations**		
	All Controls	Same State Controls	Volume Min Controls	All Controls	Same State Controls	Volume Min Controls
	(1)	(2)	(3)	(4)	(5)	(6)
DD Estimate	–1.78*	–2.08**	–0.78	–13.73	–16.55	1.40
	(1.03)	(1.04)	(1.10)	(10.06)	(10.12)	(10.89)
County FE	Yes	Yes	Yes	Yes	Yes	Yes
Stacked Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations (N)	7,960	2,630	1,760	7,960	2,630	1,760
Unique Counties	796	263	176	796	263	176
Pre-Period Mean Treated		20.1			286.6	

Notes: Diff-in-diff estimates of the effect of ASC entry on 30-day post-procedure ED visits and acute cardiac admissions. "Cath 30-day ED visits" counts emergency department visits within 30 days of any cardiac catheterization procedure (affected by the 2019 Medicare rule change). "Acute cardiac admissions" counts inpatient admissions with a principal diagnosis of Acute Myocardial Infarction (ICD-10 I21, I22) or Heart Failure (ICD-10 I50). "All" includes all control counties from Table 1. "Same State" includes only the 230 control counties that are in ASC entry states (excluding Oregon). "Volume Min" includes the counties that were within a half standard deviation (1,200) of the treated county mean volume (1,620). *** P value at 0.01 ** P value at 0.05. * P value at 0.10

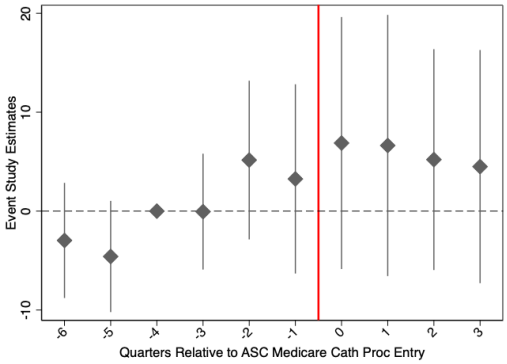
TABLE 5—PCI PROCEDURE VOLUME DIFF-IN-DIFF ESTIMATES FOR STACKED ANALYTIC DATA AND SENSITIVITY TO CONTROL GROUP RESTRICTIONS

	ASC Facilities			**HOPD Facilities**			**OBL Facilities**		
	All Controls	Same State Controls	Volume Min Controls	All Controls	Same State Controls	Volume Min Controls	All Controls	Same State Controls	Volume Min Controls
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
DD Estimate	4.39***	4.39***	4.38***	–3.14***	–3.12**	–2.01	0.08	0.04	0.06
	(1.18)	(1.18)	(1.18)	(1.20)	(1.22)	(1.29)	(0.21)	(0.21)	(0.21)
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Stacked Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations (N)	7,960	2,630	1,760	7,960	2,630	1,760	7,960	2,630	1,760
Unique Counties	796	263	176	796	263	176	796	263	176

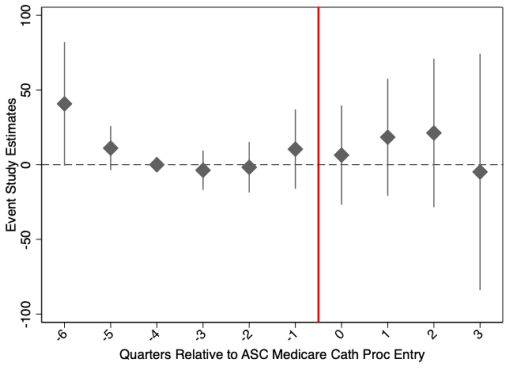
Notes: Of note, restricting the control counties to CON restricted states (see Figure 2) generates results very similar to the "All Controls" and "Same State Controls" versions. Standard errors clustered at the county level. *** P value at 0.01 ** P value at 0.05 * P value at 0.10



(a) Untargeted Volume – ASC Facilities



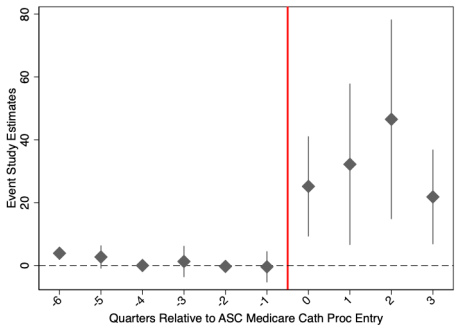
(b) Untargeted Volume – HOPD Facilities



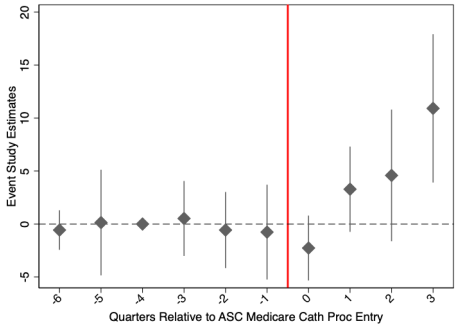
(c) Untargeted Volume – OBL Facilities

FIG 6. ENTRY SPILLOVER EFFECTS FOR UNTARGETED MEDICARE CARDIAC PROCEDURE ENCOUNTERS

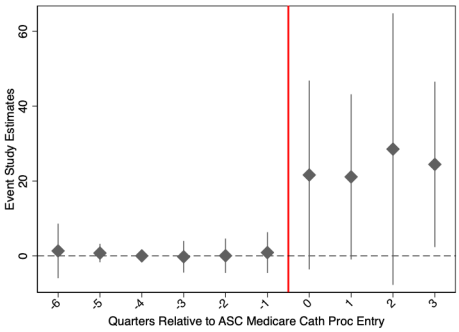
Notes: Event study estimates using national 20% sample Medicare claims data and stacked DD analytic sample (see Section V). Treated counties are those that experience ASC entry, defined as counties with 10 or more cardiac catheterization procedures performed within an ASC. "Untargeted" cardiac procedure encounters include cases performed by cardiologists and interventional cardiologists that do not involve any of the cardiac catheterization or PCI procedures included in the 2019 or 2020 Medicare rule changes.



(a) Traditional Medicare Procedures in ASC Facilities



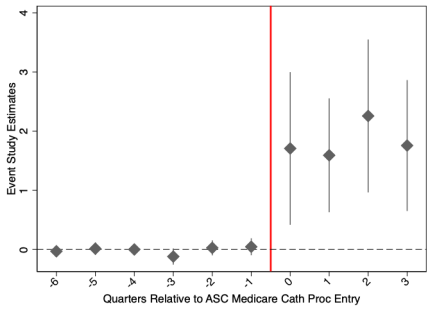
(b) Medicare Advantage Procedures in ASC Facilities



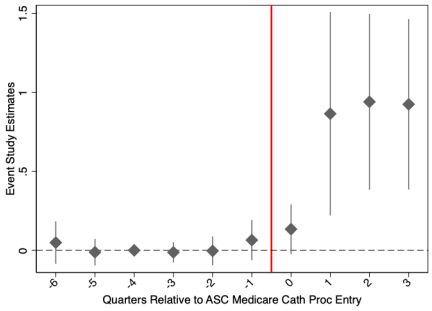
(c) Commercial Procedures in ASC Facilities

FIG 7. ENTRY SPILLOVER EFFECTS FOR UNTARGETED CARDIAC PROCEDURES BY PAYER IN FLORIDA

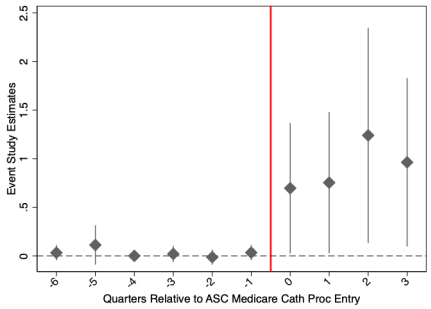
Notes: Event study estimates using Florida all-payer discharge data and stacked DD analytic sample (see Section V). Treated counties are the six counties experiencing cardiac catheterization within ASC settings. All other counties in Florida with cardiac-related outpatient procedural care are in the control group.



(a) Traditional Medicare Procedures in ASC Facilities



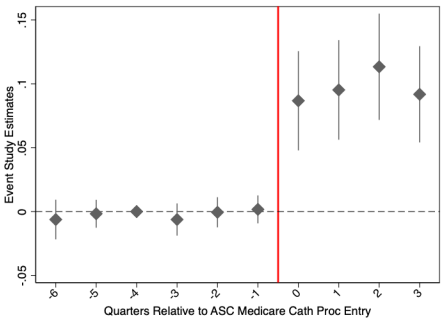
(b) Medicare Advantage Procedures in ASC Facilities



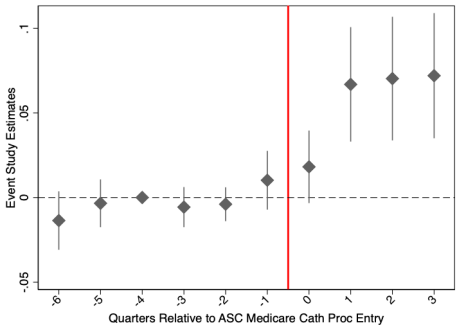
(c) Commercial Procedures in ASC Facilities

FIG 8. PHYSICIAN LEVEL EFFECTS OF CARDIAC ASC ENTRY ACROSS PAYERS IN FLORIDA

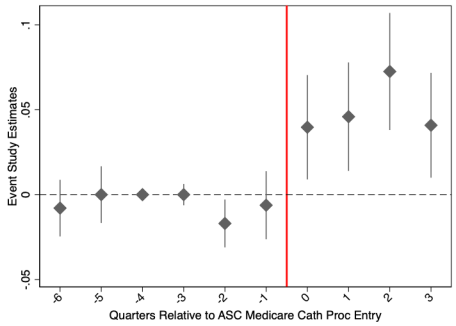
Notes: Event study estimates using stacked DD analytic sample (see Section V). Treated physicians are those with cardiac specialization and are exposed to ASC entry. Control physicians are those with cardiac specialization and work elsewhere around the state of Florida. Event studies include physician and stacked quarter-time fixed effects. Standard errors are clustered at the physician level.



(a) Any ASC Use for Traditional Medicare Cases



(b) Any ASC Use for Medicare Advantage Cases



(c) Any ASC Use for Commercial Cases

FIG 9. PHYSICIAN LEVEL EXTENSIVE MARGIN EFFECTS OF CARDIAC ASC ENTRY ACROSS PAYERS IN FLORIDA

Notes: Event study estimates using stacked DD analytic sample (see Section V). Treated physicians are those with cardiac specialization and are exposed to ASC entry. Control physicians are those with cardiac specialization and work elsewhere around the state of Florida. Event studies include physician and stacked quarter-time fixed effects. Standard errors are clustered at the physician level.

TABLE 6—DIFF-IN-DIFF AND TRIPLE DIFFERENCES ESTIMATION FOR PHYSICIAN LEVEL ASC PROCEDURE VOLUMES AND EXTENSIVE MARGIN ASC USE FOR MEDICARE PATIENTS

PANEL A

	Trad. Medicare Procs. in ASC	
	(1)	(2)
Treated x Post	0.445***	0.743***
	(0.056)	(0.098)
Treated x Post x VI		–0.675***
		(0.101)
Physician FE	Yes	Yes
Stacked Time FE	Yes	Yes
Observations (N)	206,010	206,010
Unique Physicians	20,601	20,601
Pre-Period Mean: Treated	0.09	--
Pre-Period Mean: Controls	0.01	--

PANEL B

	Any ASC Use Trad. Medicare	
	(1)	(2)
Treated x Post	0.056***	0.094***
	(0.004)	(0.007)
Treated x Post x VI		–0.086***
		(0.007)
Physician FE	Yes	Yes
Stacked Time FE	Yes	Yes
Observations (N)	206,010	
Unique Physicians	20,601	
Pre-Period Mean: Treated	0.03	--
Pre-Period Mean: Controls	0.00	--

Notes: National traditional Medicare FFS sample. "VI" is a binary indicator for physicians vertically integrated with a local hospital or health system in 2020; if 2020 status is unavailable, pre-2020 status from 2017-2019 is used. 44.1% and 65.5% of the treatment group and control group physicians, respectively, are vertically integrated in the analytic data. ASC volume is summed to the NPI-quarter-year level; Any ASC Use equals one when summed ASC volume is greater than zero. Treated physicians are assigned to counties exposed to ASC entry; control physicians are assigned to never-treated counties and receive one random placebo county anchor date. Standard errors clustered at the physician level. *** P value at 0.01 ** P value at 0.05. * P value at 0.10

TABLE 7—DIFF-IN-DIFF AND TRIPLE DIFFERENCES ESTIMATION FOR ASC PROCEDURE VOLUMES AND EXTENSIVE MARGIN ASC USE BY PAYER

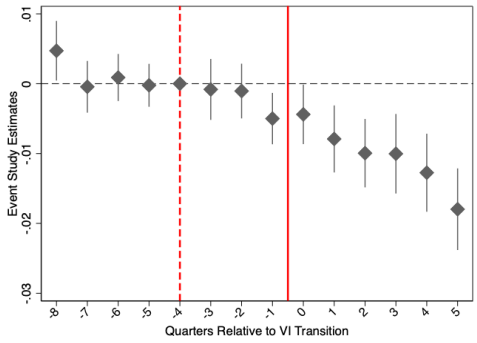
PANEL A

	Trad. Medicare Procs. in ASC		Medicare Adv. Procs. in ASC		Comm. Procs. in ASC	
	(1)	(2)	(3)	(4)	(5)	(6)
Treated x Post	1.839***	2.195***	0.702***	0.842***	0.882**	1.045**
	(0.580)	(0.691)	(0.219)	(0.261)	(0.419)	(0.500)
Treated x Post x VI		–2.157***		–0.842***		–1.007**
		(0.692)		(0.261)		(0.501)
Physician FE	Yes	Yes	Yes	Yes	Yes	Yes
Stacked Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations (N)	6,950	6,950	6,950	6,950	6,950	6,950
Unique Physicians	695	695	695	695	695	695
Pre-Period Mean: Treated	0.08	--	0.04	--	0.04	--
Pre-Period Mean: Controls	0.40	--	0.26	--	0.32	--

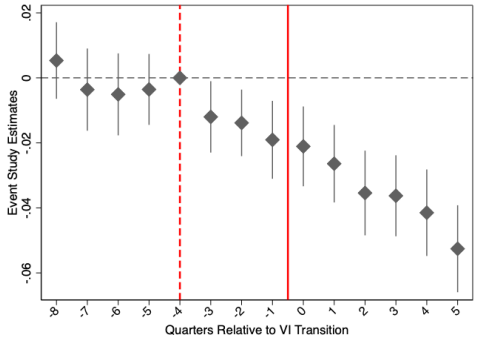
PANEL B

	Any ASC Use Trad. Medicare		Any ASC Use Medicare Adv.		Any ASC Use Comm.	
	(1)	(2)	(3)	(4)	(5)	(6)
Treated x Post	0.099***	0.116***	0.060***	0.072***	0.055***	0.066***
	(0.018)	(0.022)	(0.013)	(0.016)	(0.014)	(0.016)
Treated x Post x VI		–0.110***		–0.073***		–0.067***
		(0.022)		(0.016)		(0.017)
Physician FE	Yes	Yes	Yes	Yes	Yes	Yes
Stacked Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations (N)	6,950		6,950		6,950	
Unique Physicians	695		695		695	
Pre-Period Mean: Treated	0.02	--	0.02	--	0.02	--
Pre-Period Mean: Controls	0.03	--	0.02	--	0.03	--

Notes: "VI" is a binary indicator for physicians vertically integrated with a local hospital or health system in 2020. 16% and 23% of the treatment group and control group physicians, respectively, are vertically integrated in the analytic data. Treated physicians are those with cardiac specialization and are exposed to ASC entry. Control physicians are those with cardiac specialization and work elsewhere around the state of Florida. Standard errors clustered at the physician level. *** P value at 0.01 ** P value at 0.05. * P value at 0.10



(a) ASC share



(b) Any ASC use

FIG 10. EFFECTS OF NEW VERTICAL INTEGRATION ON ASC USE FOR MEDICARE PATIENTS

Notes: Figures report physician-level stacked event-study estimates around the first observed transition into vertical integration. The stacked analytic sample includes 563 treated physicians and 2,040 never-VI control physicians, with event time -8 to -1 defined as the pre-period and event time 0 to +5 as the post-period. In the pre-period, mean ASC share was 0.0028 for treated physicians and 0.0117 for controls; in the post-period, mean ASC share was 0.0050 for treated physicians and 0.0241 for controls. For any ASC use, pre-period means were 0.0111 for treated physicians and 0.0444 for controls; post-period means were 0.0154 for treated physicians and 0.0778 for controls.

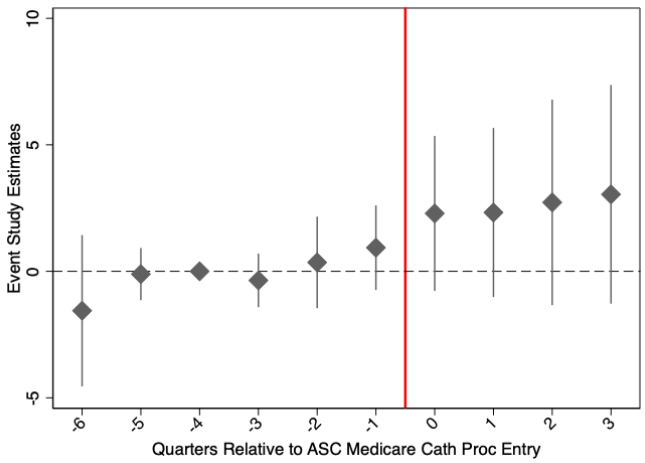


FIG 11. ASC ENTRY EFFECTS ON CARDIAC CARE PHYSICIAN VERTICAL INTEGRATION

Notes: Event study estimates using national Medicare claims data and stacked DD analytic sample (see Section IV). Treated counties are those that experience ASC entry, defined as counties with 10 or more relevant procedures performed within an ASC. We also restrict to counties satisfying the "Volume Min" restriction described in Section IVC.

Appendix

APPENDIX TABLE A1— CARDIAC CATHETERIZATION PROCEDURE VOLUME DIFF-IN-DIFF ESTIMATES WHEN STRATIFYING TREATMENT GROUP BY ENTRY INTENSITY

PANEL A

Single ASC Entry Treatment

	ASC Facilities		**OBL Facilities**	
	All Controls	Volume Min Controls	All Controls	Volume Min Controls
	(1)	(2)	(3)	(4)
DD Estimate	12.72***	12.71***	–3.41*	–3.20
	(1.23)	(1.23)	(2.04)	(2.06)
County FE	Yes	Yes	Yes	Yes
Stacked Time FE	Yes	Yes	Yes	Yes
Observations (N)	7,850	1,650	7,850	1,650
Unique Counties	785	165	785	165

PANEL B

Multiple ASC Entry Treatment

	ASC Facilities		**OBL Facilities**	
	All Controls	Volume Min Controls	All Controls	Volume Min Controls
	(1)	(2)	(3)	(4)
DD Estimate	15.39***	15.38***	–13.95***	–13.74***
	(2.20)	(2.21)	(3.63)	(3.65)
County FE	Yes	Yes	Yes	Yes
Stacked Time FE	Yes	Yes	Yes	Yes
Observations (N)	7,740	1,540	7,740	1,540
Unique Counties	774	154	774	154

Notes: “Single ASC” includes treated counties with exactly one ASC site (22 counties). “Multiple ASC” includes treated counties with two or more ASC sites (11 counties). *** P value at 0.01 ** P value at 0.05. * P value at 0.10

APPENDIX TABLE A2— CARDIAC CATHETERIZATION PROCEDURE VOLUME DIFF-IN-DIFF ESTIMATES WHEN STRATIFYING TREATMENT GROUP BY ENTRY TYPE

PANEL A

De Novo ASC Entry

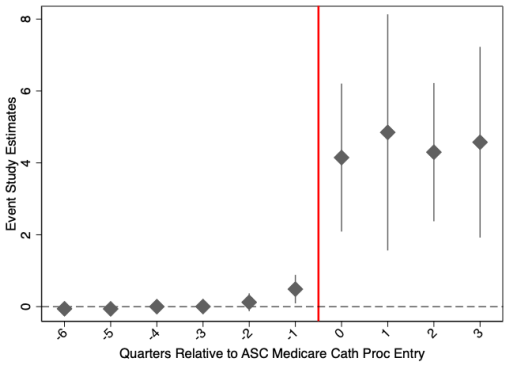
	ASC Facilities		**OBL Facilities**	
	All Controls	Volume Min Controls	All Controls	Volume Min Controls
	(1)	(2)	(3)	(4)
DD Estimate	11.65***	11.64***	–6.50**	–6.29**
	(1.19)		(2.87)	
		(1.20)		(2.88)
County FE	Yes	Yes	Yes	Yes
Stacked Time FE	Yes	Yes	Yes	Yes
Observations (N)	7,800	1,600	7,800	1,600
Unique Counties	780	160	780	160

PANEL B

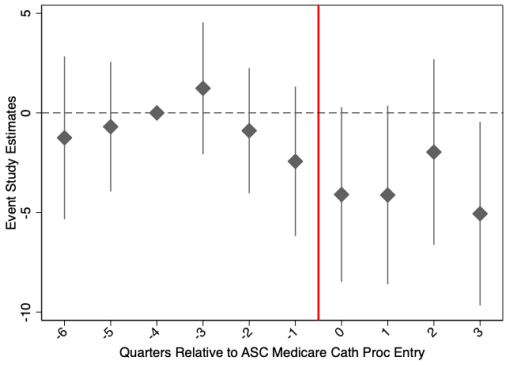
Mixed ASC Entry – Hybrid Facilities + OBL Conversions

	ASC Facilities		**OBL Facilities**	
	All Controls	Volume Min Controls	All Controls	Volume Min Controls
	(1)	(2)	(3)	(4)
DD Estimate	15.70***	15.68***	–7.37***	–7.16**
	(1.79)		(2.83)	
		(1.80)		(2.85)
County FE	Yes	Yes	Yes	Yes
Stacked Time FE	Yes	Yes	Yes	Yes
Observations (N)	7,790	1,590	7,790	1,590
Unique Counties	779	159	779	159

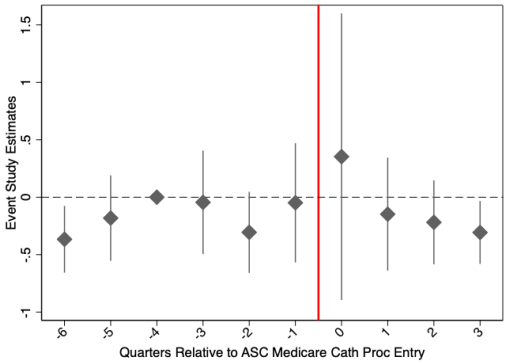
Notes: "De novo" includes the 17 treated counties whose post-policy ASC entry sites have no prior same-address OBL. "Mixed" includes treated counties that are either co-located (9 counties; every post-policy ASC site has a prior same-address OBL) or a mixture (7 counties; at least one co-located and one non-co-located post-policy ASC site). *** P value at 0.01 ** P value at 0.05. * P value at 0.10



(a) PCI – ASC Facilities



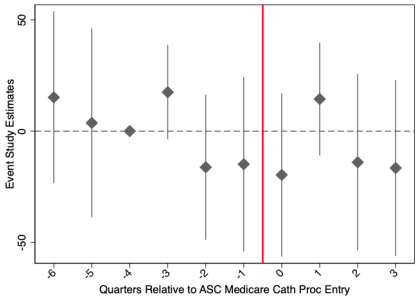
(b) PCI – HOPD Facilities



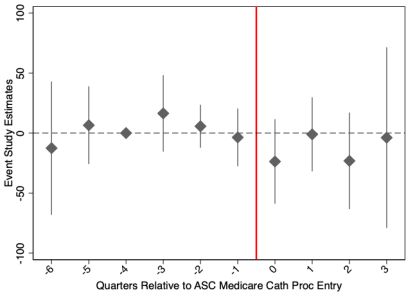
(c) PCI – OBL Facilities

APPENDIX FIG A1. EXAMINING FOLLOW-ON DEREGULATION POLICY FOR "PCI" PROCEDURE VOLUME

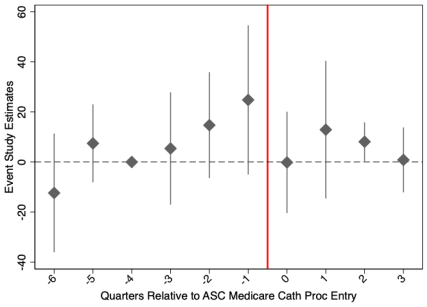
Notes: Event study estimates using national Medicare claims data and stacked DD analytic sample (see Section IV). Treated counties are those that experience ASC entry, defined as counties with 10 or more cardiac catheterization procedures performed within an ASC. Procedure volume includes the 6 PCI procedures affected by the 2020 policy change.



(a) Traditional Medicare Procedures in HOPD Facilities



(b) Medicare Advantage Procedures in HOPD Facilities



(c) Commercial Procedures in HOPD Facilities

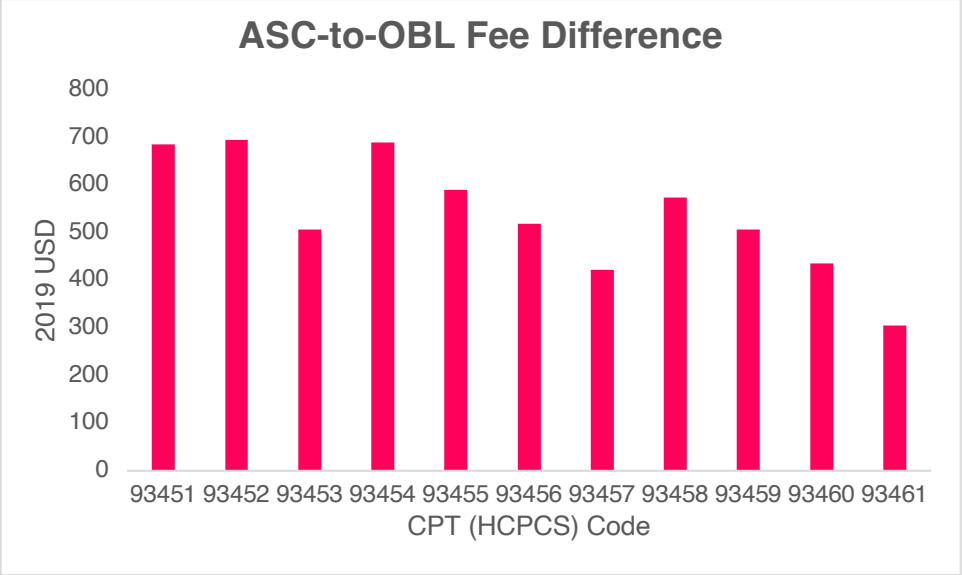
APPENDIX FIG A2. ENTRY SPILLOVER EFFECTS FOR UNTARGETED CARDIAC PROCEDURES BY PAYER IN FLORIDA

Notes: Event study estimates using stacked DD analytic sample (see Section V).

APPENDIX TABLE A3—ASC ENTRY EFFECTS ON CARDIAC PHYSICIAN VERTICAL INTEGRATION

	No. Vertically Integrated Cardiac Care Physicians	Share of Cardiac Care Physicians Vertically Integrated
	(1)	(2)
DD Estimate	2.72	0.031
	(1.67)	
		(0.017)
County FE	Yes	Yes
Stacked Time FE	Yes	Yes
Observations (N)	1,760	1,760
Unique Counties	176	176
Pre-Period Treatment Mean	15.1	0.345

Notes: Control group counties are those satisfying the "Volume Min" inclusion criterion. Standard errors clustered at the county level.
*** P value at 0.01 ** P value at 0.05



APPENDIX FIG A3. CARDIAC CATHETERIZATION MEDICARE FACILITY FEE DIFFERENTIALS, 2019

Notes: The figure shows the national average Medicare facility fee differential (ASC-to-OBL) in 2019 for the 11 cardiac catheterization procedures affected by the 2019 policy change. Sources: Medicare Procedure Price Lookup (ASC) https://www.medicare.gov/procedure-price-lookup/ and Physician Fee Schedule (OBL) https://www.cms.gov/medicare/payment/fee-schedules/physician