Administrative Pricing, Incentive Alignment, and Medical Market Supply and Competition

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A large share of US health care dollars flows through government insurance programs. Medicare, in particular, is a key payer for many firms—making its administratively set prices influential within the sector. We study a large overhaul to its fee schedule for ambulatory surgery centers (ASCs), which directly compete with hospitals and commonly include ownership stakes by physicians. ASCs ultimately experienced negative price shocks due to the Medicare policy change, which we use to investigate changes in physicians' supply of services to the market and market competition among ambulatory procedure firms. We find output reductions when ASCs and physicians have close incentive alignment; however, our most important findings pertain to strong ASC entry deterrence following the payment reforms. Supplementary analyses demonstrate that shielding hospitals from greater ASC competition can prevent losses of 10-20% of their contested cases and weaken their incentives to shift toward more efficient care delivery. (JEL Codes: H44, H51, I11, I13, I18)

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I. Introduction

The US health care system has long been noteworthy for its claim on a large share of the nation's economic resources as well as its mixed economy structure. Nearly half of the country's more than three trillion dollars in annual health care spending flows through public channels—much of it via the Medicare and Medicaid programs.[1] As these public insurers continue to grow in size, their potential influence on the health care sector increases accordingly.

Medicare, in particular, is a significant source of revenue for much of the sector's firms and can therefore shape health care markets in ways that affect Medicare and non-Medicare consumers alike. Importantly, traditional (i.e., fee-for-service) Medicare has and continues to rely primarily on a government set fee schedule for services rendered by private providers. Ostensibly, this gives the public payer some level of control over health care spending outlays; however, administrative pricing can also be vulnerable to politically driven changes (e.g., Cooper *et al.* 2017), regulatory capture (e.g., Chan and Dickstein 2018), and arbitrary rulemaking. Suboptimal decision-making, in turn, can have a variety of downstream consequences for Medicare beneficiaries, non-Medicare patients, and ultimately the country's fiscal trajectory. For these reasons, it is of economic and policy importance to understand how evolutions in Medicare's reimbursement structure impact health care delivery.

We study such a setting within ambulatory surgery markets, which experienced a Congressionally legislated overhaul of its Medicare fee schedule. A distinguishing feature of these markets is their reliance on two types of rival firms. Specifically, outpatient medical procedures, where patients are typically discharged the same day as treatment,

[1] A brief overview of recent US health care spending breakdowns from the Center for Medicare and Medicaid Services (CMS) is available here: https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/downloads/highlights.pdf.

may be performed in either a hospital outpatient department (HOPD) or a freestanding ambulatory surgery center (ASC). HOPDs represent one business line belonging to the much broader and multiproduct hospitals, whereas ASCs are far more specialized in terms of their scope of services and care delivery capacity. Another unique feature of ASCs is that they often include direct ownership stakes by individual physicians and groups—something much less common among full service hospitals.[2]

There is existing evidence that the choice of ambulatory procedure setting is linked to physician financial interests and case profitability (David and Neuman 2011; Lynk and Longley 2002; Plotzke and Courtemanche 2011), and other work demonstrates that increased exposure to ASCs is associated with lower outpatient volume and profit margins for hospitals (Bian and Morrisey 2007; Carey, Burgess, and Young 2011; Courtemanche and Plotzke 2010). ASCs have also been championed as the more efficient care setting and thus beneficial to health care consumers (Grisel et al. 2009; Hair, Hussey, and Wynn 2012; Munnich and Parente 2014; Munnich and Parente 2018; Paquette et al. 2008; Weber, 2014)—albeit for a narrower set of procedures than what hospitals supply to the market. Hospitals unsurprisingly lament the rise of ASCs, which now number more than 5,000 across the US, and tend to encourage regulatory efforts that disadvantage what they see as an unfair competitor for some of their most financially valuable cases.[3]

An example of such a federal policy intervention occurred during the mid-2000s and included one of the largest changes to ASC Medicare incentives in its previous 30-

[2] It is estimated that over 90 percent of ASCs are subject to some form of physician ownership (Dyrda 2017). Previous work remarks on the growing tension between hospitals and physician-owned facilities during the early 2000s (e.g., see Berenson, Bodenheimer, and Pham 2006).

[3] Hospitals, for example, will often argue that ASCs restrict their services to those that are highly profitable, while hospitals must offer profitable and unprofitable (but socially beneficial) care—with the former cross-subsidizing the latter as a necessary means for financial solvency (Casalino, Devers, Brewster 2003; Voelker 2003; Vogt and Romley 2009). The absolute number of ASCs is from the CMS Provider of Services files, which captures all Medicare-certified ASC facilities in the US for a given year.

year history. In 2008, Medicare began phasing in a new facility fee schedule exclusively for ASCs, which largely tilted payments in favor of HOPDs. Going forward, all outpatient procedures performed within ASCs would be arbitrarily capped below 60% of prevailing HOPD rates for the same service. As a direct consequence of this mandated ceiling, Medicare reduced facility payments for some key ASC services, while leaving HOPD reimbursement trends undisturbed. Absent any supply-side behavioral responses, the policy could operate as a blunt tool to lower Medicare spending and hence taxpayer financial obligations. However, as discussed in Section 2B, there are a variety of margins on which providers and markets could adjust, with mixed welfare implications. In fact, how these ASC reimbursement changes affected outpatient procedure flows and prevailing competition is largely unknown and requires empirical investigation.

We subsequently exploit this plausibly exogenous policy change to examine the impact of a negative Medicare price shock on the supply of associated services and the competitive landscape for ambulatory procedural care. We do so by leveraging extensive and detailed administrative data sets from Florida, which include the universe of outpatient surgery market activity from 2005-2013. Our empirical strategies rely on specific features of the Medicare policy change coupled with pre-existing market structure characteristics. We then carry out a variety of difference-in-differences analyses that utilize pre-policy exposure to and reliance on ASC-based care as our key source of variation for individual provider-level and firm-level estimation. These empirical exercises ultimately allow us to better understand the role of financial incentives in a medical market where two distinct care settings compete for the same services, with physicians working in both settings but having financial interests in only one.

We ultimately find a suggestive decline in colonoscopy output for Medicare fee-for-service (FFS) patients among individual providers more reliant on ASCs at baseline, while

spinal injection volumes are sharply lower (22%) for those exposed to the negative price shock. These injections are also a service where facility-to-provider incentive alignment appears close to complete. Perhaps our most important results relate to market entry effects. We show a sharp drop in ASC entry with the introduction of the less favorable Medicare fee schedule that never recovers. Leveraging additional features of our data, we then construct complementary analyses that help quantify, at least in part, the potential benefit of policy-induced ASC entry deterrence for incumbent firms. For hospitals, specifically, descriptive and causal estimation both imply that preventing a hospital from facing a new ASC competitor spares it a loss of 10-20% of contested cases over the short- to medium-run. Our evidence further suggests that ASC competition helps drive hospitals toward more efficient care delivery. This constellation of findings underscores the influence the Medicare program has within US health care markets, and consequently, why policymakers should proceed with caution when altering the incentives facing diverse suppliers. Administrative pricing can have broad ramifications that extend beyond the single public insurer.

II. Background

A. Outpatient Surgery Markets and Medicare Payment Policy

The number of outpatient surgeries in US community hospitals has grown considerably since the early 1980s, accompanied by a decline in inpatient cases. By 2016, approximately 80 percent of all surgeries were performed on an outpatient basis, and nearly half of all outpatient procedures were performed in ASCs, specifically.[4]

Previous research on the US outpatient surgery market has attributed much of its growth to two factors: technological advances in medicine and changes in Medicare

[4] Author calculations based on Ambulatory Surgery Center Quality Reporting program data and American Hospital Association (2018).

reimbursement policy (Ambulatory Surgery Center Association 2011; Koenig *et al.* 2009). Indeed, most of the change in hospital-based outpatient surgeries occurred in the early 1980s, when Medicare both began covering procedures performed in ASCs and also introduced the Inpatient Prospective Payment System (IPPS), which implicitly incentivized reductions in inpatient-based care.

Medicare payments for outpatient surgeries consist of a facility fee, a physician fee, and fees for other services (e.g., physical therapy and durable medical equipment). While physicians receive a site neutral payment that is the same regardless of whether a procedure was performed in an ASC or a hospital, facility payments differ across settings. In general, reimbursements for outpatient procedures in hospitals are set higher than ASCs because hospitals must meet additional regulatory requirements and treat patients who are more medically complex (MedPAC 2003). For example, in 2007, the national rate for a colonoscopy performed in ASC was $446, whereas HOPDs received 22% more ($543) for the same service.

Differences in the way ASC and HOPD payments are set, and the relative payment rates between the two types of facilities, have also varied over time. When Medicare first started covering outpatient procedures in 1982, HOPD procedures were reimbursed using a cost-based system whereas ASC procedures were grouped into one of four payment categories based on cost and clinical similarity, with every procedure in a particular category reimbursed the same amount. Across both settings, facility payments did not vary with case mix (i.e., underlying health of the patient population) and were updated annually for inflation. They were not otherwise adjusted until Medicare expanded to eight ASC payment groups in 1990, and nine in 1991 (MedPAC 2010).

In 2000, Medicare's traditional cost-based reimbursement system for outpatient care in HOPDs was replaced with the Outpatient Prospective Payment System (OPPS).

OPPS established 200 Ambulatory Payment Classifications (APCs) for hospital outpatient procedures. This change harmonized the ambulatory procedure reimbursement structures across HOPDS and ASCs; however, payment levels were still set independently. In fact, because little was known historically about costs for outpatient procedures, CMS adjusted payment rates annually depending on the perceived imbalance in ASC supply relative to HOPD supply (Scully 2/26/03, p. 46).[5]

"I've got a third of my staff in hospitals, a third in the outpatient side, and some guy setting ASC rates, and they never talk to each other…"—Tom Scully, FTC health care market hearing 2/26/2003.

In response to rapid growth in the number of ASCs, the Medicare Prescription Drug, Improvement, and Modernization Act of 2003 froze ASC payment updates and directed the Government Accountability Office (GAO) to examine the relative costs of procedures performed in ASCs and HOPDs and inform implementation of a new fee schedule by January 1, 2008 (U.S. GAO 2006). Between 2008 and 2011, Medicare rolled out a new system for ASC payments based on the 200 APCs in the OPPS as well as expanded the number of covered ASC procedures (MedPAC 2010). Under the new policy, the ASC facility fee for any procedure would be no greater than 59% of the facility fee paid to a HOPD and would be phased in fully (25 percent per year) by 2012. In the lone published study of this specific policy, Munnich and Parente (2018) show that patient care shifted from ASCs to HOPDs as the relative financial benefit of ASC treatment declined.

B. 2008 Policy Implications for Service Delivery and Market Competition

[5] Federal Trade Commission (FTC), Health Care and Competition Law hearing transcript, 2/26/2003. Available here: https://www.ftc.gov/sites/default/files/documents/public_events/health-care-competition-law-policy-hearings/030226trans.pdf

Existing research tends to consider public payer price changes to physicians or hospitals in isolation when studying care delivery outcomes. However, in a wide variety of settings, health services are jointly produced by these otherwise independent entities, which ultimately receive separate payments. This leads to varying degrees of incentive alignment between these necessary inputs through existing contractual arrangements or ownership relationships. Altering the price schedule facing one point of production (e.g., a health care facility) can have ambiguous effects on overall productivity and market structure—depending on how closely aligned the incentives are and the presence of substitution possibilities within the production process.

Both features are relevant to our context. As previously mentioned, ASCs are a unique facility type in that physicians are often co-owners and hence the residual claimants on the earnings from their personal care delivery as well as the facility's overall output (via profit-sharing arrangements). Direct and indirect exposure to the financial incentives facing the ASC can lead physicians to internalize, at least in part, the fee reductions to ASCs and adjust their output accordingly (i.e., negatively with upward sloping supply curves or positively in the case of demand-inducement). Ambulatory procedures may also have more elastic supply than care for conditions that require immediate medical attention.[6]

Yet, outpatient procedure markets commonly include "splitters"—individual physicians that deliver the same service within each setting (i.e., ASCs and HOPDs). Their allocations may favor one setting over the other due to ownership stakes, individual preferences, and patient preferences. But the case allocations could also change following

[6] For example, Clemens and Gottlieb (2014) find greater treatment intensity increases following a positive Medicare price change for elective procedures, such as cataract surgeries and colonoscopies, as opposed to less discretionary care. Hollingsworth et al. (2011) relatedly find that the opening of an ASC in a local area is positively associated with discretionary surgery use during the 1998-2006 period—though others find weaker correlations with alternative data and time periods (Koenig and Gu 2013).

the introduction of less attractive fees for ASC-based services. Total procedure output could then be preserved by redistributing some portion of ASC cases to HOPDs. This possibility necessarily assumes that hospitals have the capacity to absorb all of a given physician's cases intended for reallocation and that no other transaction costs (e.g., admitting privileges, provider/patient travel time, etc.) are sufficiently large to suppress the willingness to change settings. Any adjustment frictions or binding capacity constraints would, however, lower the aggregate flow of services to the Medicare market for a given physician. Given these potential and opposing responses to the policy (i.e., positive, negative, or none), how physician procedural throughput actually changes in this context is an open empirical question.

Finally, reforming Medicare payments to ASCs can ultimately shape their long-run profitability and hence the staying power of incumbent ASCs as well as the entry opportunities for the marginal ASC. Slowing ASC expansion or inducing contraction has intuitive benefits for incumbent firms but may harm consumers through more expensive or less efficient care delivery following weakened competition. While the policy was not explicitly framed with such an objective, there is a clear risk of this downstream consequence.

Figure 1 offers empirical support for this consideration. The data reflect all Medicare-certified ASCs across the nation from 1990 to 2015 and show a plateauing of ASC supply immediately following the fee schedule change in 2008. Importantly, the previous 18 years are home to robust growth in ASCs—often by 5-10% per year, while the subsequent 8 years typically witness increases of 1% or less. Figure 2 decomposes the supply trend from Figure 1 into annual entry and exit behavior by ASCs. A sharp change in firm behavior is most evident for market entry—exit behavior generally follows a smooth upward trend for much of this period. In the lead up to the Medicare fee change,

more than 350 new ASCs arrive to the market each year. This annual tally falls by more than 40% once the negative price changes are fully implemented (i.e., in 2012). Restraining ASC entry is likely to benefit firms already delivering ambulatory procedures, and for hospitals specifically, ASC entry deterrence could advantage hospitals well beyond mandating permanently superior fees relative to ASCs.

Our following set of empirics aims to systematically evaluate each of these potential policy effects. We begin by estimating changes in physician service flows after the ASC fee reductions, and then we move to a series of analyses focused on the implications of any ASC entry deterrence stemming from the federal pricing intervention.

III. Data

A. Florida Discharge Data

Our extensive set of analyses leverages the universe of ambulatory/outpatient procedure discharge records from the state of Florida, which we obtained from the Florida Agency for Health Care Administration (AHCA). Our administrative data also provide a long time series beginning in the first quarter of 2005 and ending in the fourth quarter of 2013—allowing us to capture ambulatory procedure market activity several years before the Medicare price shock and throughout the policy's rollout.[7] Additionally, the comprehensive nature of the data gives us the opportunity to fully track ambulatory procedure flows and related outcomes for specific payers and providers operating within the state. These detailed records include a rich set of variables, such as diagnosis and procedure codes, type of insurance, patient demographic information, and individual

[7] We intentionally truncate the analytic window at the quarter just prior to 2014. That year includes documented changes in private insurance markets via the Affordable Care Act and a large change to Medicaid managed care enrollment courtesy of state policymakers. We also restrict to ASC and HOPD cases, which removes highly specialized points of care (e.g., lithotripsy centers and cardiac catheterization centers) that account for less than 1% of discharges.

treating provider information (i.e., associated state clinical licenses).[8] Florida is also home to a large share of the nation's Medicare population (3-4 million beneficiaries in recent years) and has an accommodating regulatory environment toward ASCs (e.g., ASCs are not bound by any existing certificate of need laws).[9] In what follows, we exploit these data features to construct a variety of provider-procedure panels at both the individual physician and firm levels.[10]

B. ASC and HOPD Summary Characteristics

For additional context, Figure 3 describes the allocation of ASCs throughout Florida as of 2005—our first year of data and hence the starting point for our subsequent ambulatory procedure market analyses. A small minority of counties have a clear concentration of these firms, while many counties have few. Areas with the strongest ASC presence tend to be those with large metropolitan areas (e.g., Miami, Orlando, and Tampa Bay).

Table 1 compares the characteristics of the average ASC to the average HOPD in our baseline (2005) year of data. Hospital outpatient departments typically deliver more services and use a greater number of providers; however, the output per provider is substantially higher among ASCs, which is consistent with their prevailing business model (i.e., lower complexity, high volume cases). Consistent with the pattern seen in Figure 3, ASCs are also found in more competitive environments, i.e., those with a lower

[8] The discharge record procedure codes, specifically, are those belonging to the Current Procedure Terminology (CPT)— or Health Care Common Procedure Coding System (HCPCS)—nomenclature. All specific procedures belonging to any analysis are identified using all available CPT codes provided on a given discharge record.

[9] The size of Florida's Medicare population is second only to California among all US states (see here: https://www.kff.org/medicare/state-indicator/total-medicare-beneficiaries/?currentTimeframe=0&sortModel=%7B%22colId%22:%22Location%22,%22sort%22:%22asc%22%7D).

[10] We do note one drawback to these data is the inability to follow individual patients over time, which precludes rigorous quality of care investigations.

Herfindahl-Hirschman index (HHI).[11] Both types of firms rely on Medicare fee-for-service and the non-Medicare commercially (i.e., privately) insured markets for the bulk of their ambulatory procedure business. It is nearly an even split in procedure shares flowing to these two payer groups among ASCs—making them (and their associated price schedules) likely influential for ASC conduct and profitability. HOPDs, on average, devote a share of procedure volumes to the commercial market that is equal to that of ASCs, but they do relatively less Medicare cases and relatively more for other payers (e.g., Medicaid or self-insured patients). It is also worth noting that Florida's ASCs outnumbered HOPDs roughly 3:2 in 2005.

IV. Empirical Strategy for Output Effects

Our first analytic aim is to estimate the impact of negative price changes for ASCs on the supply of services to the Medicare market at the individual provider level. We focus on four of the most common ASC procedure types for Medicare patients in the pre-policy period: colonoscopies, spinal injections, cystoscopies, and upper endoscopies that include a tissue biopsy. These four procedure groups alone account for nearly half (46%) of all ASC Medicare cases in our pre-policy data, and importantly, experienced a negative facility fee price shock as a consequence of the 2008 policy.[12]

The evolution of the Medicare reimbursement changes can be seen in Figure 4. Medicare payments (in nominal dollars) are flat from 2005 through 2007 and then are gradually reduced from 2008-2012 as the policy is rolled out. We further summarize some key features of these procedures in Table 2. Prior to the fee schedule reforms, the majority of Medicare patients received these services within an ASC setting. All four procedures

[11] The HHI calculations are based on the facilities' market share of all ambulatory procedures within the county a given facility is located within.

[12] They are also points of empirical emphasis within the only other published paper on this specific policy change (i.e., Munnich and Parente 2018).

were also priced below the analogous HOPD facility fee just prior to policy implementation (implied by the fee ratio < 1.0)—though to varying degrees. By 2012, they are uniformly set at 58% of the prevailing HOPD Medicare facility reimbursement level—making the full negative price changes between 9-23% across our procedures of interest.

Figure 5 plots the total, statewide Medicare procedure volumes by type and over time. The patterns also foreshadow much of our individual provider-level findings. Medicare colonoscopy output falls and remains depressed following the price shock; similarly, spinal injections steadily decline over the entire post-period. By 2013, total spinal injection Medicare cases are nearly a third lower than their pre-policy (2005-2007) levels. Yet, cystoscopy and upper endoscopy (with biopsy) procedures show no clear response in aggregate.

In the following sub-sections, we diagram our difference-in-differences (DD) design and report the accompanying results. We specifically leverage pre-policy exposure to ASCs as the key source of identifying variation in the data. Although we do not expect physicians' baseline ASC reliance to be random, it should be exogenous to the Medicare policy shock introduced in the future (i.e., 2008).

A. Econometric Approach

We first categorize all individual providers performing the relevant procedure for Medicare FFS patients over our study period according to their procedure setting allocations during the pre-policy period. More specifically, we exploit the fact that some individuals are "splitters" and thereby perform the same procedure for some Medicare patients within ASCs and other Medicare patients within HOPDs. Meanwhile, other individuals exclusively perform the relevant cases in HOPDs (i.e., have zero ASC utilization). We

classify providers with at least one relevant ASC case over each year of the pre-policy period (2005-2007) as our treatment group (*Treated*) since they are plausibly exposed to the Medicare facility fee reimbursement changes introduced for ASCs in 2008. The control group is then composed of clinicians with no ASC exposure at baseline (i.e., *Treated* is set to zero for these observations). The resulting estimating equation is the simple two-by-two DD specification with individual provider fixed effects (λ):

$$Volume_{it} = \gamma Treated_i + \phi Post_t + \delta(Post * Treated)_{it} + \lambda_i + \varepsilon_{it} \quad (1)$$

The *Volume* outcome measure in Equation 1 captures the total Medicare FFS procedure output (specific to the type of case—4 in total) for provider (i) in year (t), which is importantly independent of delivery setting. In this way, we are allowing for a reallocation of procedures to different settings after the policy shock and therefore investigating changes in providers' aggregate flows of a given service to the Medicare market. Note, the gamma parameter is not identified since the *Treated* designation is a time-invariant characteristic by design. Intuitively, a negative difference-in-differences estimate (δ) would imply a drop in output for those exposed to the ASC fee reductions relative to those with no ASC reliance at baseline, whereas a positive differential would be consistent with demand-inducement. In supporting analyses, we refine the treatment group (i.e., those exposed to the policy shock) by the degree of pre-policy ASC exposure for a given provider. Doing so allows us to explore possible heterogeneity in procedure productivity effects. The variation in baseline reliance upon ASCs for the "splitter" group can also be seen in Appendix Figure 1. For all four procedures, these clinicians strongly favor ASC settings for their cases, rather than HOPDs. The allocation is almost entirely to ASCs for providers preforming spinal injections, specifically.

To ensure the validity of our inferences from the simple two-by-two DD setup, we also employ an event study model (Equation 2).

$$Volume_{it} = \gamma Treated_i + \eta_t \sum_{t=-3}^{5} Year_t + \delta_t \sum_{t=-3}^{5} (Treated * Year_t)_{it} + \lambda_i + \varepsilon_{it} \qquad (2)$$

We use a full vector of year fixed effects and make 2007 (t=-1) the reference category. The pre-policy coefficients subsequently inform us if we are satisfying the parallel trends assumption underlying our research design, and the set the post-policy coefficients allow us to observe any evolutions in the outcomes—and, in particular, if they align with the step-wise introduction of the ASC service price cuts.

Of note, our standard errors are clustered at the county level based on where the provider performed her largest share of the relevant procedure during the 2005-2006 period in both regression models.

B. Output Results

Table 3 begins our DD results. For colonoscopies, clinicians relying on ASC facilities (to some degree) deliver almost 17 fewer procedures to Medicare patients per year relative to those only using HOPD facilities (column 1, Table 3) after the ASC price shock. Spinal injection providers exposed to the policy change reduce their output by 51 procedures, on average, annually. The spinal injection DD estimate is also precisely estimated, with a t-statistic of 3.4. These changes for colonoscopy and spinal injection volumes correspond to Medicare service flow declines of 7% and 22% relative to their pre-policy output, respectively. There is no clear policy effect for cystoscopy and upper endoscopy procedures (columns 3-4, Table 3). Both DD coefficients are small and imprecisely estimated.

Table 4 repeats our DD models but with alternative treatment group compositions.[13] Columns 1 and 2 of Table 4 reveal that the negative volume effects for colonoscopies localize to where economic intuition would predict (i.e., clinicians with the highest utilization of ASCs before the Medicare fee schedule change). The most exposed individual providers have 11% lower total output to the Medicare market (relative to their pre-policy procedure volumes) following the facility price decline, on average (column 2, Table 4). Conversely, there is no detectable effect among providers with some (but much more limited) ASC exposure (column 1, Table 4). Again, no clear pattern emerges for either cystoscopy or upper endoscopy services. The DD coefficient is negative and substantive for the most exposed cystoscopy "splitters" (column 4, Table 4) but is too noisy to draw any strong inferences. The estimates are uniformly small and lack sufficient precision for upper endoscopy volumes (columns 5-6, Table 4).

The corresponding event study findings are displayed within Figure 6 (with detailed regression results in Appendix Table 1). The pre-treatment trends and post-policy changes at the individual provider level are most compelling for spinal injections, as the pre-trends are flat and near zero, while the decline in output grows steeper (i.e., become larger) as the fee reductions are phased in.[14] The pattern and inferences are more speculative for colonoscopies, however, which encourage a cautious interpretation for the DD estimate in Table 4. The event study results for cystoscopy directionally align with the negative ASC price shocks but never reach statistical significance. The differentials

[13] We do note that the ASC exposure measure for spinal injections is strongly bimodal where individual providers almost exclusively perform cases in one of the two ambulatory settings (see Appendix Figure 1, for example), which precludes heterogeneity analyses among the treatment group for this procedure—and hence its omission from Table 4.

[14] Given the strong and large changes in annual service flows for providers performing spinal injections, we also examined their procedure output for all *non*-spinal injection Medicare cases in Appendix Table 2. Although the coefficient is positive (consistent with substitution toward other ambulatory procedures), it is small and statistically insignificant, which suggests that these clinicians reallocate their time to other activities (e.g., procedures for non-Medicare payers, office visits, or leisure).

largely fluctuate around zero for upper endoscopy volumes both before and after the payment reforms.[15]

V. Empirical Strategies for Market Competition Effects

Shifting our focus away from physician-level medical care throughput, we now explore the implications of Medicare's ASC fee reforms on ambulatory procedure markets' structure and conduct. We begin by describing firm supply growth as well as entry and exit behavior in Florida over our 2005-2013 study period. Doing so allows us to determine if Florida markets parallel the national trends observed in Figures 1 and 2, which then motivate our subsequent regression analyses. More specifically, the regression analyses aim to translate how observed post-policy changes in ASC entry behavior may impact incumbent firms.

Annual growth among Florida ASCs and HOPDs is displayed in Figure 7. The supply of ASCs is increasing 4-5% per year in the lead up to the Medicare policy change but substantively slows and even contracts (i.e., experiences negative growth) during the post-period. The weakest years of ASC growth are also found after the revised fee schedule is fully implemented (i.e., 2012 and 2013). Hospital outpatient departments expectedly show more limited changes in net supply over time—typically less than 1% year-on-year. We further decompose the observed ASC trend within Figure 8, which separately displays annualized entry and exit behavior for these firms. The number of ASCs leaving the market in a given year appears largely unchanged after the new fee schedule takes hold; yet, firm entry behavior sharply declines over the policy's rollout and hits its lowest point when the price adjustments are complete. These reductions in ASC

[15] We also note that we have explored analogous outcomes for colonoscopy and spinal injection volumes within the commercially insured market. We either see no substitution effect or changes in output that parallel our Medicare market results, which suggests, if anything, price following behavior by the private insurance market (e.g., as described within Clemens and Gottlieb 2017).

entry, in turn, are primarily responsible for the net ASC growth patterns observed in Figure 7 and align with the national trends noted previously.[16]

A. Descriptive Analysis for ASC Entry Effects

If the reformulated and less generous Medicare payments do discourage the marginal ASC from entering the market, then this could represent an unintended consequence of the policy and a boon for incumbent firms, especially hospitals. To better understand and quantify the potential implications from any policy-induced ASC entry deterrence, we first implement descriptive panel models for the association between ASC entry and incumbent firms' caseloads.

We construct firm (facility) level panels and use a corresponding regression model to describe changes in procedure volumes over time:

$$Y_{jt} = \zeta ASCEntry_{j(t-1)} + \theta_{jt} + \kappa_t + \eta_j + \varepsilon_{jt} \tag{3}$$

Our outcomes of interest (Y) are the total cases, total Medicare FFS cases, and total commercial cases (all logged) for a given facility (j) in year (t). We make no restriction on the types of procedure performed, so we are capturing the summed flow of all procedures to the market, irrespective of service mix. Our focal parameter (ζ) reveals the association

[16] We do note that the initiation of this policy change does coincide with the Great Recession, which could lead to tighter liquidity constraints for marginal firms wishing to enter the ambulatory procedure market. However, the trends in ASC net growth and entry behavior do not align with the business cycle—they have gradual declines during the recession period and fall more steeply during the years of economic recovery. In this way, the patterns are more consistent with the fee schedule evolution. Entry also does not pick with the macroeconomic recovery. Additionally, Appendix Figure 2 looks at the payer mix for new entrants before and after the Medicare fee schedule change. Those entering the market in the post-period have a smaller share of Medicare cases and devote more services to other payers. This is opposite of what would be expected if entry decisions were completely shaped by concurrent macroeconomic conditions and fluctuations (e.g., see He *et al.* 2015).

between experiencing one or more new ASCs entering the facility's county of operation in the preceding year (i.e., 'ASCEntry' is a binary indicator for this market level change) and the contemporaneous year's aggregate throughput. We restrict to incumbent firms already operating in the market as of 2005 and truncate the panel at 2008, which intentionally constrains our ASC entry activity to occurrences between 2006-2008 in order to minimize the risk of post-policy confounding (i.e., to aim for a relatively clean estimate of the relationship from the pre-policy years). The specification includes year (κ) and facility (η) fixed effects, along with county ('market') level time-varying covariates (θ) for ASC exit behavior and the local level of unemployment. Equation 3 is also estimated separately for incumbent HOPDs and incumbent ASCs, and the standard errors are clustered at the county level based on a facility's geographic location.

B. Causal Estimation for ASC Entry Effects on HOPDs

Following our descriptive exercise, we exploit another nuanced feature of the 2008 Medicare fee schedule reform to generate causal estimates of ASC entry effects on incumbent firms' caseloads. We also note that causal identification strategies are largely absent from the existing ASC-hospital competition literature.

To accomplish this, we leverage the fact that Medicare would not pay ASC facilities for laparoscopic cholecystectomies (a relatively common surgical procedure) prior to 2008. This pre-existing policy virtually ruled out Medicare laparoscopic cholecystectomies for ASCs and therefore forced their full allocation to hospital-based settings (i.e., inpatient or outpatient delivery). ASCs would be paid for these particular cases going forward as part of the new ASC reimbursements implemented in 2008. Put differently, ASCs abruptly moved from a zero price to a positive price for this specific surgery within the Medicare market, and importantly, no such rule existed within the

private (commercial) market. Commercial payers could contract with ASCs for this specific service as they pleased.

The dichotomy across payer types is displayed in Figure 9. As expected, almost no Medicare cases exist prior to 2008, which is followed by an aggressive ramp up in the post-policy years.[17] Commercial cases, on the other hand, both exist within ASCs prior to 2008 and are increasing in number over much of the study period.[18] We subsequently use this exogenous shock to ambulatory surgery markets within two separate difference-in-differences frameworks to recover causal estimates of ASC entry behavior on local hospital volumes, which we then compare to the associations stemming from Section 5A's simpler (but more general in terms of procedure types) approach. Each entry-effect DD empirical strategy takes advantage of the pre-policy *commercial* market environment for laparoscopic cholecystectomies facing HOPDs as a marker of exogenous policy exposure or 'bite'—which parallels our previous analyses within Section 4.[19]

Our first approach focuses on the presence of ASCs doing commercial laparoscopic cholecystectomy cases as of 2007 (i.e., just before the Medicare rule change) within a given HOPD's county of operation. Contested markets (i.e., where HOPDs and ASCs are already competing for the same cases from commercial insurers) would plausibly be the most responsive to the introduction of Medicare payment for this particular surgery. ASCs previously delivering the exact service to merely a different payer could take

[17] It is likely that the few Medicare cases reported prior to 2008 represent discharge record reporting errors—e.g., an incorrect CPT code or, and perhaps more likely, misclassifying a Medicare Advantage patient as a Medicare FFS patient.

[18] That said, laparoscopic cholecystectomies are heavily skewed toward HOPDs for commercial payers. HOPD case volumes are roughly 10-fold higher than those of ASCs. Given ASCs advantage for so many other ambulatory procedures (e.g., see Table 2), this suggests a spillover effect from Medicare's exclusion of ASCs for laparoscopic cholecystectomies prior to 2008 (i.e., there may be important economies of scale in being able to offer the same service to both markets and/or surgeons may have strong preferences for being able to deliver care to either patient type within a given setting).

[19] For both of our causal estimation strategies pertaining to cholecystectomies, we focus on HOPDs present in 2005 and delivering this service of our study period.

advantage of existing infrastructure and surgeon relationships to capture the new revenue stream. For these reasons, we consider HOPDs in contested markets prior to the policy change as our treatment group and compare them to HOPDs that have no pre-existing ASC competition for laparoscopic cholecystectomies within their county of operation (i.e., the 'control' group). The resulting estimating equations (Equations 4 and 5) are similar in spirit to those found in Section 4:

$$Y_{ht} = \psi Post_t + \delta Post * PreExistingCompetition_{ht} + \nu_h + \varepsilon_{ht} \tag{4}$$

$$Y_{ht} = \varphi_t \sum_{t=-3}^{5} Year_t + \delta_t \sum_{t=-3}^{5} (Year_t * PreExistingCompetition)_{ht} + \nu_h + \varepsilon_{ht} \tag{5}$$

Our outcomes (Y) are surgical volume levels for hospital (h) in year (t), and we investigate four outcomes in total: total laparoscopic cholecystectomy cases, ambulatory laparoscopic cholecystectomy cases, inpatient laparoscopic cholecystectomy cases, and inpatient "open" (non-laparoscopic) cholecystectomy cases.[20] We have a time-invariant binary indicator ('Pre-Existing Competition') equal to one when a given hospital is located in a contested commercial market for these cases in 2007 and zero otherwise. There are hospital fixed effects (ν) throughout to recover within-hospital changes in surgical volumes.[21] Equation 5 simply adapts the specification to an event study setup

[20] Note, the inpatient data are also a universe of discharge records provided by Florida AHCA. The data structure and reporting are quite similar to our main data asset (i.e., the ambulatory discharge records), with the exception that cases are identified using the International Classification of Disease (ICD) 9 taxonomy for inpatient discharge records.

[21] In our main results presented below, we further refine the treatment group to only include HOPDs in counties with at least three competing ASCs in 2007 in an effort to compare markets at the extremes (i.e., those with zero competition at the time of the rule change and those with the most exposure to existing

using 2007 as the omitted reference year (t=-1), just as before, and the standard errors are clustered on HOPDs' county of location.

As a point of comparison, we again rely on Equations 4 and 5 but introduce alternative treatment-control definitions. Instead of classifying hospitals' entry shock exposure by the presence of local ASCs doing these (commercial) surgical cases, we go a step further and stratify them by the presence or absence of commercial case "splitters" immediately prior the Medicare reimbursement policy change. The intuition is straightforward in that HOPDs exposed to pre-existing commercial case splitter surgeons should be at the greatest risk of Medicare case losses once the public insurer will pay ASCs for laparoscopic cholecystectomy services since these surgeons are already allocating some portion of their commercial cases to competing ASCs and have therefore revealed themselves to be 'disloyal' from the perspective of the HOPD. Conversely, HOPDs without such surgeon splitters at baseline should have much weaker exposure to the Medicare rule change, at least in the short- to medium-run.[22] We can then compare our DD estimates across these two strategies as a way to draw stronger conclusions around ASC entry effects, which ultimately speak to the downstream consequences from Medicare policy-induced entry deterrence.

C. Descriptive Results

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competitors for laparoscopic cholecystectomies). However, we have also run the analyses with the simple distinction (i.e., any pre-existing competitors or not), which generates comparable results and inferences.

[22] If ASCs newly and quickly adopt laparoscopic cholecystectomy cases into their existing suite of services, then this would perhaps not be the case. Yet, we can see in Appendix Figure 3, that the increase in the share of ASCs performing these cases (across payers) is small. 14% of ASCs perform them in 2007, and following the Medicare rule change, there is only growth of about 2-percentage points between 2007 and 2010. The share of ASCs providing this surgical service remains stable (and low) after that. Consequently, the observed trend in Appendix Figure 3 supports the validity of the two empirical approaches diagrammed in Section 5B.

Table 5 shows the results from our descriptive exercise (Equation 3). Hospitals located within areas experiencing the recent arrival of one or more ASCs are associated with approximately 10-15% reductions in aggregate service volumes, on average and depending on the payer. Interestingly, a similar pattern of results does not emerge for incumbent ASCs. There are no statistically significant changes to their overall or Medicare FFS-specific caseloads. Their total commercial cases are associated with a decline, but it is only about half as large as the negative relationship for incumbent HOPDs. Moreover, Appendix Table 3, which uses a modified specification that separates single firm entry from multiple firm entry, demonstrates that only multiple new ASC entrants appear to negatively impact existing ASCs; meanwhile, even the introduction of a single ASC to the market strongly and negatively correlates with HOPD procedure volumes.[23] The findings in Table 6 point toward market stealing by newly arriving ASCs, which is overwhelmingly targeted at competing hospitals in the area, as opposed to other ASCs.

D. Diff-in-Diff Results

Our first difference-in-differences setup leveraging pre-existing ASC competition for cholecystectomies reveals substantive reductions in HOPD cases across delivery settings and surgical methods (Table 6). The magnitude of the effect is typically 10-15% of the pre-policy level of output for these firms in contested markets and contrasts with the typically positive volume growth for HOPDs in uncontested markets prior the Medicare rule change (i.e., the standalone *Post* coefficients found in Table 6). Figure 10 displays the corresponding event study results, which reinforce the inferences from the simple two-by-two estimates in Table 6. HOPDs in contested markets lose surgical cases once Medicare will reimburse ASCs for this particular service, and the negative effects tend to accelerate

[23] Courtemanche and Plotzke (2010) likewise show that HOPD volume is negatively correlated with ASC entry, at least for ASCs in close proximity (i.e., 2 to 4 miles).

with time. However, the differences in dynamics across hospital procedure setting and surgical approach are also of interest (which can be seen in Figure 10 and the associated regression table: Appendix Table 4). Ambulatory laparoscopic cases initially decline with the policy's introduction but temporarily rebound as inpatient laparoscopic cases and non-laparoscopic cholecystectomies begin to fall. These patterns suggest that ASC entry not only engages in market stealing from local hospitals but also drives hospitals to alter how they perform these procedures for the cases they retain (i.e., shift toward more laparoscopic and outpatient-based care delivery).[24]

Table 7 and Figure 11 offer the complementary results from our second difference-in-differences design based on the Medicare payment change for laparoscopic cholecystectomies within ASCs. The finding and inferences parallel the preceding estimates. HOPDs with pre-existing exposure to surgeon "splitters" for these cases suffer roughly a 10% reduction in ambulatory surgical volumes, on average, following the Medicare reimbursement rule change (Table 7). And once again, the declines strengthen over time for both the Medicare and commercial insurance markets (Figure 11).[25] In fact, relative to the pre-policy caseloads for these hospitals, the drops in the later years of our analytic window correspond to decreases of as much as 20% across payers. These effects are also large—e.g., some previous studies using data from earlier time periods find drops of roughly 2-4% in hospital outpatient surgical volume (and no changes for inpatient volume) with greater ASC entry (Bian and Morrisey 2007; Courtemanche and Plotzke 2010).

Taken together, our two empirical strategies exploiting this specific Medicare policy change (embedded within the larger fee schedule reform) reinforce one another and

[24] Appendix Table 5 separates the estimation and results by payer type for comparison. Although the magnitudes and precision can differ, the qualitative patterns for both payer groups align with what is seen in Table 6 and Figure 10 from the main results.

[25] Appendix Table 6 provides the regression table output underlying the results in Figure 11.

support causal interpretations that are consistent with the descriptive findings from Section 5C. Furthermore, the magnitude of the estimated caseload reductions is quite similar between the descriptive and causal approaches, despite the latter's focus on a single service while the former captured all services.[26] ASC market entry therefore negatively impacts local hospitals, who ultimately lose profitable cases to these competing firms. Entry also seems to force hospitals to adjust their care delivery style in order to compete with ASCs for future cases. If these localized findings (i.e., specific to laparoscopic cholecystectomies) are generalizable to the broader set of ambulatory procedures, restraining market entry to some degree—and perhaps inadvertently—due to the reformulated Medicare fee schedule suggests a nontrivial strategic and financial advantage for hospitals, which does not necessarily benefit consumers.

VI. Discussion

The US health care system is notorious for high levels of absolute spending, and importantly, inefficient resource use (e.g., see Abaluck *et al.* 2016; Doyle, Graves, and Gruber 2017). These salient features have unsurprisingly invited negative media and policymaker attention over many years and led many to advocate for payment reforms and more cost-effective models of care delivery—especially within the Medicare program (Cutler and Ghosh 2012; Fisher, Bynum, and Skinner 2009). However, adjustments to the Medicare program can have targeted as well as diffuse effects on health care markets due to its size and publicly administered design. They can then produce a mix of good and bad outcomes from a social welfare perspective.

[26] We have also implemented a version of the DD setup at the hospital-referral region (HRR) exposure level, as opposed to county. Briefly, we compare HOPDs at the two extremes in terms of ASCs performing commercial laparoscopic cholecystectomies in 2007 within their HRR. The minimum is 1, the maximum is seven. Appendix Table 7 again shows a pattern of results consistent with HOPDs in more contested markets pre-policy suffering a differential decline in case volumes after ASCs enter this specific surgical market for Medicare patients.

Our first set of findings reveals some reduced flows of specific services following the price decreases. Individual providers exposed to the negative ASC fee change lower their spinal injection output by more than a fifth of their pre-policy productivity. And those performing colonoscopies for Medicare FFS patients (and highly reliant on ASCs at baseline) show at least suggestive evidence of productivity declines as large as 11%. Given the size of the price reductions across these two services (see Table 2), the implied physician-level elasticity is 2.4 and 0.7, respectively. Our other two common procedures do not show clear policy responses within our physician-level DD estimation, however.

A driving force underlying the stronger and sharper changes for spinal injection may be the relatively tighter incentive alignment between ASCs and clinicians performing these services. There is nearly an "all or none" dichotomy for these procedures in terms of relying on ASC settings. It, in turn, seems plausible that these same clinicians either have stronger preferences for working within ASCs and/or more direct ownership stakes in the facilities. Either or both contextual features could explain the relatively elastic response to the price change. Another departure for spinal injections, specifically, is their therapeutic nature. These injections serve as treatments while the other investigated procedures (colonoscopies, cystoscopies, and upper endoscopies) are typically used in diagnostic roles. The potential complementarities with other downstream cases (i.e., diagnostics leading to more procedures) may have bolstered ASCs' willingness to absorb the Medicare price cuts for these services.

Upper endoscopies (with a tissue biopsy) also represent a somewhat unusual circumstance. Another common ambulatory procedure taking place within ASCs (that did not receive a negative price change) is an upper endoscopy that *excludes* tissue biopsy. These two forms of upper endoscopy (with and without biopsy) have been reimbursed equally for HOPDs, but interestingly, ASC cases including a tissue biopsy were paid 34%

more than the non-biopsy version prior to 2008. The Medicare fee reductions fully erased this ASC payment disparity by 2011. Given that it is hard to imagine infrastructure needs and facility operation costs that are meaningfully different between these two types of upper endoscopy cases, this procedure was likely (and perhaps accidentally) overpaid prior to the Medicare reforms, which thereby blunts the impact of its eventual fee decrease.

From the perspective of Medicare beneficiaries, it is not immediately obvious if lower willingness to perform spinal injections is a harmful or helpful change in provider behavior (i.e., if the new equilibrium output is closer or farther from a social optimum). To partly speak to this, we examine the trends in the share of all Medicare FFS emergency department visits in Florida for two specific acute health reasons: chronic pain/nervous system problems and post-medical procedure infections.[27] We do so for Medicare patients residing within two types of Florida counties: those where all Medicare spinal injections were exclusively performed within HOPDs and those where the vast majority (90% or more) were performed within an ASC in 2007. The trends in the incidence of these specific emergency department cases can be seen in Appendix Figure 4. Cases of post-procedure infection are quite rare, and the trends, while noisy, do not reveal a clear shift following the ASC fee reductions—and hence declines in spinal injection output. Chronic pain/nervous system health problems are much more common reasons for presenting to the emergency department (around 9% of all visits in a given year). The incidence rises to roughly 10% of visits for Medicare beneficiaries living in highly reliant ASC counties in the 2012-2013 period (when the fee reductions are fully phased in), but the patterns are only speculative.

Our arguably most important findings relate to the entry behavior of ASCs after

[27] These data are also from Florida AHCA and capture the universe of emergency department encounters. The principal reason for presenting to the emergency department (i.e., why the patient initiated the visit) is recorded using ICD-9 codes. We consequently identify all cases with corresponding ICD-9 codes four our two types of visits of interest.

the Medicare fee changes. With fewer new ASCs opening after the policy was implemented, the rate of net growth in Florida is slowed by more than half. The patterns in Florida also conform well to what is evident in the national trends. Moreover, the sharp reversal in ASC entry following the overhauled public payer fee schedule begs the question as to what restrained competition might mean for incumbent firms going forward.

Our complementary empirics imply that deterring ASC entry can protect 10-20% of a hospital's ambulatory procedure caseload—making this market-level effect of the policy financially beneficial for existing hospitals.[28] However, new entrants do more than simply steal market share. Exploiting the laparoscopic cholecystectomy rule change, which previously forced a misalignment between ASCs and providers since ASCs were prohibited from Medicare payment, we find that hospitals also shift toward outpatient and laparoscopic delivery for their remaining patients when exposed to greater ASC presence (i.e., they behave more like ASCs). These features suggest that ASCs have influence on ambulatory care typically associated with "sustaining innovations" for a given product or service (Christensen, Raynor, and McDonald 2015). Driving more efficient care delivery is an improvement for all consumers, just as restraining supplier entry can be broadly harmful.

Finally, if capping ASC fees is a means to financially benefit hospitals in order to compensate hospitals for their greater variety of services—some of which are socially valuable but loss-making—it is unclear that this is the best way to go about it. Direct transfers to subsidize care and services that the market underprovides has the potential to be more efficient. At a minimum, the amount of subsidization can be transparently verified, quantified, and tracked. Using a variety of more complex policy levers to deliver public subsidies risks misallocated spending, perverse provider responses, and market

[28] Prior work finds negative associations between hospitals' financial performance and ASC presence in Arizona, California, and Texas (Carey, Burgess, and Young 2011).

distortions. Hospitals arguments that they require public financing to support their 'full access and full service' operations may have merit. However, a collection of indirect actions, such as anti-competitive measures, side payments (e.g., the 340B and DSH programs), and tax exemptions may be a poor strategy for achieving the stated aim and can lack sufficient accountability and justification to taxpayers.

In the lead up to the overhaul of Medicare's ASC fee schedule, the director of CMS remarked:

> "*If the ASC rate is off, all of a sudden you start seeing ASCs pop up all over the place to do colonoscopies or to do outpatient surgery…But we need to start thinking about the impact we have on the market because we're such a big player.*"—Tom Scully, FTC health care market hearing 2/26/2003.

The sentiment reflects a belief that ASC payments from Medicare may have been overly generous at times but also an acknowledgment that the long-run implications are not always fully considered by the public payer. Our findings speak directly to this note of caution, and somewhat ironically, reveal another instance where the market-level effects were likely overlooked. Competition within the outpatient surgery market can benefit consumers as well as overall health care spending, so there are important ramifications from suppressing it (intentionally or inadvertently) through government intervention.

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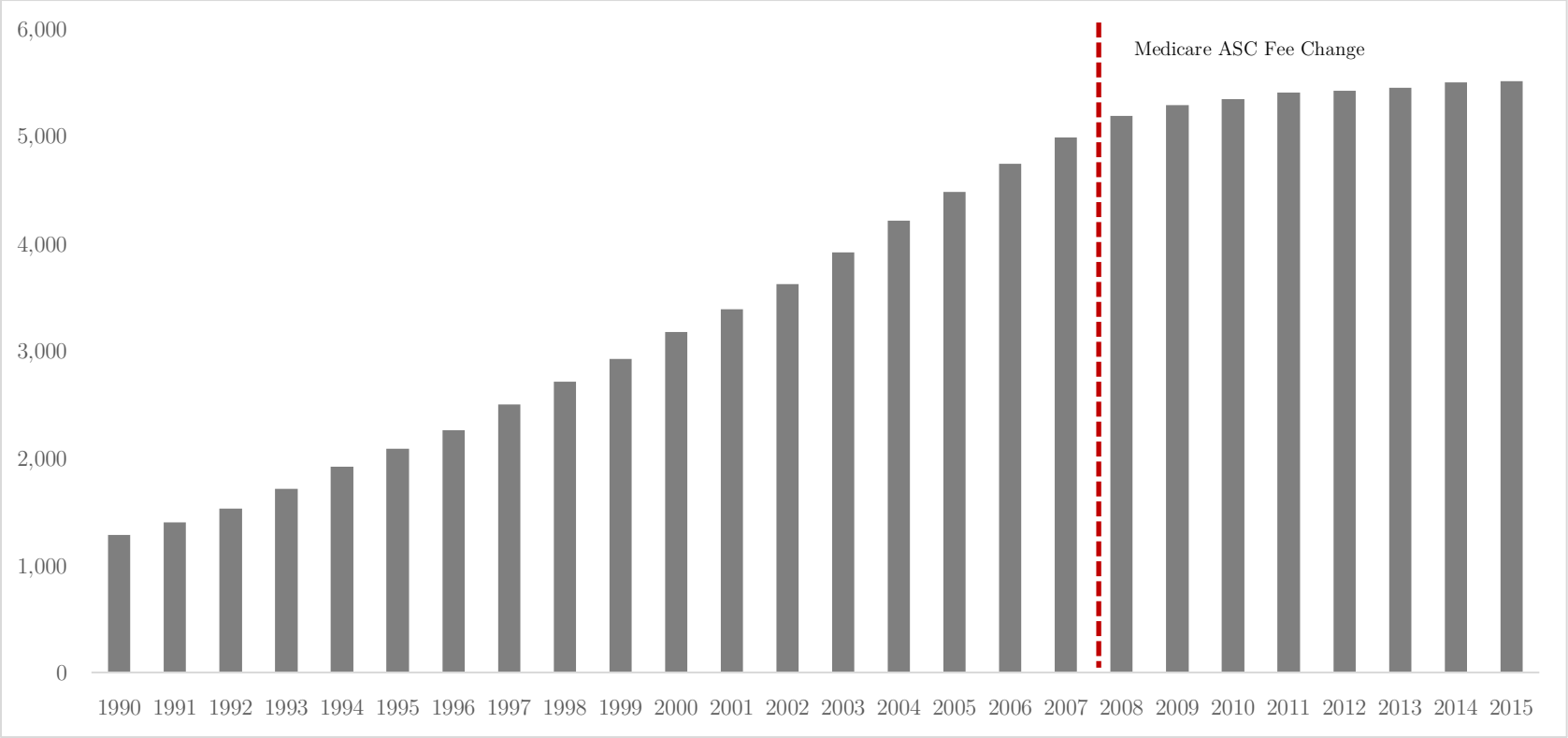
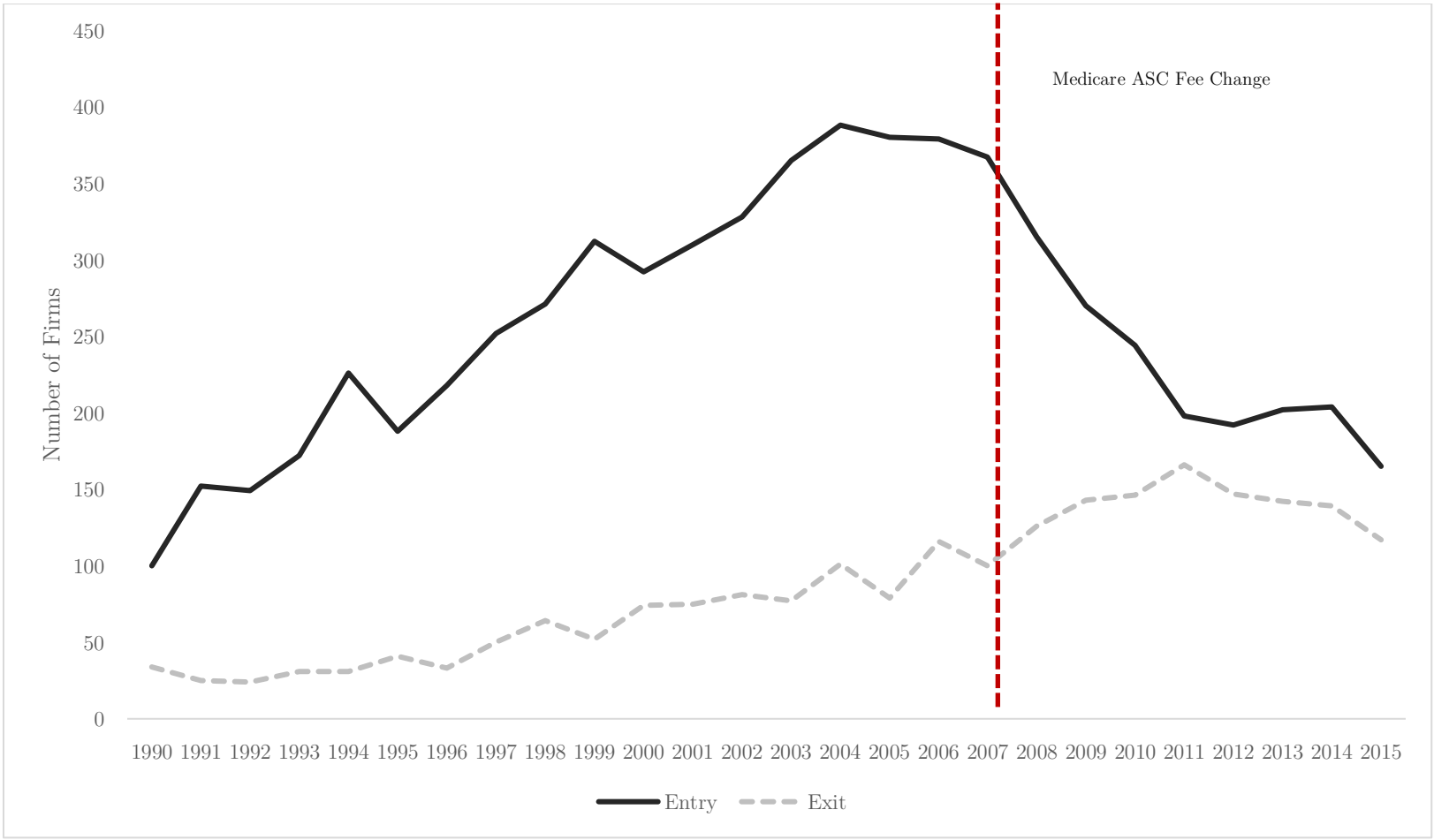
MAIN RESULTS

FIGURE 1—MEDICARE-CERTIFIED ASCs NATIONALLY 1990-2015



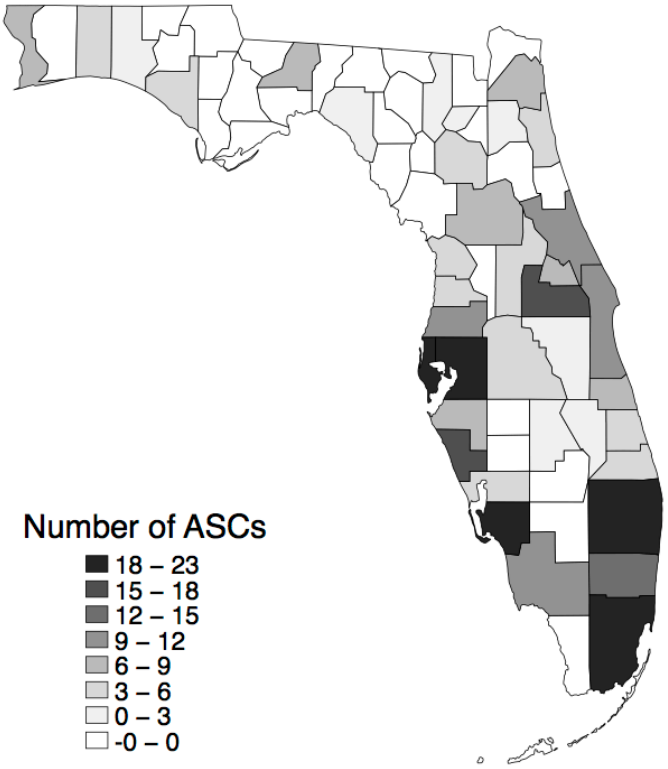
Notes: Data are from the Medicare Provider of Services files

FIGURE 2—ASC ENTRY AND EXIT BEHAVIOR ACROSS US 1990-2015



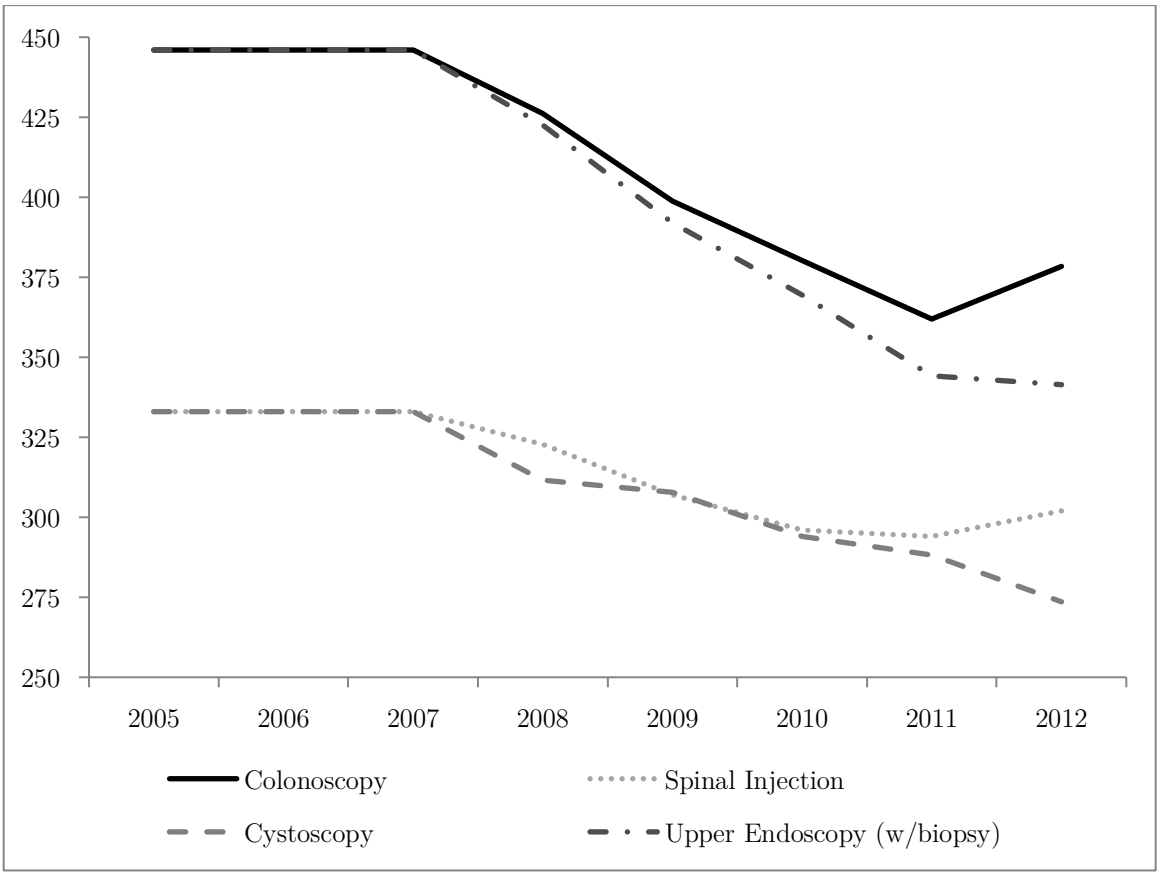
Notes: Data are from the Medicare Provider of Service files

FIGURE 3—2005 FLORIDA COUNTY LEVEL AMBULATORY SURGERY CENTER (ASC) ALLOCATION



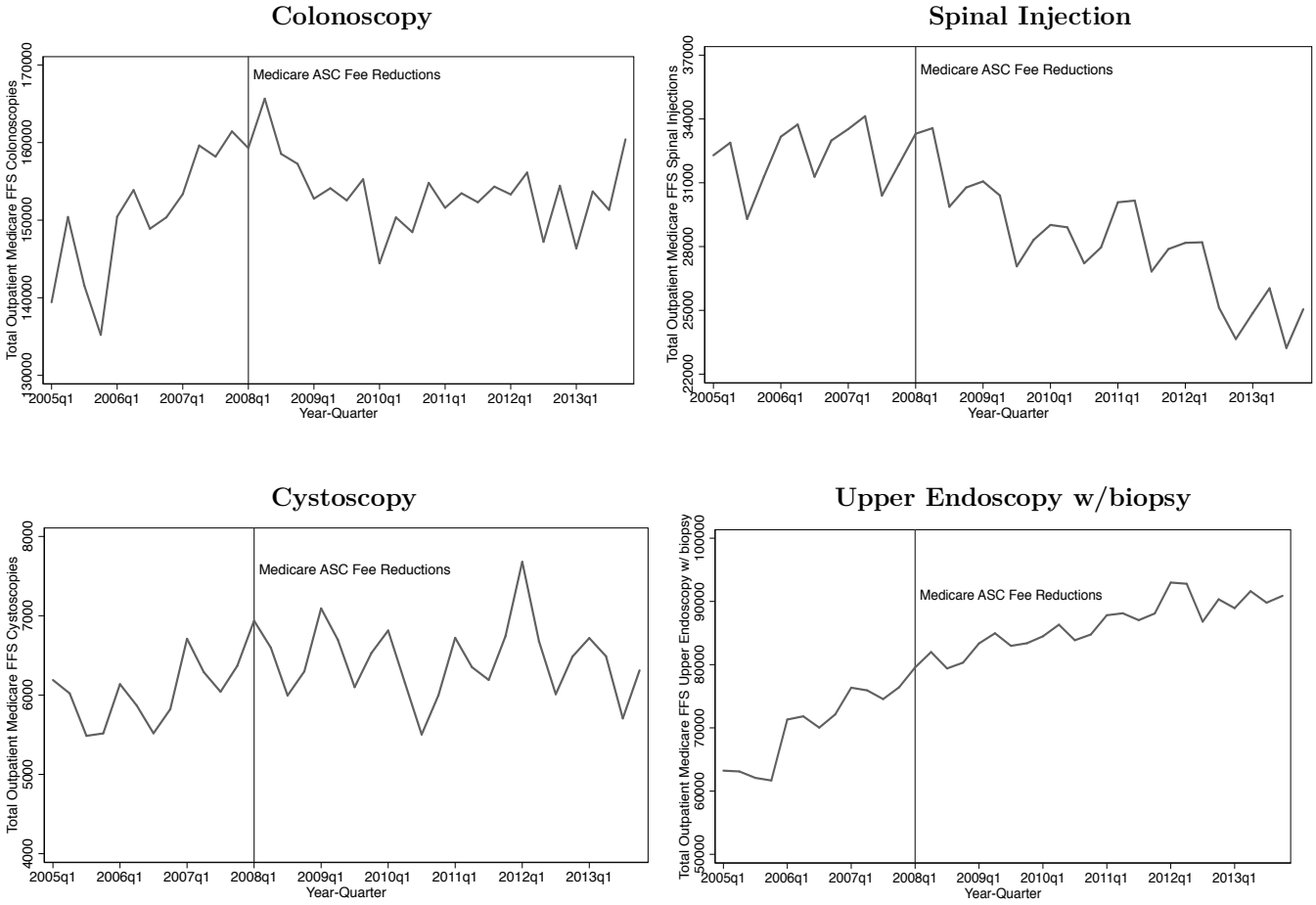
Notes: Florida AHCA ambulatory procedure discharge data and facility lists

FIGURE 4—MEDICARE FFS ASC FACILITY FEE TRENDS BY SERVICE TYPE



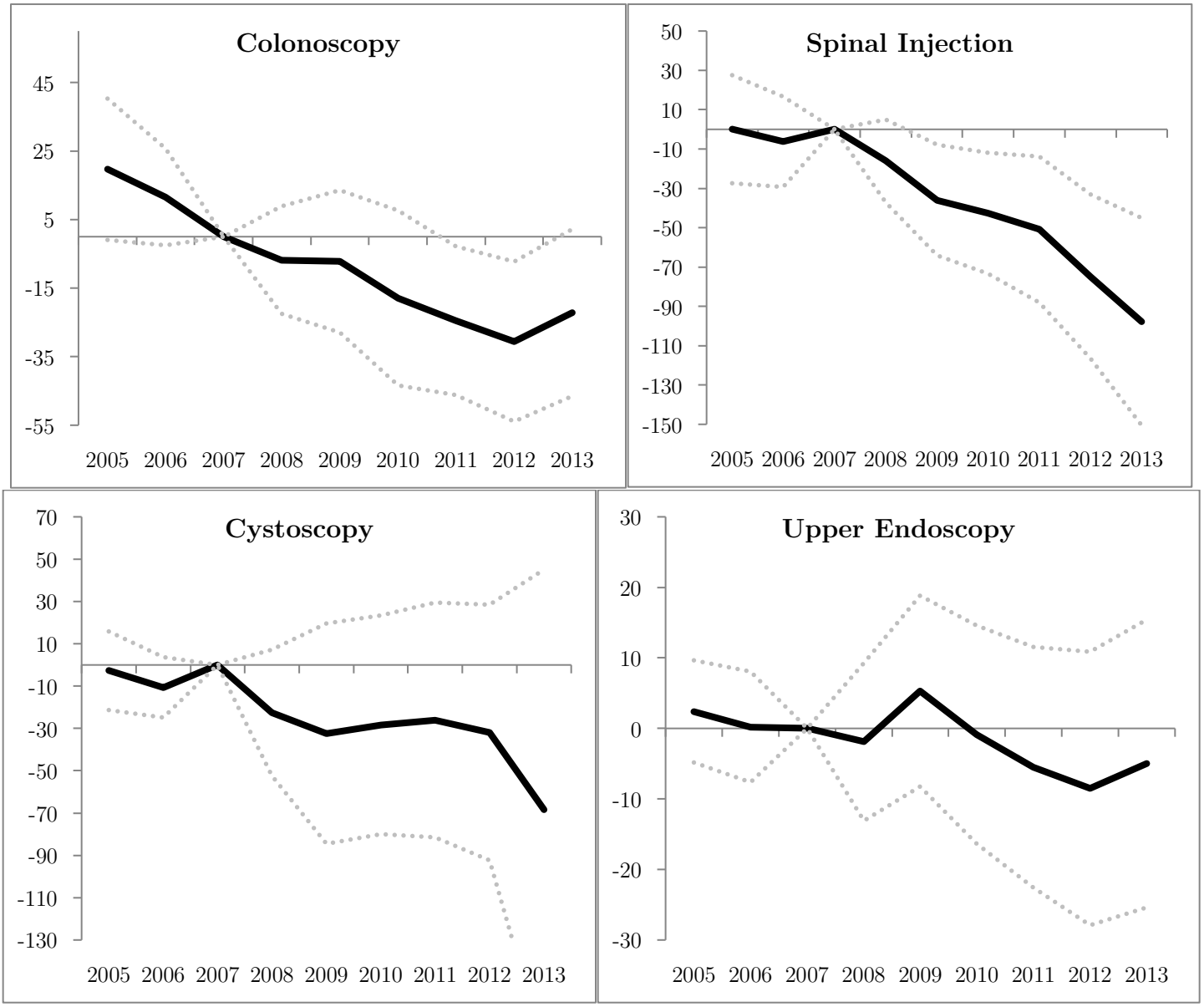
Notes: These four procedure types account for 46% of all Florida Medicare FFS ASC cases in the pre-policy period (2005-2007). Fee levels are in nominal dollars and can found here: https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/ASCPayment/index.html.

FIGURE 5—AGGREGATE AMBULATORY PROCEDURE MEDICARE FFS VOLUMES IN FLORIDA OVER TIME



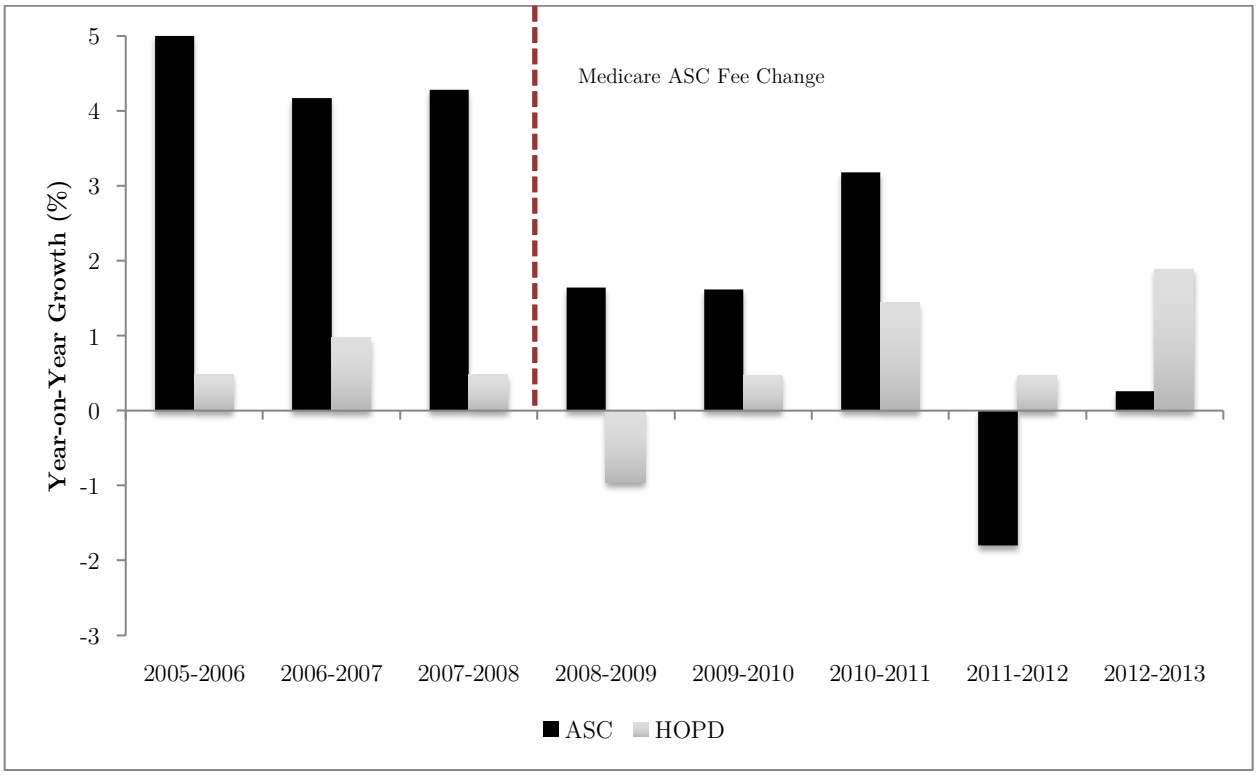
Notes: The trend analyses place no restriction on the location (i.e., ASC versus HOPD) on service provision. Discharge records are at the quarterly level from 2005-2013.

FIGURE 6—EVENT STUDIES FOR POLICY EFFECTS ON INDIVIDUAL PROVIDERS WITH HIGH ASC RELIANCE IN THE PRE-POLICY PERIOD



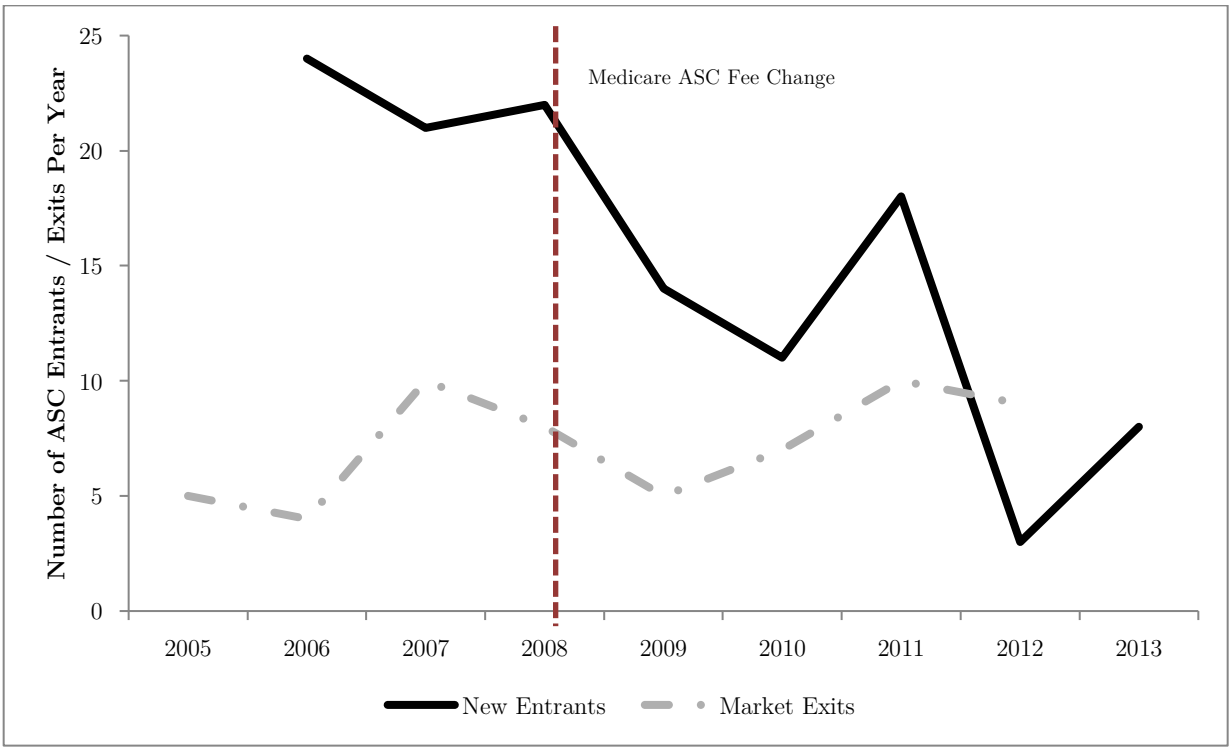
Notes: Event study estimates from Equation 2 (Section 4A) by procedure type. Treatment group is restricted to those with the highest ASC reliance at baseline—though this refinement is not possible for the spinal injection procedure where the ASC allocations are strongly bimodal (i.e., roughly all or none for a given physician).

FIGURE 7—OUTPATIENT SURGICAL FACILITY GROWTH BY FACILITY TYPE 2005-2013



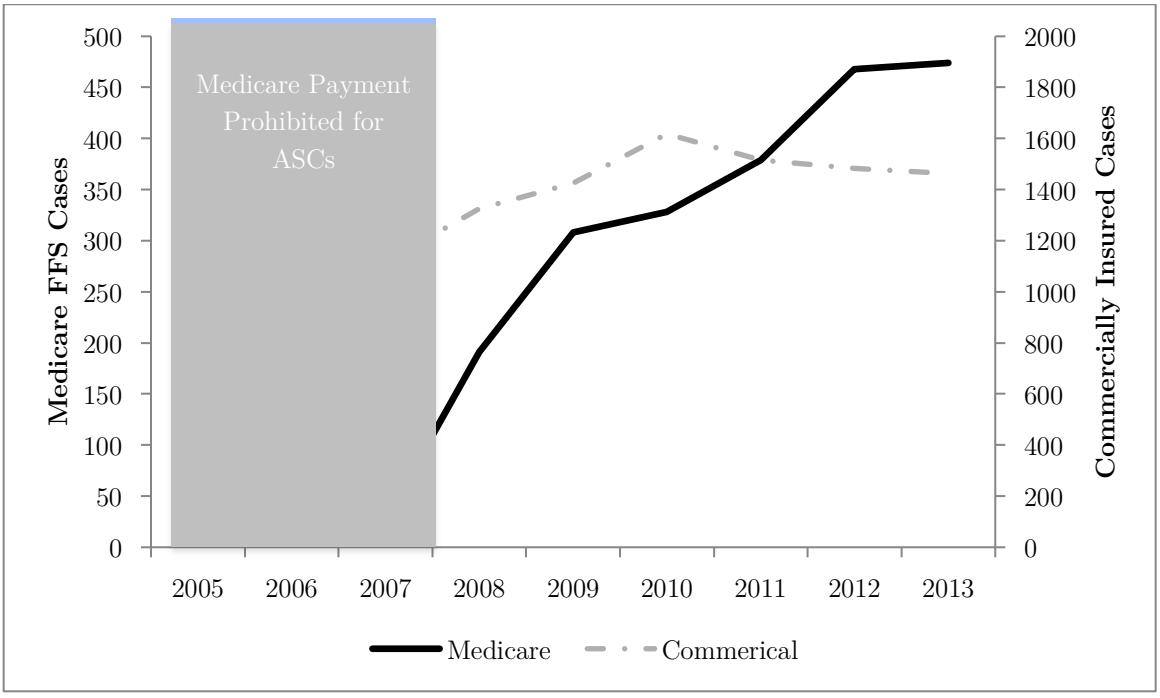
Notes: Florida AHCA discharge data capturing the universe of ambulatory surgical cases and facilities per year.

FIGURE 8—ENTRY AND EXIT BY AMBULATORY SURGICAL CENTERS OVER TIME



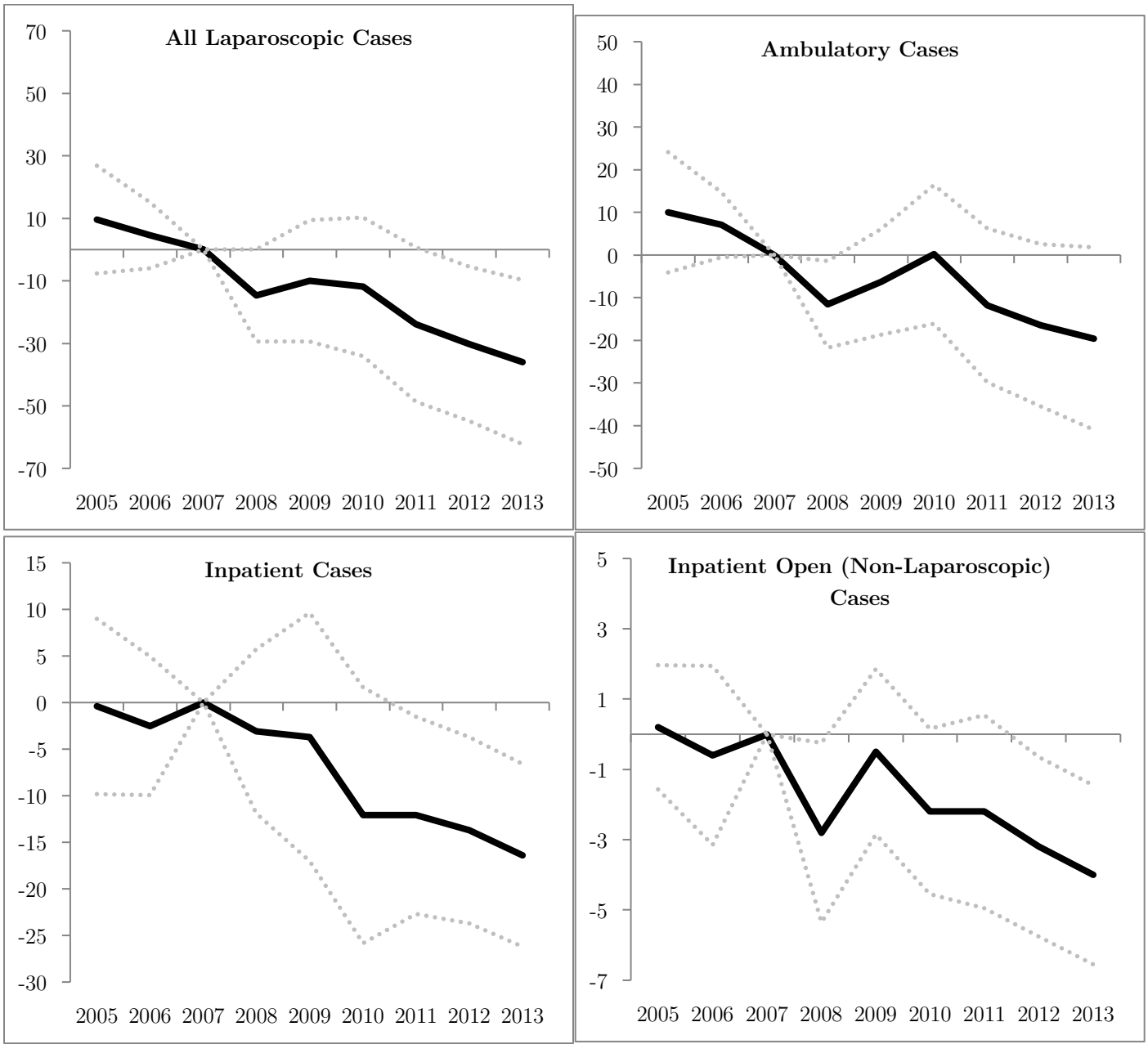
Notes: Florida AHCA discharge data capturing the universe of ambulatory surgical cases and facilities per year.

FIGURE 9—ASC LAPAROSCOPIC CHOLECYSTECTOMY PROCEDURE VOLUMES FOR MEDICARE AND COMMERCIALLY INSURED PAYERS 2005-2013



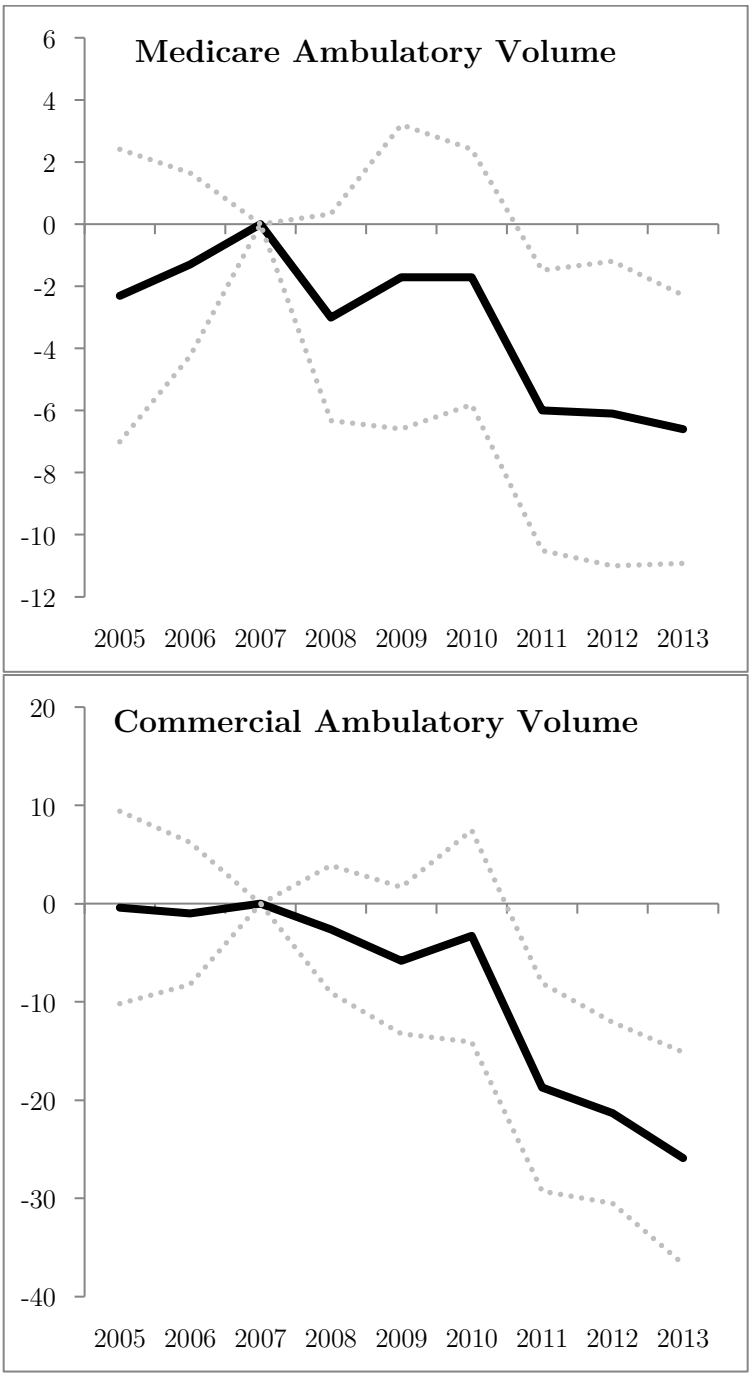
Notes: Florida AHCA discharge data capturing the universe of ambulatory surgical cases. Laparoscopic cholecystectomies are identified via the corresponding HCPCS (CPT) codes.

FIGURE 10—EVENT STUDIES FOR ASC ENTRY EFFECT ON HOSPITALS' CHOLECYSTECTOMY CASE LOADS



Notes: Standard errors clustered at the county level based on facility location. Treated hospitals are those located in counties with three or more ASCs performing commercial laparoscopic cholecystectomy cases in 2007. The control comparison hospitals are those located in counties with zero ASCs performing these procedures as of 2007. Analytic sample is also restricted to hospitals performing cholecystectomies over the full study period.

FIGURE 11—EVENT STUDIES FOR ASC ENTRY EFFECT ON HOSPITALS' AMBULATORY CHOLECYSTECTOMY CASE LOADS BY PRESENCE OF COMMERCIAL "SPLITTERS" PRIOR TO MEDICARE REIMBURSEMENT CHANGE



Notes: The analytic sample is identical to Table 11. 2007 is the omitted reference year.

TABLE 1—BASELINE SUMMARY STATISTICS FOR AMBULATORY SURGERY CENTERS AND HOSPITAL OUTPATIENT DEPARTMENTS

	ASC	**HOPD**
	Mean (SD)	Mean (SD)
Number of Providers	24.2 (30.4)	202.4 (168.0)
Number of Cases	4103.3 (2804.2)	7276.1 (6420.9)
HHI	0.11 (0.09)	0.18 (0.26)
Share of Cases	(%)	(%)
Medicare FFS	42.8	34.5
Commercial	42.2	42.6
All Others	15.1	22.9

Restricted to ASC and HOPD facilities in operation as of 2005 and therefore present in the Florida AHCA ambulatory discharge data in that year. In total, there are 320 and 204 ASCs and HOPDs, respectively, present in Florida in 2005. Unique providers are identified by the license information provided within the discharge data. Herfindahl-Hirschman index (HHI) measures are constructed at the county level based on the share of all ambulatory procedures performed within a given facility.

TABLE 2—DELIVERY SETTING AND MEDICARE PRICE CUT FOR SELECT AMBULATORY SURGICAL SERVICES

Outpatient Surgical Procedure	Medicare Share Performed in ASC (%)	ASC to HOPD Fee Ratio 2007	ASC to HOPD Fee Ratio 2012	Facility Fee Change 2007-2012 (%)
Colonoscopy	68.0	0.82	0.58	-15.2
Spinal Injection	77.0	0.72	0.58	-9.3
Cystoscopy	77.1	0.80	0.58	-17.8
Upper Endoscopy (w/biopsy)	68.5	0.87	0.58	-23.4

Cases are identified from the Florida ambulatory discharge data using the corresponding HCPCS (CPT) codes. The second column captures the share of all Medicare FFS cases over 2005-2006. The Medicare facility fee schedule is in nominal dollars and by HCPCS code. The corresponding fees can also be found here: https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/ASCPayment/index.html.

TABLE 3—POLICY EFFECT ON INDIVIDUAL PROVIDERS' TOTAL MEDICARE FFS VOLUME BY TYPE

	Colonoscopy	Spinal Injection	Cystoscopy	Upper Endoscopy (w/biopsy)
	(1)	(2)	(3)	(4)
Post	-12.96*	3.69	-13.47	8.83**
	(7.34)	(7.56)	(13.53)	(3.66)
Post*Treated	-16.78**	-50.97***	-4.04	1.14
	(8.31)	(15.14)	(14.15)	(4.68)
Provider FE	Yes	Yes	Yes	Yes
N	6,498	1,674	1,080	6,138
Unique Providers	722	186	120	682
Pre-Period ASC Provider Outcome Mean	225.1	227.6	113.1	128.6

*** P value at 0.01 level ** P value at 0.05 level * P value at 0.10 level, standard errors clustered at the county where the individual provider performs the majority of the relevant procedures during the 2005-2006 period. The analytic sample is restricted to providers serving the Medicare market over the 9-year study period. The treatment groups ("Treated") are composed of individual providers relying on ASCs to perform cases in the pre-policy period. Throughout all four columns, the control comparison group is composed of individual providers that exclusively delivered these services to Medicare patients within Hospital Outpatient Department (HOPD) settings at baseline.

TABLE 4—POLICY EFFECT ON INDIVIDUAL PROVIDERS' TOTAL MEDICARE FFS PROCEDURE VOLUME WITH PRE-EXPOSURE HETEROGENEITY

	Colonoscopy		Cystoscopy		Upper Endoscopy (w/biopsy)	
	Low ASC Reliance as Treatment Group	High ASC Reliance as Treatment Group	Low ASC Reliance as Treatment Group	High ASC Reliance as Treatment Group	Low ASC Reliance as Treatment Group	High ASC Reliance as Treatment Group
	(1)	(2)	(3)	(4)	(5)	(6)
Post	-12.96*	-12.96*	-13.37	-13.47	8.83**	8.83**
	(7.34)	(7.35)	(13.57)	(13.59)	(3.66)	(3.66)
Post*Treated	-3.95	-28.66**	8.15	-30.54	-2.07	-3.64
	(7.93)	(12.13)	(12.93)	(28.26)	(4.82)	(7.00)
Provider FE	Yes	Yes	Yes	Yes	Yes	Yes
N	3,141	3,132	621	612	2,826	2,817
Unique Providers	349	348	69	68	314	313
Pre-Period ASC Provider Outcome Mean	174.0	262.2	20.4	193.1	105.7	149.6

*** P value at 0.01 level ** P value at 0.05 level * P value at 0.10 level, standard errors clustered at the county where the individual provider performs the majority of the relevant procedures during the 2005-2006 period. The analytic sample is restricted to providers serving the Medicare market over the 9-year study period. The treatment groups ("Treated") are composed of individual providers relying on ASCs to perform cases in the pre-policy period. Columns 2 and 3 (and 5 and 6) further refine the treatment groups based on the degree of reliance (i.e., bottom and top third for average ASC share of relevant cases during 2005-2007, respectively). Throughout all columns, the control comparison group is composed of individual providers that exclusively delivered these services to Medicare patients within Hospital Outpatient Department (HOPD) settings at baseline.

TABLE 5—ASC ENTRY EFFECT ON INCUMBENT FIRMS' CASE LOADS IN THE PRE-POLICY PERIOD BY FACILITY TYPE

	Hospital Outpatient Departments			**Ambulatory Surgery Centers**		
	Total Cases (in logs)	Total Medicare Cases (in logs)	Total Comm. Cases (in logs)	Total Cases (in logs)	Total Medicare Cases (in logs)	Total Comm. Cases (in logs)
	(1)	(2)	(3)	(4)	(5)	(6)
ASC Entry	-0.155***	-0.110**	-0.127***	-0.035	-0.022	-0.069**
(Lagged One Year)	(0.057)	(0.051)	(0.042)	(0.023)	(0.023)	(0.034)
County Level Controls	Yes	Yes	Yes	Yes	Yes	Yes
Facility FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Unique Facilities	203	203	203	302	298	301

*** P value at 0.01 level ** P value at 0.05 level * P value at 0.10 level, standard errors clustered at the county level based on facility location. The analytic data are restricted to the 2006-2008 period and facilities in operation in 2005 (baseline data year) and through 2008. "ASC Entry" is a binary variable equal to one for incumbent firms located in counties that experienced new ASC entry in a given year. All models control for lagged number of ASC exits and county-level unemployment rates.

TABLE 6—ASC ENTRY EFFECT ON HOSPITALS' CHOLECYSTECTOMY CASE LOADS

	All Laparoscopic	Ambulatory Laparoscopic	Inpatient Laparoscopic	Inpatient Open (Non-Laparoscopic)
	(1)	(2)	(3)	(4)
Post	13.63**	9.60**	4.02	-3.43***
	(6.06)	(4.24)	(3.47)	(0.71)
Post*Pre-Existing ASC	-25.83**	-16.62**	-9.22*	-2.34**
Competition	(10.63)	(7.19)	(5.12)	(0.94)
HOPD FE	Yes	Yes	Yes	Yes
N	1,026	1,026	1,026	1,026
Unique HOPDs	114	114	114	114
Pre-Policy Outcome Mean for Treated	199.0	108.6	90.4	14.7

*** P value at 0.01 level ** P value at 0.05 level * P value at 0.10 level, standard errors clustered at the county level based on facility location. "Pre-Existing ASC Competition" is equal to one for hospitals located in counties with three or more ASCs performing commercial laparoscopic cholecystectomy cases in 2007 and zero otherwise. The control comparison hospitals are those located in counties with zero ASCs performing these procedures as of 2007. Analytic sample is also restricted to hospitals performing cholecystectomies over the full study period.

TABLE 7—ASC ENTRY EFFECT ON HOSPITALS' CHOLECYSTECTOMY CASE LOADS BY PRESENCE OF COMMERCIAL "SPLITTERS" PRIOR TO MEDICARE REIMBURSEMENT CHANGE

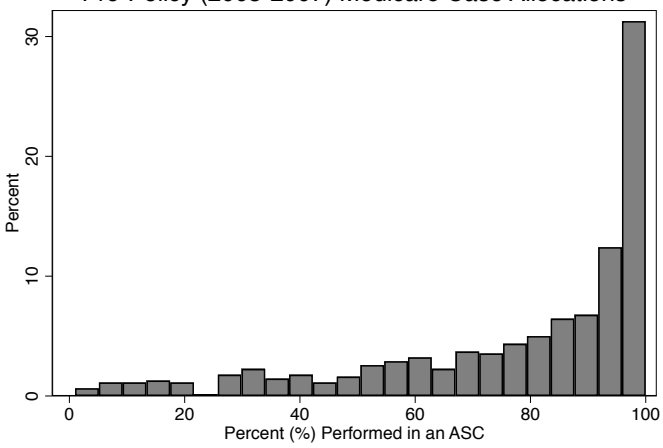
	Medicare FFS Ambulatory Cases	Commercial Ambulatory Cases
	(1)	(2)
Post	4.42***	1.56
	(1.03)	(2.08)
Post*Pre-Existing	-2.98*	-12.44***
Splitters	(1.71)	(3.77)
HOPD FE	Yes	Yes
N	1,629	1,629
Unique Hospitals	181	181
Pre-Policy Outcome Mean for Treated	32.4	112.9

*** P value at 0.01 level ** P value at 0.05 level * P value at 0.10 level, standard errors clustered at the county level based on facility location. Pre-Existing Splitters" is equal to one for hospitals with at least one provider performing cholecystectomies at the hospital as well as an ASC in 2007 (i.e., splitting cases between the two settings). The control comparison hospitals are those with zero cholecystectomy splitters performing these cases within the hospital in 2007.

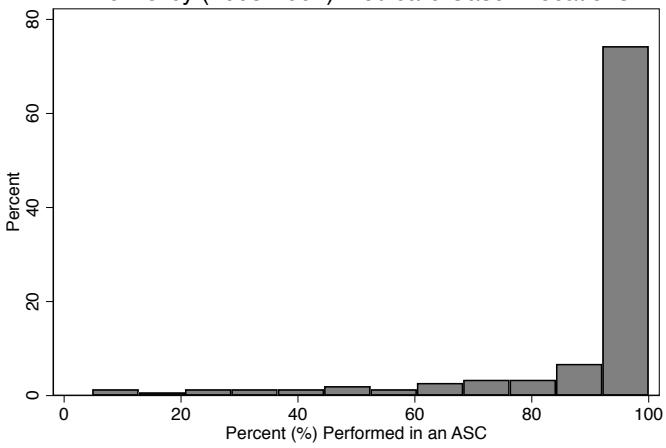
APPENDIX RESULTS

Appendix Figure 1: Variation in ASC Reliance Among "Splitters" by Procedure Type

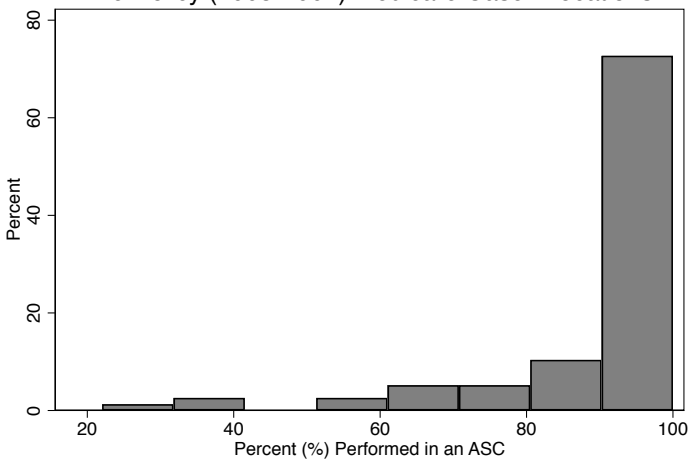
Colonoscopy



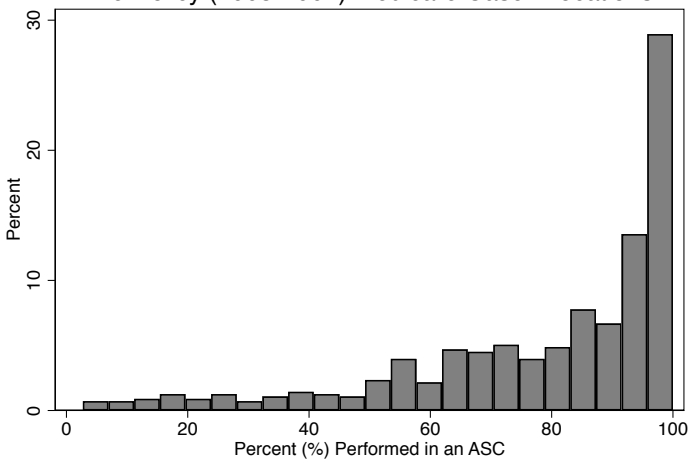
Spinal Injection



Cystoscopy



Upper Endoscopy (w/ biopsy)



Appendix Table 1—Event Studies for Providers' Total Procedural Output Comparing Those With High Baseline ASC Reliance to Those Using HOPDs Exclusively

	Colonoscopy	Spinal Injection	Cystoscopy	Upper Endoscopy (w/biopsy)
	(1)	(2)	(3)	(4)
2005*Treated	19.74*	0.01	-2.74	2.43
	(10.54)	(14.04)	(9.52)	(3.66)
2006* Treated	11.59	-6.35	-10.56	0.23
	(7.19)	(11.66)	(7.34)	(3.99)
2008* Treated	-6.79	-16.13	-22.50	-1.87
	(7.96)	(10.73)	(15.22)	(5.72)
2009* Treated	-7.21	-36.01**	-32.49	5.28
	(10.57)	(14.44)	(26.44)	(6.92)
2010* Treated	-17.95	-42.71***	-28.35	-0.93
	(12.99)	(15.69)	(26.42)	(7.87)
2011* Treated	-24.49**	-50.93***	-26.15	-5.49
	(11.13)	(18.88)	(28.31)	(8.74)
2012* Treated	-30.65**	-74.92***	-31.94	-8.52
	(11.93)	(21.28)	(30.78)	(9.94)
2013* Treated	-22.21*	-97.78***	-68.40	-4.99
	(12.44)	(26.92)	(57.89)	(10.40)
Provider FE	Yes	Yes	Yes	Yes
N	3,132	1,674	612	2,817
Unique Providers	348	186	68	313

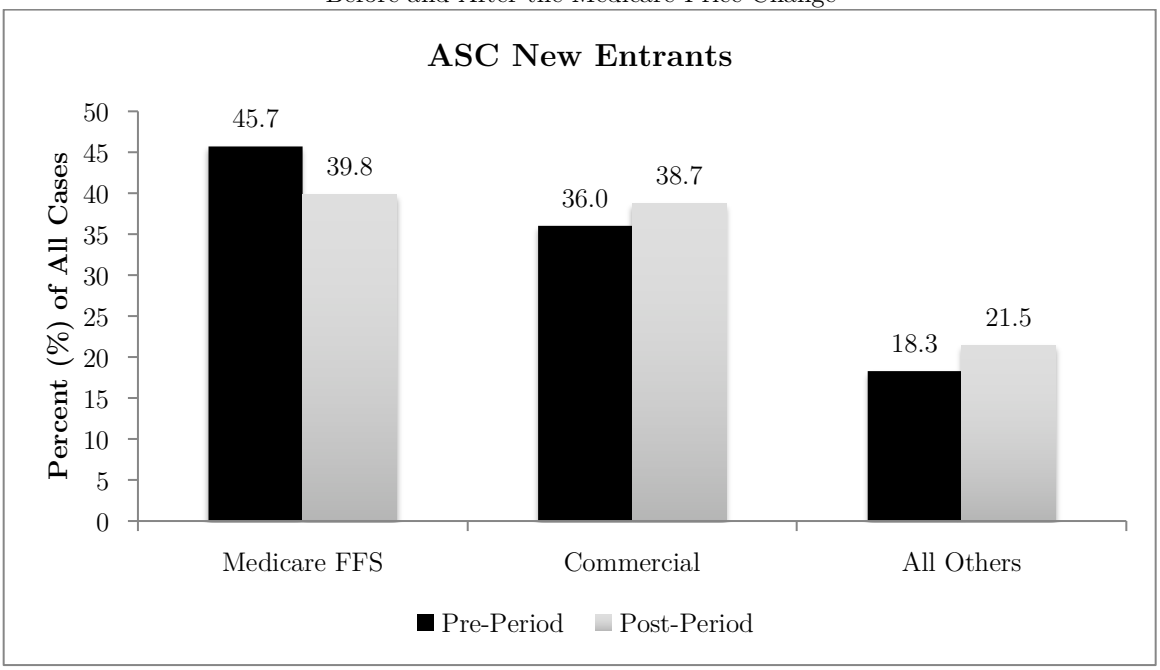
*** P value at 0.01 level ** P value at 0.05 level * P value at 0.10 level, standard errors clustered at the county where the individual provider performs the majority of the relevant procedures during the 2005-2006 period. The analytic sample is restricted to providers serving the Medicare market over the study period.

Appendix Table 2—Policy Effect on Individual Providers' Total Medicare FFS Volume for Non-Spinal Injection Cases
(Among Spinal Injection Providers)

Post	10.01
	(7.71)
Post*Treated	4.56
	(10.54)
Provider FE	Yes
N	1,674
Unique Providers	186
Pre-Period ASC Provider Outcome Mean	122.7

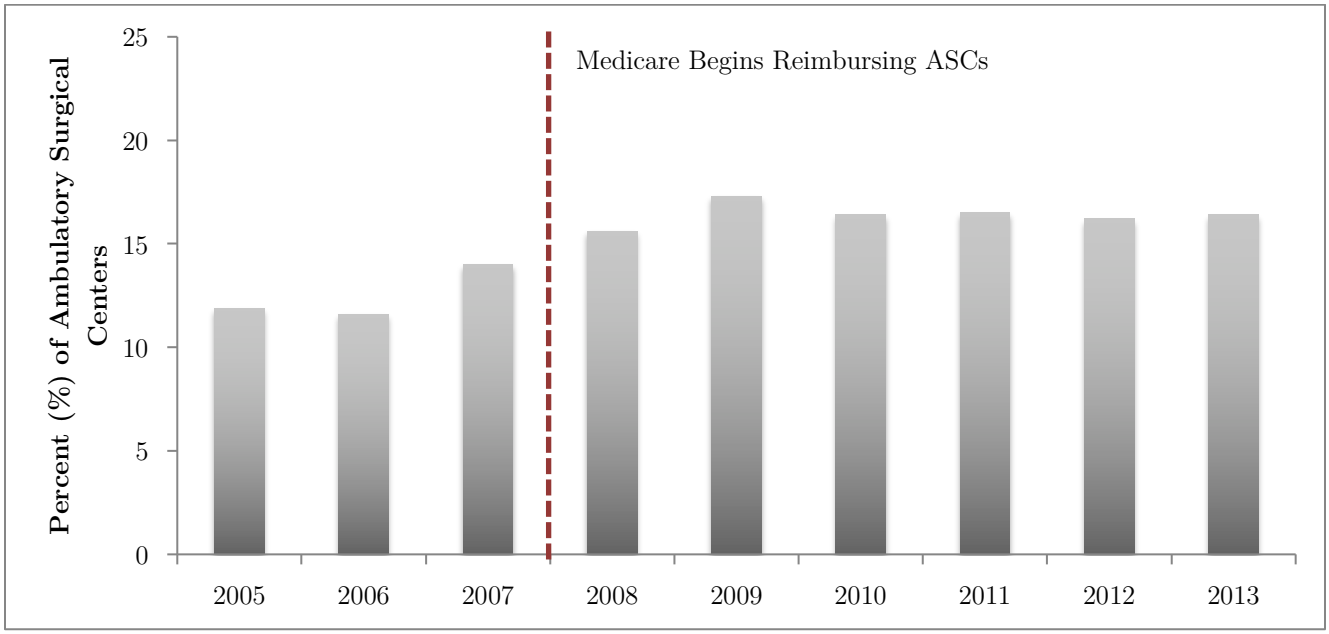
*** P value at 0.01 level ** P value at 0.05 level * P value at 0.10 level, standard errors clustered at the county where the individual provider performs the majority of the relevant procedures during the 2005-2006 period. The analytic sample is the same as that of Table 4. The procedure volume outcome variable captures all Medicare FFS cases for a given provider-year that are not a spinal injection.

Appendix Figure 2—Payer Breakdown for ASC New Market Entrants
Before and After the Medicare Price Change



Notes: Florida AHCA discharge data capturing the universe of ambulatory surgical cases and facilities per year. Restricted to facilities that newly entered the Florida market between 2006 and 2013. Post-period are the years after the Medicare FFS facility fee cut.

Appendix Figure 3—Percent of ASCs Delivering Laparoscopic Cholecystectomy Procedures to the Commercial and/or Medicare Markets



Notes: Analytic data are from Florida AHCA ambulatory procedure discharge records. Laparoscopic cholecystectomy cases are identified by the reported HCPCS (CPT) codes within each discharge record.

Appendix Table 3—ASC Entry Effect On Incumbent Firms' Case Loads In The Pre-Policy Period

	Hospital Outpatient Departments			**Ambulatory Surgical Centers**		
	Total Cases (in logs)	Total Medicare Cases (in logs)	Total Comm. Cases (in logs)	Total Cases (in logs)	Total Medicare Cases (in logs)	Total Comm. Cases (in logs)
	(1)	(2)	(3)	(4)	(5)	(6)
One New ASC	-0.158***	-0.122**	-0.132***	-0.022	-0.012	-0.049
(Lagged One Year)	(0.056)	(0.051)	(0.042)	(0.027)	(0.027)	(0.038)
Multiple New ASCs	-0.150**	-0.090	-0.117**	-0.062***	-0.043*	-0.111***
(Lagged One Year)	(0.067)	(0.063)	(0.054)	(0.022)	(0.024)	(0.030)
County Level Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Unique Facilities	203	203	203	302	298	301

*** P value at 0.01 level ** P value at 0.05 level * P value at 0.10 level, standard errors clustered at the county level based on facility location. The analytic data are restricted to the 2006-2008 period and facilities in operation in 2005 (baseline data year) and through 2008. All models control for lagged ASC exit and county-level unemployment rates.

Appendix Table 4—Event Studies for Medicare Laparoscopic Cholecystectomy Payment Policy Effects on Incumbent Hospital Outpatient Department Case Volumes

	All Laparoscopic Cases	Ambulatory Cases	Inpatient Cases	Inpatient Non-Laparoscopic Cases
	(1)	(2)	(3)	(4)
2005*Treated	9.58	9.95	-0.38	0.19
	(8.77)	(7.21)	(4.78)	(0.88)
2006* Treated	4.58	7.06	-2.47	-0.56
	(5.41)	(3.89)	(3.81)	(1.28)
2008* Treated	-14.71*	-11.63**	-3.08	-2.75**
	(7.49)	(5.25)	(4.52)	(1.25)
2009* Treated	-10.02	-6.32	-3.70	-0.50
	(9.95)	(6.28)	(6.81)	(1.17)
2010* Treated	-11.93	0.17	-12.09*	-2.18*
	(11.26)	(8.26)	(7.04)	(1.22)
2011* Treated	-23.90*	-11.83	-12.07**	-2.21
	(12.60)	(9.16)	(5.35)	(1.40)
2012* Treated	-30.18**	-16.51*	-13.67***	-3.15**
	(12.65)	(9.67)	(5.11)	(1.31)
2013* Treated	-35.98**	-19.57*	-16.41***	-4.01***
	(13.36)	(10.88)	(5.00)	(1.27)
HOPD FE	Yes	Yes	Yes	Yes
N	1,026	1,026	1,026	1,026
Unique HOPDs	114	114	114	114
Pre-Period Treated Outcome Mean	199.0	108.6	90.4	14.7

*** P value at 0.01 level ** P value at 0.05 level * P value at 0.10 level, standard errors clustered at the county level based on facility location. "Treated" is equal to one for hospitals located in counties with three or more ASCs performing commercial laparoscopic cholecystectomy cases in 2007 and zero otherwise. The control comparison hospitals are those located in counties with zero ASCs performing these procedures as of 2007. Analytic sample is also restricted to hospitals performing cholecystectomies over the full study period.

Appendix Table 5—Diff-in-Diff Estimates for Medicare Laparoscopic Cholecystectomy Payment Policy Effects on Incumbent Hospital Outpatient Department Case Volumes Stratified by Payer Type

	Medicare FFS				**Commercially Insured**			
	All Laparoscopic Cases	Ambulatory Cases	Inpatient Cases	Inpatient Non-Laparoscopic Cases	All Laparoscopic Cases	Ambulatory Cases	Inpatient Cases	Inpatient Non-Laparoscopic Cases
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post	6.78*	5.95***	0.83	-2.65***	6.84**	3.65	3.19*	-0.78***
	(3.49)	(1.78)	(2.36)	(0.65)	(3.07)	(2.85)	(1.67)	(0.19)
Post*Treated	-9.88**	-5.25**	-4.63	-0.54	-15.95**	-11.37*	-4.59*	-1.80***
	(4.58)	(2.06)	(3.11)	(0.83)	(7.03)	(5.79)	(2.58)	(0.30)
HOPD FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	1,026	1,026	1,026	1,026	1,026	1,026	1,026	1,026
Unique HOPDs	114	114	114	114	114	114	114	114
Pre-Period Treated Outcome Mean	55.6	20.3	35.3	8.4	143.4	88.3	55.1	6.3

*** P value at 0.01 level ** P value at 0.05 level * P value at 0.10 level, standard errors clustered at the county level based on facility location. "Treated" is equal to one for hospitals located in counties with three or more ASCs performing commercial laparoscopic cholecystectomy cases in 2007 and zero otherwise. The control comparison hospitals are those located in counties with zero ASCs performing these procedures as of 2007. Analytic sample is also restricted to hospitals performing cholecystectomies over the full study period.

Appendix Table 6—Diff-in-Diff and Event Study Estimates for Medicare Laparoscopic Cholecystectomy Payment Policy Effects on Incumbent Hospital Outpatient Department Case Ambulatory Surgical Volumes Stratified by Payer Type

	Medicare FFS		**Commercial**	
	(1)	(2)	(3)	(4)
Post	4.42***		1.56	
	(1.03)		(2.08)	
Post*Treated	-2.98*		-12.44***	
	(1.71)		(3.77)	
2005*Treated		-2.26		-0.36
		(2.44)		(4.99)
2006* Treated		-1.33		-1.04
		(1.48)		(3.69)
2008* Treated		-3.02*		-2.55
		(1.66)		(3.35)
2009* Treated		-1.67		-5.78
		(2.55)		(3.83)
2010* Treated		-1.66		-3.25
		(2.06)		(5.48)
2011* Treated		-5.99**		-18.66***
		(2.34)		(5.41)
2012* Treated		-6.09**		-21.31***
		(2.49)		(4.66)
2013* Treated		-6.65***		-25.93***
		(2.22)		(5.52)
HOPD FE	Yes	Yes	Yes	Yes
N	1,629	1,629	1,629	1,629
Unique HOPDs	181	181	181	181
Pre-Period Treated Outcome Mean	32.4	32.4	112.9	112.9

*** P value at 0.01 level ** P value at 0.05 level * P value at 0.10 level, standard errors clustered at the county level based on facility location. "Treated" is equal to one for hospitals with existing surgeons performing commercially insured cases within the hospital ***as well as*** performing such cases within ASCs in 2007 and zero otherwise. The control comparison hospitals are those within the presence of commercial "splitters" for these cases in 2007. Analytic sample is also restricted to hospitals performing cholecystectomies over the full study period.

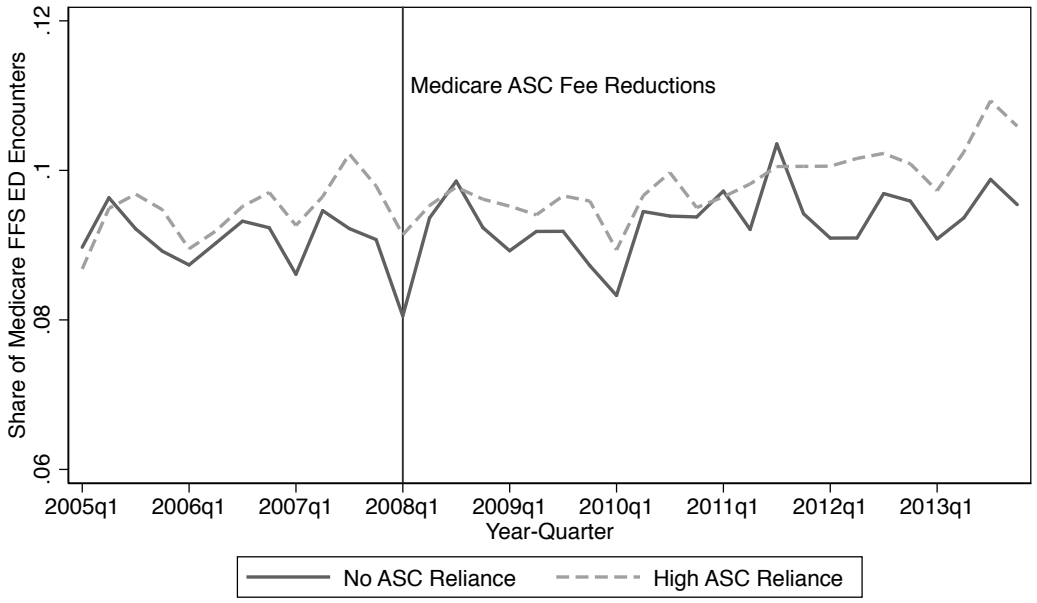
Appendix Table 7—Diff-in-Diff and Event Study Estimates for Medicare Laparoscopic Cholecystectomy Payment Policy Effects on Incumbent Hospital Outpatient Department Case Ambulatory Surgical Volumes Stratified by Payer Type—Using HRR as Market Boundaries for Pre-Policy ASC Exposure

	Medicare FFS		**Commercial**	
	(1)	(2)	(3)	(4)
Post	10.07***		6.57*	
	(2.40)		(3.50)	
Post*Treated	-9.32***		-9.91**	
	(2.80)		(4.75)	
2005*Treated		0.86		-4.94
		(3.89)		(6.82)
2006* Treated		2.76		-1.26
		(2.20)		(4.29)
2008* Treated		-3.80		-3.57
		(3.22)		(5.45)
2009* Treated		-2.99		-8.50
		(3.37)		(6.15)
2010* Treated		-8.52***		-15.52
		(2.92)		(10.01)
2011* Treated		-13.71***		-18.83**
		(3.87)		(8.58)
2012* Treated		-10.31**		-13.41*
		(2.22)		(7.53)
2013* Treated		-9.37**		-12.06
		(3.59)		(7.69)
HOPD FE	Yes	Yes	Yes	Yes
N	648	648	648	648
Unique HOPDs	72	72	72	72
Pre-Period Treated Outcome Mean	29.7	29.7	90.9	90.9

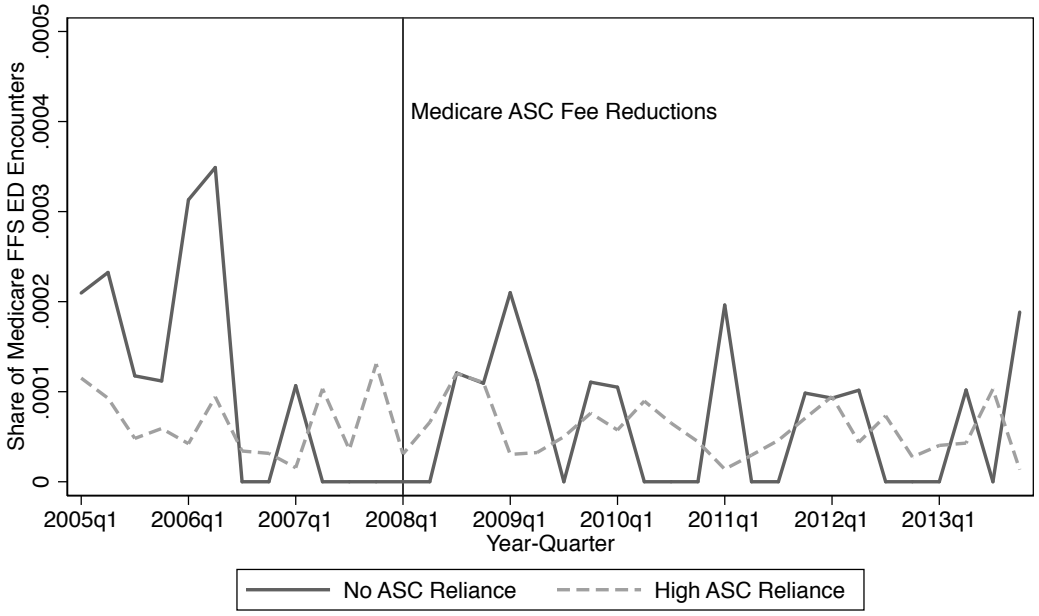
*** P value at 0.01 level ** P value at 0.05 level * P value at 0.10 level, standard errors clustered at the county level based on facility location. "Treated" is equal to one for hospitals with seven ASCs performing commercial lap chole procedures in 2007 within their HRR. The control comparison hospitals are those that only have a single ASC performing these cases in 2007 within their HRR. In short, we are comparing the most and least exposed HOPDs by HRR market definitions. Analytic sample is also restricted to hospitals performing cholecystectomies over the full study period.

Appendix Figure 4—Trends in Florida Medicare FFS Encounters for Issues Linked to Chronic Pain/Nerve Disease (Panel A) and Post-Medical-Procedure Infections (Panel B)

PANEL A



PANEL B



Notes: Analytic data include the universe of Florida Medicare ED visits for Medicare FFS beneficiaries at the quarterly level from 2005-2013