Winners and Losers of Entry Deregulation: Evidence from Ambulatory Surgery Centers

Anthony Yu*

Job Market Paper

November 2022

URL to latest file:
`http://scholar.harvard.edu/anthonyyu/files/yu_jmp_harvard.pdf`

Abstract

Who is helped or harmed by entry deregulation in healthcare? Studies of other markets suggest that removing entry regulations benefits consumers through lower prices but harms labor through lower wages. In healthcare, however, due to administratively set prices, deregulation affects consumers through convenience and quality rather than price and, due to entrepreneurship, allows doctors (labor) to earn more. Using administrative data from Medicare, I study the impact of a change to Missouri's certificate of need law on consumers, insurers, and healthcare providers. The reform relaxed entry restrictions on ambulatory surgery centers (ASCs), predominantly physician-owned facilities that specialize in procedures such as cataract surgeries and colonoscopies and have lower prices than hospitals. Using a difference-in-differences strategy, I find that the reform increased the number of ASCs in urban areas by 58% but did not significantly increase utilization per capita. Instead, patients shifted their care from hospitals to ASCs, traveling and waiting less with no evidence of higher complication rates. To quantify the welfare trade-offs associated with ASC entry for Medicare, I estimate a structural model of provider choice and quality. Simulations show that, on average, consumer welfare per procedure increases by \$2.59, arising from differences in access and facility characteristics. In contrast, Medicare reimbursement falls by \$153. Hence, the primary winners of deregulation are insurers and entrepreneurial physicians at the expense of hospitals.

*Harvard University, Department of Economics. Email: `ayu@g.harvard.edu`. I am very grateful to my advisors David Cutler, Edward Glaeser, and Robin Lee for their unwavering support and guidance. I thank Vilsa Curto, Elizabeth Engle, Harris Eppsteiner, Bruce Hall, Edward Kong, Tim Layton, Jeremy Majerovitz, Robbie Minton, Erica Moszkowski, Elizabeth Munnich, Ariel Pakes, Dominic Russel, Mark Shepard, Ashley Swanson, Yin Wei Soon, Myles Wagner, and participants of the Harvard IO, Public Economics, and health economics student workshops, the NBER Health and Aging Seminar, and the 2022 ASHEcon annual meeting for numerous useful comments and suggestions. I also thank the staff at the National Bureau of Economic Research (NBER), ASC association and administrators at Barnes Jewish Hospital for industry background and insight. This research is supported by the National Institute on Aging, Grant Number T32-AG000186. All errors are my own.

1 Introduction

Who are the winners and losers of entry deregulation in healthcare? Empirical evidence on deregulation in the airline (Borenstein and Rose, 2014), trucking (Rose, 1987; Winston, 1990), banking (Jayaratne and Strahan, 1998; Kroszner and Strahan, 2014), and railroad (Winston, 1990; MacDonald and Cavalluzzo, 1996) industries show that entry deregulation trades off lower prices and higher quantity with decreased rent sharing with workers and entry costs. Entrants may be lower quality, but prices also fall.

In healthcare, the effects of removing regulatory barriers to entry on consumers and firms may be different from other industries for several reasons. Because consumers are insured, insurers, rather than consumers, benefit from the effects on price. For public insurers, such as Medicare (insurance for aged 65 and older) and Medicaid (insurance for the low-income), prices are administratively determined. Hence, without large price effects, entry may benefit consumers through non-price characteristics, such as access and quality. However, scarce inputs or high fixed costs may lead to incumbent provider exit that harms consumers.[1] Healthcare services are also learning-by-doing products (Luft et al., 1987), so scale effects through competition may further reduce quality. Finally, doctors can benefit rather than lose from deregulation due to firm ownership (Munnich et al., 2021; Swanson, 2021).

In this paper, I provide empirical evidence on the distributional effects of entry deregulation in healthcare. I focus on the growth of ambulatory surgery centers (ASCs) in the context of certificate of need (CON) regulations and Medicare. ASCs conduct more than half of outpatient surgeries in the United States, a $132 billion sector (Kumar and Parthasarathy, 2020). Billed as "focused factories," ASCs allow surgeons, who are also typically facility owners (Yee, 2011; Munnich et al., 2021), to perform high-volume and low-risk procedures. Standard procedures include cataract surgeries, upper GI endoscopies, and colonoscopies. Since ASCs are believed to have lower costs than hospital outpatient departments (HOPD), most public and private insurance companies reimburse them at much lower rates. ASCs, unlike hospitals, do not have extensive emergency equipment or intensive care units, lowering the cost of providing care (Government Accountability Office, 2006). In 2022, the Centers for Medicare and Medicaid Services (CMS) reimburses, on average, $1062 to an ASC and $2120 to a HOPD for the same cataract surgery, leading policymakers to support ASC growth as a way to cut costs.

Thirty-five states enforce CON laws, which emerged in 1964, to regulate entry and investment in healthcare. CON laws can be expansive; they regulate hospital construction, ASCs, imaging scanners, dialysis clinics, and more. Proponents of CON argue that absent regulation, firms will

[1] Throughout, I refer to costs associated with keeping a product available as "fixed costs." These costs would include hiring costs and rent for fixed capital. I refer to the costs of setting up a facility (e.g., the construction costs) as "entry costs."

engage in a "medical arms race," leading to over-capacity and price inflation (Kessler and McClellan, 2000). Opponents note that CON laws also protect market power and may have the opposite effect: driving up prices and keeping out efficient entrants (Ohlhausen, 2015). Many states in the 1980s repealed CON laws as part of a national push for deregulation. In 2002, Missouri amended its CON law, lifting restrictions on ASC entry and hospital renovations.

I leverage this natural experiment to estimate the impact of entry deregulation using a 20% random sample of Medicare claims and enrollment data from 1992 to 2013. To provide descriptive evidence, I employ a matched differences-in-differences research design that compares ZIP codes in Missouri to control ZIP codes in states that continually enforce ASC-CON laws during the study period. I find that the policy leads to a 55% increase in the number of ASCs in urban markets, with no entry in rural areas.

To quantify the magnitude of the consumer benefit and rent redistribution associated with ASC entry following CON deregulation, I estimate a structural model of the outpatient surgery market. The model consists of two parts: a provider choice model (following McFadden (1978); Berry et al. (2004)) in which consumers choose surgeon-facility pairs and an outcome model (following Gaynor et al. (2005)) that translate patient choices into expected complication rates. I estimate the model separately for three procedures: cataract surgeries, colonoscopies, and upper GI endoscopies. Consumer choice responds significantly to changes in distance, transit access, and facility type. Complication rates for cataract surgeries and colonoscopies decline with surgeon volume. To simulate welfare trade-offs associated with ASC entry, I construct counterfactual choice sets by removing surgeon-facility pairs that entered after 2002 and reintroducing surgeon-facility pairs of the affected surgeons that were available before 2002.

There are several potential winners and losers that result from removing regulatory barriers in Missouri: patients, physicians, hospitals, and the insurer (Medicare). For patients, I document that they are more likely to receive a procedure at an ASC than a hospital; 12% of the market shifts over. Despite the dramatic increase in ASC operating room capacity, there is no evidence of market expansion. This result is surprising because physicians usually own ASCs, which gives them the added incentive to do more procedures relative to the hospital.

Nevertheless, deregulation benefits consumers on the intensive margin. Except for low-income consumers in St. Louis, who travel 2 miles more on average, I find that most consumers benefit from lower travel distance or wait times. On average, patients travel 1.5 fewer miles. For rural patients, wait times for cataract surgeries fall 17%, or 4 days. Although patients see less experienced surgeons who are 14% lower volume, patients are 11% more likely to avoid surgeons with very low volume, such as a cataract surgeon that operates fewer than 100 Medicare eyes per year.

These consumer benefits end up being minimal. Simulations using the structural model show the consumer benefit associated with post reform ASC entry is $2.59 per episode. Consumers save three minutes in drive time round-trip, valued at $1.04 per episode. Effects on complications are equally inconsequential, with increases translating into $0.25 of additional Medicare spending per episode. Nevertheless, there are notable differences between patient groups. For instance, Medicaid patients experience a 30% smaller change. Rural patients benefit $1.84 while urban patients benefit between $2.70 and $2.80.

In contrast, for physicians and doctors, the reform leads to substantial rent redistribution. Because ASCs are usually physician-owned, the 12% shift from hospitals to ASCs represents a sizable physician benefit at the expense of hospitals. There is also rent redistribution between physicians. Patients shift to less-experienced and lower-volume doctors following entry deregulation. Deregulation in Missouri increases the revenue from Medicare to ASCs by $20 million and decreases revenue to hospitals by $39 million per year. Relaxing entry regulations may also yield nonpecuniary benefits for physicians, such as being closer to desirable amenities and having greater scheduling control (lower wait times). While the number of surgeons in Missouri increases by 5%, high-income urban areas have 13% more physicians. In contrast, surgeon count in rural and low-income urban areas declines by 4-13%.

Reimbursement differences imply that insurers, such as Medicare and Medigap (supplemental insurance) carriers, also benefit from rent redistribution between ASCs and hospitals. Per procedure, I find that insurers pocket $153, dwarfing changes to consumer welfare. A back-of-the-envelope calculation suggests that society benefits $57-$131 per procedure when changes to government reimbursement reflect real cost differences at ASCs compared to hospitals.

Overall, these empirical results highlight the heterogeneous impacts of entry deregulation on consumers while acknowledging that the effects are modest relative to the changes in Medicare spending. In this setting, the main winners of the reform are taxpayers (Medicare) and surgeon owners, and the main losers are the hospitals.

This paper relates to an extensive empirical literature in industrial organization that studies deregulation (Rose, 1987; Joskow and Rose, 1989; Winston, 1990; Olley and Pakes, 1996; Borenstein and Rose, 2014; Rose, 2014; Jayaratne and Strahan, 1998). Unlike these other studies, my analysis shows that deregulation does not provide material benefits to consumers and reductions to wages. Instead, due to the unique features of ASCs and Medicare, removal of entry barriers primarily redistributes rents among Medicare, physicians, and hospitals. There are heterogeneous consumer welfare impacts, but magnitudes in either direction are small relative to the cost savings to Medicare. Workers, who are physicians, benefit from the reform as they are allowed to capture greater rents from new facilities or existing hospitals.

I also contribute to a literature studying the effects of CON laws. The bulk of the early literature studies the effect of CON on costs and utilization, suggesting that they did little to reduce spending (Sloan and Conover, 1998). More recent literature has leveraged quasi-experimental research designs to recover the causal effects of CON repeal in the context of cardiac bypass (Cutler et al., 2010), imaging scanners (Perry, 2017), and dialysis clinics (Rosenkranz, 2021). I build upon this work by studying outpatient surgery markets, a setting with high potential unmet need (e.g., screening colonoscopies) but also some scope for moral hazard (Murphy et al., 2016). In parallel work, Chicoine and Munnich (2021) considers the impact of ASC-CON repeals on aggregate outpatient utilization levels using a border discontinuity research design, also finding limited evidence of market expansion. Using reduced form and structural methods, I provide empirical evidence on how consumers across geography respond to ASC-CON reform across a wide array of new outcomes, such as distance, complication rates, and wait times. I focus instead on the distributional consequences of a tailored CON reform on consumers and firms providing ophthalmology and gastroenterology procedures.

This paper connects to a growing literature studying the economics of specialized facilities in healthcare, such as specialty hospitals (Barro et al., 2006; Sachs, 2021; Swanson, 2021) and ASCs. Much of the ASC literature focuses on understanding the causal effects of ASCs (Hollenbeck et al., 2014; Munnich and Parente, 2014, 2017; Whaley, 2018). Others focus on the potential effects of promoting ASCs on costs (Whaley et al., 2017; Baker et al., 2019), the physician-ASC relationship, such as board membership or ownership (David and Neuman, 2011; Yee, 2011; Munnich et al., 2021), cost-shifting (Carey et al., 2011), and the welfare consequences of ever introducing ASCs in healthcare (Weber, 2014).

My results also relate to research on the role of competition on the quality and patient allocation in the healthcare sector. Greater choice appears to lead to better providers gaining market share over time (Cutler et al., 2010; Chandra et al., 2016). However, it may also be harmful through a secondary effect on scale, which I test in my setting as well.

The rest of the paper proceeds as follows. Section 2 describes the institutional background, policy variation, and outlines competing hypotheses for the incidence of entry deregulation. Section 3 describes the data sources. Section 4 presents the reduced form evidence of the impacts of entry deregulation of ASCs. Section 5 describes and estimates the structural model of the outpatient surgery market. Section 6 presents welfare trade-offs from policy simulations. Section 7 concludes.

2 Background and Setting

In this section, I first provide background on the setting: ASCs and CON laws. Then, I consider opposing theories of the effects of entry deregulation in healthcare on different agents.

2.1 Ambulatory Surgery Centers

Ambulatory Surgery Centers (ASCs) emerged in the early 1970s as a setting to conduct low-risk surgical procedures that require only part of the body to be under anesthesia. Following Medicare approval of payment to ASCs for procedures in 1982, there was rapid growth of new ASCs. Figure B.1 plots ASC entry patterns over time. The initial wave of ASC entrants were ophthalmology clinics. Later, ASCs that focus on endoscopies and other specialties follow. As of 2016, there were about 5,500 Medicare-licensed ASCs nationwide. About two-thirds of these facilities engage in ophthalmology and gastroenterology. The remaining specialties include dentistry and orthopedics (for hand surgery, spinal injections). For comparison, there are about 6,000 hospitals in the United States. ASCs are usually for-profit and located in suburban and urban areas. Only 28% of hospitals nationally are for-profit and there are more hospitals in rural areas.

Building an ASC is a major capital investment. Estimates place the cost of opening an ASC at around $1 million per operating room. A single-specialty ASC with two operating rooms costs between $2-3 million. A larger facility costs between $4-6 million (Wasek, 2008). This dollar figure includes the expense of acquiring the land, the site design, equipment, and construction costs. In comparison, the cost of a coronary artery bypass graft department is around $3-4 million and a new MRI machine typically costs around $2 million (Cutler et al., 2010; Perry, 2017).

2.1.1 ASCs and Insurer reimbursement

Reimbursement for procedures common to ASCs usually consists of two parts.[2] First, the insurer pays the physician for the procedure, known as a "physician" or "professional" fee. Second, the insurer pays the facility for the procedure, known as the "facility fee."

Society may benefit because Medicare facility fee payments to ASCs are also substantially lower than that of hospitals. For instance, the average Medicare reimbursement for cataract surgery (66984) at the ASC is $1,606. In contrast, the average physician's fee is $544 and the facility fee is $1,062. The HOPD is reimbursed $2,664 in total, $2,120 being the facility fee.[3] Table B.1 presents average Medicare reimbursements for common ASC procedures between 2006-2009. On average, Medicare reimburses a cataract surgery, colonoscopy, and upper GI endoscopy 36 to 49% less than that at the hospital.

These payment differences may reflect actual cost differences. ASCs do not have the facilities and equipment needed to handle emergencies, such as emergency departments and intensive care units that are available at hospitals. Government reports and trade publications suggest that ASCs have lower resource costs than hospitals. According to a 2006 Government Accountabil-

[2] There are alternative payment designs, but the focus here is fee-for-service.

[3] `https://www.medicare.gov/procedure-price-lookup/cost/66984/`

ity Office (GAO) report, ASCs are estimated to have 16-40% lower costs than hospital outpatient departments.

2.1.2 ASCs and the Hospital-Surgeon Relationship

Physicians play a crucial role in the establishment of ASCs. Unlike hospitals, well over 80% of ASCs are owned wholly or in part by the surgeons that operate there.[4] Surgeons have a financial incentive to open an ASC because they are entitled to the facility fee paid by Medicare on top of their normal physician reimbursement. In principle, hospitals should be able to negotiate a split of the facility fee with the surgeon. However, these types of contracts are banned due to the Stark Law and Anti-Kickback statute, which prohibit medical providers from paying or receiving kickbacks in exchange for referrals.[5] ASCs are carved out from the anti-kickback statute and Stark Law.

Based on interviews with ASC owners, entrepreneurial surgeons usually partner with an ASC development company (e.g., AmSurg and Surgicenter) or even a local hospital to lower the individual cost of developing the facility. These corporate partners handle the administrative part of running an ASC and reimbursement negotiations with private insurers. Even after surgeons open an ASC, many still hold operating room privileges at hospitals, because patients may need the extra equipment available at a hospital. Hospitals oppose the entry of ASCs and the expansion of the types of procedures that can be performed in the outpatient setting. They argue that ASCs steal valuable profits used to cross-subsidize unprofitable, but socially valuable services (Ohlhausen, 2015).

2.1.3 ASCs and CON regulations

Many states regulate ASC entry through Certificate of Need (CON) laws. Since the 1970s, CON laws require new facilities and services to undergo regulatory review. New entrants prove that there is unmet need for their services and would not duplicate existing offerings. CON laws vary across states and can apply to a wide variety of projects, including new hospital construction or renovation, imaging equipment acquisition, long-term care and nursing home construction, and ambulatory surgery center construction.

The original intent of these laws was cost containment. Concerns that competition between providers leads to a "medical arms race" (Kessler and McClellan, 2000) encouraged the federal

[4]While gastroenterologists are not surgeons, to be consistent with language and avoid confusion, I use surgeons and physicians interchangeably throughout the text to refer to both gastroenterologists and cataract surgeons.

[5]Some hospitals have purchased ASCs and converted them into HOPDs to take advantage of the higher facility fee. However, surgeons can benefit from this purchase only if they also become salaried employees (i.e., vertically integrated) of the hospital. Due to reimbursement differences between ASCs and HOPDs being large, there is limited incentive for hospitals to own an ASC without converting it to an HOPD except to foster better hospital-surgeon relationships.

government to support CON. However, in the 1980s, the federal government reversed course and pushed for deregulation in a variety of industries and reduced federal funding for CON programs. While half of states repealed CON laws by the early 1990s, many continue to enforce pared back versions of CON (AHPA, 2016). Regulatory agencies, such as the Federal Trade Commission (FTC, 2008), argue that CON is used to protect incumbents with market power.

My empirical work exploits a significant amendment to Missouri's CON law beginning on January 1, 2002. At the end of 1999, Missouri's legislature passed legislation to relax two major provisions of its CON law starting in 2002 (Worsing et al., 2002; Romano, 2003).[6] First, new ASCs no longer neededd to undergo review in order to proceed with construction. Second, the reform removed review for hospital construction projects on existing campuses. Importantly, Missouri continues to maintain oversight over many other healthcare investments, including imaging scanners, cardiac surgery units, nursing homes, and new hospital construction. Figure 1 plots cumulative and net ASC entry in Missouri over time compared to states with ASC-CON and no CON laws. Following the reform in 2002, ASC entry in Missouri accelerates, approaching the average in no CON states.

2.1.4 ASCs and returns to scale in quality

Many ASC procedures exhibit a volume-outcome correlation (Bell et al., 2007; Chukmaitov et al., 2013; Forbes et al., 2020). That is, the more volume a surgeon receives, the probability of complication falls. ASCs may enable surgeons to move down the volume-outcome curve, because they are unencumbered by hospital operating room scheduling. Some literature suggests that ASCs may be better places of care, due to specialization (Whaley, 2018; Munnich and Parente, 2014, 2017). Too much competition among surgeons may reduce surgeon volume and, hence, quality.

Figure 2 shows this raw relationship in the data for cataract surgeries, colonoscopies, and endoscopies, the most common procedures performed on Medicare patients in ASCs during the early 2000s. These correlations show that having a surgeon with inadequate volume is associated with a higher likelihood of a complication. Once surgeons reach a few dozen procedures, the relationship flattens out.

[6] During the mid-1990s, there are several state reforms to CON laws. For example, Pennsylvania and Ohio repealed their laws in 1996 and 1997, respectively. During the mid-2000s, states like Illinois and Michigan made subtle changes (e.g., changing the regulatory board composition or capital threshold for review) to their CON laws that may have resulted in substantial entry. To the extent I am able to identify these changes, I exclude markets from these states in my empirical analysis.

2.2 Incidence of Entry Regulations

Three competing hypotheses of the incidence of entry regulations on consumers, providers, and the insurer emerge from the distinct features of my setting. I describe these hypotheses below and what they imply about the empirical analysis. Appendix A provides a simple model of quality choice that can generate these hypotheses.

In the outpatient surgery market for Medicare patients, the incidence of entry regulations may differ from other industries. Since Medicare regulates prices, they do not respond to entry deregulation. Most consumers are fully insured, so instead of price, they may benefit from changes to quality and access. However, countervailing forces distinct to healthcare may harm patients. Healthcare facilities may have high operating costs from fixed labor or capital, leading to provider exit. Exit harms individuals who prefer incumbents over entrants. Procedure quality exhibits learning by doing (i.e., volume-outcome) effects, harming patients if there is too much dispersion among providers. Furthermore, specialized entrants may be directly owned by incumbent physicians, mitigating any negative effects on labor from cost-cutting.

Hypothesis 1. *Entry regulations lead to the under-supply of quality and access in equilibrium; in its absence, consumers would benefit at the expense of firms.*

The simplest way to think about this prediction is that if firms face excess demand, then they do not have to increase quality in order to attract new patients. Hence, entry regulations hinder access and lower quality. Similarly, intuition from Ellis and McGuire (1986) tells us that in procedure markets where prices are set administratively and paid regardless of quality, profit maximizing firms or physicians will tend to under-supply quality, overvaluing profits and disregarding patient welfare. Competition may mitigate the under-provision of quality (Spence, 1975; Ellis and McGuire, 1986).

If this prediction is correct, entry deregulation should increase quality and access. Intensive margin quality and access measures, such as complication rates, distance, and wait times will fall upon deregulation. Examining the effect on market size also tests for this prediction. Note, market expansion need not be efficient. Due to insurance, increases in utilization could reflect unmet need or moral hazard (Pauly, 1968). Nevertheless, the change in consumer welfare would still be positive even if it exceeds the insurer cost of providing the procedure or reflects business stealing. In the ASC setting, physician ownership of facilities encourages market expansion as doctors also earn the facility profits (McGuire and Pauly, 1991).

Hypothesis 2. *Entry regulations increase quality and access. High fixed costs and a reduced ability to cross-subsidize may lead providers to exit. Due to learning by doing, there is a concern about having procedures spread across too many physicians.*

Entry decreases the marginal revenue of the firm at every level of quality, which leads to a lower equilibrium quality absent shifts to marginal costs. The marginal cost of quality may also shift up due to increased demand for inputs, further exacerbating quality declines. These consequences harm infra-marginal patients, forcing them to decrease utilization or use a less-preferred facility. In addition, providers may exit if physician supply is relatively inelastic or there are high fixed costs of keeping a facility open for surgeries. In particular, the equilibrium wage needed to attract physicians or the cost of keeping an operating room set aside for endoscopies or eye procedures exceeds the total profits to the hospital for those services.

Hospitals also argue that regulation is needed to prevent cream-skimming by entrants Swanson (2021), stealing rents used to cross-subsidize other socially valuable services (David et al., 2014; Horwitz, 2005; Horwitz and Nichols, 2009). Socially valuable services would include emergency departments and inpatient psychiatric beds. While I do not test for cross-subsidies in this paper, I discuss its importance when considering the implications of entry deregulation on society.

The final part of this prediction relates to the volume-outcome relationship, a common empirical observation that, as a provider conducts more procedures, the higher the quality (Luft et al., 1987; Gaynor et al., 2005). Entry may decrease concentration among providers and thus harm patients, all else equal. However, these effects also influence facility demand and costs, so they have an uncertain effect on equilibrium quality. Declines in total volume, longer drive times, lower physician counts, facility exits, and increased complication rates is evidence that supports this prediction.

Hypothesis 3. *Entry regulations redistribute rents between hospitals, physicians, and insurers, with limited effects on consumer welfare.*

This prediction relates to Stigler (1971), which posits that regulations are often created to benefit those with political influence. Reimbursement in Medicare, for example, is heavily influenced by whether the committee contains specialists who would also stand to gain from favorable pricing (Chan and Dickstein, 2019). Moreover, since most ASCs are owned by physicians (Munnich et al., 2021), key inputs into hospital services, entry regulations may benefit hospitals at the expense of doctors.

If regulation is primarily rent redistribution, it might entail small effects on market expansion and consumer welfare, and large shifts from incumbents to entrants. Since ASCs are paid less, there may be effects on the insurer through reimbursement differences. These differences may reflect a social welfare gain if regulations protect higher-cost and inefficient firms by keeping out more efficient entrants. New entrants, however, must pay setup costs while incumbents do not. As noted above, hospitals may decide to reposition socially valuable services, which may decrease social welfare. Data limitations mean that I can only partially test some of these effects. I discuss how various calibrations of costs affect social welfare estimates in Section 6.4.

Aspects of these hypotheses are not mutually exclusive. For example, large effects on consumer surplus also leads to rent redistribution through higher wages. All hypotheses do not rule out heterogeneous effects on consumers and producers; some patient groups may benefit at the expense of others. In the following sections, I provide evidence for and against these hypotheses.

3 Data

3.1 Medicare Claims

To test the theories outlined in the previous section, I leverage data from CMS. The primary data are enrollment and insurance claims for a 20% random sample of Traditional Medicare enrollees from 1992 to 2013. Established in 1965, Traditional Medicare is a federally run fee-for-service health insurance program for Americans aged 65 and over. It pays for both inpatient (Part A) and outpatient medical care (Part B), with some degree of cost-sharing. For outpatient care, consumers pay a monthly premium. After an annual deductible of $100, the enrollee is responsible for 20% of the reimbursement. Most individuals are not subject to the 20% coinsurance as employer wrap-around coverage and supplemental plans (e.g., Medigap) cover well over 80% of Part B enrollees. For each enrollee, I observe demographics and claims for healthcare services across physician and hospital settings. With these data, I construct three analysis samples.

First, I construct an episode-level dataset for cataract surgeries, colonoscopies, and upper gastrointestinal endoscopies across outpatient and inpatient settings from 1998 to 2013. For the time period analyzed, these are the most popular services at ASCs, accounting for 41% of revenue and 67% of volume billed by ASCs. Ophthalmology and gastroenterology procedures account for 85% of volume at ASCs. For each episode of care, I gather information on facility, surgeon, and patient characteristics and outcomes. I use the 20% Carrier file, Hospital outpatient, and MedPAR to identify episodes of care. The Carrier file provides information on physician and ASC visits between 1998 to 2013. These include data across all locations as long as a physician submits a claim. The hospital outpatient file validates episode-level data from Carrier file. Lastly, MedPAR provides data on inpatient stays. Together, these three sources allow me to identify the operating surgeon, facility type, location, reimbursements paid by CMS, and calculate risk scores and outcomes (e.g., complication) for each patient. I merge in patient demographic characteristics from the Medicare Beneficiary Summary Files (MBSF) and 2000 Decennial Census. The latter data provides information on ZIP code level income and demographics. I calculate travel distance as the straight-line distance between the ZIP code centroid of the facility and the patient's home. To flag metropolitan, micropolitan, and rural markets, I use 2000 rural-urban commuting area (RUCA) codes from the Department of Agriculture. Surgeon information, such as specialty, is extracted from the Medicare

Data on Provider Practice and Specialty (MD-PPAS) files from 2008 to 2013, UPIN directory from 2005-2007, and the National Plan and Provider Enumeration System (NPPES). This analysis sample, containing episode-level care between 1998-2013, after matching similar ZIP codes, is used to estimate the effect of deregulation on equilibrium characteristics, such as distance, wait times, and surgeon volumes in the last 12 months.

From the episode-level data described above, I construct a balanced panel of ZIP codes that collapses data from a 20% random sample of Medicare patients from 1998 and 2013. Since I observe a 20% sample of hospital outpatient data beginning in 1992, I merge in ZIP code level measures of utilization between 1992 and 1998. I restrict my analysis from 1992-2013 when analyzing outcomes derived from only hospital claims and 1998-2013 when analyzing outcomes wholly or partially derived from physician claims. I merge in market structure data from the provider of services (POS) files. For each ASC, the POS provides when the facility opened and closed as well as specialty information. After matching, these ZIP code level data are used to estimate the effect of deregulation on utilization.

Finally, using the episode-level data, I construct surgeon-facility choice data from 1998-2013 for outpatient cataract surgeries, colonoscopies, and upper gastrointestinal endoscopies across hospital and ASC settings for Missouri enrollees. For each procedure type and four-year period (1998-2001, 2002-2005, 2006-2009, 2010-2013), I construct individual level choice sets of surgeon-facility pairs around each ZIP code.[7] I average across episodes in order to construct measures of reimbursement. I restrict choice sets to alternatives within 65 miles and collapse alternatives with fewer than 20 procedures per year into a catch-all category.

Matching ZIP codes To improve the comparability between treatment and control groups, I match each ZIP code in Missouri to control ZIP codes in states that continually enforce CON for ASC between 1992 and 2013. To match ZIP codes, I estimate a propensity score of the probability of being a Missouri ZIP code on pre-reform control and outcome variables. For example, I include market structure nearby (acute care hospitals and ASCs), pre-reform total number of surgeries per capita, pre-reform total number of surgeries at hospitals per capita, and median household income. Then, I match exactly on urban/rural status and wealth quartile (measured by income times population) and nearest neighborhood match on the propensity score, requiring matches to be within 0.2 standard deviations. I match three control ZIP codes for each ZIP code in Missouri. I report additional details about the matching procedure in Appendix D.3.

[7] For these data, I define a facility as a tax number (ASC) or Medicare provider number (hospital). Surgeons are identified by their UPIN or NPI number. I am able to link UPIN to NPIs using crosswalks provided by the NBER.

Limitations of Medicare data Since the analysis focuses on Traditional Medicare patients, I am unable to say much about the behavior of the privately insured. To the extent that I miss a price margin of response, we would expect the change in consumer welfare to underestimate the true welfare effect. Private insurance prices for cataract surgeries and colonoscopies may fall after the reform at hospitals, leading to further consumer welfare benefits. That said, many papers find that Medicare responses are similar to non-Medicare responses. Second, for ophthalmology procedures especially, the market is dominated by Medicare patients, with over two-thirds of cataracts being Medicare patients.

Measuring complications from surgery I flag complications for each surgery by examining the primary diagnosis codes of claims across all settings between 1 and 30 days after the surgery. I derive diagnoses codes from Stein, 2012; Chukmaitov et al., 2013; Garg et al., 2017; Whaley, 2018. For GI procedures, I focus on gastrointestinal bleeding, which includes severe events like perforation. For cataract surgery, infections related to vitreous or retinal detachments are flagged. A full list of diagnosis codes is found in Appendix D.1. Given some diagnoses are age-related, such as macular degeneration, I require that the patient, prior to and including the surgery date, does not have that condition code on any of their claims in the year prior to the surgery. This restriction ensures that the change in diagnosis is more likely to be related to the procedure. The average complication rate for cataract surgeries, colonoscopies, and endoscopies is 1%, 0.8%, and 0.1%, respectively.

Patient heterogeneity Throughout the paper, I separate the analysis into four patient groups: metropolitan and above median household income, metropolitan and below median household income, micropolitan, and rural. The definitions for metropolitan, micropolitan, and rural areas come from the U.S. Department of Agriculture (USDA), which publishes rural-urban commuting area (RUCA) codes for ZIP codes. I use the 2000 vintage. Areas with a primary RUCA between 1-3 are metropolitan, 4-6 micropolitan, and 7-10 rural. The median household income for each ZIP code is taken from the national distribution from the 2000 census. The vast majority of micropolitan and rural areas are below the median, so I do not further distinguish these areas by income.

3.2 Summary statistics

Table 1 reports baseline characteristics in 2000 at the market and episode levels. Columns (1) and (2) present summary statistics before matching. Columns (3) and (4) present summary statistics after matching. Prior to matching, CON ZIP codes tend to be much larger and urban, with greater Medicare enrollment and population densities. They also tend to have more ASCs and hospitals, suggesting that they are less strict with their CON compared to Missouri. After matching, these differences in hospital counts shrink.

In the bottom panel of the table, I report statistics for the episodes of care corresponding to the matched ZIP codes. The sample consists of *outpatient* cataract surgeries, colonoscopies, and upper gastrointestinal endoscopies performed at a hospital or ASC. Compared to inpatient procedures, outpatient procedures do not require a hospital admission with an overnight stay. In my data, Missouri residents travel farther but otherwise have similar characteristics before the reform. Conditional on receiving one of these three procedures, the patient gets 1.4 episodes of care on average. Intuitively, this makes sense because cataracts may develop in both eyes.

4 Impact of Missouri CON Reform

In order to test the predicted effects outlined in section 2.2, I begin by providing descriptive evidence of the effect of Missouri's ASC CON reform. First, I present the policy variation in a series of maps before describing the matched difference-in-differences research design. Then, I investigate the effect of the reform on ASC entry and how that translates into utilization patterns, convenience, and quality.

4.1 Spatial Variation and Empirical Strategy

Figure 3a plots the market structure of the outpatient surgery market for cataract surgeries, colonoscopies, and endoscopies and how that changes between 1998-2001 and 2006-2009. Overall, ASCs, even when CON was effective, entered in the larger urban centers of the state. After the reform, Missouri receives an additional 82 new ASCs between 2002 and 2009. As shown in Figures 3b and 3c, most entry occurs in the largest metropolitan areas, St. Louis and Kansas City, which receive around 40 and 20 new ASCs, respectively. There does not appear to be entry in rural areas, though a few smaller micropolitan areas see a few ASCs come in.

For each hospital, I plot whether the hospital shrinks or grows in 2006-2009 relative to their 1998-2001 outpatient volume for these selected procedures. To deal with changes in Medicare enrollment, I construct catchment areas around each hospital consisting of the nearest ZIP codes that together make up 70% of total reimbursements in the 1992 claims data. 38% of hospitals grow, 53% of hospital shrink, and 9% of hospitals exit.

Figure 4 maps how facility ZIP code market shares change between 1998-2001 and 2006-2009 for four patient subgroups: metropolitan and above median household income patients, metropolitan and below median household income patients, micropolitan patients, and rural patients. The red outline denotes which ZIP codes patients reside. The blue shading plots the change in total facility market share for ZIP code. For metropolitan patients, facilities located in suburban ZIP codes gain the most market share, while those near the city center lose out. Appendix Figure B.2 zooms into St. Louis and Kansas City for these patients and confirms this pattern. For micropolitan and rural patients, areas that receive ASCs or have hospital growth are positively correlated with larger shifts in facility ZIP code market share.

To test whether the spatial variation reflects the effect of the reform or an aggregate trend, I compare ZIP codes in Missouri to matched ZIP codes in states that continue to have ASC-CON policies over time using a difference-in-differences research design. I estimate specifications of the following form:

$$y_{z,t} = \alpha_z + \beta_t + \sum_{\tau \neq -1} \delta_\tau \mathrm{MO}_z \cdot D_{t+\tau} + \rho X_{z,t} + \varepsilon_{z,t} \tag{1}$$

where y denotes the outcome for each ZIP code z in year t. α_z and β_t are ZIP code and year fixed effects, respectively. MO_z is an indicator for whether the ZIP code is located in Missouri and $D_{t+\tau}$ are indicators for relative years to the policy implementation. The coefficients δ_τ quantify the impact of Missouri's reform on the market-level outcomes relative to their matched control groups. My baseline specification does not include controls $X_{z,t}$, but my robustness analyses allow for controls of varying richness. Utilization outcomes are normalized by annual Traditional Medicare enrollment (thousands) in each ZIP code. This corrects for differential Medicare enrollment patterns in Missouri compared to control areas.

In tables, I report estimates from a pooled version of (1):

$$y_{z,t} = \alpha_z + \beta_t + \delta_{in} \mathrm{MO}_z \cdot D_t^{in} + \delta_{sr} \mathrm{MO}_z \cdot D_t^{sr} + \delta_{mr} \mathrm{MO}_z \cdot D_t^{mr} + \rho X_{z,t} + \varepsilon_{z,t} \tag{2}$$

where δ's correspond to interim (2002-2005), short-run (2006-2009), and medium-run (2010-2013) estimates of the policy effect. I focus on the short-run effects δ_{sr} from 2006-2009, when the growth of ASCs in Missouri levels off.

These difference-in-difference regressions rely on the parallel trends assumption absent Missouri's CON reform. That is, the counterfactual outcome of interest would have evolved in the same way as those in control groups without the policy change. For all specifications, I cluster standard errors at the ZIP code level. While the policy is at the state level, exposure to the reform varies at the ZIP code level. For instance, deregulation is more likely to induce entry in areas with larger numbers of affluent consumers. In contrast, rural areas are less likely to receive entry as there are fewer patients.

4.2 Changes to the market structure of ASCs and physicians

Missouri's reform dramatically changes the market structure for outpatient surgeries. Figure 5a plots the raw trends in the average number of ASCs within 15 miles of a ZIP code in Missouri compared to those in the matched control group. The raw trends show that Missouri ZIP codes looked similar to those matched in ASC-CON states prior to the reform in 2002. After the reform, the number of ASCs around each ZIP code sharply increases, leveling off in 2008.

Similar to the binned scatter plot, the event study in Figure 5b shows flat pre-trends, with a sharp change following the reform, translating to a 58% increase in the number of ASCs. Overall, the reform increases the number of ASCs and hospitals by 25%. While the estimates are highly statistically significant, the wide confidence intervals in the post-period relative to the pre-period suggest heterogeneity within Missouri. Figure B.3 presents similar results for a 10 mile radius.

Table 2 presents the pooled estimates from equation (2), focusing on the 2006-2009 time period for comparison. The top panel shows results for the number of ASCs in 10 miles while the bottom panel reports results for 15 miles. Column (1) shows that ZIP codes receive one additional ASC within 15 miles.

In columns (2)-(5), I report results by geography. Consistent with the maps, metropolitan areas such as St. Louis and Kansas City receive around 2.5 new facilities, a 62% increase. Income differences matter for nearby entry. Within a tighter radius of 10 miles, low-income metropolitan areas receive 0.4 facilities, compared to 1.7 around rich metropolitan areas. Smaller cities receive about 0.2 facilities or an 83% increase.

Production of surgeries is determined by the availability of space and physicians. While there is a large increase in the number of facilities, this may not represent a comparable change in capacity if surgeons were previously already fully utilized. Therefore, I also measure whether surgeon supply in each market changed. I construct the surgeon count by measuring the number of surgeons that perform at least 20 procedures per year within 10 and 15 miles radii of a ZIP code. Surgeons may be double-counted if they practice at more than one facility.

Table 3 presents the effect of deregulation on the number of surgeons in 10 and 15 mile radii. Consistent with ASC entry patterns, there is more entry in metropolitan and wealthier areas. However, I do not find statistically significant results for surgeon entry in smaller cities. For low-income metropolitan areas, the number of surgeons decreases between 0-10 miles, but increases between 10-15 miles. For rural areas, the number of surgeons falls by 13%.

These results may indicate that surgeons relocate to suburban ASCs from hospitals in low-income urban or rural areas. Nevertheless, this analysis still shows a net increase in supply. On average, ZIP codes see a 4-6% increase in the number of surgeons, which is smaller than the change in facility count.

4.3 Changes to utilization patterns

When there is a large increase in potential supply, a natural follow-up question is whether it changes patient utilization patterns. ASCs are often owned by operating surgeons, who have an incentive to increase the number of surgeries they do in aggregate; they earn an additional facility fee that they forgo in the hospital setting. Absent moral hazard, testing for market expansion is a first-order approximation for whether deregulation and subsequent ASC entry has a positive effect on consumer welfare.

Figure 6a plots the event study estimates of the effect of the reform on ASC utilization and hospital outpatient utilization per ZIP code enrollment (1000s), pooling across cataract surgeries, colonoscopies, and upper GI endoscopies. Event study estimates begin in 1998 for outcomes that require the use of ASC data. Each coefficient is divided by the average market size in Missouri in 2001, giving it a percentage point interpretation. After the reform, 12% of the market shifts over to ASCs. Hospital outpatient department utilization decreases by a similar amount. Figure 6b plots the event study result for total utilization per enrollment, showing noisy estimates for market expansion. As a robustness check, to show that these results look similar across procedure types, Appendix Figure B.4 plots similar event study estimates by surgery.

Figure 7 plots the event study estimates of the effect of the reform by patient subgroups. Each panel plots event studies showing substitution patterns between ASCs and hospitals, and whether the market expands following the reform. Across all patient groups, the estimates for market expansion are indistinguishable from zero, although they are imprecise. Substitution to ASCs away from hospitals is most present in micropolitan, rural, and metropolitan and above median household income patients. In contrast, I do not detect a statistically significant shift toward ASCs for metropolitan and below median income areas, though the point estimates are consistent with substitution.

Table 4 summarizes the event study results. Column (1) presents estimates for substitution to ASCs between 2006-2009, Column (2) presents estimates for hospital outpatient utilization, and Column (5) presents the combined ASC and hospital outpatient utilization. ASC utilization per enrollment increases by 49%, while hospital utilization per enrollment falls by 12.5%. The shift is larger in rural and micropolitan areas compared to metropolitan and wealthier areas, but these areas also have lower baseline ASC share. Metropolitan and low-income areas do not exhibit strong substitution towards ASCs. While the point estimates are positive, the estimates for market expansion are not statistically significantly different from zero.

Column (3) shows that the reform had little effect on inpatient and emergency utilization. Column (4) repeats the analysis using an alternative measure of hospital utilization that includes inpatient and emergency utilization; I find similar substitution patterns.

Appendix Tables B.8-B.14 show that the regressions above are robust to a battery of robustness checks. I include additional controls: population bin by year fixed effects, income quartile by year fixed effects, wealth quartile by year fixed effects, RUCA by year fixed effects[8], and matched group by year trends. I also specify alternative function forms: log linear and inverse hyperbolic sine.[9] Appendix C.1 presents robustness of the event study results using the 'Honest' difference-in-difference methodology from Rambachan and Roth (2022).

The results from this section provide strong support for rent redistribution from incumbents to entrants. The lack of sizable market expansion across all geographies shows that consumers, at least on the extensive margin, did not benefit from relaxing regulatory restrictions.

4.4 Changes to convenience from travel distance and wait times

Market expansion is not the only way consumers may have been affected by the reform. The reform may affect other aspects of care, such as distance, wait time, and measures of quality. Exploring these outcomes may also explain some of the empirical patterns from the previous section, such as lack of market expansion or rural use of ASCs. For instance, average quality and access may have decreased, leading to an off-setting effect on utilization.

I estimate difference-in-difference regressions at the episode level:

$$y_{i,p,z,t} = \alpha_{p,z} + \beta_{p,t} + \sum_{\tau \neq -1} \delta_\tau \mathrm{MO}_z \cdot D_{t+\tau} + \rho X_{i,p} + \eta_{i,p,z,t} \tag{3}$$

The regression compares episode distance and wait times of individuals in Missouri to those in matched zip codes for cataract surgeries, colonoscopies, and upper GI endoscopies. I control for procedure code by ZIP code fixed effects $\alpha_{p,z}$, which allow for differences within zip code across procedure code. Procedure code by year fixed effects $\beta_{p,t}$ control for aggregate shocks over time to specific procedures, such as changes to Medicare policies. $X_{i,p}$ includes fixed effects for procedure code by demographic cells, constructed from gender, race, age bin, and risk score quartile cells (Elixhauser et al., 1998). The Elixhauser comorbidity index is generated as the sum of indicator variables for common conditions, such as hypertension and diabetes. Standard errors are clustered by ZIP code.

Column (1) of Table 5 presents the effect of the reform on distance. This variable is constructed as the straight line distance between the ZIP code centroid of the patient and the ZIP code centroid of the facility. I drop episodes of care with distance above the 98th percentile of distance in the pre-period, about 120 miles. On average, consumers travel 1.5 fewer miles round trip, on average, for common ASC services, a 5.5% reduction. I find patients from smaller cities experience larger

[8] These are automatically included in the regressions exploring heterogeneity by patient group.

[9] I use $\log(1+y)$ for this specification. Note that alternative function forms such as log or inverse hyperbolic sine impose parallel trends in the change in the outcome variable rather than the level.

declines in travel times while those from larger cities and rural areas do not. Column (2) of Table 5 presents a robustness check to the distance regression by using a log specification. I find similar reductions in average travel distance, with larger effects for micropolitan patients. These estimates suggest that benefits in distance come from greater entry in smaller cities rather than major cities like St. Louis or Kansas City.

Columns (3) and (4) of Table 5 present analogous regressions for wait time. This variable is constructed as the number of days between the consultation with the surgeon and the day of the surgery; the average wait time is about 1 month. I am able to measure wait time for cataract surgeries only, which require examinations before the surgery. I do not find that the reform lowers wait times when pooling across all cataract surgeries, but I find that rural patients wait about half a week less, a four day or 17% reduction. Lower wait times, a characteristic of ASCs, may explain the shift towards these new facilities by rural patients.

Figure 8 plots event studies for log distance and log wait times pooling across ZIP codes and for the patient subgroups that explain the downward trajectory. On average, patients travel about 5% fewer miles, with micropolitan patients traveling closer to 20% less. Cataract surgery wait time does not decline for consumers on average. When zooming into rural areas, wait times decline following deregulation.

The pattern of responses on the intensive margin suggests that, on average, consumers benefit heterogeneously from the reform, providing evidence for the first prediction and against the second prediction. However, the magnitudes are small relative to the baseline mean.

Heterogeneity in Border Areas Spatial variation in Missouri suggests substantial heterogeneity across metropolitan areas. Since Kansas City and St. Louis receive such a large number of ASCs compared to the rest of the state, I perform a separate analysis focusing on patients from these areas. Kansas City and St. Louis are fundamentally different from each other in terms of pre-reform access. Kansas City, Missouri shares a porous border with an unregulated state, so we shouldn't expect capacity to be particularly constrained. St. Louis, shares a border with Illinois, which at the time in 2001 also had an ASC-CON law. As a result, residents in St. Louis may be more constrained than those in Kansas City.

The top two panels of Table 6 examine the effect of the reform on convenience for patients in St. Louis and Kansas City by ZIP code income. Rich residents benefit in both areas. Travel distance falls in both Kansas City and St. Louis, but this is only statistically significant for Kansas City. These results are consistent with the suburban growth of ASCs. Richer patients see large reductions in wait times in St. Louis but not Kansas City, down a week from 39 days. In Kansas City, however, the average wait time prior to the reform is just 26 days, highlighting the unregulated border.

Interestingly, in St. Louis, the reform leads to longer driving distances for low-income residents, a 4 mile or 27% increase round-trip. This result is consistent with physician practice locations; surgeons appear to leave inner-city areas. Patients from low-income zip codes do not see significant declines in distance or wait times in Kansas City. This may be explained by the proximity to more facilities in Kansas. Low-income residents in Kansas City face lower baseline travel distances and wait times relative to those in St. Louis.

Heterogeneity in Rural Areas I also examine rural areas in greater detail. I divide rural areas into three groups depending on their location relative to major interstates in Missouri: above I-70, between I-70 and I-44, and below I-44. These roughly correspond to northern Missouri, southwestern Missouri and the Osage plains, and southeastern Missouri and the Ozark plateau. The bottom panel of 6 presents the effects of deregulation on measures of convenience for patients in these areas. Overall, the drop in wait time is universal across all locations, about a 14-19% reduction. Distance falls for patients in Northern Missouri by 18%, but not others. For southeastern Missouri, the point estimate is positive, suggesting that patients travel more, but it is noisy.

The regressions taken together suggest lower wait times for rural patients may explain the shift towards ASCs. Greater travel distances in St. Louis and a porous border in Kansas City, in part, rationalizes the lack of responses for low-income urban patients.

4.5 Changes to physician access and quality

The analyses so far paint a complicated picture of the incidence of deregulation. There is evidence for rent redistribution across providers and consumer benefits from convenience, but not market expansion. Like convenience, the reform may affect on the quality of care patients receive. There are two sources of potential quality effects. First, providers may invest differently in quality. Second, additional competition may indirectly affect quality through scale (often called the volume-outcome relationship). I start by investigating whether patients see different physicians. Then I ask whether the reform affects quality. Since the procedures at ASCs exhibit volume-outcome relationships, I measure quality both in terms of surgeon volume and observed outcomes.

Because low-income metropolitan patients do not shift to ASCs from hospitals on average and the market size remains constant, migration of surgeons away from these markets implies that low-income urban patients see new doctors. To directly test whether patients see different physicians, Column (1) of Table 7 presents the effects of the reform on pre-reform annual volume. Patients are more likely to see a 6% ex-ante lower-volume physician, showing that the reform leads patients to see different physicians. This effect is strongest in areas that shift to ASCs. Metropolitan and low-income patients are not more likely to see a less experienced surgeon. Consistent with Cutler et al. (2010), CON reform redistributes volume from incumbent surgeons to young upstarts. In this setting, however, it is ASCs rather than hospitals that win.

To test whether the reallocation has an effect on health outcomes, Column (2) uses actual volume as an outcome variable and finds similar results. The magnitudes are larger, a 14% decline compared to the control group. The shift to lower-volume surgeons poses a problem if patients are more likely to see the lowest-volume surgeons. I construct an indicator for insufficient volume surgeon as follows: a cataract surgeon who does fewer than 100 cases in Medicare in the last 12 months or a gastroenterologist who does fewer than 20 cases in Medicare in the last 12 months. I drop all episodes that take place in 1998 as I need a 12-month lead to construct the variable. Column (3) shows that the reform leads consumers to reduce visits to these low quality surgeons, a 28% reduction. Hence, the reform leads patients to shift from very high-volume to middle volume surgeons. I confirm this finding with distribution regressions, which are presented in Appendix C.2.

As a final test, I examine observed quality. Column (4) of Table 7 reports the effect of the reform on 30-day complication rates pooling across all ZIP codes and separately by patient group. I do not find evidence of statistically significant effects. Columns (5)-(7) use alternative measures of quality, such as hospital readmissions and the inclusion of cardiac complications. Here, I also do not find statistically significant effects. The noisy results are consistent with existing literature (Munnich and Parente, 2014; Whaley, 2018), which find the effect of treatment at an ASC on complications is negative.

Figure 9 plots event study estimates for pre-reform surgeon volume, surgeon volume in the last 12 months, the probability of a low-volume surgeon, and complication rates. The effects are consistent with the difference-in-difference regressions reported in the tables. There is a noisy zero on complication rates. Patients avoid the lowest volume physicians, a benefit.

Appendix Table B.5 presents heterogeneous results for St. Louis, Kansas City, and rural areas on quality. The results are consistent with those presented above; the effects on complication rates are noisy, but patients see lower-volume surgeons uniformly.

Stepping back, the analysis on provider quality rejects major consumer harm and supports rent redistribution. While patients see different and lower volume surgeons, they avoid the lowest-volume physicians. High-volume surgeons lose to middle-volume surgeons.

5 Structural Model of Consumer Choice and Quality

So far, I have presented evidence that Missouri's reform leads to substitution from hospitals to ASCs, but limited evidence of market expansion. The patterns in the data support rent redistribution, but are less definite on whether consumers win or lose from the reform. Consumers do experience lower travel, lower wait times, and see lower volume surgeons, but it remains unanswered how much these effects matter for patient welfare overall and for different patients. To quantify the effects of the CON law reforms on consumer welfare and how this trades off with government costs, I estimate a structural model of the outpatient surgery market.

There are several benefits of the model. First, since ASC services are differentiated, a structural model provides a summary measure of welfare that captures this differentiation. This measure is important for estimating the magnitude of the effect on consumer welfare, allowing me to distinguish between whether CON is about patients or firms. Second, the parametric model allows me to quantify effects on smaller subgroups that I would not have power to do so in a state like Missouri, e.g., nonwhite patients, which comprise a small share of Medicare. Even if consumers benefit on average, any consumer harm should be noted as policymakers may have redistributive preferences. Finally, the model allows me to experiment with alternative choice sets, providing insight on optimal CON design.

The model consists of two separate components: (1) a surgeon-facility s, j choice model and (2) an outcome model for complications. Consumers choose a single surgeon-facility s, j. Conditional on choosing s, j, patients realize a health shock that determines whether they experience a complication within 30 days of the procedure. I estimate models for each outpatient procedure: cataract surgeries, colonoscopies, and upper GI endoscopies.

In this section, I present and estimate the model. In the following section, I use the parameter estimates to quantify effects the consumer welfare and cost effects of rolling back the reform. Note, the demand model and outcome model can be interpreted separately.

5.1 Demand for surgeons and facilities

The consumer i, which consists of a patient and referring physician, chooses a surgeon-facility couple s, j from an individual-specific choice set J_i. The indirect utility for consumer i for receiving a procedure from surgeon-facility s, j is:

$$U_{i,s,j} = \underbrace{\delta_{i,s,j}}_{\text{surgeon-facility quality}} - \underbrace{\beta_i^{dr} drivetime_{i,j} + \beta_i^{tr} transitaccess_{i,j}}_{\text{travel cost}} + \underbrace{\varepsilon_{i,s,j}}_{\text{logit error}} \tag{4}$$

Travel cost depends on drive time and whether a location has transit access. I construct drive times and transit access from Google Maps. Transit access is an indicator for whether Google Maps is able to find a route from the ZIP code centroid of the patient to the ZIP code centroid of the facility using public transportation.

To facilitate estimation, surgeon facility quality $\delta_{i,sj}$ is further parameterized as

$$\delta_{i,s,j} = \delta_{s,j,\tau(i)} + \beta_i^a ASC_j + \beta_i^s SurgAge_{i,s} \tag{5}$$

Surgeon-facility-time period fixed effects $\delta_{s,j,\tau(i)}$ allow for heterogeneity in the average popularity across surgeon-facilities in the pre $\tau(i) = 0$ and post $\tau(i) = 1,2,3$ periods. Low volume surgeon-facility pairs, those that have fewer than 20 episodes in a four year period, are normalized to zero $\delta_{small,\tau(i)} = 0$. Interactions of patient and referring physician demographics with an ASC indicator ASC_j and operating surgeon age allow for preference heterogeneity across alternatives as a function of observable characteristics. I allow heterogeneous coefficients to vary with de-meaned demographics and health-related characteristics as follows:

$$\beta_i^t = \bar{\beta}^t + \beta_D^t demog_i + \beta_H^t health_i \quad \text{for } t \in \{dr, tr\} \tag{6}$$

$$\beta_i^v = \bar{\beta}^v + \beta_H^v health_i \quad \text{for } v \in \{a, s\} \tag{7}$$

Specifically, $demog_i = (female_i, nonwhite_i, Medicaid_i)$ and $health_i = (elix_i, age_i)$.

There are several limitations of this choice model. First, I abstract away from price sensitivity. According to the Medicare Current Beneficiary Surveys, 80% of consumers have supplemental insurance (e.g., Medigap, employer wrap-around coverage, and Medicaid), somewhat ameliorating concerns. Conditional on ASC or hospital within a geography, there is limited identifying variation across facilities. To obtain estimates of consumer surplus in dollars, I rely on estimates of the value of time.

Second, this model is on the intensive margin. This assumption is supported by the reduced form evidence; I do not find an extensive margin response on average across various sub-populations. The extensive margin is also challenging as it is a missing data problem: I do not observe the pool of potential patients. Patients with senile cataracts can wait many years before needing to operate. There is also discretion with gastrointestinal procedures, where there are not clear diagnoses that predict a procedure. I note that the demand estimates will still be consistent for a model with an extensive margin if there is no selection on unobservable characteristics into surgery.

Finally, there is a question of whose preferences the choice model identifies. In principle, the preferences are those of the consumer, which is likely to be a joint decision of the patient and their referring physician. Therefore, interpreting welfare using parameter estimates as those reflecting the patient requires assuming that the referring physician has no preferences of their own. To ameliorate this common issue for hospital and provider demand models, in addition to reporting welfare, I also report changes to average drive time from the patient ZIP code to the facility ZIP code, which represents a more patient-focused statistic.

Identification and Estimation Since all of the covariates are observed, the first stage of estimation proceeds via maximum likelihood. To ease the computational burden, I restrict to episodes of patients who reside in Missouri between 1998-2001 and 2006-2009. Table B.15 presents summary statistics of the choice samples.

Table 8 presents the results for cataract surgeries, colonoscopies, and upper GI endoscopies in terms of marginal willingness to pay in minutes per procedure. On average, consumers are willing to pay six minutes for transit access, with nonwhite consumers willing to pay an additional 30 minutes. Older and sicker patients are more sensitive to distance and prefer ASCs less than the average Medicare patient. Table B.6 presents the raw demand estimates. The inclusion of observed complication rates in the past year does not meaningfully change estimates; I note that the effect is not statistically significant or is of the wrong sign.

Table B.7 presents average own and cross-distance elasticities for the preferred specification across zip codes. Each elasticity is calculated at the surgeon-facility-zip-τ level. I estimate average own-distance elasticities around -4.3. Cataract surgeries are less sensitive to distance compared to outpatient upper GI endoscopies. These are high when benchmarked against facility-choice models, which tend to have distance elasticities around -1 to -3 (Weber, 2014). Mechanically, this makes sense because there are more than double the number of surgeon-facilities relative to facilities. To compute a cross-distance elasticity for each surgeon-facility ZIP code and time s, j, z, τ, I evaluate a one mile change in all other alternatives for the zip code z and time τ, and then take the average. Given the large choice sets, the cross-distance elasticities are small, but positive, as expected.

In my main specification, I do not allow β_i^v to vary with demographics such as race. I did not find significant differential substitution patterns towards ASCs between white and nonwhite patients, as shown in Table C.1. As a robustness check, I present estimates allowing for these interactions in the appendix Table B.16.

5.2 Outcome model

To translate consumer choice into medical quality, I specify an outcome model. Conditional on choosing a facility, consumers realize a health shock ν_{isj}. Let $C_{isj} \in \{0,1\}$ be an indicator for whether consumer i experiences a complication within 1 to 30 days after the surgery at surgeon-facility s, j.

I model the outcome as a threshold crossing model:

$$C_{isj} = 1\left\{\underbrace{x_{isj}\phi^x + \phi^v \log(vol_{is}) + \nu_{isj}}_{\equiv C^*_{isj}} > 0\right\} \tag{8}$$

The outcome is a function of x_{isj}, a vector of individual characteristics, surgeon-facility characteristics, and interactions of thereof; vol_{is}, 12 month lagged volume of the surgeon in the time leading up to surgery i; and ν_{isj} an unobservable health shock realized after the choice has been made. x_{isj} includes year fixed effects and interactions of demographic characteristics $demog_i$ with surgeon age and an ASC dummy.[10] The parameters of interest are $\phi = (\phi^x, \phi^v)$. ϕ^x captures the effect of observable patient and facility characteristics and ϕ^v captures the volume-outcome relationship.

Identification and estimation For identification, the main concern is that ν_{isj} is correlated with vol_{isj} due to unobserved consumer or surgeon-facility characteristics. Similar to the choice model, I abstract from selection on unobservable consumer characteristics. Correlation between δ and ν remains a concern. Since I lack a good source of exogenous identification, I estimate several specifications to show the robustness of the outcome model estimates.

Table 9 presents estimates from several specifications of the outcome model across the three procedures. My preferred specification is presented in column (1), in which I use a simple probit specification with a log functional form on volume. I find that complication rates fall when the surgeon does more volume in a given year. Column (2) uses a square root specification instead of log and I obtain similar estimates for cataract surgeries. The GI procedures models exhibit a less robust volume-outcome relationship, though the point estimates are consistent with scale effects. Regardless, the models can still be used to translate choices into quality outcomes. The final two columns present linear models that include surgeon-facility fixed effects, which directly address the concern of correlation between δ and ν. Fixed effects in nonlinear models face an incidental parameters problem. I find that the marginal effects from linear fixed effects models are close to those implied by the preferred specification.

[10] To deal with zeros, I use $\log(1 + vol_{is})$ in practice. However, I provide robustness to alternative functional forms, such as $\sqrt{vol_{is}}$.

6 Welfare Trade-offs of Entry Deregulation

6.1 Consumer welfare and Medicare reimbursement

Having estimated the parameters of the demand and outcome models, I perform a set of counterfactual exercises to simulate the roll back Missouri's policy reform. Using observed choices from 2006-2009, I examine the effect on consumer surplus, equilibrium product characteristics (drive time and complication rates), and the cost to the insurers.

I measure consumer surplus using the log-sum formula implied by logit errors for the compensating variation. The compensating variation from a change from a choice set J_i' to J_i is given by:

$$CV_i(J_i', J_i) \equiv \frac{1}{\beta_i^{dt}} \left\{ \log\left(\sum_{sj \in J_i} \exp\left(U_{isrj} - \varepsilon_{isrj}\right) \right) - \log\left(\sum_{sj \in J_i'} \exp\left(U_{isrj} - \varepsilon_{isrj}\right) \right) \right\} \tag{9}$$

where β_i^{dt} is the coefficient on drive time. The compensating variation is measured in minutes, but I also provide a dollar measure by multiplying by estimates of the time value of money. Following recent estimates from Goldszmidt et al. (2020), I use a conversion of \$19 per hour.

As the regulator may value more than just consumer welfare, I also report changes to insurer spending and other equilibrium outcomes x_i, such as cost and transit access, which is given by:

$$\Delta x_i(J_i', J_i) \equiv \sum_{sj \in J_i} \sigma_{i,s,j}(J_i) x_{i,s,j} - \sum_{sj \in J_i} \sigma_{i,s,j}(J_i') x_{i,s,j} \tag{10}$$

where $\sigma_{isrj}(\cdot)$ are the equilibrium choice probabilities and $x_{i,s,j}$ is the product characteristic for alternative s, j. Let J_i denote the baseline 2006-2009 choice set. I report the change in x_i or welfare from counterfactual world to the baseline period, simulating the effect of the reform.

I consider two counterfactual exercises that simulate the welfare effects associated with entry.

- **Counterfactual 1: Remove post-2002 ASC entry:** First, I consider counterfactual choice sets J_i^1 that remove alternatives of ASCs that entered after 2002. In Missouri, 82 ASCs entered between 2001 and 2009. Empirically, I delete ASC-surgeon pairs in which I do not see any patient activity in the 1998-2001 data. Simply deleting alternatives from choice sets implies that consumer welfare must mechanically increase after deregulation.

- **Counterfactual 2: Remove post-2002 ASC entry and relocate surgeons:** Since the first counterfactual may not reflect reality as physicians would have worked elsewhere, my main simulation constructs counterfactual choice sets J_i^2 by removing new alternatives and reintroducing alternatives previously used by the affected surgeons. For example, if Dr. Smith in

2006 works exclusively at a new ASC but worked at a hospital in 2001, I remove (Dr. Smith, ASC) in 2006 and add back in (Dr. Smith, Hospital) from 2001 to patient choice sets.[11]

Relocating surgeons creates a potential source of welfare loss. Incumbent surgeon-facility exit means that, for some individuals, they no longer have access to an alternative in the 2006-2009 period relative to the counterfactual choice set.

Table 10 presents average changes comparing the baseline 2006-2009 choices to those implied by these two sets of counterfactual exercises. The top panel reports average effects for the counterfactual that rolls back entry without relocating surgeons. Column (1) reports the change in ASC utilization. The likelihood of using an ASC increases 24 percentage points. Column (2) reports the average compensating variation, which I find to be \$5 when pooling across all procedures. Part of this benefit is explained by changes in drive times, as shown in Column (3); consumers save 7 minutes on average. The decline in drive time is valued at \$2.24 or 45% of the average compensating variation.

The remaining columns in Table 10 present the effect on complication rates, and Medicare reimbursement. Column (4) shows that the decline in surgeon volume translates into higher complication rates 0.04%, consistent with the reduced form estimates. However, the additional Medicare reimbursement needed to pay for these additional complications is minimal, \$0.14 per episode. The average cost of a complication is \$1252. Column (5) shows that these quality effects are dwarfed by the decrease in Medicare reimbursement of \$271. 80% of these savings benefit CMS and remaining 20% benefit the Medigap insurer.

The bottom panel of Table 10 repeats the aforementioned analysis for the second counterfactual simulation. Here, the likelihood of using an ASC increases by 16 percentage points. These effects are comparable with the magnitudes from the reduced form analysis, which show shifts of between 10-20%, depending on the geography. The compensating variation is 48% smaller, averaging \$2.59 per procedure. As before, about a third of the consumer welfare change can be explained by declines to drive time.

For quality measures, surgeon volume still falls. Using the outcome model, these shifts to volume and changes in where patients go translates to a small increase in complication rates. On average, Medicare spending increases an additional \$0.17 per episode of care due to the increase in complications. This increased spending is dwarfed by Medicare savings from moving procedures

[11] I update parameters δ for the prior alternative by the time-period fixed effect. I project the recovered fixed effects onto surgeon-facility characteristics

$$\delta_{s,j,\tau(i)} = \bar{\beta}^a ASC_j + \xi_s + \xi_{\tau(i)} + \zeta_{s,j,\tau(i)} \tag{11}$$

where ξ_s and ξ_τ are surgeon and time-period fixed effects. If an alternative is no longer available as of 2006, to reintroduce the alternative, I update the estimated surgeon-facility-time period fixed effect with the time fixed effect for 2006: $\tilde{\delta}_{s,j,\tau=2} = \delta_{s,j,\tau=0} + \xi_{\tau=2}$

from the hospital to the ASC, $153 per procedure.

More results by procedure type are presented in Table B.17. The compensating variation is larger for cataract surgeries, $9, compared to GI procedures, $2.3-$2.6. Cataract surgery patients save about 12 minutes of drive time compared to 4 minutes for GI procedures. The drop in ASC between the first and second simulations is driven by cataract surgeries rather than GI procedures. For cataract surgeries, ASC use increases by 39 percentage points in the first simulation, but only 18 percentage points in the second simulation. Compared to the first simulation, however, the likelihood of visiting a facility with transit access falls by 1.3 percentage points, 3 times larger. This finding indicates that some physicians used to practice in areas with more transit access, such as inner-city hospitals.

One reason for such limited consumer welfare consequences is that there is no extensive margin response. Intuitively, if a procedure takes an entire day, the marginal welfare cost of driving an additional mile is small relative to the lost work day. These results demonstrate support for Prediction 3, while casting doubt on Prediction 1. In the following distributional analyses, I present results using the second counterfactual, which generates shifts to ASCs similar to the reduced form regressions and also allows for negative effects on consumer welfare.

6.2 Consumer Welfare and Cost Trade-offs by Market

Surgeon relocation plays an important role in mitigating the consumer welfare gains from CON reform. To quantify this effect, note that the compensating variation can be decomposed as:

$$\underbrace{CV_i(J_i^2, J_i)}_{\textbf{Counterfactual 2}} = \underbrace{CV_i(J_i^1, J_i)}_{\textbf{Counterfactual 1}} + \underbrace{CV_i(J_i^2, J_i^1)}_{\textbf{Surgeon relocation}}$$

The left-hand side is the welfare effect associated with moving from the choice sets implied by the second experiment to the baseline. The first term on the right-hand side is the welfare effect associated with moving from the choice sets implied by the first experiment to the baseline. The second term is the welfare effect associated with moving between choice sets implied by the second and first simulations. The second term makes it possible to have a negative welfare effect from provider exit. Surgeon-facility exit may reverse the benefits associated with ASC entry. An analogous expression can be derived for Δx_i.

Figure 10a plots a map of the average compensating variation $CV_i(J_i^2, J_i)$ across ZIP codes. Metropolitan and micropolitan areas have larger consumer welfare benefits compared to rural areas. Moreover, most markets appear to benefit on average, though areas in southeastern Missouri and pockets in western Missouri are harmed. The maximum welfare loss in minutes is 30 minutes or about $10. This loss is explained by surgeon relocation. Figure 10b plots the average $CV_i(J_i^2, J_i^1)$

by ZIP code, the change in consumer welfare associated with surgeon relocation. Southeastern and northwestern Missouri have the largest change, as much as a 93 minute decrease.

An alternative way to measure consumer surplus is the change in patient drive time. Figure 10c plots the average change in drive time by ZIP code $\Delta drtime_i(J_i^2, J_i)$. The largest increase in drive time is 24 minutes. Consistent with the reduced form evidence, inner-city patients experience no change in or face longer drive times, and areas nearby new ASCs enjoy declines in drive time.

Figure 10e plots the average change in Medicare reimbursement $\Delta reimb_i(J_i^2, J_i)$ by ZIP code. The spatial pattern is highly correlated with ASC entry. Areas may spend more on Medicare costs; this is due to ASC exit between the pre- and post- period choice sets. In southeastern Missouri, Medicare savings indicate that patients move from hospitals to ASCs. This result suggests that there is also surgeon-ASC exit.

As shown in Figures 10d and 10f, reintroducing surgeon-facilities available in the pre-reform period may attenuate drive time and Medicare reimbursement changes. For instance, urban areas such as Kansas City see increases in reimbursement, suggesting that surgeon reintroduction shifts patients to hospitals. This makes intuitive sense as most reintroductions are surgeons at hospitals.

Figures B.5 and B.6 plot the compensating variation, change in drive time, and change in reimbursement zooming into Kansas City and St. Louis associated with ASC entry and surgeon relocation, respectively. Consistent with the reduced form analysis, inner-city individuals trade off drive time with lower reimbursements.

'Win-Win' markets How many procedure markets save the insurer costs and improve consumer welfare? Figure 11a plots the average compensating variation effect and Medicare savings for each ZIP code and procedure. The size of the marker is weighted by the number of procedures observed in the data. Markets in the top right quadrant have both positive compensating variation and Medicare savings. I find that 14% of ZIP codes for cataract surgeries are harmed by the reform, while only 0.2% of markets for GI procedures have negative compensating variation. This suggests that cataract surgery had larger redistributive effects between markets compared to GI procedures. The average consumer harm, conditional on a negative market effect, is \$5 per episode. For these same markets, insurers still save on average \$270 per episode, outweighing the consumer harm.

Figure 11b plots an analogous figure of drive time savings against government savings, with the top left quadrant representing win-win markets. Here, using drive time as a measure of consumer welfare suggests that many more markets are harmed by the reform. 44% of markets face higher drive times. The average change is 3 minutes, worth around a dollar. In comparison, the simulation still saves insurers \$71 on average.

6.3 Heterogeneous Effects by Patient Demographics and Health

A redistributive regulator may care more about marginalized patients such as rural individuals or people with low income. Therefore, I also investigate the effects associated with ASC entry by patient demographics and health.

The top panel of Table 11 presents average welfare trade-offs by patient demographics. Medicaid and patients from the bottom quartile of household income, on average, have smaller consumer benefit ranging from \$1.17-\$1.75. Given the expansion of facilities in the suburbs, where nonwhite residents seldom live, white patients experience larger declines in drive times, and thus benefit more on average, \$2.64.

The bottom panel reports the average of each statistic conditional on patients being in the bottom or top 10% of that variable. The average effect in the tails is also negative for Medicaid and patients from low-income ZIP codes. Part of this harm is explained by higher drive times in the bottom 25% of ZIP codes; they drive about 1-2 minutes more compared to a wealthier neighborhood. Increases in complication rates have less than a \$2 effect on the government's budget. These results reinforce the regressive nature of the policy, but also show that the negative effects are small.

Table 12 repeats the analysis by characteristics such as age and risk score. On average, older and sicker patients tend to benefit less. This is consistent with the intuition that ASCs select healthier and younger patients due to lack of emergency equipment. For instance, the compensating variation for a patient aged 85 and older is 17% less than that for a patient between 65 and 69. Regardless of group, the government savings are large. Rural areas save the least at \$121; many continue going to hospitals which have higher rates. In the tails, sicker and older people do not appear to be harmed on average.

Tables B.18 and B.19 report additional results on transit access and surgeon volume. Nonwhite individuals prefer transit, which can be seen through the smaller decline in transit access and smaller ASC take-up. For robustness, Tables B.21 and B.22 present counterfactual simulations using a choice model that permits demographic interactions on ASC and surgeon age. Results are qualitatively and quantitatively similar.

6.4 Social welfare

To investigate the effects of deregulation on social welfare of Medicare patients, I perform a simple back-of-the-envelope calculation. To start, I need a social welfare function and additional assumptions about the behavior of non-Medicare share and entry costs. My social welfare function equals the sum of consumer surplus and producer surplus net entry costs. Externalities may arise from the cost of raising taxes and cross-subsidies.

In general, the change in social welfare from a change in the choice set for each episode of care can be expressed as:

$$\Delta W_i = \Delta CS_i + 0.8(1-\eta)\Delta reimb_i + (1-\eta^{SV})\Delta\pi_i^{hosp} - \Delta cost_i - EC_i \tag{12}$$

where CS_i is consumer surplus, $reimb_i$ is insurer (Medicare and Medigap) reimbursement, $\Delta\pi_i^{hosp}$ is the change in hospital profits ($reimb_i^{hosp} - cost_i^{hosp}$), $cost_i$ is the marginal resource cost of the surgery (capital and labor), and EC_i are the entry costs associated with entry. The constant 0.8 represents the fraction that CMS pays and η captures the degree to which lower reimbursement helps the CMS through lower taxation. η^{SV} captures the degree to which hospitals cross-subsidize socially valuable services (David et al., 2014). If $\eta^{SV} > 1$, society loses from taking profits away from hospitals. A complete derivation is provided in Appendix C.4.

For consumer surplus, I use the average CV_i of \$2.59 and $\Delta reimb_i = -\$153$. For entry costs, Wasek (2008) puts the cost of opening a new ASC around \$2-8 million per ASC. Since 82 ASCs are built, a social discount rate of 7% yields an annualized entry cost between \$3-\$12 million. To get a cost per episode, I adjust the Medicare volume upwards by accounting for the fact that these three procedures amount to 0.67 of outpatient surgeries and Medicare is around 25% of total facility revenue. This yields entry costs between \$25-\$99. I do not observe costs so I cannot recover hospital profits. Therefore, for all scenarios I set $\eta^{SV} = 1$, eliminating the cross-subsidization margin.

The remaining parameters to be calibrated are η and $\Delta cost_i$. Table 13 presents bounds on social welfare under various calibrations of these parameters. Regardless of the parameters calibrations, the results indicate that deregulation transfers revenues from hospitals to ASCs and insurers. On average, ASCs revenue increases by \$173 per procedure while hospitals lose \$326 per procedure. Deregulation, for just the Medicare portion, amounts to a 20 million dollar annual windfall for ASCs and a 39 million dollar annual misfortune for hospitals.

If ASCs are truly lower cost such that $\Delta reimb_i = \Delta cost_i$, social welfare would increase substantially, between \$57 and \$131 per episode. Summing across Medicare patients in Missouri, this amounts to a \$7-16 million annual societal benefit. A slight cost of government funds between $\eta = 1.09$ and 1.16 increases the societal benefit. Cost efficiencies would be consistent with the Government Accountability Office (2006), which found that ASCs have about 40% lower costs than hospitals, the basis for CMS's reimbursement difference. If ASCs are not any lower cost such that $\Delta cost_i = 0$, the change in social welfare tends to be negative or close to zero due to high entry costs.

My calculations involve several caveats beyond those enumerated above. Given the discussion in the identification section, the compensating variation may reflect a joint utility between the consumer and referring physician. It is unclear how additional preference heterogeneity would change the results, though consumer surplus would be too high if the change in drive time better captures consumer welfare. My calculations also do not consider benefits from reduced coinsurance or endogenous Medicare pricing; both of these would negatively bias the welfare estimates as consumer value would understate the benefits of entry. My calculations also do not account for additional costs incurred by the reform, such as changes to hospital hiring costs and bargaining power. Finally, hospitals are considered losers in this setting, but they could have expanded other activities that mitigate losses. These effects would be captured by η^{SV}.

7 Discussion and Conclusion

Unlike other settings, healthcare is characterized by administratively determined prices, high rates of insurance, and physician ownership of firms. These features imply that deregulation in healthcare differs from standard markets in at least two ways. First, consumers benefit from convenience and quality rather than price. Second, deregulation may lead doctors to become entrepreneurs that compete with incumbent hospitals, increasing their rents. This paper considers the distributional effects of entry deregulation in healthcare in the context of ambulatory surgery centers.

My analysis draws on a 2002 CON policy change in Missouri to study the impact of ASC entry. Using a differences-in-differences research design, I find that 12% of the types of procedures at ASCs move away from hospitals, but I find no evidence of market expansion. Nevertheless, patients benefit from the reform. On average, patients experience lower travel times and rural areas see wait time reductions. There are a few losers: in St. Louis, low-income consumers move to ASCs and have to travel two miles more for care.

The lack of significant market expansion means that consumers only benefit a small amount from deregulation. Simulations from a structural model show that removing new entrants and relocating surgeons to their previous employer increases consumer welfare by \$2.59. Expected complication rates also increase, but have little effect on reimbursement, less than \$1 per surgery.

In this setting, deregulation is more about rent redistribution. Medicare reimbursement falls \$153 on average. Missouri hospitals lose \$39 million per year in Medicare revenue to entrepreneurial surgeons and the taxpayer. Since ASCs have a cost advantage, this reform benefits society despite entry costs. These results do not imply that society should move all hospital services to ASCs. Some high-risk patients benefit from having an intensive care unit, available only at hospitals.

This paper has several limitations that I hope to address in future research. First, I do not examine the non-Medicare market. The lack of market expansion may just be that it is occurring in the private market rather than in care for the elderly. Second, the social welfare calculation makes clear that the key parameters that drive the conclusion are ASC/hospital cost differences, the social value of hospital profits or the marginal cost of funds. These objects need to be measured to provide a more credible measure of the effect of deregulation on social welfare. Finally, the structural model imposes strong assumptions on consumer behavior; it is a fully rational model that abstracts away from prices, capacity, and the extensive margin. Future studies may seek to incorporate these margins and allow for more patient preference heterogeneity.

References

AHPA. 2016. "National Directory of State Certificate of Need Programs and Health Planning Agencies."Technical report, Amercan Health Planning Association.

Antitrust Division of the US Department of Justice, and Federal Trade Commission. 2008. "Competition In Health Care And Certificates Of Need." September.

Baker, Laurence C., M.K. Bundorf, and Daniel P. Kessler. 2019. "Competition in Outpatient Procedure Markets." *Medical Care* 57 36–41.

Barro, Jason R., Robert S. Huckman, and Daniel P. Kessler. 2006. "The effects of cardiac specialty hospitals on the cost and quality of medical care." *Journal of Health Economics* 25 (4): 702–721. 10.1016/j.jhealeco.2005.11.001.

Bell, Chaim M., Wendy V. Hatch, Geta Cernat, and David R. Urbach. 2007. "Surgeon Volumes and Selected Patient Outcomes in Cataract Surgery." *Ophthalmology* 114 (3): 405–410. 10. 1016/j.ophtha.2006.08.036.

Berry, Steven, James Levinsohn, and Ariel Pakes. 2004. "Differentiated Products Demand Systems from a Combination of Micro and Macro Data: The New Car Market." *Journal of Political Economy* 112 (1): 68–105.

Borenstein, Severin, and Nancy Rose. 2014. "How Airline Markets Work... or Do They? Regulatory Reform in the Airline Industry." In *Economic Regulation and Its Reform: What Have We Learned?*, 64–135, National Bureau of Economic Research.

Callaway, Brantly, and Tong Li. 2019. "Quantile treatment effects in difference in differences models with panel data." *Quantitative Economics* 10 (4): 1579–1618. 10.3982/QE935.

Carey, Kathleen, James F. Burgess, and Gary Young. 2011. "Hospital competition and financial performance: The Effects of Ambulatory Surgery Centers." *Health Economics* 20 571–581.

Chan, David C, and Michael J Dickstein. 2019. "Industry Input in Policy Making: Evidence from Medicare*." *The Quarterly Journal of Economics* 134 (3): 1299–1342. 10.1093/qje/qjz005.

Chandra, Amitabh, Amy Finkelstein, Adam Sacarny, and Chad Syverson. 2016. "Health Care Exceptionalism? Performance and Allocation in the US Health Care Sector." *American Economic Review* 106 (8): 2110–2144. 10.1257/aer.20151080.

Chicoine, Luke, and Elizabeth Munnich. 2021. "State Regulation and Competition in Outpatient Surgery Markets." *Mimeo*.

Chukmaitov, Askar, Cathy J. Bradley, Bassam Dahman, Umaporn Siangphoe, Joan L. Warren, and Carrie N. Klabunde. 2013. "Association of polypectomy techniques, endoscopist volume, and facility type with colonoscopy complications." *Gastrointestinal Endoscopy* 77 (3): 436–446. 10.1016/j.gie.2012.11.012.

Cutler, David M., Robert S. Huckman, and Jonathan T. Kolstad. 2010. "Input Constraints and the Efficiency of Entry: Lessons from Cardiac Surgery." *American Economic Journal: Economic Policy* 2 (1): 51–76, `https://www.jstor.org/stable/25760051`.

David, Guy, Richard C. Lindrooth, Lorens A. Helmchen, and Lawton R. Burns. 2014. "Do hospitals cross-subsidize?" *Journal of Health Economics* 37 (C): 198–218.

David, Guy, and Mark D. Neuman. 2011. "Physician division of labor and patient selection for outpatient procedures." *Journal of Health Economics* 30 (2): 381–391.

Elixhauser, Anne, Claudia Steiner, D. Robert Harris, and Rosanna M. Coffey. 1998. "Comorbidity Measures for Use with Administrative Data:." *Medical Care* 36 (1): 8–27. 10.1097/00005650-199801000-00004.

Ellis, Randall P., and Thomas G. McGuire. 1986. "Provider behavior under prospective reimbursement." *Journal of Health Economics* 5 (2): 129–151. 10.1016/0167-6296(86)90002-0.

Forbes, Nauzer, Devon J. Boyne, Matthew S. Mazurek et al. 2020. "Association Between Endoscopist Annual Procedure Volume and Colonoscopy Quality: Systematic Review and Meta-analysis." *Clinical Gastroenterology and Hepatology* 18 (10): 2192–2208.e12. 10.1016/j.cgh.2020.03.046.

Garg, Sushil, Chimaobi Anugwom, James Campbell, Vaibhav Wadhwa, Nancy Gupta, Rocio Lopez, Sukhman Shergill, and Madhusudhan Sanaka. 2017. "Early esophagogastroduodenoscopy is associated with better Outcomes in upper gastrointestinal bleeding: a nationwide study." *Endoscopy International Open* 05 (05): E376–E386. 10.1055/s-0042-121665.

Gaynor, Martin, Harald Seider, and William B Vogt. 2005. "The Volume Outcome Effect, Scale Economies, and Learning-by-Doing." *American Economic Review* 95 (2): 243–247. 10.1257/000282805774670329.

Goldszmidt, Ariel, John List, Robert Metcalfe, Ian Muir, V. Kerry Smith, and Jenny Wang. 2020. "The Value of Time in the United States: Estimates from Nationwide Natural Field Experiments."Technical Report w28208, National Bureau of Economic Research, Cambridge, MA. 10.3386/w28208.

Government Accountability Office. 2006. "Payment for Ambulatory Surgical Centers Should Be Based on the Hospital Outpatient Payment System."Technical Report GAO-07-86.

Hollenbeck, Brent, Rodney Dunn, Anne Suskind, Yun Zhang, John Hollingsworth, and John Birkmeyer. 2014. "Ambulatory Surgery Centers and Outpatient Procedure Use Among Medicare Beneficiaries." *Medical Care* 52 (10): 926–931. 10.1097/MLR.0000000000000213.

Horwitz, Jill R. 2005. "Making Profits and Providing Care: Comparing Nonprofit, For-Profit, and Government Hospitals." *Health Affairs* 24 (3): 790–801.

Horwitz, Jill R., and Austin Nichols. 2009. "Hospital ownership and medical services: Market mix, spillover effects, and nonprofit objectives." *Journal of Health Economics* 28 924–937.

Jayaratne, Jith, and Philip E. Strahan. 1998. "Entry Restrictions, Industry Evolution, and Dynamic Efficiency: Evidence From Commercial Banking." *The Journal of Law and Economics* 41 (1): 239–274. 10.1086/467390.

Joskow, Paul L., and Nancy L. Rose. 1989. "Chapter 25 The effects of economic regulation." In *Handbook of Industrial Organization*, Volume 2. 1449–1506, Elsevier, . 10.1016/S1573-448X(89)02013-3.

Kessler, D. P., and M. B. McClellan. 2000. "Is Hospital Competition Socially Wasteful?" *The Quarterly Journal of Economics* 115 (2): 577–615. 10.1162/003355300554863.

Kroszner, Randall, and Philip Strahan. 2014. "Regulation and Deregulation of the US Banking Industry: Causes, Consequences, and Implications for the Future." In *Economic Regulation and its Reform: What have we learned?*, University of Chicago Press.

Kumar, Pooja, and Ramya Parthasarathy. 2020. "Walking out of the hospital: the continued rise of ambulatory care and how to take advantage of it."Technical report, McKinsey.

Luft, H S, S S Hunt, and S C Maerki. 1987. "The volume-outcome relationship: practice-makes-perfect or selective-referral patterns?" *Health services research* 22 (2): 157–182, https://pubmed.ncbi.nlm.nih.gov/3112042.

MacDonald, James M., and Linda C. Cavalluzzo. 1996. "Railroad Deregulation: Pricing Reforms, Shipper Responses, and the Effects on Labor." *Industrial and Labor Relations Review* 50 (1): 80. 10.2307/2524390.

McFadden, Daniel. 1978. "Modeling the Choice of Residential Location." *Transportation Research Record* 673 72–77.

McGuire, Thomas G, and Mark V Pauly. 1991. "Physician response to fee changes with multiple payers." *Journal of Health Economics* 10 (4): 385–410. 10.1016/0167-6296(91)90022-F.

Munnich, Elizabeth L., and Stephen T. Parente. 2014. "Procedures Take Less Time At Ambulatory Surgery Centers, Keeping Costs Down and Ability To Meet Demand Up." *Health Affairs* 33 (5): 764–769.

Munnich, Elizabeth L., and Stephen T. Parente. 2017. "Returns to specialization: Evidence from the outpatient surgery market." *Journal of Health Economics* 57 (2018): 147–167.

Munnich, Elizabeth, Michael Richards, Christopher Whaley, and Xiaoxi Zhao. 2021. "Raising the Stakes: Physician Facility Investments and Provider Agency." *Mimeo*.

Murphy, Caitlin C., Robert S. Sandler, Janet M. Grubber, Marcus R. Johnson, and Deborah A. Fisher. 2016. "Underuse and Overuse of Colonoscopy for Repeat Screening and Surveillance in the Veterans Health Administration." *Clinical Gastroenterology and Hepatology* 14 (3): 436–444.e1. 10.1016/j.cgh.2015.10.008.

Ohlhausen, Maureen K. 2015. "Certificate of Need Laws: A Prescription for Higher Costs." *Antiturst* 30 (1): 50–54.

Olley, G. Steven, and Ariel Pakes. 1996. "The Dynamics of Productivity in the Telecommunications Equipment Industry." *Econometrica* 64 (6): 1263. 10.2307/2171831.

Pauly, Mark. 1968. "The Economics of Moral Hazard: Comment." *American Economic Review* 58 (3): 531–537.

Perry, Bryan J. 2017. "Certificate of Need Regulation and Hospital Behavior: Evidence from MRIs in North Carolina." *Mimeo*.

Rambachan, Ashesh, and Jonathan Roth. 2022. “A More Credible Approach to Parallel Trends.” *Review of Economic Studies*.

Romano, Michael. 2003. “Pros and cons of certificates.” *Modern Healthcare*.

Rose, Nancy L. 1987. “Labor Rent Sharing and Regulation: Evidence from the Trucking Industry.” *Journal of Political Economy* 96 (6): 1146–1178.

Rose, Nancy L. ed. 2014. *Economic regulation and its reform: what have we learned?*. National Bureau of Economic Research conference report, Chicago ; London: The University of Chicago.

Rosenkranz, David. 2021. “Entry Barriers in Provider Markets: Evidence from Dialysis Certificate-of-Need Programs.” *Mimeo*.

Sachs, Rebecca. 2021. “Safety Net Cutbacks and Hospital Service Provision: Evidence From Psychiatric Care.” *Mimeo*.

Sloan, Frank A., and Christopher J. Conover. 1998. “Does Removing Certificate-of-Need Regulations Lead to a Surge in Helath Care Spending?” *Journal of Health Politics, Policy, and Law* 23 (3): 455–481.

Spence, A. Michael. 1975. “Monopoly, Quality, and Regulation.” *The Bell Journal of Economics* 6 (2): 417. 10.2307/3003237.

Stein, Joshua D. 2012. “Serious adverse events after cataract surgery.” *Current Opinion in Ophthalmology* 23 (3): 219–225. 10.1097/ICU.0b013e3283524068.

Stigler, George J. 1971. “The Theory of Economic Regulation.” *The Bell Journal of Economics and Management Science* 2 (1): 3. 10.2307/3003160.

Swanson, Ashley. 2021. “Physician investment in hospitals: Specialization, selection, and quality in cardiac care.” *Journal of Health Economics* 80 102519. 10.1016/j.jhealeco.2021.102519.

Wasek, Stephanie. 2008. “Cost to Build: Sample 2-OR ASC.” *Becker’s ASC Review* 2008 (5): .

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

Whaley, Christopher. 2018. “Premium Service: Comparing Cost and Quality for Colorectal Cancer Screening.” *Mimeo*.

Whaley, Christopher M., Chaoran Guo, and Timothy T. Brown. 2017. "The moral hazard effects of consumer responses to targeted cost-sharing." *Journal of Health Economics* 56 201–221. 10.1016/j.jhealeco.2017.09.012.

Winston, Clifford. ed. 1990. *The Economic effects of surface freight deregulation*. Washington, D.C: Brookings Institution.

Worsing, Robert A., Lorin E. Patterson, and Kimberly Gibbens. 2002. "Opportunity at Sunset: Missouri Relaxes its Certificate of Need Requirements for Ambulatory Surgery Centers." *Missouri Medicine* 99 (2): 67–71.

Yee, Christine. 2011. "Physicians on board: An examination of physician financial interests in ASCs using longitudinal data." *Journal of Health Economics* 30 (1): 908–014.

8 Tables

Table 1: Summary statistics

Panel A: ZIP code-level sample	Before matching: Missouri		Before matching: CON		After matching: Missouri		After matching: CON	
Traditional Medicare								
Enrollment (000s)	0.58	(0.91)	0.70	(1.09)	0.53	(0.85)	0.51	(0.86)
% Female	0.64	(0.35)	0.63	(0.35)	0.64	(0.35)	0.63	(0.36)
% Nonwhite	0.03	(0.15)	0.09	(0.23)	0.03	(0.14)	0.09	(0.23)
Age in 2000	76.51	(4.93)	76.77	(4.80)	76.48	(4.96)	76.67	(4.99)
Average Elixhauser risk score	2.16	(0.59)	2.21	(0.65)	2.15	(0.58)	2.16	(0.65)
ZIP code characteristics in 2000								
Median household income (10,000s)	4.95	(1.69)	5.71	(2.40)	4.91	(1.62)	5.12	(1.84)
Unemployment rate	0.06	(0.05)	0.06	(0.05)	0.05	(0.04)	0.06	(0.05)
Urban/Rural	0.63	(0.48)	0.69	(0.46)	0.61	(0.49)	0.61	(0.49)
Number of acute-care hospitals								
within 10 miles	1.61	(3.63)	2.18	(6.18)	1.25	(3.00)	1.18	(3.19)
within 15 miles	3.14	(5.98)	4.04	(10.12)	2.53	(5.09)	2.37	(5.69)
Number of ASCs								
within 10 miles	0.88	(2.26)	1.97	(7.23)	0.72	(2.11)	0.69	(2.58)
within 15 miles	1.76	(4.09)	3.69	(11.97)	1.41	(3.79)	1.22	(3.84)
Unique zip codes	1,008		12,453		921		2,510	

Panel B: Episode sample	Missouri		CON		Missouri		CON	
Share ASC	0.25	(0.43)	0.28	(0.45)	0.25	(0.43)	0.27	(0.44)
Distance (mi)	12.95	(14.30)	11.62	(12.92)	14.06	(14.80)	12.33	(13.39)
Max out-of-pocket cost ($100s)	2.12	(1.20)	2.23	(1.27)	2.12	(1.19)	2.22	(1.25)
% Female	0.62	(0.49)	0.62	(0.48)	0.62	(0.49)	0.62	(0.49)
% Nonwhite	0.04	(0.20)	0.08	(0.27)	0.04	(0.19)	0.09	(0.29)
Age	76.01	(6.58)	75.93	(6.49)	75.90	(6.56)	75.86	(6.47)
Elixhauser score	2.77	(2.33)	2.86	(2.29)	2.74	(2.32)	2.86	(2.29)
Unique patients	13,010		66,022		11,169		26,407	
Episodes	17,126		85,888		14,748		34,574	

NOTE: This table presents means, counts, and standard deviations (in parentheses) in 2000 from the analysis samples used in difference-in-difference regressions. The unmatched market level sample includes all ZIP codes in Missouri and always ASC-CON states. The episode sample includes outpatient cataract surgery, upper gastrointestinal endoscopy, and colonoscopy episodes of Traditional Medicare enrollees in Missouri and always ASC-CON states. The "matched" episode sample subsets to patients in the matched zip codes.

Table 2: Deregulation leads to greater ASC entry in high income urban areas

	(1)	(2)	(3)	(4)	(5)
ASCs (10 miles)	All ZIPs	Metropolitan & Above Median HH Income	Metropolitan & Below Median HH Income	Micropolitan	Rural
Interim	0.143***	0.463***	0.191	-0.000	-0.008**
	(0.042)	(0.132)	(0.130)	(0.021)	(0.004)
Post (2006, 2009)	0.492***	1.663***	0.409*	0.077*	-0.001
	(0.102)	(0.346)	(0.248)	(0.044)	(0.006)
Pre-period mean	0.89	2.03	1.93	0.11	0.01
ASCs (15 miles)					
Interim	0.357***	0.806***	0.915***	0.046	-0.011*
	(0.071)	(0.200)	(0.250)	(0.037)	(0.006)
Post (2006, 2009)	1.069***	2.564***	2.377***	0.188***	0.007
	(0.170)	(0.505)	(0.549)	(0.060)	(0.012)
Pre-period mean	1.85	4.01	4.21	0.29	0.02
N	55,072	55,072	55,072	55,072	55,072

NOTE: This table presents difference-in-difference regressions of the effect of CON repeal in Missouri on number of nearby ASCs. The data are a ZIP code by year panel from 1998 to 2013. Standard errors are clustered at the ZIP code level and reported in parentheses. All regressions control for ZIP code fixed effects and year fixed effects. Columns 2-5 control for patient group (metropolitan & above median income,…,rural) by year fixed effects. * p <.1, ** p <.05, *** p<.01

Table 3: Surgeons leave rural and low income urban areas for high income urban areas

	(1)	(2)	(3)	(4)	(5)
		Metropolitan &	Metropolitan &		
		Above Median	Below Median		
Surgeons (10 miles)	All ZIPs	HH Income	HH Income	Micropolitan	Rural
Interim	0.245	1.692**	-0.427	-0.227*	-0.123***
	(0.197)	(0.658)	(0.522)	(0.117)	(0.032)
Post (2006, 2009)	0.562*	3.585***	-1.423*	-0.097	-0.120***
	(0.315)	(1.074)	(0.825)	(0.115)	(0.043)
Pre-period mean	13.80	28.60	32.18	1.71	0.90
Surgeons (15 miles)					
Interim	1.198***	2.731***	3.874***	-0.040	-0.291***
	(0.342)	(0.972)	(1.205)	(0.206)	(0.053)
Post (2006, 2009)	1.536***	4.835***	2.762**	0.131	-0.335***
	(0.463)	(1.521)	(1.268)	(0.211)	(0.067)
Pre-period mean	26.31	55.81	56.96	4.36	2.40
N	55,072	55,072	55,072	55,072	55,072

NOTE: This table presents difference-in-difference regressions of the effect of CON repeal in Missouri on number of nearby surgeons. Some surgeons might be double counted since they practice in multiple locations. They are counted if they do at least 20 procedures per year among Traditional Medicare enrollees. The data are ZIP code and year panel from 1998 to 2013. Standard errors are clustered at the ZIP code level and reported in parentheses. All regressions control for ZIP code fixed effects and year fixed effects. Columns 2-5 control for patient group (metropolitan & above median income,…,rural) by year fixed effects. * p <.1, ** p <.05, *** p<.01

Table 4: Patients shift to ASCs, but no evidence of market expansion

	(1) ASCs	(2) Hospital outpatient	(3) Hospital inpatient/ER	(4) Any Hospital	(5) ASC + Hospital outpatient
All ZIP codes					
Post (2006, 2009)	18.427***	-14.760***	1.591	-13.053***	3.667
	(2.208)	(2.870)	(1.501)	(3.341)	(3.295)
Pre-period mean	37.14	117.51	34.04	151.56	154.65
Metropolitan and Above Med HH Inc					
Post (2006, 2009)	18.641***	-11.641**	0.456	-11.084*	7.000
	(3.656)	(5.236)	(2.498)	(5.886)	(6.132)
Pre-period mean	48.87	113.23	40.45	153.69	162.11
Metropolitan and Below Med HH Inc					
Post (2006, 2009)	1.241	-0.684	0.215	-0.457	0.557
	(4.326)	(5.666)	(3.203)	(6.823)	(6.445)
Pre-period mean	36.03	96.10	42.62	138.79	132.13
Micropolitan					
Post (2006, 2009)	25.903***	-27.512***	1.706	-25.783***	-1.610
	(6.094)	(6.051)	(2.968)	(7.039)	(7.756)
Pre-period mean	38.72	125.26	28.76	154.03	163.99
Rural					
Post (2006, 2009)	22.048***	-16.610***	2.804	-13.589**	5.438
	(3.649)	(5.253)	(2.872)	(6.159)	(5.794)
Pre-period mean	28.83	126.92	28.17	155.09	155.75
Number of observations	55072	55072	55072	55072	55072

NOTE: This table presents difference-in-difference regressions of the effect of CON repeal in Missouri on episodes per 1000 enrollees. The data consist of ZIP codes between 1998 and 2013. Standard errors are clustered at the ZIP code level and reported in parentheses. All regressions control for ZIP code fixed effects and year fixed effects. * p <.1, ** p <.05, *** p<.01

Table 5: Distance and cataract surgery wait times fall after deregulation

	(1)	(2)	(3)	(4)
	Distance (mi)	Log Distance (mi)	Wait time (days, cataracts)	Log wait time (days, cataracts)
All ZIP codes				
Post (2006, 2009)	-0.758***	-0.070***	-1.036	-0.045
	(0.259)	(0.025)	(0.807)	(0.029)
Baseline mean	14.69	2.09	29.71	3.08
Heterogeneity in Post (2006, 2009) Effect				
Metropolitan and Above Med Inc	-0.274	-0.037	-0.888	0.011
	(0.220)	(0.032)	(1.312)	(0.037)
Metropolitan and Below Med Inc	-0.643	-0.040	2.708	0.133*
	(0.717)	(0.068)	(2.230)	(0.070)
Micropolitan	-1.694**	-0.190**	-1.105	-0.163*
	(0.813)	(0.074)	(1.721)	(0.090)
Rural	-1.351*	-0.065	-4.119***	-0.169***
	(0.805)	(0.049)	(1.313)	(0.049)

NOTE: This table presents difference-in-difference coefficients of the effect of Missouri's regulation on measures of convenience. I report the medium-run effect, which pools 2006-2009. The data used is an episode-level dataset consisting of outpatient cataract, colonoscopy, and endoscopies from 1998 to 2013. Standard errors are clustered at the ZIP code level and reported in parentheses. All regressions control for procedure code by year fixed effects, procedure code by ZIP code fixed effects, and patient demographic ce by procedure code fixed effects. I drop observations with distance greater than the 98th percentile of the national distribution in the pre-period. Wait time is measured as the number of days between a consultation and a procedure. Wait times longer than 1 year are dropped and exclude 1998 data. Heterogeneity regressio also control for patient group by procedure code by year fixed effects. * p <.1, ** p <.05, *** p<.01

Table 6: Low income patients drive more in constrained metropolitan areas

	(1)	(2)	(3)	(4)	(5)
	ASC	Distance (mi)	Log Distance (mi)	Wait time (days, cataracts)	Log wait time (days, cataracts)
Above Median HH Income					
St. Louis					
Post (2006, 2009)	0.133***	-0.091	-0.053	-6.022**	-0.185***
	(0.029)	(0.344)	(0.040)	(2.650)	(0.068)
Baseline mean	0.25	8.07	1.90	38.95	3.37
Kansas City					
Post (2006, 2009)	-0.023	-1.060***	-0.124**	-2.095	0.066
	(0.024)	(0.352)	(0.055)	(2.433)	(0.056)
Baseline mean	0.37	9.27	1.90	25.90	2.91
Below Median HH Income					
St. Louis					
Post (2006, 2009)	0.134**	2.065**	0.265*	-1.332	0.001
	(0.056)	(0.824)	(0.155)	(4.953)	(0.145)
Baseline mean	0.17	6.25	1.75	35.37	3.23
Kansas City					
Post (2006, 2009)	0.026	-0.607	-0.052	-8.375	-0.217
	(0.078)	(0.731)	(0.075)	(5.505)	(0.170)
Baseline mean	0.30	5.39	1.65	23.92	2.80
Rural areas					
Above I-70					
Post (2006, 2009)	0.050*	-3.763**	-0.178*	-2.094	-0.136*
	(0.026)	(1.544)	(0.095)	(2.166)	(0.078)
Baseline mean	0.16	32.80	3.01	30.85	3.20
Between I-70 and I-44					
Post (2006, 2009)	0.056**	-1.692	-0.075	-5.880**	-0.186**
	(0.027)	(1.497)	(0.101)	(2.379)	(0.090)
Baseline mean	0.17	24.24	2.41	27.08	3.04
Below I-44					
Post (2006, 2009)	0.079***	0.850	0.041	-4.018*	-0.164**
	(0.029)	(1.124)	(0.068)	(2.169)	(0.083)
Baseline mean	0.22	33.07	3.04	28.18	3.06

NOTE: This table presents difference-in-difference coefficients of the effect of Missouri's regulation on measures of convenience. I report the medium-run effect, which pools 2006-2009. The data used is an episode-level dataset consisting of outpatient cataract, colonoscopy, and endoscopies from 1998 to 2013. Standard errors are clustered at the ZIP code level and reported in parentheses. All regressions control for procedure code by year fixed effects, procedure code by ZIP code fixed effects, and patient demographic cells by procedure code fixed effects. I drop observations with distance greater than the 98th percentile of the national distribution in the pre-period. Wait time is measured as the number of days between a consultation and a procedure. Wait times longer than 1 year are dropped and exclude 1998 data. Heterogeneity regressions also control for patient group by procedure code by year fixed effects. * p <.1, ** p <.05, *** p<.01

Table 7: Patients see less experienced physicians who are no worse in quality

Surgeon volume/quality	(1) Pre-reform annual volume	(2) Volume in last 12 months	(3) Low volume (<20 for GI, <100 Cataracts)	
All ZIP codes				
Post (2006, 2009)	-23.068***	-34.075***	-0.013***	
	(4.526)	(4.443)	(0.004)	
Baseline mean	273.09	243.27	0.09	
Heterogeneity in Post (2006, 2009) Effect				
Metropolitan and Above Med Inc	-15.278***	-31.648***	-0.019***	
	(5.556)	(6.129)	(0.006)	
Metropolitan and Below Med Inc	-11.485	-11.234	-0.014	
	(10.709)	(12.006)	(0.012)	
Micropolitan	-36.281***	-44.498***	-0.010	
	(11.492)	(10.146)	(0.008)	
Rural	-36.030***	-46.239***	-0.000	
	(12.015)	(10.622)	(0.009)	

Observed 30-day Quality	(4) 30-day complication rate (0-100)	(5) 30-day complication rate including cardiac (0-100)	(6) 30-day readmission rate (0-100)	(7) 30-day readmission rate including cardiac (0-100)
All ZIP codes				
Post (2006, 2009)	-0.056	0.123	0.046	0.004
	(0.096)	(0.135)	(0.146)	(0.171)
Baseline mean	0.71	1.56	1.73	2.38
Heterogeneity in Post (2006, 2009) Effect				
Metropolitan and Above Med Inc	-0.009	0.090	0.022	-0.160
	(0.139)	(0.192)	(0.222)	(0.265)
Metropolitan and Below Med Inc	0.119	0.400	-0.160	0.135
	(0.272)	(0.354)	(0.337)	(0.378)
Micropolitan	-0.297	0.107	0.209	0.266
	(0.232)	(0.316)	(0.291)	(0.327)
Rural	-0.062	0.075	0.133	0.072
	(0.201)	(0.324)	(0.337)	(0.401)

NOTE: This table presents difference-in-difference coefficients of the effect of Missouri's regulation on measures of quality. I report the medium-run effect, which pools data from 2006-2009. The data used is an episode-level dataset consisting of outpatient cataract, colonoscopy, and endoscopies from 1998 to 2013. Standard errors are clustered at the zip code level and reported in parentheses. All regressions control for procedure code by year fixed effects, procedure code by zip code fixed effects, and patient demographic cells by procedure code fixed effects. Heterogeneity regressions also control for area by procedure code by year fixed effects. All regressions control for zip code fixed effects and year fixed effects. * p <.1, ** p <.05, *** p<.01

Table 8: Choice model estimates (MWTP in minutes)

WTP (min/surgery)		*Health*		*Demographics*		
Surgeon-Facility Attributes	Baseline	Age	Elixhauser	Medicaid	Female	Nonwhite
Cataract surgeries						
Drive time (min)	-1	-0.192	-0.57	-3.348	-2.028	0.39
		(0.060)	(0.192)	(1.596)	(0.732)	(2.874)
Transit access	6.312	0.228	0.612	-4.752	1.632	19.398
	(2.982)	(0.150)	(0.294)	(4.002)	(1.254)	(3.636)
Surgeon Age	18.09	0.012	-0.006			
	(1.044)	(0.006)	(0.006)			
ASC		-0.132	-1.026			
		(0.060)	(0.144)			
Colonoscopies						
Drive time (min)	-1	-0.48	0.294	-7.104	-1.644	-6.78
		(0.066)	(0.180)	(1.974)	(0.684)	(3.042)
Transit access	6.828	-0.072	0.258	-9.774	-1.386	21.732
	(2.616)	(0.126)	(0.270)	(3.690)	(0.876)	(3.342)
Surgeon Age	23.286	0.018	-0.042			
	(1.230)	0.000	(0.006)			
ASC		-0.24	-0.288			
		(0.048)	(0.132)			
Upper GI endoscopies						
Drive time (min)	-1	-0.45	0.366	-3.93	-2.976	-2.472
		(0.090)	(0.204)	(2.340)	(1.008)	(3.324)
Transit access	5.598	-0.006	0.366	-4.464	-1.344	20.796
	(2.778)	(0.120)	(0.276)	(5.094)	(1.398)	(4.458)
Surgeon Age	32.688	0.006	-0.048			
	(2.112)	(0.006)	(0.012)			
ASC		-0.132	-0.96			
		(0.072)	(0.174)			

Table 9: Cataract surgeries and colonoscopies exhibit volume-outcome relationship

	Probit				Linear	
Variable	(1)	Marginal Effects	(2)	Marginal Effects	(3)	(4)
Cataract Surgeries						
Log(volume)	-0.0659***	-0.00168***			-0.00187***	
	(0.0155)	(0.000401)			(0.000448)	
$volume^{0.5}$			-0.00906**	-0.000231**		-0.000318**
			(0.00370)	(0.0000977)		(0.000139)
N	94273	94273	94273	94273	94273	94273
Pseudo-R2	0.0207		0.0200			
Colonoscopies						
Log(volume)	-0.0234**	-0.000400**			-0.000559***	
	(0.0119)	(0.000198)			(0.000169)	
$volume^{0.5}$			-0.00354	-0.0000605		-0.000120*
			(0.00330)	(0.0000557)		(0.0000643)
N	102646	102646	102646	102646	102646	102646
Pseudo-R2	0.0108		0.0106			
Upper GI Endoscopies						
Log(volume)	-0.0273	-0.000117			0.0000660	
	(0.0324)	(0.000138)			(0.0000989)	
$volume^{0.5}$			-0.0114	-0.0000488		0.0000158
			(0.00973)	(0.0000417)		(0.0000439)
N	53064	53064	53064	53064	55598	55598
Pseudo-R2	0.0108		0.0106			
Surgeon by Facility FE					x	x

NOTE: This table reports regression of complication on surgeon volume in the last 12 months. All regression include year FE, ASC by patient characteristics interactions (sex, age, nonwhite, and Elixhauser risk score). Standard errors are clustered at the surgeon-facility level. * p <.1 ** p <.05 *** p <.01.

Table 10: Consumers benefit $2.59 while Medicare saves $153 from deregulation

Procedure	(1) ΔASC	(2) Comp. variation (minutes)	$	(3) ΔDrive time (minutes)	$	(4) ΔExpected complication	$	(5) ΔInsurer Cost ($)
Roll back entry								
	0.24	15.88	5.03	-7.09	-2.24	0.00040	0.14	-270.53
Roll back entry + surgeon relocation								
	0.16	8.19	2.59	-3.30	-1.04	0.00015	0.17	-153.11

NOTE: This table compares the mean impact of changing patients' choice sets on consumer welfare, drive time, expected complication, and Medicare reimbursement pooling observed episodes of cataract surgery, colonoscopy, and upper GI endoscopy between 2006-2009. Rolling back entry deletes any surgeon-facility alternative not in the 1998-2001 choice set. Surgeon relocation adds back in surgeon-facilities from the 1998-2001 choice set where the surgeons affected by ASC removal who used to work. Expected complication rates are calculated using estimates from a probit with log specification on surgeon volume; this change is calculated on data from 2007-2009 because the surgeon volume requires a one-year lag.

Table 11: Low income consumers benefit less, but save Medicare similarly to others

	(1)	(2)		(3)		(4)		(5)
		Comp. variation		ΔDrive time		ΔExpected		ΔInsurer
Procedure	ΔASC	(minutes)	$	(minutes)	$	comp.	$	Cost ($)
Mean								
Overall	0.16	8.19	2.59	-3.30	-1.04	0.0001	0.18	-153.11
ZIP Code Income								
0-25%	0.15	3.70	1.17	-3.03	-0.96	0.0002	0.20	-155.52
25-50%	0.13	10.54	3.34	-6.76	-2.14	0.0001	0.16	-126.01
50-75%	0.12	8.13	2.57	-2.86	-0.91	0.0002	0.20	-110.07
75-100%	0.18	8.44	2.67	-1.30	-0.41	0.0002	0.25	-161.74
Insurance								
Medicaid	0.15	5.53	1.75	-3.82	-1.21	0.0002	0.19	-156.71
Non-Medicaid	0.16	8.34	2.64	-3.27	-1.03	0.0001	0.18	-152.91
Race								
Nonwhite	0.14	5.63	1.78	-0.71	-0.22	0.0004	0.47	-131.19
White	0.16	8.34	2.64	-3.45	-1.09	0.0001	0.17	-154.37
Mean in Top/Bottom 10%								
Overall	0.00	0.10	0.03	3.78	1.20	0.0009	1.10	0.00
ZIP Code Income								
0-25%	0.00	-6.86	-2.17	5.06	1.60	0.0007	0.89	0.00
25-50%	0.00	0.08	0.02	4.19	1.33	0.0007	0.93	0.00
50-75%	0.00	0.16	0.05	3.21	1.02	0.0009	1.09	0.00
75-100%	0.01	0.76	0.24	4.51	1.43	0.0011	1.37	-7.47
Insurance								
Medicaid	0.00	-0.59	-0.19	3.99	1.26	0.0009	1.11	0.00
Non-Medicaid	0.00	0.11	0.04	3.77	1.19	0.0009	1.10	0.00
Race								
Nonwhite	0.00	0.27	0.09	3.31	1.05	0.0014	1.72	-2.53
White	0.00	0.09	0.03	3.80	1.20	0.0009	1.07	0.00

NOTE: This table compares the mean impact of changing patients' choice sets on consumer welfare, drive time, expected complication, and Medicare reimbursement pooling observed episodes of cataract surgery, colonoscopy, and upper GI endoscopy between 2006-2009. Rolling back entry deletes any surgeon-facility alternative not in the 1998-2001 choice set. Surgeon relocation adds back in surgeon-facilities from the 1998-2001 choice set where the surgeons affected by ASC removal who used to work. Expected complication rates are calculated using estimates from a probit with log specification on surgeon volume; this change is calculated on data from 2007-2009 because the surgeon volume requires a one-year lag.

Table 12: Healthy and younger patients benefit more than sicker and older patients

	(1)	(2)		(3)		(4)		(5)
		Comp. variation		ΔDrive time		ΔExpected		ΔInsurer
Procedure	ΔASC	(minutes)	$	(minutes)	$	comp.	$	Cost ($)
Mean								
Overall	0.16	8.19	2.59	-3.30	-1.04	0.0001	0.18	-153.11
Age								
65-69	0.17	8.94	2.83	-3.24	-1.02	0.0002	0.21	-157.93
70-74	0.16	8.33	2.64	-3.23	-1.02	0.0001	0.18	-149.43
75-79	0.16	8.18	2.59	-3.39	-1.07	0.0002	0.25	-157.95
80-84	0.16	7.89	2.50	-3.17	-1.00	0.0001	0.13	-156.52
85+	0.15	7.40	2.34	-3.51	-1.11	0.0001	0.11	-139.84
Elixhauser								
Q1	0.16	8.03	2.54	-3.59	-1.14	0.0002	0.20	-122.76
Q2	0.16	8.16	2.58	-3.03	-0.96	0.0003	0.31	-152.16
Q3	0.17	9.23	2.92	-3.41	-1.08	0.0003	0.34	-190.93
Q4	0.15	7.55	2.39	-3.43	-1.09	0.0001	0.09	-129.10
Q5	0.16	7.66	2.42	-2.97	-0.94	-0.0001	-0.08	-163.25
Mean in Top/Bottom 10%								
Overall	0.00	0.10	0.03	3.78	1.20	0.0009	1.10	0.00
Age								
65-69	0.00	0.15	0.05	3.92	1.24	0.0009	1.07	-0.03
70-74	0.00	0.13	0.04	3.82	1.21	0.0008	1.02	0.00
75-79	0.00	0.09	0.03	3.75	1.19	0.0011	1.35	0.00
80-84	0.00	0.08	0.03	3.83	1.21	0.0008	1.03	0.00
85+	0.00	0.07	0.02	3.52	1.12	0.0007	0.93	0.00
Elixhauser								
Q1	0.00	0.10	0.03	3.58	1.13	0.0008	1.00	0.00
Q2	0.00	0.09	0.03	3.91	1.24	0.0012	1.45	0.00
Q3	0.00	0.13	0.04	4.54	1.44	0.0011	1.43	0.00
Q4	0.00	0.09	0.03	3.15	1.00	0.0004	0.49	0.00
Q5	0.00	0.09	0.03	3.51	1.11	0.0005	0.68	0.00

NOTE: This table compares the mean impact of changing patients' choice sets on consumer welfare, drive time, expected complication, and Medicare reimbursement pooling observed episodes of cataract surgery, colonoscopy, and upper GI endoscopy between 2006-2009. Rolling back entry deletes any surgeon-facility alternative not in the 1998-2001 choice set. Surgeon relocation adds back in surgeon-facilities from the 1998-2001 choice set where the surgeons affected by ASC removal who used to work. Expected complication rates are calculated using estimates from a probit with log specification on surgeon volume; this change is calculated on data from 2007-2009 because the surgeon volume requires a one-year lag.

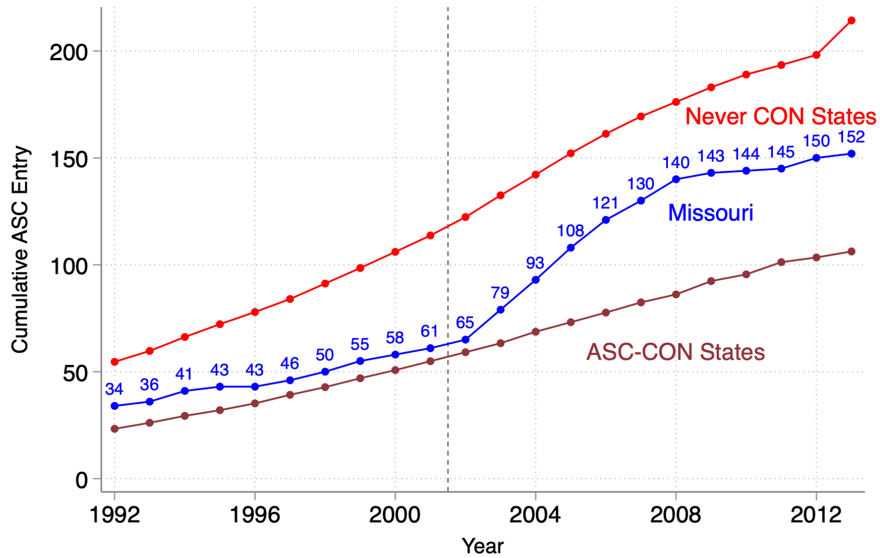
Table 13: Social welfare increases when reimbursement savings are cost savings

Wedge	Per Medicare Episode ($)		Missouri Medicare per Year ($ millions)	
Compensating variation	2.6		0.3	
ΔTransfers				
ASCs (i.e. entrant surgeons)	172.7		20.4	
Hospitals	-325.7		-38.5	
Insurer reimbursement	-153.0		-18.1	
Medicare	-122.4		-14.5	
Medigap	-30.60		-3.63	
	min	max	min	max
Entry Costs (7% discount rate)	24.7	98.7	2.9	11.5
ΔSocial welfare (η^{SV}=1)	min	max	min	max
ΔCost = ΔReimb , η = 1	56.9	130.9	7.0	15.6
ΔCost = ΔReimb , η = 1.16	76.4	150.5	9.3	17.9
ΔCost = ΔReimb , η = 1.09	67.9	141.9	8.3	16.9
ΔCost = 0 , η = 1	-96.1	-22.1	-11.2	-2.6
ΔCost = 0, η = 1.16	-76.6	-2.5	-8.9	-0.2
ΔCost = 0, η = 1.09	-85.1	-11.1	-9.9	-1.3

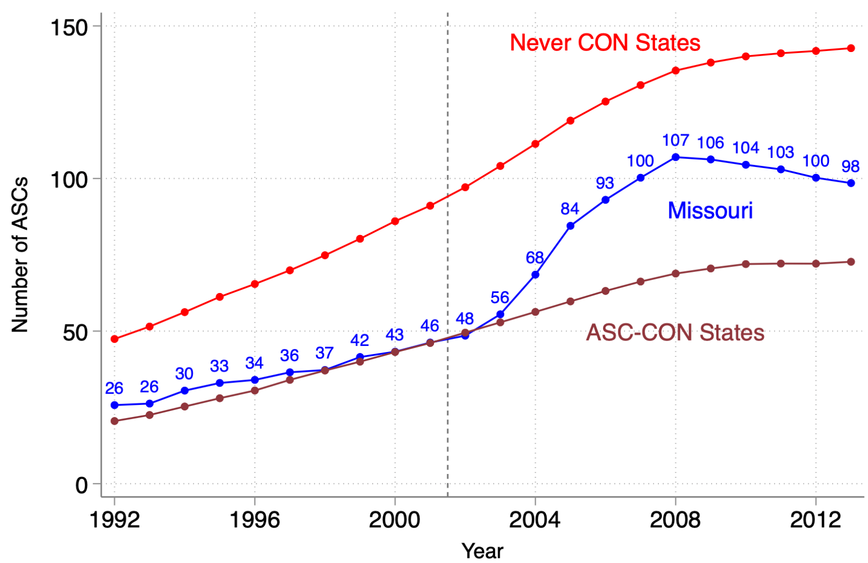
9 Figures

Figure 1: Trends in ASC entry by State Regulation

(a) Average Cumulative ASC Entry



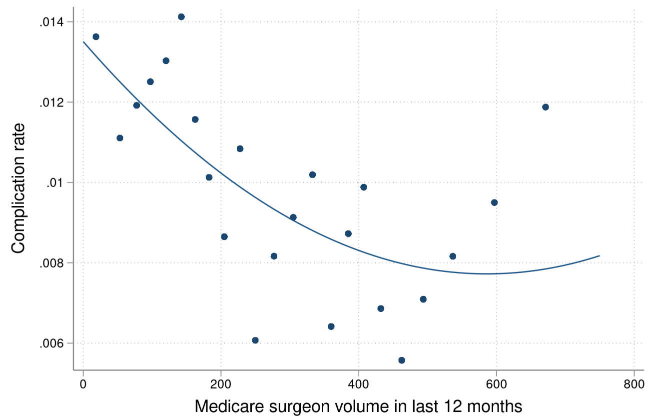
(b) Average Net ASC Entry



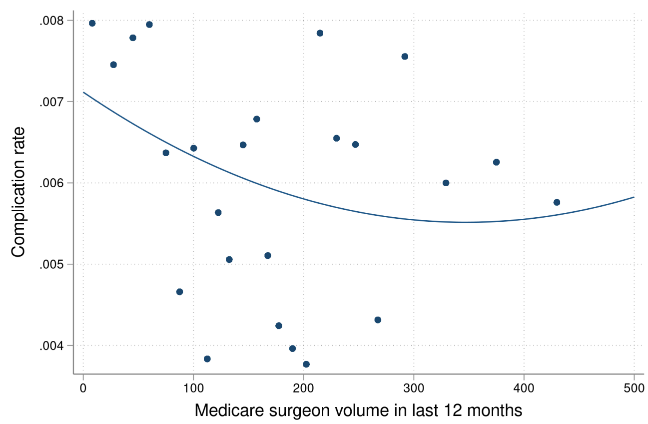
NOTE: These figures plot the average cumulative number and net number of ASC entrants between 1984 and 2013, with the graph restricted between 1992 and 2013. States with CON policy changes between 1984 and 2013 are excluded.

Figure 2: Volume Outcome Relationship for Top ASC Procedures

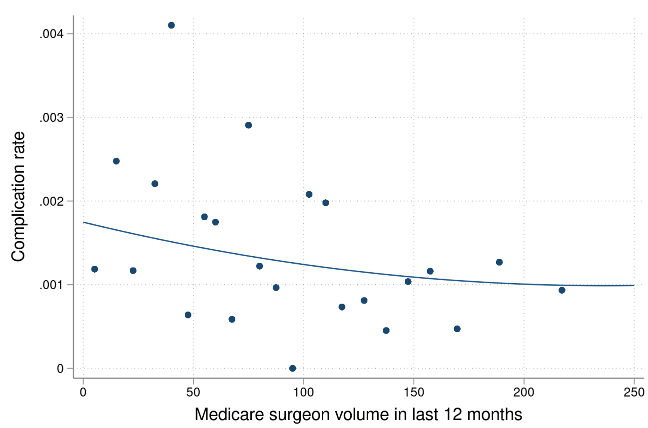
(a) Cataract surgery



(b) Colonoscopy



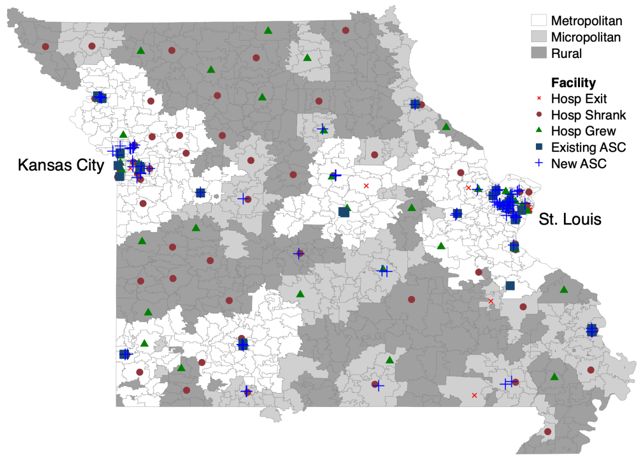
(c) Upper GI endoscopy



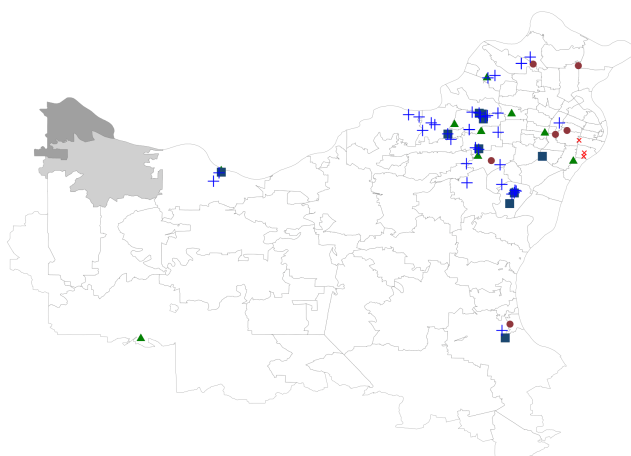
NOTE: Each figure is a binned scatter plot of complication rate against physician volume 12 months before the procedure, with a quadratic line of best fit.

Figure 3: Market Structure of ASCs and Hospitals in Missouri

(a) Entire state



(b) St. Louis area



(c) Kansas City, MO area

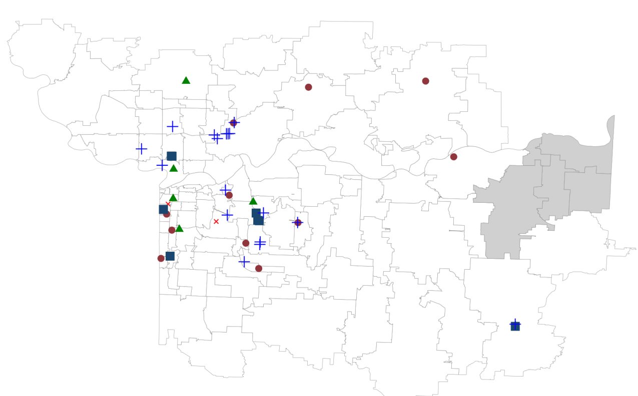
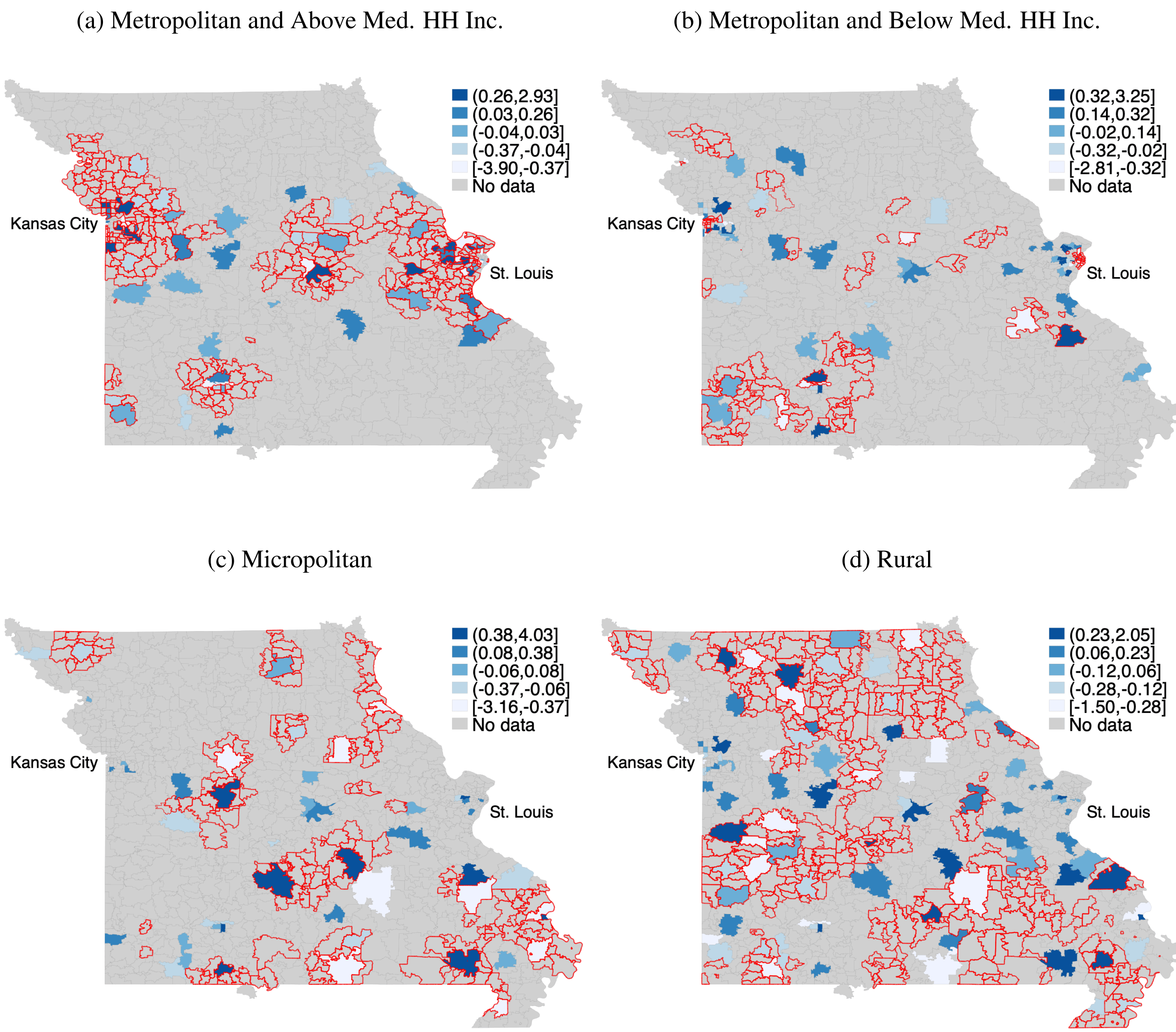


Figure 4: Change in Facility ZIP Market Share between 1998-2001 and 2006-2009



(a) Metropolitan and Above Med. HH Inc.

(b) Metropolitan and Below Med. HH Inc.

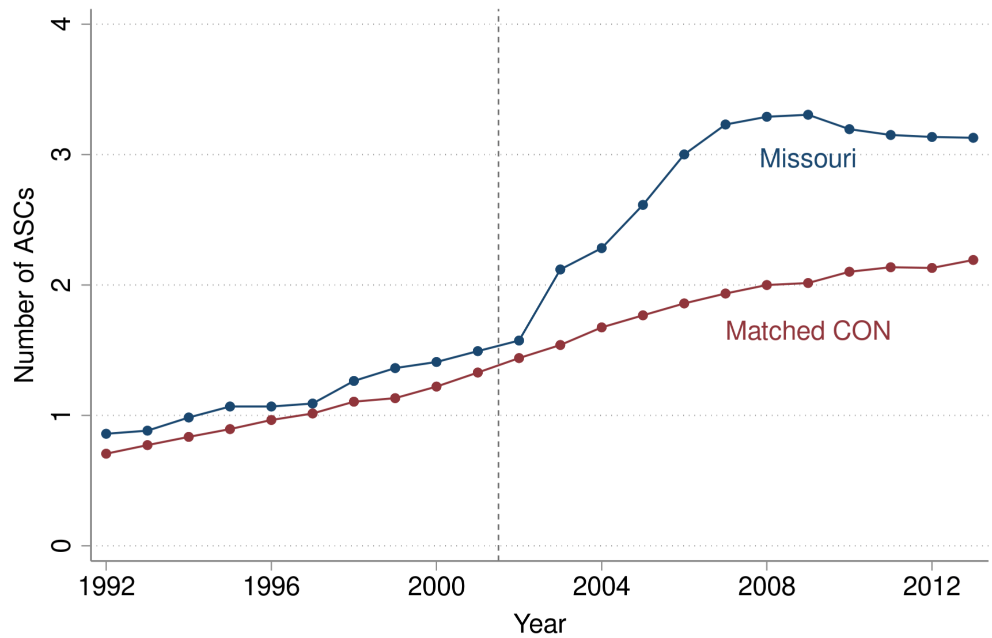
(c) Micropolitan

(d) Rural

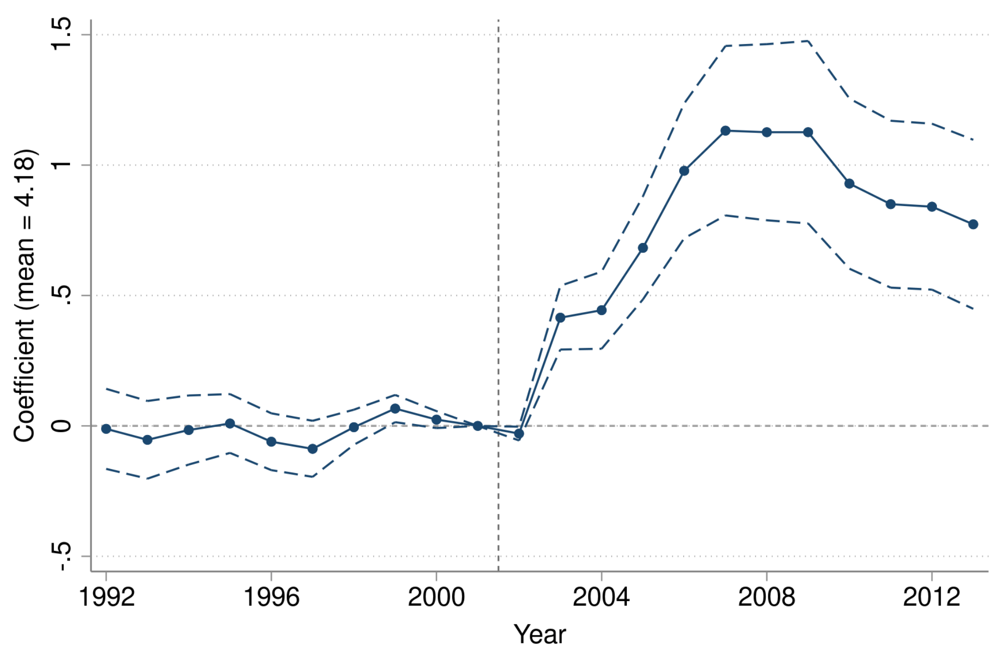
NOTE: These maps plot the change in market share (in percentage points) between 1998-2001 and 2006-2009 for each facility ZIP code for a sub-population from ZIP codes outlined in red.

Figure 5: Effect of Deregulation on Number of ASCs (15 mi)

(a) Binned Scatter Plot



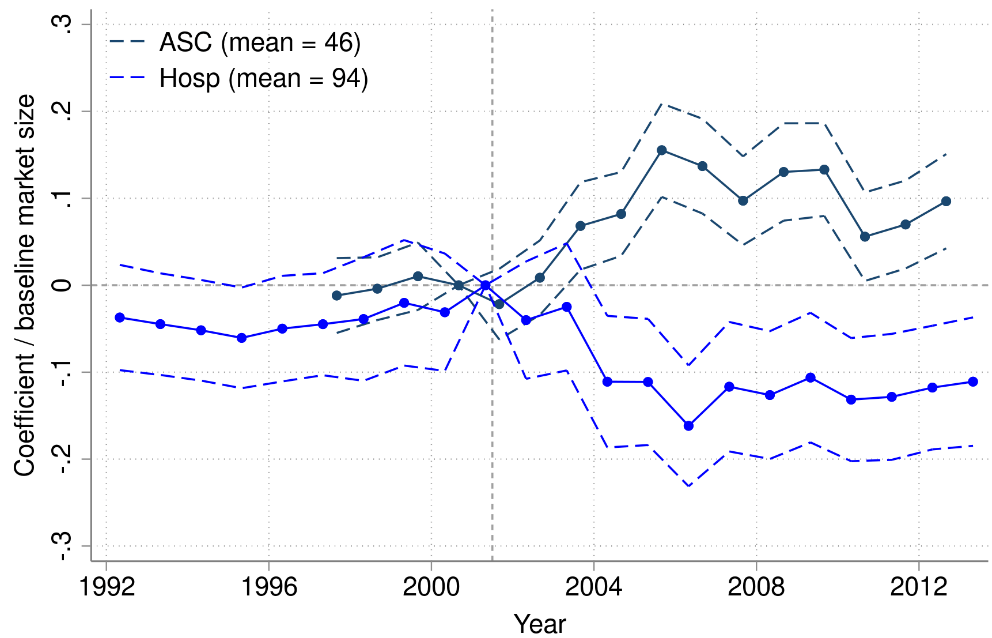
(b) Event Study



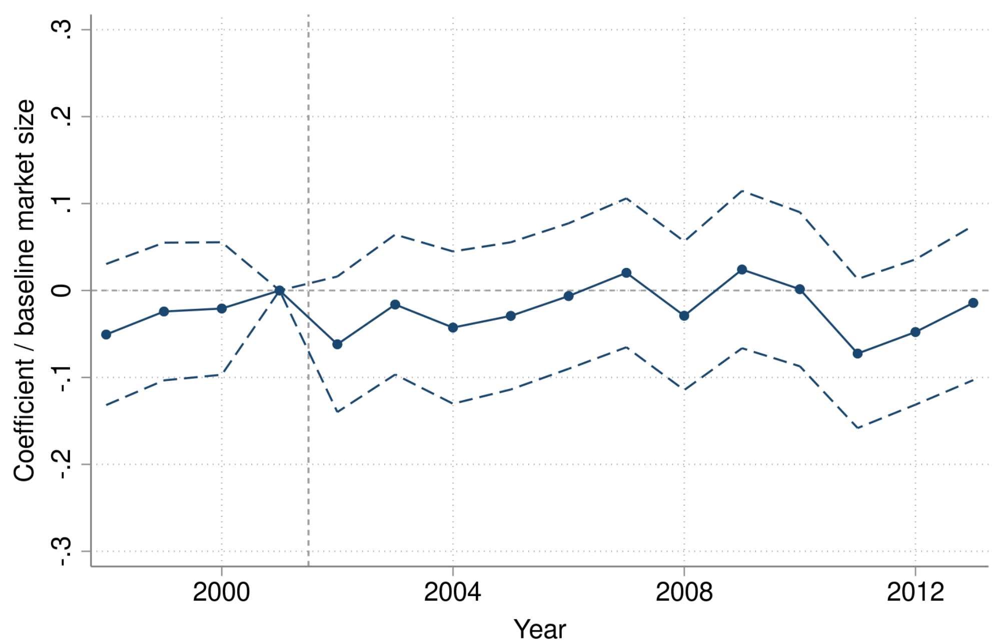
NOTE: These figures plot difference-in-difference coefficients and 95% confidence intervals of the impact of the CON repeal on ASCs within 15 miles. The coefficients are normalized by the 2001 mean in Missouri, so the y-axis can be interpreted as a percentage point gain relative to baseline. Standard errors are clustered at the zip code level. All regressions control for year and zip code fixed effects.

Figure 6: Event Studies of the Effect of Deregulation on Patient Utilization

(a) ASC and Hospital episodes per enrollment (1000s)



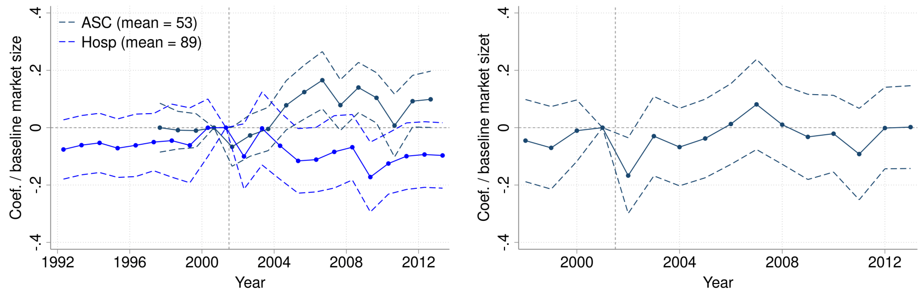
(b) Surgeries per enrollment (1000s)



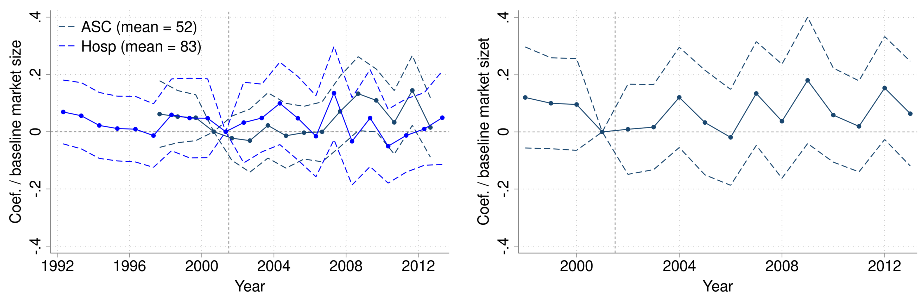
NOTE: These figures plot difference-in-difference coefficients and 95% confidence intervals of the impact of the CON repeal on utilization per 1000 Medicare enrollees. The coefficients are normalized by the 2001 mean in Missouri, so the y-axis can be interpreted as a percentage point gain relative to baseline. Standard errors are clustered at the zip code level. All regressions control for year and zip code fixed effects.

Figure 7: Heterogeneous Event Studies of Deregulation on Utilization

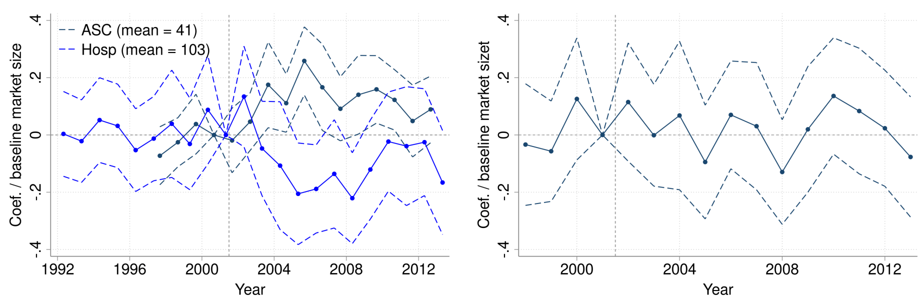
(a) By facility and overall: Metropolitan & $\geq$ Med. Inc.



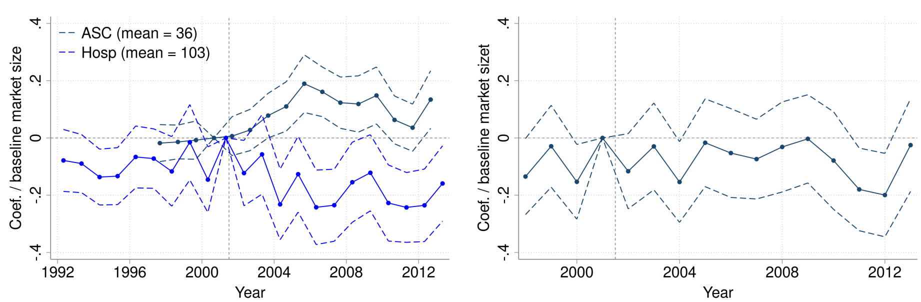
(b) Metropolitan & $<$ Med. Inc.



(c) Micropolitan

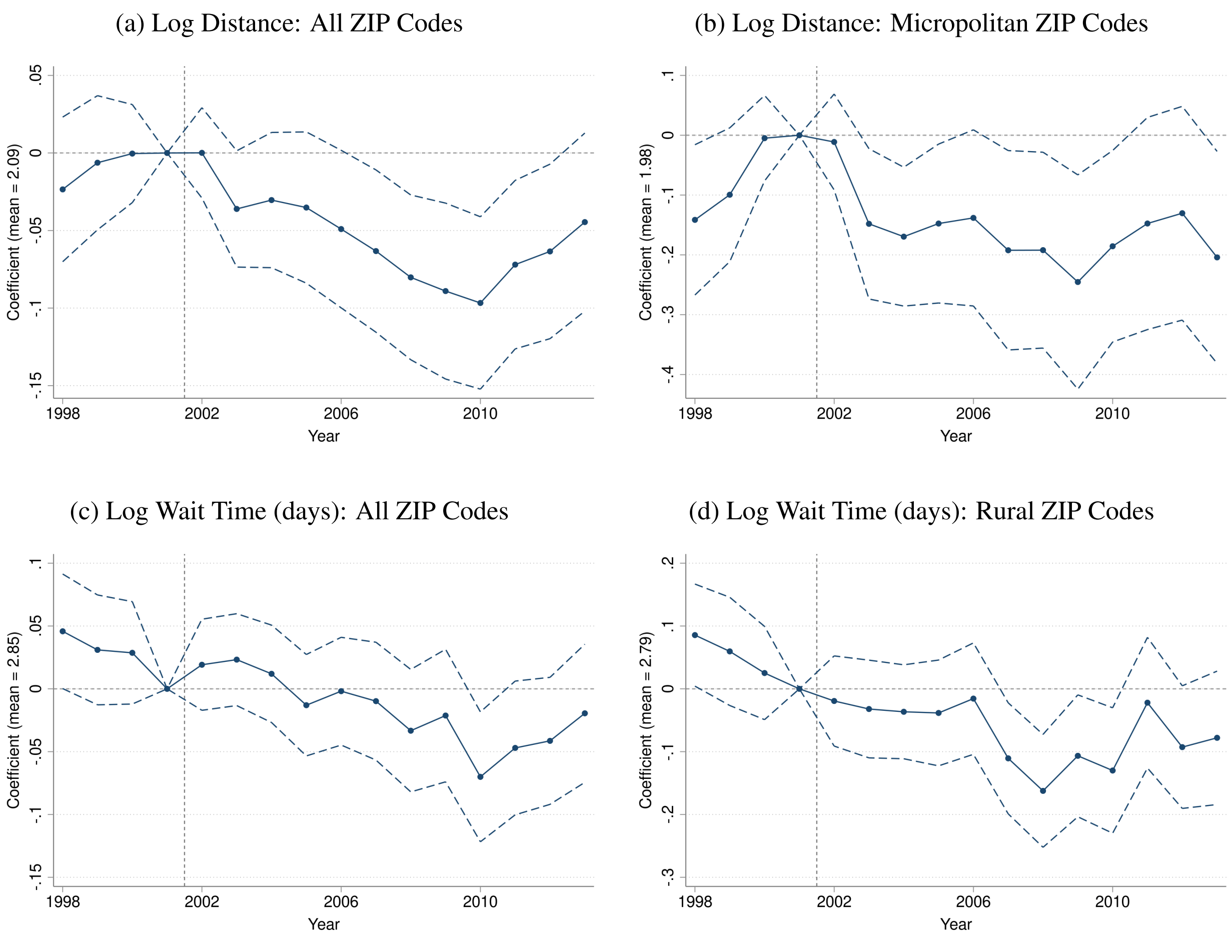


(d) Rural



NOTE: These figures plot difference-in-difference coefficients and 95% confidence intervals of the impact of the CON repeal on utilization per 1000 Medicare enrollees. The coefficients are normalized by the 2001 mean in Missouri, so the y-axis can be interpreted as a percentage point gain relative to baseline. Standard errors are clustered at the zip code level. All regressions control for year and zip code fixed effects.

Figure 8: Change in Travel Distance and Wait Times



(a) Log Distance: All ZIP Codes

(b) Log Distance: Micropolitan ZIP Codes

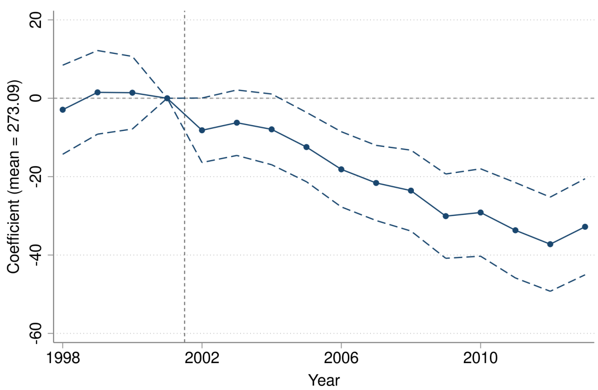
(c) Log Wait Time (days): All ZIP Codes

(d) Log Wait Time (days): Rural ZIP Codes

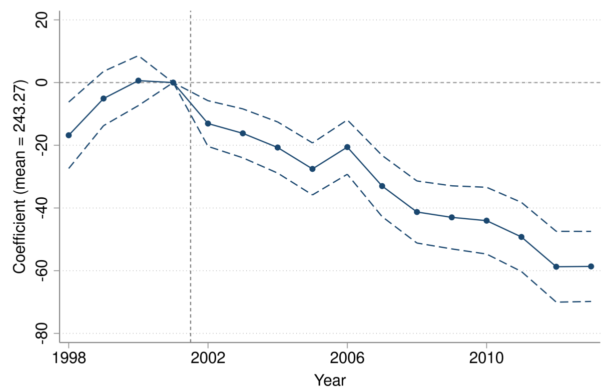
NOTE: These figures plot event studies of the effect of the reform on log patient travel distance and log cataract surgery wait times for all ZIP codes and selected subgroups. The subgroups, micropolitan for distance and rural for wait times, illustrate what variation is driving a decline. 95% confidence intervals, with standard errors clustered by ZIP code, are shown with the dashed lines. All regressions control for ZIP code by procedure code, year by procedure code, and patient demographic/health cells by procedure code fixed effects. Regressions for micropolitan and rural areas also control for second order interaction terms.

Figure 9: Change in Provider Quality

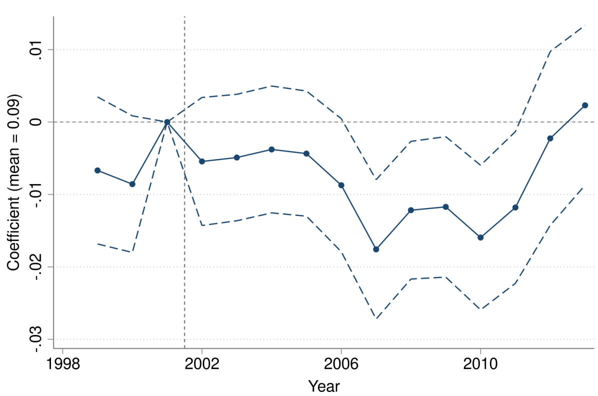
(a) Ex-ante annual surgeon volume



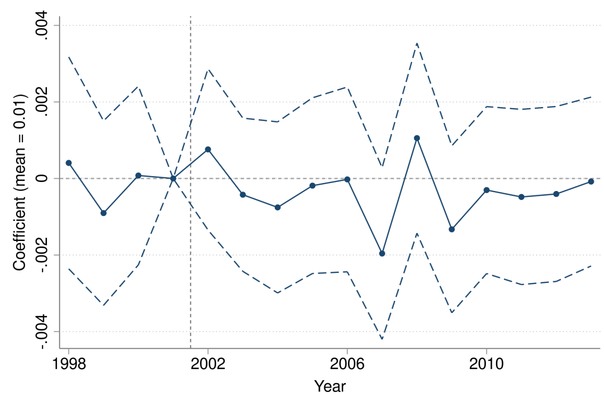
(b) Surgeon volume



(c) Low volume surgeon ($<$ 100 Cataract, $<$ 20 GI)



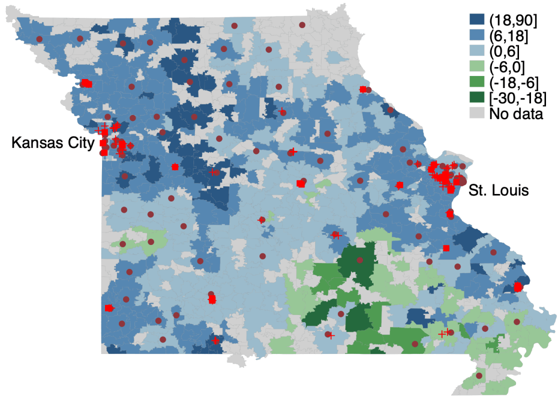
(d) Complication



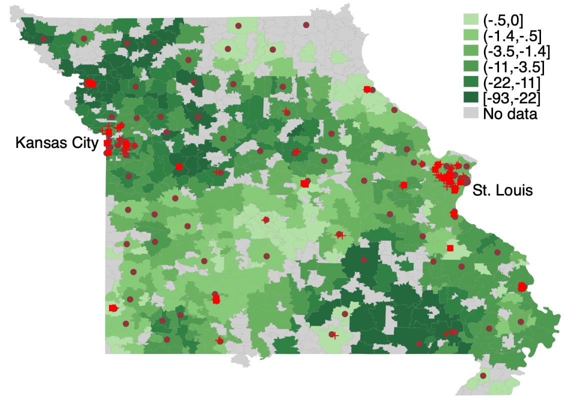
NOTE: These figures plot event studies of the effect the reform on complication rates and surgeon type: low volume or pre-reform experience. 95% confidence intervals, with standard errors clustered by ZIP code, are shown with the dashed lines. All regressions control for ZIP code by procedure code, year by procedure code, and patient demographic/health cells by procedure code fixed effects.

Figure 10: Distributional Effects of CON Deregulation

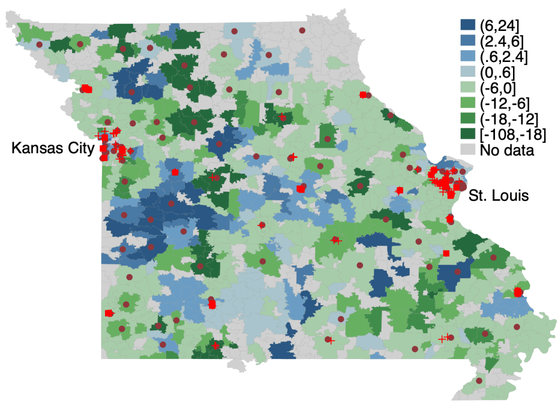
(a) $CV : J_i^2 \to J_i$



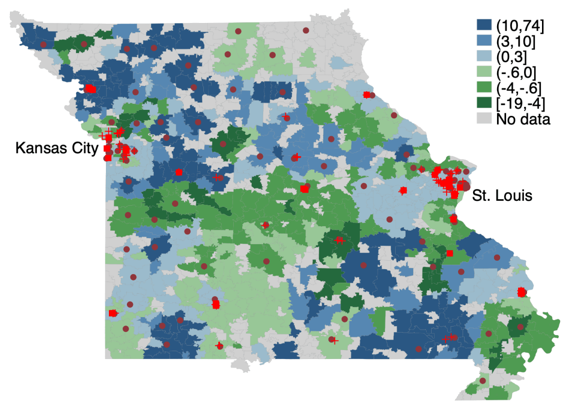
(b) $CV : J_i^2 \to J_i^1$



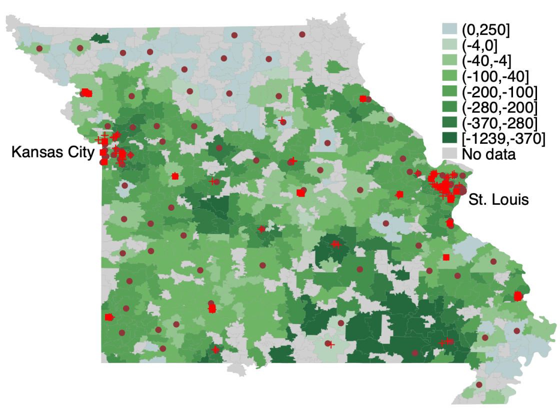
(c) Δ Drive Time $J_i^2 \to J_i$



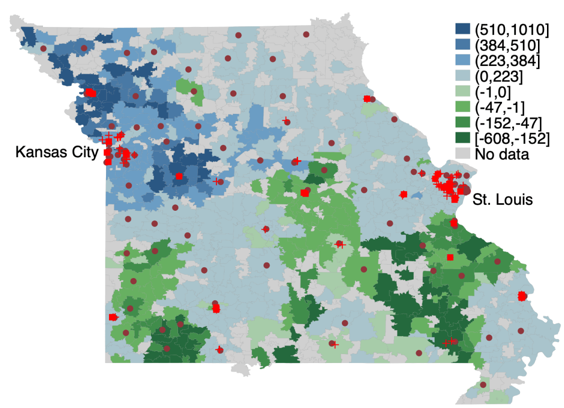
(d) Δ Drive Time $J_i^2 \to J_i^1$



(e) Δ Medicare reimbursements $J_i^2 \to J_i$



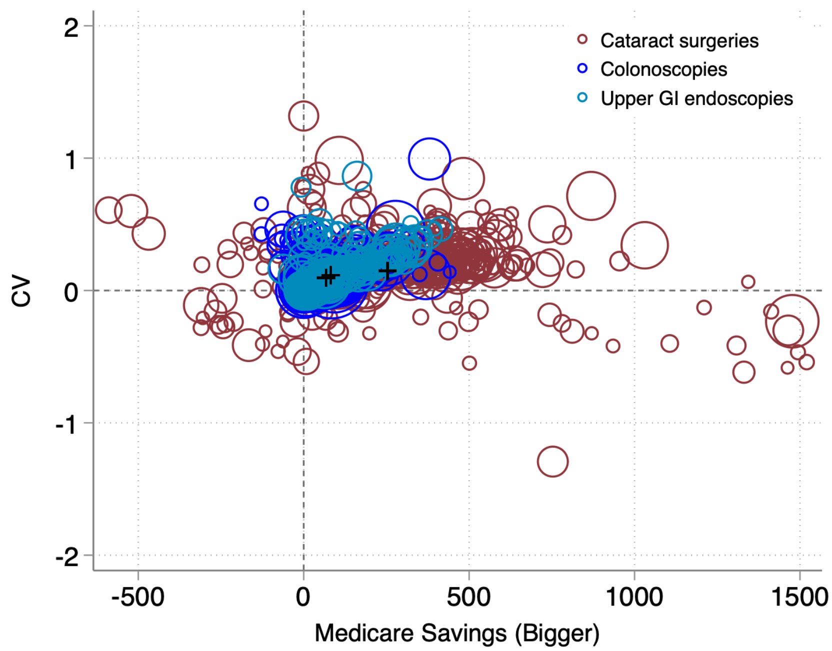
(f) Δ Medicare reimbursements $J_i^2 \to J_i^1$



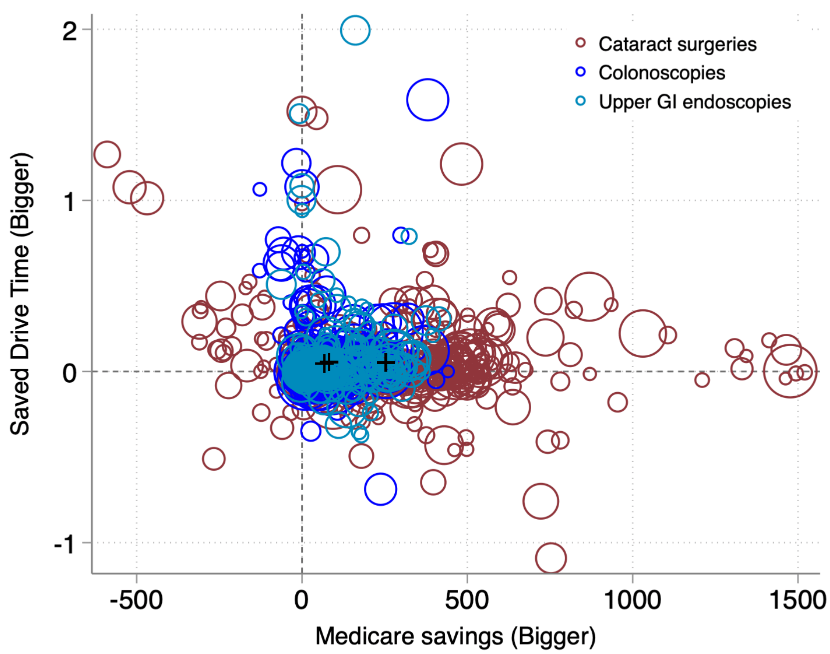
NOTE: The left panels plot the change associated with moving from the second counterfactual choice set to the baseline choice set $J_i^2 \to J_i$. The right panels plot the change associated with moving from the second to the first counterfactual choice sets $J_i^2 \to J_i^1$, accounting for surgeon relocation. Maroon dots are the hospitals, red dots are pre-reform ASCs, and red crosses are ASC entrants.

Figure 11: Welfare and Cost Trade-offs by ZIP code and Procedure

(a) Compensating Variation vs. Government Savings



(b) Change in Drive Time vs. Government Savings



NOTE: Each marker is a ZIP code weighted by episode count for the selected procedure. The upper right quadrant presents markets in which consumers benefit and save the government reimbursement. The black crosses denote that average across markets, by procedure.

Appendices

A Stylized Model

The following model illustrates the role of entry deregulation on the decision of an incumbent firm to invest in quality. Quality can be thought of as any non-price characteristic: complication rates, advertising, and convenience.

The effect of entry deregulation on quality is ambiguous. If the monopolist faces excess demand and entry relaxes the incumbent's binding capacity constraint, quality increases on average. On the other hand, no excess demand implies deregulation decreases quality, harming consumers. In the both cases, rent-sharing increases as labor demand increases, driving up the physician wage. A volume-outcome relationship may ameliorate or exacerbate negative effects on consumers.

A.1 Setup

In this model, there are three agents: firms, physicians, and consumers. Firms demand labor in order to maximize profits. The number of physicians they hire affects quality. Physicians supply labor, maximizing utility subject to a budget constraint. Patients choose among facilities depending on quality and idiosyncratic cost shocks, which we can think of as distance or private costs.

- The market either has $N = 1$ (regulated) or $N = 2$ (deregulated) firms.
- Firms employ labor at cost wL to generate quality:

  $$Q_j = \underline{Q} + L_j^{\beta} N^{\gamma}$$

  where L_j is labor and N is total firms. $\underline{Q}$ is some baseline level of quality no matter the labor. Assume that $\beta \in (0,1)$ and $\gamma \leq 0$.
- The labor market is competitive and there's an aggregate labor supply of

  $$L^s = Dw^{\eta}$$

  where D is total number of physicians and η is the labor supply elasticity. We can micro-found this labor supply as follows. A representative physician chooses labor to maximize utility

  $$u(c) = c - \frac{1}{1+\frac{1}{\eta}} l^{1+\frac{1}{\eta}}$$

  subject to a budget constraint: $c = wl + \sum_j s_j \pi_j$ where s_j are exogenous ownership stakes in the firms. In what follows, assume that $s_1 = 0$ and $s_2 = 1$.
- A measure 1 of consumers i chose facility j based on iid cost shocks $c_{ij} \sim_{iid} U[0,C]$. We can interpret the cost shocks as heterogeneous preferences or individual-specific distances. Indirect utility is:

  $$U_{ij} = Q_j - p_j - c_{ij}$$

where p_j is price, and Q_j is quality. Assume that $p_j = 0$.

- Under duopoly, the total market to firm 1 is

$$Y_1 = \frac{Q_1}{C} - \frac{1}{2C^2} Q_1 Q_2$$

and $Y_1 = Q_1/C$ under monopoly.

- The left panel of Figure A.1 plots the set of consumers that choose firm 1 given a low c_{i1}. The right panel shows that with a duopoly the market expands, including consumers who face low c_{i2} but high c_{i1}. Business stealing occurs; consumers with $\frac{c_{i2}}{c_{i1}} < \frac{Q_2}{Q_1}$ switch to the entrant.

• Firms have a capacity constraint $\bar{Y}_j = \bar{Y}$.

A.2 Effects of Deregulation (No Scale Effects)

In what follows, I consider the simpler case of no scale effects, setting $\gamma = 0$.

Deregulation decreases quality Suppose that $\frac{\underline{Q}}{C} < \bar{Y}$ (no excess demand). Then the firm's profit function is:

$$\pi_1 = r\left(\frac{\underline{Q} + L^\beta}{C} - \frac{\underline{Q} + L^\beta}{2C^2} Q_2\right) - wL$$

This implies the first order condition:

$$\left(\frac{r}{C} - r\frac{Q_2}{2C^2}\right) \beta L^{\beta-1} = w$$

Under a monopoly, this yields the labor demand curve:

$$L_1^{d,M} = \left(\frac{r}{C}\frac{\beta}{w}\right)^{\frac{1}{1-\beta}}$$

Under a duopoly, the labor demand solves:

$$0 = \frac{1}{\beta} w L^{1-\beta} + \frac{r}{2C^2} L^\beta - \left(\frac{r}{C} - \frac{r\underline{Q}}{2C^2}\right)$$

For closed form solutions, let $\beta = 0.5, \eta = 2$. Then aggregate labor demand under monopoly is: $L^{d,M} = \left(\frac{r}{2wC}\right)^2$ and under duopoly is: $2L^{d,D} = 2\left(\frac{\frac{r}{C} - r\frac{\underline{Q}}{2C^2}}{2w + \frac{r}{2C^2}}\right)^2$.

Labor market equilibrium (aggregate labor demand = labor supply) implies that under monopoly the wage is:

$$w^M = \left(\frac{r}{2\sqrt{D}C}\right)^{\frac{1}{0.5\eta+1}} = \sqrt{\frac{r}{2DC}}$$

Under duopoly:

$$0 = w^{0.5\eta+1} + \frac{r}{4C^2}w^{0.5\eta} - \frac{1}{\sqrt{2D}}\left(\frac{r}{C} - \frac{r\underline{Q}}{2C^2}\right)$$
$$= w^2 + \frac{r}{4C^2}w - \frac{1}{\sqrt{2D}}\left(\frac{r}{C} - \frac{r\underline{Q}}{2C^2}\right)$$

Using the quadratic formula,

$$w^D = -\frac{r}{8C^2} + \frac{1}{2}\sqrt{\frac{r^2}{16C^4} + \frac{4\sqrt{2}}{2\sqrt{D}}\left(\frac{r}{C} - \frac{r\underline{Q}}{2C^2}\right)}$$

When $D = .5, \underline{Q} = .2, r = .1, C = 1$, $w^M = .266$ and $w^D = 0.288$. Hence, deregulation leads increased rent-sharing through higher wages and π_2. Inframarginal consumers are harmed through lower quality as firm labor demand falls for the incumbent.

The left panel of Figure A.2 plots the labor market equilibrium. The incumbent decreases labor demand, which leads to lower equilibrium labor. However, aggregate demand for labor increases, driving up the wage and increasing rent-sharing to physicians. The right panel shows how decreasing labor for the firm leads to both market decline and expansion. First, entrants draw in people with high c_{i1} but low c_{i2}, increasing the market size. However, declines in labor at firm 1 decreases quality, decreasing the threshold c_{i1}, shrinking the market for the incumbent.

Deregulation increases quality Now suppose that $\frac{\underline{Q}}{C} > \bar{Y}$, $\frac{\underline{Q}}{C} - \frac{\underline{Q}^2}{2C^2} < \bar{Y}$. Then the firm faces "excess demand" under monopoly, but not under duopoly. In this world, a profit maximizing monopolist sets $L_j = 0$ and equilibrium wage is zero. Quality is just $\underline{Q}$. Upon deregulation, quality increases, rent sharing with physician increases $0 \to w^D$and the entrant's profits are positive $\pi_2 > 0$, and there's market expansion. Consumers uniformly benefit as $Q_1 = Q_2 = \underline{Q} + L(w^D)^\beta > \underline{Q}$.

The left panel of Figure A.3 plots the labor market equilibrium. The incumbent increases labor demand, which leads to a higher equilibrium labor and wage. The right panel shows how increasing labor for the firm leads to market expansion. First, entrants draw in people with high c_{i1} but low c_{i2}. Second, endogenous labor increases quality for firm 1, increasing the threshold c_{i1}.

Deregulation only redistributes rent Suppose that $\partial Y/\partial Q = 0$. This can be microfounded by assuming that $U_{ij} = Q_j$ for all individuals and firms. Then patients randomly choose between firm 1 or firm 2. For the firms, it is optimal to set $Q_1 = Q_2 = \underline{Q}$ and hire no labor. Wages remain zero. Nevertheless, there is rent redistribution because firms split the total surplus and physicians benefit through their ownership stake in firm 2.

A.3 Effects of Deregulation (Scale Effects)

In what follows, I consider a case with scale effects, setting $\gamma = -1$. Therefore, firm quality follows:

$$Q_j = \underline{Q} + L_j^\beta N^{-1}$$

where N is the **number of firms** in the market. Under a monopoly, we have the same solution as before.

Consider a duopoly. Profits for firm 1 are:

$$\pi_1 = r\left(\frac{\underline{\underline{Q}} + L^{\beta}N^{-1}}{C} - \frac{\underline{\underline{Q}} + L^{\beta}N^{-1}}{2C^2}Q_2\right) - wL$$

This implies:

$$0 = \frac{Nw}{\beta}L^{1-\beta} + \frac{rL^{\beta}}{2NC^2} - \left(\frac{r}{C} - \frac{r\underline{\underline{Q}}}{2C^2}\right)$$

As before, we assume that $\beta = 0.5$ for a closed form solution. Then aggregate labor demand under duopoly is: $2L^{d,D} = 2\left(\frac{\frac{r}{C} - r\frac{\underline{Q}}{2C^2}}{2Nw + \frac{r}{2NC^2}}\right)^2$. Is aggregate labor demand higher or lower compared to the no-scale-effects case?

$$\begin{aligned}
\frac{1}{2Nw + \frac{r}{2NC^2}} &> \frac{1}{2w + \frac{r}{2C^2}} \\
2w + \frac{r}{2C^2} &> 4w + \frac{r}{4C^2} \\
\frac{r}{8C^2} &> w
\end{aligned}$$

It's theoretically ambiguous. For some wages it's higher and for other it's lower. Therefore, the effect on rent-sharing is uncertain compared to the no-scale-effects case.

Using the same numerical values as above, if $\eta = 2$, $D = .5, \underline{Q} = .2, r = .1, C = 1$, then $w^M = .266$, $w^D = 0.288$, and $w^D_{Scale} = 0.21$. In this case, firms further reduce labor, decreasing wages. As a result, quality falls even more:

$$dQ\Big|_{N=1} = \underbrace{-L^{\beta}\partial N}_{\text{Scale}} + \underbrace{\beta L^{\beta-1}\partial L}_{\text{Knock-on labor mkt effect}}$$

Here, scale effects harm infra-marginal consumers even more and marginal consumers benefit less from the market expansion. Since labor demand falls, doctors also see decreased rent-sharing through wages, but because doctors own the new firm, they might make it up through π_2. Figure A.4 plots this example. The left panel plots how the aggregate labor demand shifts to the left due to scale, lowering the equilibrium wage and decreasing labor overall. The right panel plots the effect on inframarginal quality at the incumbent. The presence of new entrants shifts the curve down $\underline{Q} + L^{\beta} \rightarrow \underline{Q} + \frac{L^{\beta}}{2}$ and endogeneous labor exacerbates the drop in quality.

Figure A.1: Duopoly leads to business-stealing and market expansion

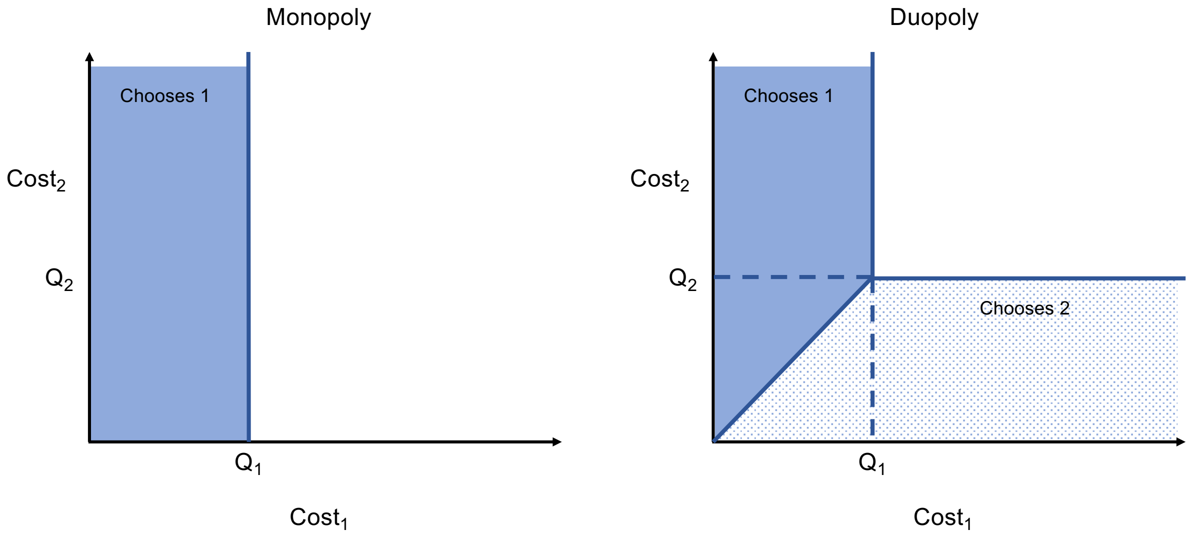


Figure A.2: No excess demand leads to quality decreases upon deregulation

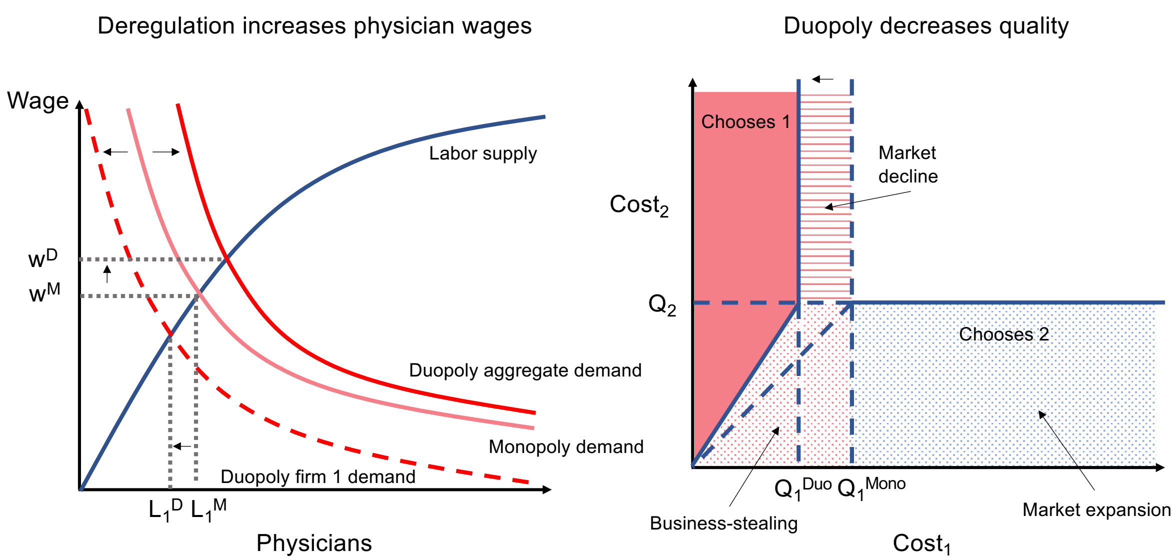
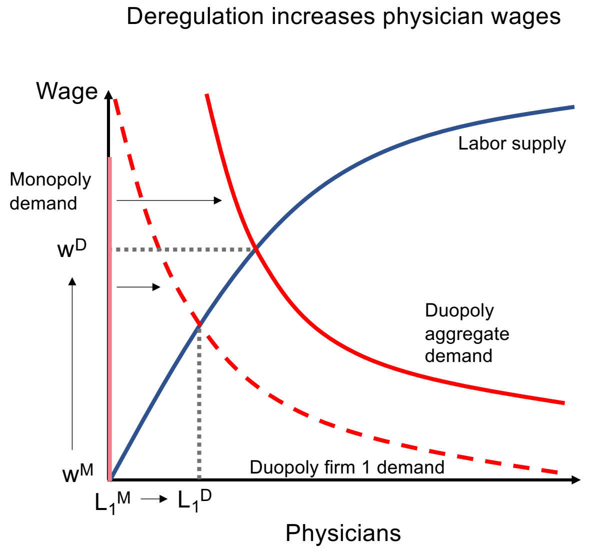


Figure A.3: Excess demand leads to quality increases upon deregulation



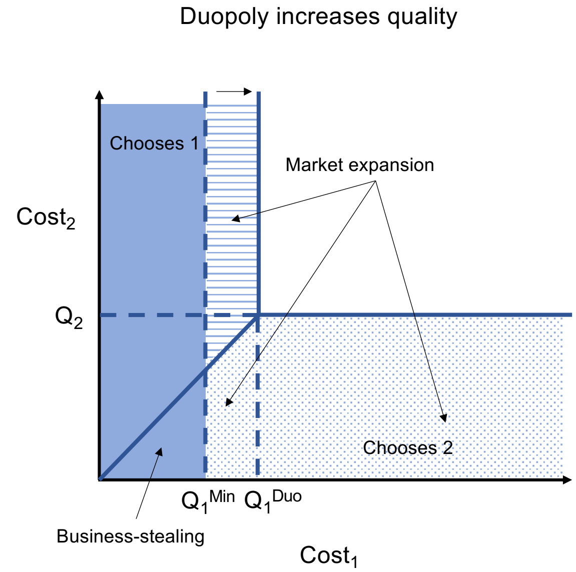
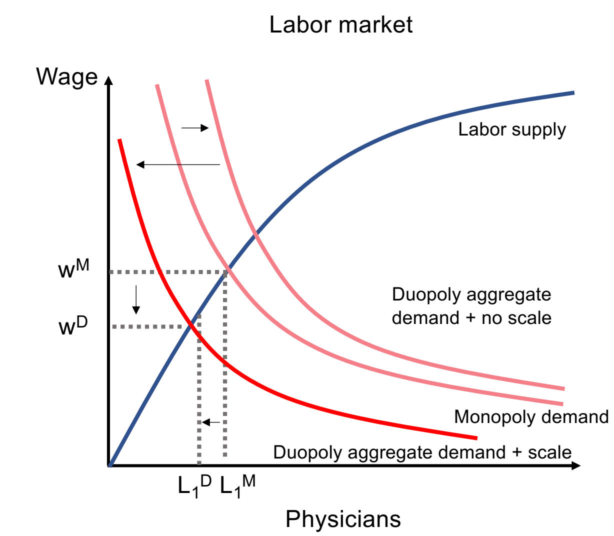
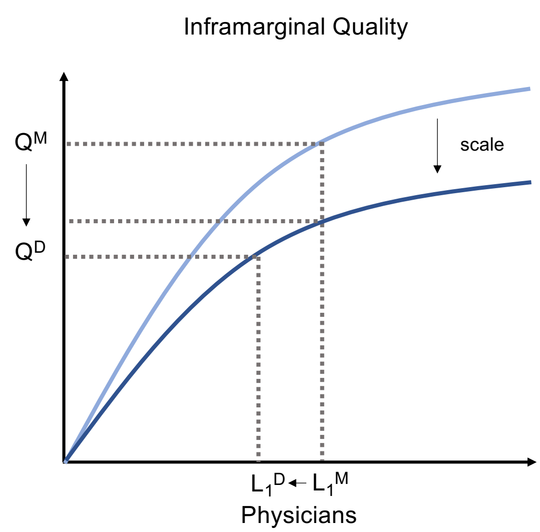


Figure A.4: Volume-outcome effects





B Additional Tables and Figures

Table B.1: Medicare reimbursement rates (2006-2009) at ASCs lower than hospitals

Procedure	ASC	HOPD	Ratio
Cataract surgery	$1,564	$3,088	51%
Screening Colonoscopy	$797	$1,391	57%
Diagnostic Colonoscopy	$676	$1,054	64%
Upper GI Endoscopy	$678	$1,231	55%

NOTE: This table reports the average total Medicare reimbursement by procedure and setting in Missouri between 2006-2009. This value includes both the facility fee and physician fee.

Table B.2: Heterogeneous Effects of Deregulation on Cataract Surgeries

	(1) ASCs	(2) Hospital outpatient	(3) Any Hospital	(4) ASC + Hospital outpatient
All ZIP codes				
Post (2006, 2009)	9.800***	-6.564***	-6.448***	3.235
	(1.690)	(1.476)	(1.480)	(2.131)
Pre-period mean	28.85	32.68	32.69	61.53
Metropolitan and Above Med HH Inc				
Post (2006, 2009)	5.926**	1.290	1.391	7.217**
	(2.650)	(2.424)	(2.431)	(3.599)
Pre-period mean	37.07	24.70	24.70	61.77
Metropolitan and Below Med HH Inc				
Post (2006, 2009)	5.510	-1.372	-1.360	4.138
	(3.340)	(3.367)	(3.367)	(4.422)
Pre-period mean	30.40	20.42	20.50	50.82
Micropolitan				
Post (2006, 2009)	13.606***	-15.519***	-15.496***	-1.913
	(4.895)	(3.513)	(3.514)	(5.816)
Pre-period mean	30.32	36.83	36.83	67.15
Rural				
Post (2006, 2009)	12.230***	-9.312***	-9.095***	2.917
	(2.787)	(2.554)	(2.566)	(3.542)
Pre-period mean	21.70	42.00	42.00	63.70
Number of observations	55072	55072	55072	55072

NOTE: This table presents difference-in-difference regressions of the effect of CON repeal in Missouri on episodes per 1000 enrollees. The data consist of ZIP codes between 1998 and 2013. Standard errors are clustered at the ZIP code level and reported in parentheses. All regressions control for ZIP code fixed effects and year fixed effects. * p <.1, ** p <.05, *** p<.01

Table B.3: Heterogeneous Effects of Deregulation on Colonoscopies

	(1) ASCs	(2) Hospital outpatient	(3) Hospital inpatient/ER	(4) Any Hospital	(5) ASC + Hospital outpatient
All ZIP codes					
Post (2006, 2009)	5.489***	-5.450***	1.168*	-4.282**	0.039
	(0.932)	(1.561)	(0.682)	(1.683)	(1.618)
Pre-period mean	5.74	52.13	12.41	64.54	57.87
Metropolitan and Above Med HH Inc					
Post (2006, 2009)	8.618***	-7.256***	0.461	-6.796**	1.362
	(1.729)	(2.786)	(1.269)	(3.017)	(2.853)
Pre-period mean	7.65	55.47	15.82	71.28	63.12
Metropolitan and Below Med HH Inc					
Post (2006, 2009)	-3.197*	1.922	2.123	4.045	-1.274
	(1.917)	(3.312)	(1.424)	(3.697)	(3.386)
Pre-period mean	4.36	45.29	14.75	60.04	49.64
Micropolitan					
Post (2006, 2009)	10.139***	-8.979***	-0.595	-9.574***	1.160
	(2.595)	(3.212)	(1.431)	(3.409)	(3.691)
Pre-period mean	5.20	51.40	10.38	61.78	56.61
Rural					
Post (2006, 2009)	4.953***	-5.891**	2.069*	-3.821	-0.938
	(1.374)	(2.854)	(1.232)	(3.047)	(2.889)
Pre-period mean	5.37	53.59	9.97	63.56	58.97
Number of observations	55072	55072	55072	55072	55072

NOTE: This table presents difference-in-difference regressions of the effect of CON repeal in Missouri on episodes per 1000 enrollees. The data consist of ZIP codes between 1998 and 2013. Standard errors are clustered at the ZIP code level and reported in parentheses. All regressions control for ZIP code fixed effects and year fixed effects. * p <.1, ** p <.05, *** p<.01

Table B.4: Heterogeneous Effects of Deregulation on Upper GI Endoscopies

	(1) ASCs	(2) Hospital outpatient	(3) Hospital inpatient/ER	(4) Any Hospital	(5) ASC + Hospital outpatient
All ZIP codes					
Post (2006, 2009)	3.139***	-2.746*	0.423	-2.323	0.393
	(0.647)	(1.470)	(1.145)	(1.938)	(1.557)
Pre-period mean	2.55	32.70	21.63	54.33	35.25
Metropolitan and Above Med HH Inc					
Post (2006, 2009)	4.097***	-5.675**	-0.004	-5.679*	-1.578
	(1.079)	(2.456)	(1.730)	(3.163)	(2.698)
Pre-period mean	4.15	33.07	24.64	57.70	37.21
Metropolitan and Below Med HH Inc					
Post (2006, 2009)	-1.072	-1.235	-1.908	-3.143	-2.307
	(1.273)	(2.270)	(2.539)	(3.721)	(2.556)
Pre-period mean	1.27	30.39	27.86	58.26	31.66
Micropolitan					
Post (2006, 2009)	2.157	-3.014	2.301	-0.713	-0.856
	(1.488)	(3.530)	(2.189)	(4.016)	(3.767)
Pre-period mean	3.20	37.03	18.38	55.41	40.23
Rural					
Post (2006, 2009)	4.866***	-1.407	0.735	-0.672	3.459
	(1.188)	(2.770)	(2.251)	(3.754)	(2.868)
Pre-period mean	1.76	31.33	18.20	49.53	33.09
Number of observations	55072	55072	55072	55072	55072

NOTE: This table presents difference-in-difference regressions of the effect of CON repeal in Missouri on episodes per 1000 enrollees. The data consists of ZIP codes between 1998 and 2013. Standard errors are clustered at the ZIP code level and reported in parentheses. All regressions control for ZIP code fixed effects and year fixed effects. * p <.1, ** p <.05, *** p<.01

Table B.5: Heterogeneous effects of Deregulation on Quality

	(1)	(2)	(3)	(4)	(5)
	30-day complication rate (0-100)	30-day readmission rate (0-100)	Pre-reform annual volume	Volume in last 12 months	Low volume (<20 for GI, <100 Cataracts)
Above Median HH Income					
St. Louis					
Post (2006, 2009)	0.055	0.152	-2.142	-18.395***	-0.038***
	(0.243)	(0.365)	(6.574)	(6.676)	(0.011)
Baseline mean	0.79	1.54	203.71	146.57	0.10
Kansas City					
Post (2006, 2009)	0.038	-0.049	-43.709***	-72.791***	-0.014
	(0.281)	(0.373)	(10.163)	(9.358)	(0.012)
Baseline mean	0.86	1.71	355.18	255.04	0.09
Below Median HH Income					
St. Louis					
Post (2006, 2009)	-0.180	-0.137	-35.501**	-52.718***	-0.033
	(0.923)	(0.953)	(16.776)	(18.098)	(0.033)
Baseline mean	0.74	1.57	195.51	135.48	0.17
Kansas City					
Post (2006, 2009)	0.814*	0.442	-19.143	-15.971	0.020
	(0.447)	(0.696)	(23.702)	(18.838)	(0.028)
Baseline mean	0.70	1.81	267.79	180.56	0.13
Rural areas					
Above I-70					
Post (2006, 2009)	-0.124	-0.148	-88.937***	-66.288***	0.020
	(0.343)	(0.565)	(27.963)	(22.780)	(0.015)
Baseline mean	0.75	1.76	342.57	263.11	0.10
Between I-70 and I-44					
Post (2006, 2009)	-0.491	-0.136	-9.892	-28.211	0.010
	(0.419)	(0.601)	(16.176)	(17.927)	(0.017)
Baseline mean	0.50	1.74	330.70	245.59	0.07
Below I-44					
Post (2006, 2009)	0.220	0.426	-14.191	-43.533***	-0.026*
	(0.304)	(0.507)	(16.827)	(15.309)	(0.014)
Baseline mean	0.66	1.31	406.98	268.02	0.11

NOTE: This table presents difference-in-difference coefficients of the effect of Missouri's regulation on measures of quality. I report the medium-run effect, which pools data from 2006-2009. The data used is an episode-level dataset consisting of outpatient cataract, colonoscopy, and endoscopies from 1998 to 2013. Standard errors are clustered at the ZIP code level and reported in parentheses. All regressions control for procedure code by year fixed effects, procedure code by ZIP code fixed effects, and patient demographic cells by procedure code fixed effects. Heterogeneity regressions also control for patient group by procedure code by year fixed effects. * p <.1, ** p <.05, *** p<.01

Table B.6: Demand estimates

	(1)	(2)	(3)	(4)	(5)	(6)
	Cataract Surgeries		Colonoscopies		Upper GI Endoscopies	
Drive time (hours)	-3.042***	-3.048***	-3.366***	-3.431***	-3.184***	-3.147***
	(0.124)	(0.116)	(0.138)	(0.158)	(0.157)	(0.155)
Drive time squared	0.0443	0.0353	0.0559	0.0893*	0.0493	0.0402
	(0.0352)	(0.0301)	(0.0463)	(0.0541)	(0.0550)	(0.0559)
Drive time x Medicaid	-0.170**	-0.166**	-0.399***	-0.372***	-0.209*	-0.202
	(0.0792)	(0.0838)	(0.109)	(0.112)	(0.124)	(0.135)
Drive time x Elixhauser	-0.0289***	-0.0262***	0.0165	0.0177*	0.0195*	0.0224**
	(0.00958)	(0.00992)	(0.0101)	(0.0102)	(0.0109)	(0.0113)
Drive time x Age	-0.00970***	-0.00907***	-0.0269***	-0.0261***	-0.0240***	-0.0251***
	(0.00309)	(0.00332)	(0.00396)	(0.00401)	(0.00487)	(0.00500)
Drive time x Female	-0.103***	-0.115***	-0.0924**	-0.0918**	-0.158***	-0.165***
	(0.0378)	(0.0407)	(0.0389)	(0.0393)	(0.0539)	(0.0565)
Drive time x Nonwhite	-0.103***	-0.115***	-0.0924**	-0.0918**	-0.131	-0.165***
	(0.146)	(0.151)	(0.168)	(0.180)	(0.176)	(0.187)
Transit access	0.320**	0.273*	0.383***	0.383***	0.297**	0.317**
	(0.147)	(0.148)	(0.141)	(0.142)	(0.140)	(0.139)
Transit x Medicaid	-0.241	-0.241	-0.548***	-0.643***	-0.237	-0.253
	(0.201)	(0.202)	(0.205)	(0.202)	(0.270)	(0.277)
Transit x Elixhauser	0.0310**	0.0362**	0.0145	0.0175	0.0193	0.0267*
	(0.0146)	(0.0153)	(0.0152)	(0.0153)	(0.0147)	(0.0153)
Transit x Age	0.0115	0.0131*	-0.00413	-0.00180	-0.000216	0.001000
	(0.00763)	(0.00769)	(0.00701)	(0.00725)	(0.00645)	(0.00656)
Transit x Female	0.0826	0.0828	-0.0776	-0.0837*	-0.0713	-0.0980
	(0.0627)	(0.0651)	(0.0493)	(0.0480)	(0.0740)	(0.0746)
Transit x Nonwhite	0.984***	0.983***	1.219***	1.216***	1.104***	1.084***
	(0.179)	(0.182)	(0.181)	(0.183)	(0.231)	(0.230)
Complication rate (date-365)		0.983**		0.675		2.046
		(0.418)		(0.469)		(1.792)
ASC x Elixhauser	-0.0520***	-0.0490***	-0.0161**	-0.0165**	-0.0510***	-0.0492***
	(0.00686)	(0.00715)	(0.00734)	(0.00765)	(0.00929)	(0.00937)
ASC x Age	-0.00669**	-0.00724**	-0.0134***	-0.0128***	-0.00714*	-0.00705*
	(0.00304)	(0.00315)	(0.00265)	(0.00269)	(0.00382)	(0.00376)
Surgeon age	0.917***	0.888***	1.306***	1.294***	1.735***	1.753***
	(0.0400)	(0.0432)	(0.0537)	(0.0563)	(0.0758)	(0.0848)
Surgeon age squared	-0.00398***	-0.00362***	-0.00348***	-0.00331***	-0.00279***	-0.00273***
	(0.000475)	(0.000503)	(0.000364)	(0.000403)	(0.000496)	(0.000574)
Surgeon age x Elixhauser	-0.000157	-0.0000648	-0.00242***	-0.00240***	-0.00241***	-0.00242***
	(0.000364)	(0.000377)	(0.000320)	(0.000327)	(0.000493)	(0.000499)
Surgeon age x Age	0.000665***	0.000658***	0.000898***	0.000881***	0.000416**	0.000358**
	(0.000152)	(0.000157)	(0.000146)	(0.000155)	(0.000179)	(0.000182)
Surgeon-facility-time FE	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R2	0.365	0.364	0.419	0.417	0.464	0.459
Observations	2107426	1955175	3055228	2870502	1305413	1235905

NOTE: Standard errors, clustered by zip code, in parentheses. * p < .1 ** p < .05 *** p <.01

Table B.7: Demand elasticities

	Own drive time		Avg. cross drive time	
Procedure	Mean	Median	Mean	Median
All	-4.343	-3.617	0.742	0.349
Cataract surgeries	-4.199	-3.598	0.935	0.421
Colonoscopies	-4.450	-3.623	0.597	0.297
Upper GI Endoscopies	-4.326	-3.628	0.769	0.384

NOTE: I report quantity-weighted averages and medians of elasticities estimated at the is for a zip code-facility-surgeon-(pre/post).

Table B.8: Robustness of Patient Utilization, Pooled

		Controls					Functional form	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Baseline	Population Quartile by Year FE	Income Quartile by Year FE	Wealth Quartile by Year FE	Rural/Urban by Year FE	Matched Group by Year Trend	Log Linear	asinh-Linear
ASC and Hospital Outpatient								
Interim	-1.905	-2.180	-2.008	-2.227	-1.866	-1.267	-0.056	-0.062
	(3.097)	(3.105)	(3.143)	(3.098)	(3.098)	(3.050)	(0.042)	(0.047)
Post (2006, 2009)	3.667	3.677	3.689	3.650	3.692	4.943	0.042	0.045
	(3.295)	(3.303)	(3.344)	(3.307)	(3.294)	(3.017)	(0.045)	(0.051)
Pre-period mean	154.65	154.65	154.65	154.65	154.65	154.65	154.65	154.65
ASCs								
Interim	5.004***	4.725***	4.737***	4.694***	4.990***	5.119***	0.109**	0.117**
	(1.733)	(1.740)	(1.768)	(1.739)	(1.733)	(1.724)	(0.047)	(0.054)
Post (2006, 2009)	18.427***	18.426***	18.686***	18.420***	18.391***	18.657***	0.439***	0.483***
	(2.208)	(2.189)	(2.201)	(2.188)	(2.201)	(2.050)	(0.055)	(0.063)
Pre-period mean	37.14	37.14	37.14	37.14	37.14	37.14	37.14	37.14
Hospital Outpatient								
Interim	-6.909**	-6.905**	-6.745**	-6.922**	-6.856**	-6.387**	-0.085*	-0.092*
	(2.777)	(2.793)	(2.823)	(2.786)	(2.779)	(2.730)	(0.045)	(0.051)
Post (2006, 2009)	-14.760***	-14.749***	-14.997***	-14.771***	-14.698***	-13.714***	-0.175***	-0.190***
	(2.870)	(2.892)	(2.924)	(2.897)	(2.864)	(2.644)	(0.049)	(0.056)
Pre-period mean	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51
N	55072	53328	53328	53328	55072	55072	55072	55072

NOTE: This table presents difference-in-difference regression coefficients of the effect of CON repeal in Missouri on episodes per 1000 enrollees (pooling cataract surgeries, colonoscopies, and gastrointestinal endoscopies) with various controls. The data is a zip-year panel from 1998 to 2013. Standard errors are clustered at the zip code level and reported in parentheses. All regressions control for zip code fixed effects and year fixed effects. * p <.1, ** p <.05, *** p<.01

Table B.9: Robustness of Patient Utilization, Cataract Surgery

	Controls						Functional form	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Baseline	Population Quartile by Year FE	Income Quartile by Year FE	Wealth Quartile by Year FE	Rural/Urban by Year FE	Matched Group by Year Trend	Log Linear	asinh-Linear
ASC and Hospital Outpatient								
Interim	-0.066	-0.089	-0.282	-0.107	-0.067	0.220	0.008	0.007
	(2.062)	(2.071)	(2.085)	(2.065)	(2.065)	(2.041)	(0.046)	(0.052)
Post (2006, 2009)	3.235	3.067	3.098	3.052	3.237	3.807**	0.076	0.082
	(2.131)	(2.131)	(2.151)	(2.125)	(2.133)	(1.936)	(0.048)	(0.055)
Pre-period mean	61.53	61.53	61.53	61.53	61.53	61.53	61.53	61.53
ASCs								
Interim	3.158**	2.917**	2.769**	2.923**	3.158**	3.238**	0.107**	0.118**
	(1.372)	(1.371)	(1.383)	(1.370)	(1.372)	(1.374)	(0.045)	(0.052)
Post (2006, 2009)	9.800***	9.449***	9.362***	9.450***	9.797***	9.959***	0.265***	0.292***
	(1.690)	(1.670)	(1.683)	(1.669)	(1.687)	(1.575)	(0.050)	(0.057)
Pre-period mean	28.85	28.85	28.85	28.85	28.85	28.85	28.85	28.85
Hospital Outpatient								
Interim	-3.224**	-3.006*	-3.051*	-3.030*	-3.226**	-3.018*	-0.055	-0.060
	(1.625)	(1.634)	(1.639)	(1.628)	(1.625)	(1.601)	(0.046)	(0.053)
Post (2006, 2009)	-6.564***	-6.382***	-6.264***	-6.398***	-6.561***	-6.152***	-0.243***	-0.277***
	(1.476)	(1.489)	(1.492)	(1.484)	(1.472)	(1.361)	(0.050)	(0.058)
Pre-period mean	32.68	32.68	32.68	32.68	32.68	32.68	32.68	32.68
N	55072	53328	53328	53328	55072	55072	55072	55072

NOTE: This table presents difference-in-difference regression coefficients of the effect of CON repeal in Missouri on cataract surgery episodes per 1000 enrollees with various controls. The data is a zip-year panel from 1998 to 2013. Standard errors are clustered at the zip code level and reported in parentheses. All regressions control for zip code fixed effects and year fixed effects. * p <.1, ** p <.05, *** p<.01

Table B.10: Robustness of Patient Utilization, Colonoscopies

		Controls					Functional form	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Baseline	Population Quartile by Year FE	Income Quartile by Year FE	Wealth Quartile by Year FE	Rural/Urban by Year FE	Matched Group by Year Trend	Log Linear	asinh-Linear
ASC and Hospital Outpatient								
Interim	-3.053**	-3.255**	-3.016**	-3.273**	-3.023**	-2.910*	-0.051	-0.056
	(1.501)	(1.498)	(1.510)	(1.496)	(1.497)	(1.494)	(0.043)	(0.049)
Post (2006, 2009)	0.039	0.075	-0.093	0.092	0.051	0.325	0.012	0.013
	(1.618)	(1.609)	(1.624)	(1.609)	(1.615)	(1.542)	(0.045)	(0.052)
Pre-period mean	57.87	57.87	57.87	57.87	57.87	57.87	57.87	57.87
ASCs								
Interim	0.553	0.536	0.686	0.512	0.544	0.558	0.087**	0.103**
	(0.687)	(0.691)	(0.695)	(0.692)	(0.683)	(0.681)	(0.037)	(0.043)
Post (2006, 2009)	5.489***	5.762***	6.025***	5.751***	5.460***	5.500***	0.394***	0.459***
	(0.932)	(0.922)	(0.926)	(0.921)	(0.921)	(0.880)	(0.048)	(0.056)
Pre-period mean	5.74	5.74	5.74	5.74	5.74	5.74	5.74	5.74
Hospital Outpatient								
Interim	-3.606**	-3.791***	-3.702**	-3.785***	-3.567**	-3.468**	-0.073	-0.079
	(1.439)	(1.438)	(1.451)	(1.437)	(1.440)	(1.417)	(0.045)	(0.051)
Post (2006, 2009)	-5.450***	-5.687***	-6.118***	-5.659***	-5.409***	-5.174***	-0.133***	-0.147***
	(1.561)	(1.549)	(1.553)	(1.550)	(1.560)	(1.464)	(0.048)	(0.055)
Pre-period mean	52.13	52.13	52.13	52.13	52.13	52.13	52.13	52.13
N	55072	53328	53328	53328	55072	55072	55072	55072

NOTE: This table presents difference-in-difference regression coefficients of the effect of CON repeal in Missouri on colonoscopies per 1000 enrollees with various controls. The data is a zip-year panel from 1998 to 2013. Standard errors are clustered at the zip code level and reported in parentheses. All regressions control for zip code fixed effects and year fixed effects. * p <.1, ** p <.05, *** p<.01

Table B.11: Robustness of Patient Utilization, Upper GI endoscopies

		Controls					Functional form	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Baseline	Population Quartile by Year FE	Income Quartile by Year FE	Wealth Quartile by Year FE	Rural/Urban by Year FE	Matched Group by Year Trend	Log Linear	asinh-Linear
ASC and Hospital Outpatient								
Interim	1.214	1.163	1.290	1.153	1.224	1.423	0.050	0.057
	(1.343)	(1.359)	(1.389)	(1.366)	(1.345)	(1.346)	(0.044)	(0.051)
Post (2006, 2009)	0.393	0.535	0.685	0.505	0.405	0.810	0.011	0.012
	(1.557)	(1.569)	(1.610)	(1.583)	(1.556)	(1.493)	(0.046)	(0.053)
Pre-period mean	35.25	35.25	35.25	35.25	35.25	35.25	35.25	35.25
ASCs								
Interim	1.294**	1.272**	1.282**	1.259**	1.288**	1.323**	0.096***	0.114***
	(0.530)	(0.531)	(0.548)	(0.534)	(0.532)	(0.541)	(0.030)	(0.036)
Post (2006, 2009)	3.139***	3.215***	3.299***	3.219***	3.133***	3.198***	0.303***	0.363***
	(0.647)	(0.643)	(0.641)	(0.643)	(0.646)	(0.637)	(0.039)	(0.046)
Pre-period mean	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55
Hospital Outpatient								
Interim	-0.079	-0.109	0.008	-0.106	-0.064	0.099	0.015	0.018
	(1.284)	(1.302)	(1.333)	(1.309)	(1.285)	(1.271)	(0.045)	(0.051)
Post (2006, 2009)	-2.746*	-2.680*	-2.615*	-2.714*	-2.728*	-2.388*	-0.099**	-0.112**
	(1.470)	(1.489)	(1.537)	(1.504)	(1.469)	(1.382)	(0.047)	(0.054)
Pre-period mean	32.70	32.70	32.70	32.70	32.70	32.70	32.70	32.70
N	55072	53328	53328	53328	55072	55072	55072	55072

NOTE: This table presents difference-in-difference regression coefficients of the effect of CON repeal in Missouri on upper gastrointestinal endoscopy episodes per 1000 enrollees with various controls. The data is a zip-year panel from 1998 to 2013. Standard errors are clustered at the zip code level and reported in parentheses. All regressions control for zip code fixed effects and year fixed effects. * p <.1, ** p <.05, *** p<.01

Table B.12: Robustness of Patient Utilization by Group

		Controls			Functional form	
	(1)	(2)	(3)	(4)	(5)	(6)
Main effects	Baseline	Population Quartile by Year FE	Wealth Quartile by Year FE	Matched Group by Year Trend	Log Linear	asinh-Linear
ASC						
Metropolitan & Above Med HH Inc	18.641***	20.500***	20.386***	19.170***	0.318***	0.331***
	(3.656)	(3.596)	(3.599)	(3.599)	(0.100)	(0.114)
Metropolitan & Below Med HH Inc	1.241	1.407	1.278	0.804	0.081	0.085
	(4.326)	(4.331)	(4.324)	(4.305)	(0.120)	(0.138)
Micropolitan	25.903***	25.454***	25.517***	26.961***	0.691***	0.767***
	(6.094)	(6.088)	(6.091)	(5.355)	(0.133)	(0.152)
Rural	22.048***	20.939***	20.984***	22.047***	0.550***	0.614***
	(3.649)	(3.599)	(3.600)	(3.459)	(0.090)	(0.103)
Hospitals						
Metropolitan & Above Med HH Inc	-11.641**	-10.673**	-10.515**	-11.793**	-0.017	-0.009
	(5.236)	(5.143)	(5.137)	(4.837)	(0.096)	(0.108)
Metropolitan & Below Med HH Inc	-0.684	-0.973	-0.800	2.407	-0.047	-0.052
	(5.666)	(5.679)	(5.668)	(5.356)	(0.105)	(0.118)
Micropolitan	-27.512***	-27.848***	-27.995***	-27.664***	-0.420***	-0.462***
	(6.051)	(6.138)	(6.167)	(5.468)	(0.101)	(0.113)
Rural	-16.610***	-16.796***	-16.942***	-15.182***	-0.208**	-0.229**
	(5.253)	(5.311)	(5.325)	(4.898)	(0.088)	(0.099)
Combined						
Metropolitan & Above Med HH Inc	7.000	9.827	9.871	7.377	0.112	0.122
	(6.132)	(6.038)	(6.032)	(5.638)	(0.086)	(0.096)
Metropolitan & Below Med HH Inc	0.557	0.435	0.477	3.211	0.018	0.022
	(6.445)	(6.460)	(6.446)	(6.068)	(0.095)	(0.107)
Micropolitan	-1.610	-2.394	-2.478	-0.703	0.001	0.002
	(7.756)	(7.852)	(7.863)	(6.991)	(0.098)	(0.109)
Rural	5.438	4.142	4.042	6.865	0.030	0.029
	(5.794)	(5.804)	(5.818)	(5.396)	(0.080)	(0.090)
N	55072	53328	53328	55072	55072	55072
Baseline means						
Metropolitan & Above Med HH Inc	162.11					
Metropolitan & Below Med HH Inc	132.13					
Micropolitan	163.99					
Rural	155.75					

NOTE: This table presents heterogeneity in the main effects from 2006-2009 of difference-in-difference regressions of the effect of CON repeal in Missouri on episodes per 1000 enrollees. The data is a zip-year panel from 1998 to 2013. Standard errors are clustered at the zip code level and reported in parentheses. All regressions control for zip code fixed effects, year fixed effects, and urban/rural by year fixed effects.* p <.1, ** p <.05, *** p<.01

Table B.13: Robustness of Patient Utilization by Group, Cataract Surgeries

		Controls			Functional form	
	(1)	(2)	(3)	(4)	(5)	(6)
Main effects	Baseline	Population Quartile by Year FE	Wealth Quartile by Year FE	Matched Group by Year Trend	Log Linear	asinh-Linear
ASC						
Metropolitan & Above Med HH Inc	5.926**	6.516**	6.468**	6.873***	0.121	0.124
	(2.650)	(2.652)	(2.662)	(2.589)	(0.086)	(0.100)
Metropolitan & Below Med HH Inc	5.510	5.536*	5.521*	4.336	0.066	0.060
	(3.340)	(3.343)	(3.341)	(3.210)	(0.113)	(0.130)
Micropolitan	13.606***	12.915***	12.965***	14.600***	0.426***	0.474***
	(4.895)	(4.933)	(4.932)	(4.257)	(0.127)	(0.146)
Rural	12.230***	11.249***	11.279***	12.047***	0.363***	0.410***
	(2.787)	(2.682)	(2.684)	(2.697)	(0.081)	(0.093)
Hospitals						
Metropolitan & Above Med HH Inc	1.290	2.136	2.142	1.027	0.206**	0.245**
	(2.424)	(2.431)	(2.430)	(2.264)	(0.093)	(0.108)
Metropolitan & Below Med HH Inc	-1.372	-1.415	-1.411	-0.128	-0.047	-0.053
	(3.367)	(3.379)	(3.364)	(2.860)	(0.115)	(0.134)
Micropolitan	-15.519***	-15.827***	-15.869***	-15.071***	-0.558***	-0.637***
	(3.513)	(3.534)	(3.532)	(3.202)	(0.119)	(0.138)
Rural	-9.312***	-9.130***	-9.161***	-8.853***	-0.453***	-0.525***
	(2.554)	(2.578)	(2.579)	(2.429)	(0.082)	(0.094)
Combined						
Metropolitan & Above Med HH Inc	7.217**	8.652**	8.609**	7.899**	0.277***	0.312***
	(3.599)	(3.617)	(3.625)	(3.334)	(0.089)	(0.102)
Metropolitan & Below Med HH Inc	4.138	4.121	4.110	4.207	0.129	0.145
	(4.422)	(4.426)	(4.409)	(3.923)	(0.106)	(0.120)
Micropolitan	-1.913	-2.912	-2.904	-0.471	-0.005	-0.009
	(5.816)	(5.860)	(5.854)	(5.070)	(0.110)	(0.125)
Rural	2.917	2.119	2.117	3.194	-0.033	-0.043
	(3.542)	(3.506)	(3.507)	(3.310)	(0.082)	(0.094)
N	55072	53328	53328	55072	55072	55072
Baseline means						
Metropolitan & Above Med HH Inc	61.77					
Metropolitan & Below Med HH Inc	50.82					
Micropolitan	67.15					
Rural	63.70					

NOTE: This table presents heterogeneity in the main effects from 2006-2009 of difference-in-difference regressions of the effect of CON repeal in Missouri on cataract surgery episodes per 1000 enrollees. The data is a zip-year panel from 1998 to 2013. Standard errors are clustered at the zip code level and reported in parentheses. All regressions control for zip code fixed effects, year fixed effects, and urban/rural by year fixed effects.* p <.1, ** p <.05, *** p<.01

Table B.14: Robustness of Patient Utilization by Group, Gastroenterology

	Colonoscopy						Upper GI Endoscopy					
		Controls			Functional form			Controls			Functional form	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Main effects	Baseline	Population Quartile by Year FE	Wealth Quartile by Year FE	Matched Group by Year Trend	Log Linear	asinh-Linear	Baseline	Population Quartile by Year FE	Wealth Quartile by Year FE	Matched Group by Year Trend	Log Linear	asinh-Linear
ASC												
Metropolitan & Above Med HH Inc	8.618***	9.625***	9.590***	8.324***	0.605***	0.693***	4.097***	4.359***	4.328***	3.973***	0.482***	0.574***
	(1.729)	(1.688)	(1.686)	(1.683)	(0.099)	(0.117)	(1.079)	(1.016)	(1.015)	(1.117)	(0.080)	(0.096)
Metropolitan & Below Med HH Inc	-3.197*	-3.124	-3.192*	-2.808	-0.036	-0.026	-1.072	-1.004	-1.051	-0.724	0.068	0.093
	(1.917)	(1.905)	(1.903)	(1.951)	(0.108)	(0.127)	(1.273)	(1.275)	(1.274)	(1.309)	(0.091)	(0.110)
Micropolitan	10.139***	10.272***	10.250***	10.176***	0.495***	0.570***	2.157	2.267	2.301	2.185	0.244***	0.290***
	(2.595)	(2.564)	(2.562)	(2.474)	(0.112)	(0.130)	(1.488)	(1.474)	(1.484)	(1.486)	(0.094)	(0.111)
Rural	4.953***	4.883***	4.878***	5.045***	0.396***	0.466***	4.866***	4.806***	4.828***	4.954***	0.324***	0.384***
	(1.374)	(1.382)	(1.385)	(1.313)	(0.070)	(0.082)	(1.188)	(1.202)	(1.201)	(1.165)	(0.055)	(0.065)
Hospitals												
Metropolitan & Above Med HH Inc	-7.256***	-7.982***	-7.867***	-6.729**	-0.069	-0.064	-5.675**	-4.826**	-4.790**	-6.091***	-0.147*	-0.160
	(2.786)	(2.622)	(2.619)	(2.646)	(0.086)	(0.098)	(2.456)	(2.364)	(2.361)	(2.290)	(0.086)	(0.099)
Metropolitan & Below Med HH Inc	1.922	1.832	1.923	2.400	-0.002	-0.000	-1.235	-1.390	-1.313	0.135	-0.056	-0.061
	(3.312)	(3.284)	(3.284)	(3.299)	(0.101)	(0.115)	(2.270)	(2.271)	(2.271)	(2.459)	(0.101)	(0.117)
Micropolitan	-8.979***	-8.530***	-8.545***	-9.360***	-0.337***	-0.382***	-3.014	-3.491	-3.580	-3.233	-0.230**	-0.263**
	(3.212)	(3.226)	(3.237)	(3.036)	(0.111)	(0.127)	(3.530)	(3.555)	(3.566)	(3.031)	(0.109)	(0.126)
Rural	-5.891**	-6.177**	-6.206**	-5.578**	-0.131	-0.147	-1.407	-1.489	-1.575	-0.750	-0.021	-0.025
	(2.854)	(2.866)	(2.871)	(2.660)	(0.086)	(0.099)	(2.770)	(2.826)	(2.855)	(2.679)	(0.082)	(0.095)
Combined												
Metropolitan & Above Med HH Inc	1.362	1.643	1.723	1.595	0.097	0.114	-1.578	-0.467	-0.462	-2.117	0.005	0.010
	(2.853)	(2.718)	(2.709)	(2.772)	(0.080)	(0.091)	(2.698)	(2.535)	(2.528)	(2.586)	(0.081)	(0.093)
Metropolitan & Below Med HH Inc	-1.274	-1.293	-1.269	-0.408	-0.066	-0.072	-2.307	-2.394	-2.364	-0.589	-0.084	-0.093
	(3.386)	(3.381)	(3.383)	(3.439)	(0.094)	(0.108)	(2.556)	(2.555)	(2.554)	(2.770)	(0.102)	(0.118)
Micropolitan	1.160	1.742	1.705	0.816	-0.014	-0.018	-0.856	-1.224	-1.279	-1.048	-0.119	-0.137
	(3.691)	(3.695)	(3.697)	(3.601)	(0.103)	(0.117)	(3.767)	(3.791)	(3.803)	(3.369)	(0.106)	(0.121)
Rural	-0.938	-1.294	-1.328	-0.533	0.003	0.001	3.459	3.317	3.253	4.205	0.126	0.139
	(2.889)	(2.900)	(2.903)	(2.710)	(0.082)	(0.094)	(2.868)	(2.924)	(2.953)	(2.819)	(0.080)	(0.092)
N	55072	53328	53328	55072	55072	55072	55072	53328	53328	55072	55072	55072
Baseline means												
Metropolitan & Above Med HH Inc	63.12						37.21					
Metropolitan & Below Med HH Inc	49.64						31.66					
Micropolitan	56.61						40.23					
Rural	58.97						33.09					

NOTE: This table presents heterogeneity in the main effects from 2006-2009 of difference-in-difference regressions of the effect of CON repeal in Missouri on colonoscopy and upper endoscopy episodes per 1000 enrollees. The data is a zip-year panel from 1998 to 2013. Standard errors are clustered at the zip code level and reported in parentheses. All regressions control for zip code fixed effects, year fixed effects, and urban/rural by year fixed effects.* p <.1, ** p <.05, *** p<.01

Table B.15: Summary Statistics: Choice Sample

	Cataract Surgeries		Colonoscopies		Upper GI Endoscopies	
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
ASC	0.56	0.50	0.26	0.44	0.24	0.43
Drive time (minutes)	49.12	43.87	41.89	46.38	43.44	36.71
Transit access	0.25	0.44	0.29	0.45	0.27	0.45
Surgeon age	49.05	8.42	49.98	8.15	49.71	8.44
Medicare surgeon volume (last year)	326.15	237.66	183.02	139.81	104.08	78.99
Complication in 30 days	0.01	0.11	0.01	0.08	0.00	0.04
Patient age	76.92	6.53	74.42	6.32	75.88	6.91
Elixhauser risk score	2.70	2.30	2.82	2.31	3.61	2.66
Female	0.64	0.48	0.57	0.49	0.62	0.49
Medicaid	0.07	0.25	0.05	0.21	0.07	0.25
Nonwhite	0.04	0.21	0.06	0.24	0.05	0.23
Number of episodes	47,678		49,454		26,900	

NOTE: This table presents summary statistics of the choice sample used for demand estimation.

Table B.16: Demand estimates with demographic by ASC interactions

	(1)	(2)	(3)	(4)	(5)	(6)
	Cataract Surgeries		Colonoscopies		Upper GI Endoscopies	
Drive time (hours)	-3.034***	-3.041***	-3.364***	-3.429***	-3.180***	-3.142***
	(0.0318)	(0.0318)	(0.0306)	(0.0368)	(0.0513)	(0.0532)
Drive time squared	0.0431***	0.0341***	0.0557***	0.0890***	0.0482**	0.0390*
	(0.0116)	(0.0112)	(0.0113)	(0.0149)	(0.0211)	(0.0219)
Transit access	0.323***	0.275***	0.376***	0.376***	0.294***	0.314***
	(0.0362)	(0.0374)	(0.0367)	(0.0382)	(0.0505)	(0.0524)
Complication rate (date-365)		0.996***		0.671		2.062
		(0.362)		(0.435)		(1.714)
ASC x Medicaid	-0.274***	-0.288***	-0.138*	-0.183**	-0.0925	-0.112
	(0.0526)	(0.0550)	(0.0816)	(0.0838)	(0.0914)	(0.0941)
ASC x Elixhauser	-0.0473***	-0.0448***	-0.0125**	-0.0127**	-0.0491***	-0.0472***
	(0.00553)	(0.00577)	(0.00628)	(0.00642)	(0.00758)	(0.00775)
ASC x Age	-0.00718***	-0.00767***	-0.0142***	-0.0136***	-0.00753***	-0.00745**
	(0.00192)	(0.00202)	(0.00235)	(0.00241)	(0.00290)	(0.00297)
ASC xFemale	-0.0224	-0.0328	-0.0133	-0.00808	0.00267	-0.00179
	(0.0258)	(0.0271)	(0.0286)	(0.0294)	(0.0399)	(0.0409)
ASC x Nonwhite	-0.820***	-0.762***	-0.649***	-0.625***	-0.366***	-0.372***
	(0.0573)	(0.0599)	(0.0655)	(0.0666)	(0.0929)	(0.0946)
Surgeon age	0.917***	0.887***	1.308***	1.296***	1.732***	1.750***
	(0.0252)	(0.0278)	(0.0297)	(0.0323)	(0.0472)	(0.0512)
Surgeon age squared	-0.00395***	-0.00359***	-0.00350***	-0.00333***	-0.00277***	-0.00270***
	(0.000304)	(0.000338)	(0.000328)	(0.000364)	(0.000441)	(0.000489)
Surgeon age x Medicaid	-0.0114***	-0.0102***	-0.0112***	-0.0109***	-0.00175	-0.00149
	(0.00276)	(0.00287)	(0.00381)	(0.00394)	(0.00420)	(0.00435)
Surgeon age x Elixhauser	-0.0000255	0.0000648	-0.00228***	-0.00226***	-0.00236***	-0.00237***
	(0.000279)	(0.000288)	(0.000317)	(0.000326)	(0.000371)	(0.000383)
Surgeon age x Age	0.000652***	0.000642***	0.000910***	0.000891***	0.000409***	0.000351**
	(0.0000983)	(0.000102)	(0.000116)	(0.000120)	(0.000140)	(0.000145)
Surgeon age x Female	0.00364***	0.00336**	-0.00761***	-0.00765***	-0.00227	-0.00311
	(0.00132)	(0.00137)	(0.00142)	(0.00147)	(0.00194)	(0.00200)
Surgeon age x Nonwhite	-0.00618**	-0.00859***	-0.0233***	-0.0232***	-0.0141***	-0.0152***
	(0.00294)	(0.00304)	(0.00329)	(0.00339)	(0.00475)	(0.00488)
Surgeon-facility-time FE	Yes	Yes	Yes	Yes	Yes	Yes
Drive time by Demog. & Health Ixns	Yes	Yes	Yes	Yes	Yes	Yes
Transit access by Demog. & Health Ixns	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R2	0.366	0.365	0.419	0.418	0.465	0.459
Observations	2107426	1955175	3055228	2870502	1305413	1235905

NOTE: Standard errors, clustered by zip code, in parentheses. * p < .1 ** p < .05 *** p <.01

Table B.17: Consumers benefit $2.59 while Medicare saves $153 from deregulation

	(1)	(2)		(3)		(4)	(5)	(6)		(7)
Procedure	ΔASC	Comp. variation (minutes)	$	ΔDrive time (minutes)	$	ΔTransit Access	ΔSurgeon volume	ΔExpected complication	$	ΔInsurer Cost ($)
Roll back entry										
Overall	0.24	15.88	5.03	-7.09	-2.24	-0.004	-87.29	0.00040	0.14	-270.53
Cataract surgery	0.39	30.09	9.53	-11.82	-3.74	0.002	-222.74	0.00106	0.35	-592.60
Colonoscopy	0.14	7.18	2.27	-4.43	-1.40	-0.006	-7.96	0.00002	0.02	-75.45
Upper GI Endoscopy	0.17	8.20	2.60	-4.06	-1.29	-0.010	-7.28	0.00002	0.04	-92.56
Roll back entry + surgeon relocation										
Overall	0.16	8.19	2.59	-3.30	-1.04	-0.013	-22.35	0.00015	0.17	-153.11
Cataract surgery	0.18	10.49	3.32	-3.38	-1.07	-0.022	-51.04	0.00037	0.47	-275.04
Colonoscopy	0.14	6.44	2.04	-3.20	-1.01	-0.007	-4.94	0.00001	0.02	-77.41
Upper GI Endoscopy	0.16	7.60	2.41	-3.35	-1.06	-0.011	-6.55	0.00002	0.03	-89.25

NOTE: This table compares the mean impact of changing patients' choice sets on consumer welfare, drive time, transit access, surgeon volume, expected complication, and Medicare reimbursement using observed episodes of cataract surgery, colonoscopy, and upper GI endoscopy between 2006-2009. Rolling back entry deletes any surgeon-facility alternative not in the 1998-2001 choice set. Surgeon relocation adds back in surgeon-facilities from the 1998-2001 choice set where the surgeons affected by ASC removal who used to work. Surgeon volume in the last 12 months is calculated on data from 2007-2009 because the variable requires a one-year lag. Expected complication rates are calculated using estimates from a probit with log specification on surgeon volume.

Table B.18: Poor consumers benefit less, but save Medicare similarly to others

	(1)	(2)		(3)		(4)	(5)	(6)		(7)
Procedure	ΔASC	Comp. variation (minutes)	$	ΔDrive time (minutes)	$	ΔTransit Access	ΔSurgeon volume	ΔExpected comp.	$	ΔInsurer Cost ($)
Mean										
Overall	0.16	8.19	2.59	-3.30	-1.04	-0.013	-22.35	0.0001	0.18	-153.11
Geography										
Metropolitan	0.16	8.56	2.71	-1.60	-0.51	-0.024	-22.39	0.0002	0.19	-150.62
Micropolitan	0.20	8.83	2.80	-9.44	-2.99	0.028	-28.46	0.0002	0.24	-201.58
Rural	0.10	5.84	1.85	-5.89	-1.86	0.000	-16.67	0.0001	0.12	-121.49
ZIP Code Income										
0-25%	0.15	3.70	1.17	-3.03	-0.96	-0.004	-19.36	0.0002	0.20	-155.52
25-50%	0.13	10.54	3.34	-6.76	-2.14	0.008	-23.22	0.0001	0.16	-126.01
50-75%	0.12	8.13	2.57	-2.86	-0.91	-0.019	-33.84	0.0002	0.20	-110.07
75-100%	0.18	8.44	2.67	-1.30	-0.41	-0.029	-27.51	0.0002	0.25	-161.74
Insurance										
Medicaid	0.15	5.53	1.75	-3.82	-1.21	-0.004	-24.24	0.0002	0.19	-156.71
Non-Medicaid	0.16	8.34	2.64	-3.27	-1.03	-0.014	-22.24	0.0001	0.18	-152.91
Race										
White	0.16	8.34	2.64	-3.45	-1.09	-0.01	-22.41	0.0001	0.17	-154.37
Nonwhite	0.14	5.63	1.78	-0.71	-0.22	-0.01	-21.23	0.0004	0.47	-131.19
Mean in Top/Bottom 10%										
Overall	0.00	0.10	0.03	3.78	1.20	-0.027	-97.40	0.0009	1.10	0.00
Geography										
Metropolitan	0.00	0.64	0.20	3.49	1.10	-0.083	-89.58	0.0009	1.13	-1.27
Micropolitan	0.00	-4.91	-1.56	4.36	1.38	0.000	-136.98	0.0010	1.23	0.00
Rural	-0.01	-3.13	-0.99	5.87	1.86	0.000	-97.53	0.0007	0.85	4.43
ZIP Code Income										
0-25%	0.00	-6.86	-2.17	5.06	1.60	0.000	-93.32	0.0007	0.89	0.00
25-50%	0.00	0.08	0.02	4.19	1.33	-0.005	-78.90	0.0007	0.93	0.00
50-75%	0.00	0.16	0.05	3.21	1.02	-0.042	-141.85	0.0009	1.09	0.00
75-100%	0.01	0.76	0.24	4.51	1.43	-0.111	-147.29	0.0011	1.37	-7.47
Insurance										
Medicaid	0.00	-0.59	-0.19	3.99	1.26	-0.008	-104.83	0.0009	1.11	0.00
Non-Medicaid	0.00	0.11	0.04	3.77	1.19	-0.027	-96.75	0.0009	1.10	0.00
Race										
White	0.00	0.09	0.03	3.80	1.20	-0.026	-98.06	0.0009	1.07	0.00
Nonwhite	0.00	0.27	0.09	3.31	1.05	-0.061	-73.46	0.0014	1.72	-2.53

NOTE: This table compares the mean impact of changing patients' choice sets on consumer welfare, drive time, transit access, surgeon volume, expected complication, and Medicare reimbursement using observed episodes of cataract surgery, colonoscopy, and upper GI endoscopy between 2006-2009. Rolling back entry deletes any surgeon-facility alternative not in the 1998-2001 choice set. Surgeon relocation adds back in surgeon-facilities from the 1998-2001 choice set where the surgeons affected by ASC removal who used to work. Surgeon volume in the last 12 months is calculated on data from 2007-2009 because the variable requires a one-year lag. Expected complication rates are calculated using estimates from a probit with log specification on surgeon volume.

Table B.19: Healthy and younger patients benefit more than sicker and older patients

Procedure	(1) ΔASC	(2) Comp. variation (minutes)	$	(3) ΔDrive time (minutes)	$	(4) ΔTransit Access	(5) ΔSurgeon volume	(6) ΔExpected comp.	$	(7) ΔInsurer Cost ($)
Mean										
Overall	0.16	8.19	2.59	-3.30	-1.04	-0.013	-22.35	0.0001	0.18	-153.11
Age										
65-69	0.17	8.94	2.83	-3.24	-1.02	-0.014	-23.64	0.0002	0.21	-157.93
70-74	0.16	8.33	2.64	-3.23	-1.02	-0.014	-21.68	0.0001	0.18	-149.43
75-79	0.16	8.18	2.59	-3.39	-1.07	-0.014	-23.25	0.0002	0.25	-157.95
80-84	0.16	7.89	2.50	-3.17	-1.00	-0.011	-22.94	0.0001	0.13	-156.52
85+	0.15	7.40	2.34	-3.51	-1.11	-0.011	-19.39	0.0001	0.11	-139.84
Elixhauser										
Q1	0.16	8.03	2.54	-3.59	-1.14	-0.012	-17.59	0.0002	0.20	-122.76
Q2	0.16	8.16	2.58	-3.03	-0.96	-0.014	-24.28	0.0003	0.31	-152.16
Q3	0.17	9.23	2.92	-3.41	-1.08	-0.018	-31.86	0.0003	0.34	-190.93
Q4	0.15	7.55	2.39	-3.43	-1.09	-0.011	-15.51	0.0001	0.09	-129.10
Q5	0.16	7.66	2.42	-2.97	-0.94	-0.010	-19.94	-0.0001	-0.08	-163.25
Mean in Top/Bottom 10%										
Overall	0.00	0.10	0.03	3.78	1.20	-0.027	-97.40	0.0009	1.10	0.00
Age										
65-69	0.00	0.15	0.05	3.92	1.24	-0.027	-99.28	0.0009	1.07	-0.03
70-74	0.00	0.13	0.04	3.82	1.21	-0.026	-95.43	0.0008	1.02	0.00
75-79	0.00	0.09	0.03	3.75	1.19	-0.027	-103.58	0.0011	1.35	0.00
80-84	0.00	0.08	0.03	3.83	1.21	-0.026	-101.90	0.0008	1.03	0.00
85+	0.00	0.07	0.02	3.52	1.12	-0.026	-87.15	0.0007	0.93	0.00
Elixhauser										
Q1	0.00	0.10	0.03	3.58	1.13	-0.024	-73.40	0.0008	1.00	0.00
Q2	0.00	0.09	0.03	3.91	1.24	-0.028	-101.28	0.0012	1.45	0.00
Q3	0.00	0.13	0.04	4.54	1.44	-0.038	-162.71	0.0011	1.43	0.00
Q4	0.00	0.09	0.03	3.15	1.00	-0.026	-68.37	0.0004	0.49	0.00
Q5	0.00	0.09	0.03	3.51	1.11	-0.021	-93.34	0.0005	0.68	0.00

NOTE: This table compares the mean impact of changing patients' choice sets on consumer welfare, drive time, transit access, surgeon volume, expected complication, and Medicare reimbursement using observed episodes of cataract surgery, colonoscopy, and upper GI endoscopy between 2006-2009. Rolling back entry deletes any surgeon-facility alternative not in the 1998-2001 choice set. Surgeon relocation adds back in surgeon-facilities from the 1998-2001 choice set where the surgeons affected by ASC removal who used to work. Surgeon volume in the last 12 months is calculated on data from 2007-2009 because the variable requires a one-year lag. Expected complication rates are calculated using estimates from a probit with log specification on surgeon volume.

Table B.20: Average consumer welfare trade-offs, with demographic by ASC interactions

Procedure	(1) ΔASC	(2) Comp. variation (minutes)	$	(3) ΔDrive time (minutes)	$	(4) ΔTransit Access	(5) ΔSurgeon volume	(6) ΔExpected complication	$	(7) ΔInsurer Cost ($)
Roll back entry										
Overall	0.23	15.98	5.06	-7.09	-2.24	-0.004	-87.29	0.00040	0.13	-269.33
Cataract surgery	0.39	30.29	9.59	-11.84	-3.75	0.003	-222.33	0.00106	0.35	-590.20
Colonoscopy	0.13	7.22	2.29	-4.42	-1.40	-0.006	-8.33	0.00001	0.02	-74.79
Upper GI Endoscopy	0.17	8.23	2.61	-4.05	-1.28	-0.010	-7.28	0.00002	0.03	-92.38
Roll back entry + surgeon relocation										
Overall	0.16	8.26	2.61	-3.29	-1.04	-0.013	-22.69	0.00015	0.17	-152.29
Cataract surgery	0.18	10.61	3.36	-3.40	-1.08	-0.021	-51.60	0.00037	0.47	-273.51
Colonoscopy	0.14	6.47	2.05	-3.17	-1.00	-0.007	-5.27	0.00001	0.01	-76.86
Upper GI Endoscopy	0.16	7.63	2.42	-3.35	-1.06	-0.011	-6.53	0.00002	0.02	-89.11

NOTE: This table compares the mean impact of changing patients' choice sets on consumer welfare, drive time, transit access, surgeon volume, expected complication, and Medicare reimbursement using observed episodes of cataract surgery, colonoscopy, and upper GI endoscopy between 2006-2009. Rolling back entry deletes any surgeon-facility alternative not in the 1998-2001 choice set. Surgeon relocation adds back in surgeon-facilities from the 1998-2001 choice set where the surgeons affected by ASC removal who used to work. Surgeon volume in the last 12 months is calculated on data from 2007-2009 because the variable requires a one-year lag. Expected complication rates are calculated using estimates from a probit with log specification on surgeon volume.

Table B.21: Robustness of heterogeneous trade-offs by demographics to demographic by ASC interactions

	(1)	(2)		(3)		(4)	(5)	(6)		(7)
Procedure	ΔASC	Comp. variation (minutes)	$	ΔDrive time (minutes)	$	ΔTransit Access	ΔSurgeon volume	ΔExpected comp.	$	ΔInsurer Cost ($)
Mean										
Overall	0.16	8.26	2.61	-3.29	-1.04	-0.013	-22.69	0.0004	0.50	-152.29
Geography										
Metropolitan	0.16	8.64	2.73	-1.60	-0.51	-0.023	-22.81	0.0005	0.69	-149.50
Micropolitan	0.20	8.87	2.81	-9.44	-2.99	0.028	-28.53	0.0001	0.19	-201.50
Rural	0.10	5.89	1.86	-5.88	-1.86	0.000	-16.83	-0.0001	-0.10	-121.43
ZIP Code Income										
0-25%	0.15	3.64	1.15	-3.04	-0.96	-0.003	-18.98	0.0001	0.14	-153.94
25-50%	0.13	10.55	3.34	-6.75	-2.14	0.008	-23.63	0.0002	0.27	-125.68
50-75%	0.12	8.18	2.59	-2.85	-0.90	-0.019	-34.27	0.0005	0.59	-109.12
75-100%	0.18	8.56	2.71	-1.29	-0.41	-0.029	-28.12	0.0007	0.87	-161.09
Insurance										
Medicaid	0.15	4.93	1.56	-3.90	-1.23	-0.003	-23.07	0.0002	0.24	-153.73
Non-Medicaid	0.16	8.45	2.67	-3.26	-1.03	-0.014	-22.67	0.0004	0.52	-152.20
Race										
White	0.16	8.49	2.69	-3.44	-1.09	-0.013	-22.98	0.0004	0.48	-153.99
Nonwhite	0.12	4.25	1.35	-0.81	-0.26	-0.005	-17.61	0.0008	0.94	-122.59
Mean in Top/Bottom 10%										
Overall	0.00	0.10	0.03	3.78	1.20	-0.026	-98.18	0.0017	2.08	0.00
Geography										
Metropolitan	0.00	0.59	0.19	3.54	1.12	-0.077	-90.77	0.0022	2.71	-1.20
Micropolitan	0.00	-4.78	-1.51	4.40	1.39	0.000	-133.11	0.0011	1.36	0.00
Rural	-0.01	-2.98	-0.94	5.89	1.86	0.000	-97.72	0.0008	1.04	5.24
ZIP Code Income										
0-25%	0.00	-6.40	-2.03	4.80	1.52	0.000	-92.86	0.0008	1.06	0.00
25-50%	0.00	0.08	0.02	4.19	1.33	-0.005	-80.12	0.0012	1.45	0.00
50-75%	0.00	0.14	0.05	3.30	1.05	-0.041	-137.19	0.0016	2.01	0.00
75-100%	0.01	0.72	0.23	4.52	1.43	-0.108	-148.27	0.0028	3.53	-7.54
Insurance										
Medicaid	0.00	-0.94	-0.30	3.75	1.19	-0.007	-104.65	0.0011	1.43	0.00
Non-Medicaid	0.00	0.11	0.04	3.78	1.20	-0.027	-97.74	0.0017	2.11	0.00
Race										
White	0.00	0.10	0.03	3.84	1.22	-0.026	-100.01	0.0016	2.00	0.00
Nonwhite	0.00	0.18	0.06	2.71	0.86	-0.043	-65.64	0.0026	3.21	-1.73

NOTE: This table compares the mean impact of changing patients' choice sets on consumer welfare, drive time, transit access, surgeon volume, expected complication, and Medicare reimbursement using observed episodes of cataract surgery, colonoscopy, and upper GI endoscopy between 2006-2009. Rolling back entry deletes any surgeon-facility alternative not in the 1998-2001 choice set. Surgeon relocation adds back in surgeon-facilities from the 1998-2001 choice set where the surgeons affected by ASC removal who used to work. Surgeon volume in the last 12 months is calculated on data from 2007-2009 because the variable requires a one-year lag. Expected complication rates are calculated using estimates from a probit with log specification on surgeon volume.

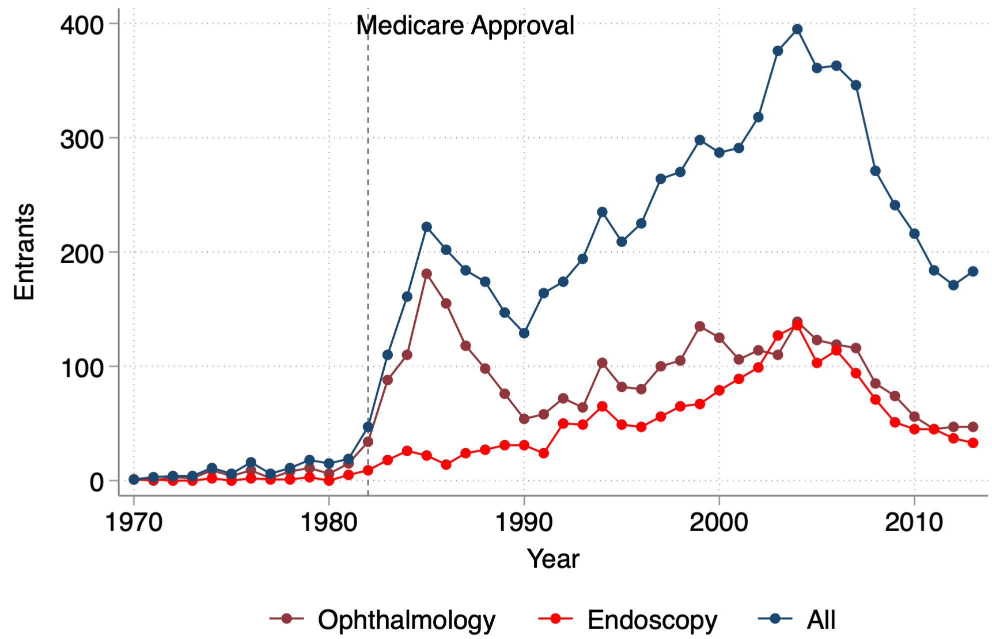
Table B.22: Robustness of heterogeneous trade-offs by health to demographic by ASC interactions

	(1)	(2)		(3)		(4)	(5)	(6)		(7)
Procedure	ΔASC	Comp. variation (minutes)	$	ΔDrive time (minutes)	$	ΔTransit Access	ΔSurgeon volume	ΔExpected comp.	$	ΔInsurer Cost ($)
Mean										
Overall	0.16	8.26	2.61	-3.29	-1.04	-0.013	-22.69	0.0001	0.18	-152.29
Age										
65-69	0.17	9.00	2.85	-3.22	-1.02	-0.014	-23.96	0.0002	0.21	-157.08
70-74	0.16	8.39	2.66	-3.24	-1.02	-0.014	-21.98	0.0001	0.18	-148.51
75-79	0.16	8.25	2.61	-3.38	-1.07	-0.014	-23.67	0.0002	0.25	-156.96
80-84	0.15	7.97	2.52	-3.18	-1.01	-0.011	-23.27	0.0001	0.13	-155.81
85+	0.15	7.45	2.36	-3.52	-1.11	-0.011	-19.69	0.0001	0.11	-139.41
Elixhauser										
Q1	0.15	8.08	2.56	-3.57	-1.13	-0.012	-17.96	0.0002	0.20	-122.32
Q2	0.16	8.22	2.60	-3.03	-0.96	-0.013	-24.57	0.0002	0.31	-151.35
Q3	0.17	9.31	2.95	-3.41	-1.08	-0.018	-32.27	0.0003	0.34	-190.01
Q4	0.15	7.60	2.41	-3.43	-1.09	-0.011	-15.80	0.0001	0.09	-128.25
Q5	0.15	7.73	2.45	-2.97	-0.94	-0.009	-20.24	-0.0001	-0.09	-162.11
Mean in Top/Bottom 10%										
Overall	0.00	0.10	0.03	3.78	1.20	-0.026	-98.18	0.0009	1.11	0.00
Age										
65-69	0.00	0.15	0.05	3.96	1.25	-0.027	-100.61	0.0009	1.07	-0.03
70-74	0.00	0.12	0.04	3.80	1.20	-0.026	-96.37	0.0008	1.02	0.00
75-79	0.00	0.09	0.03	3.76	1.19	-0.026	-104.19	0.0011	1.35	0.00
80-84	0.00	0.08	0.03	3.83	1.21	-0.025	-102.35	0.0008	1.03	0.00
85+	0.00	0.07	0.02	3.54	1.12	-0.024	-86.62	0.0007	0.94	0.00
Elixhauser										
Q1	0.00	0.10	0.03	3.68	1.17	-0.023	-74.01	0.0008	1.00	0.00
Q2	0.00	0.09	0.03	3.91	1.24	-0.027	-102.04	0.0012	1.45	0.00
Q3	0.00	0.13	0.04	4.53	1.44	-0.037	-165.00	0.0012	1.45	0.00
Q4	0.00	0.09	0.03	3.21	1.02	-0.025	-69.28	0.0004	0.49	0.00
Q5	0.00	0.09	0.03	3.47	1.10	-0.021	-94.87	0.0005	0.65	0.00

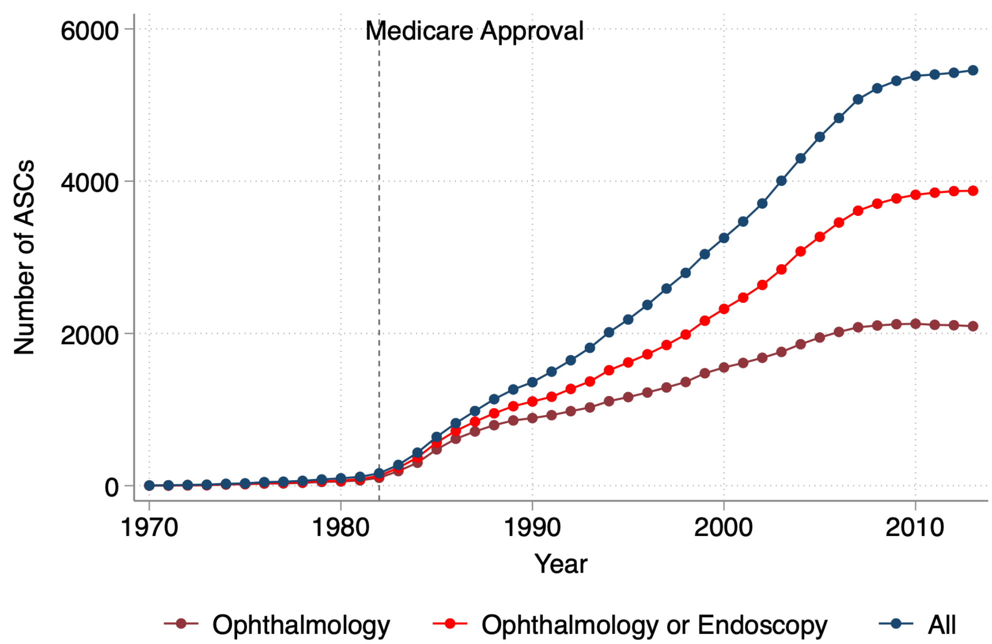
NOTE: This table compares the mean impact of changing patients' choice sets on consumer welfare, drive time, transit access, surgeon volume, expected complication, and Medicare reimbursement using observed episodes of cataract surgery, colonoscopy, and upper GI endoscopy between 2006-2009. Rolling back entry deletes any surgeon-facility alternative not in the 1998-2001 choice set. Surgeon relocation adds back in surgeon-facilities from the 1998-2001 choice set where the surgeons affected by ASC removal who used to work. Surgeon volume in the last 12 months is calculated on data from 2007-2009 because the variable requires a one-year lag. Expected complication rates are calculated using estimates from a probit with log specification on surgeon volume.

Figure B.1: Prevalence of Ambulatory Surgery Centers Over Time

(a) ASC Openings by Year



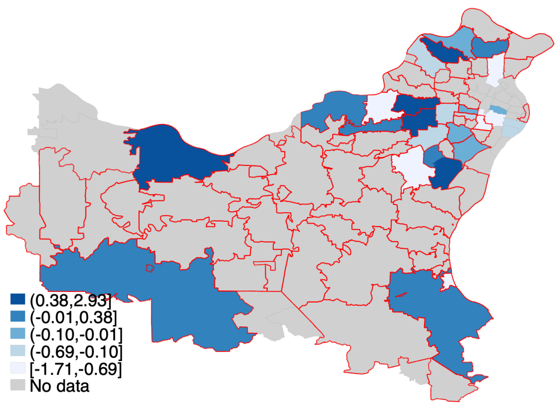
(b) Cumulative Number of ASCs Net of Exit



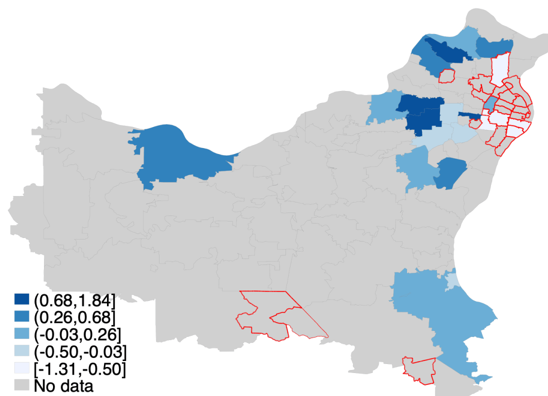
NOTE: The top figure plots the number of new ASC entrants each year by specialty from 1970 to 2013. The bottom figure plots the cumulative number of ASCs by specialty from 1970 to 2013.

Figure B.2: Change in Facility ZIP Market Share in St. Louis and Kansas City

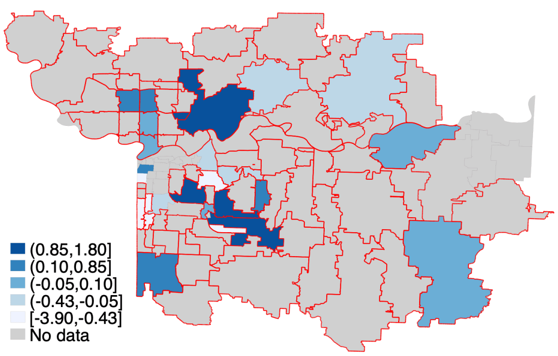
(a) St. Louis area and Above Med HH Inc.



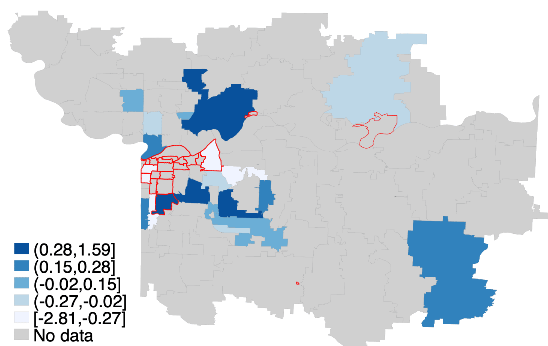
(b) St. Louis area and Below Med HH Inc.



(c) Kansas City area and Above Med HH Inc.



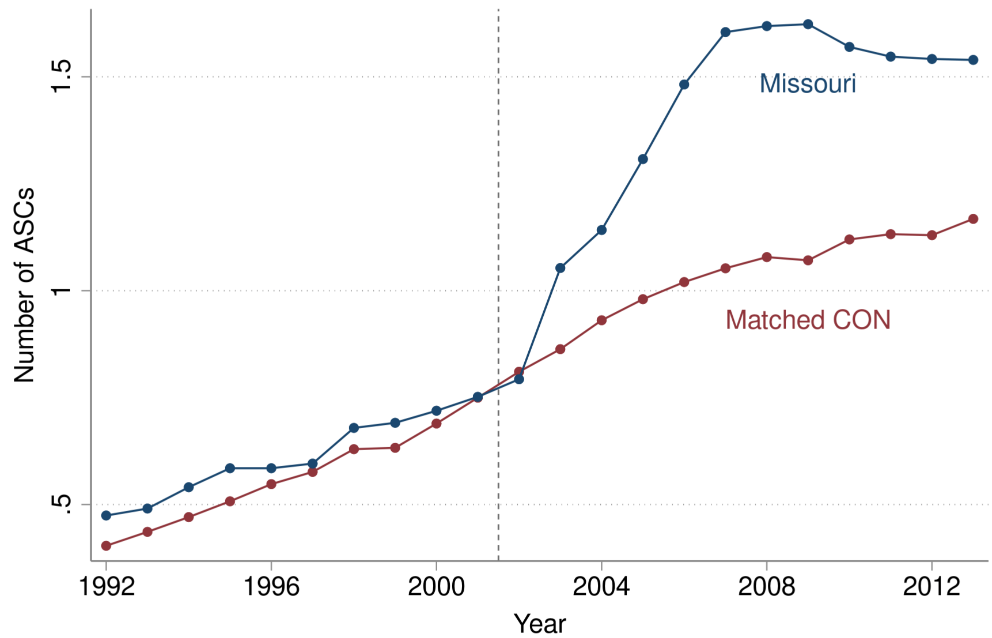
(d) Kansas City area and Below Med HH Inc.



NOTE: These zoom into St. Louis and Kansas City of Figures 4a and 4b. They plot the change in market share (in percentage points) between 1998-2001 and 2006-2009 for each facility ZIP code for a sub-population (metropolitan and above median HH income, metropolitan and below median HH income) from ZIP codes outlined in red.

Figure B.3: Effect of Deregulation on Number of ASCs (10 mi)

(a) Binned Scatter Plot

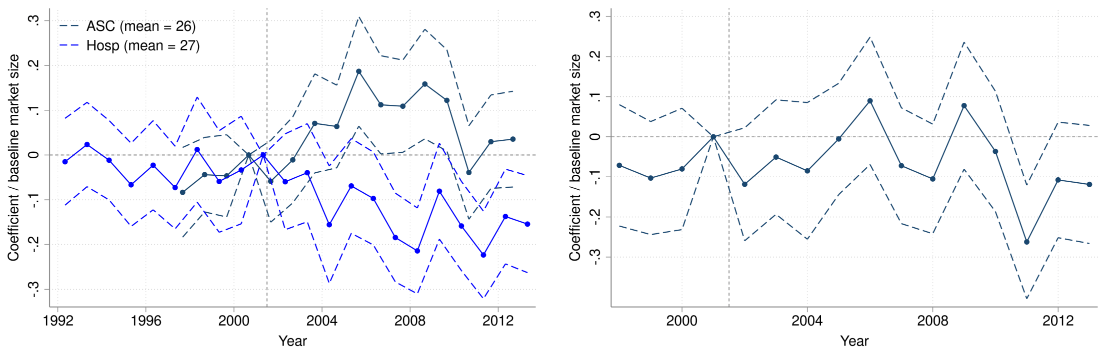


(b) Event Study

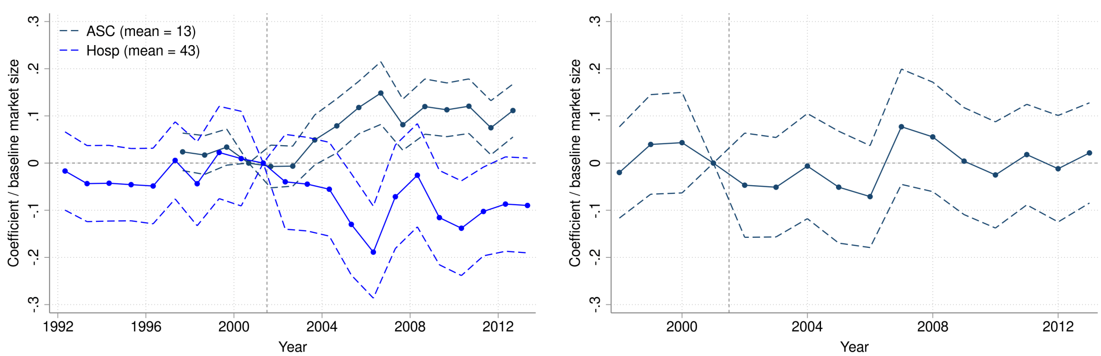
NOTE: These figures plot difference-in-difference coefficients and 95% confidence intervals of the impact of the CON repeal on ASCs within 10 miles. The coefficients are normalized by the 2001 mean in Missouri, so the y-axis can be interpreted as a percentage point gain relative to baseline. Standard errors are clustered at the zip code level. All regressions control for year and zip code fixed effects.

Figure B.4: Event Studies of Reform on Utilization, by Procedure

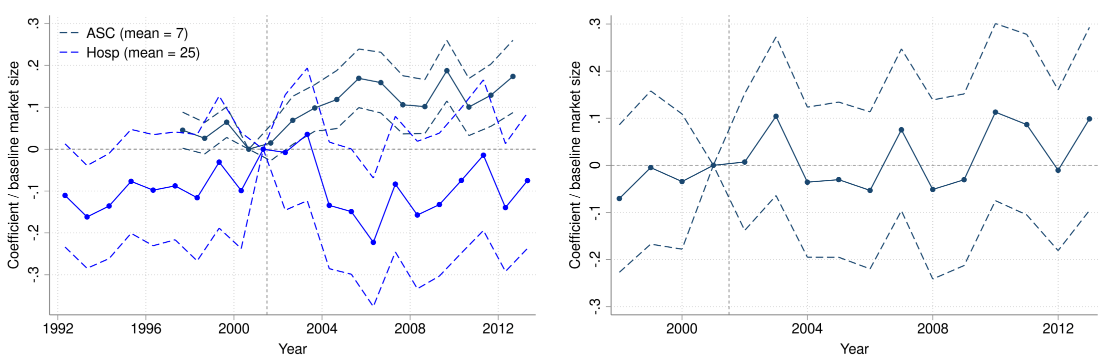
(a) Cataract surgeries



(b) Colonoscopies

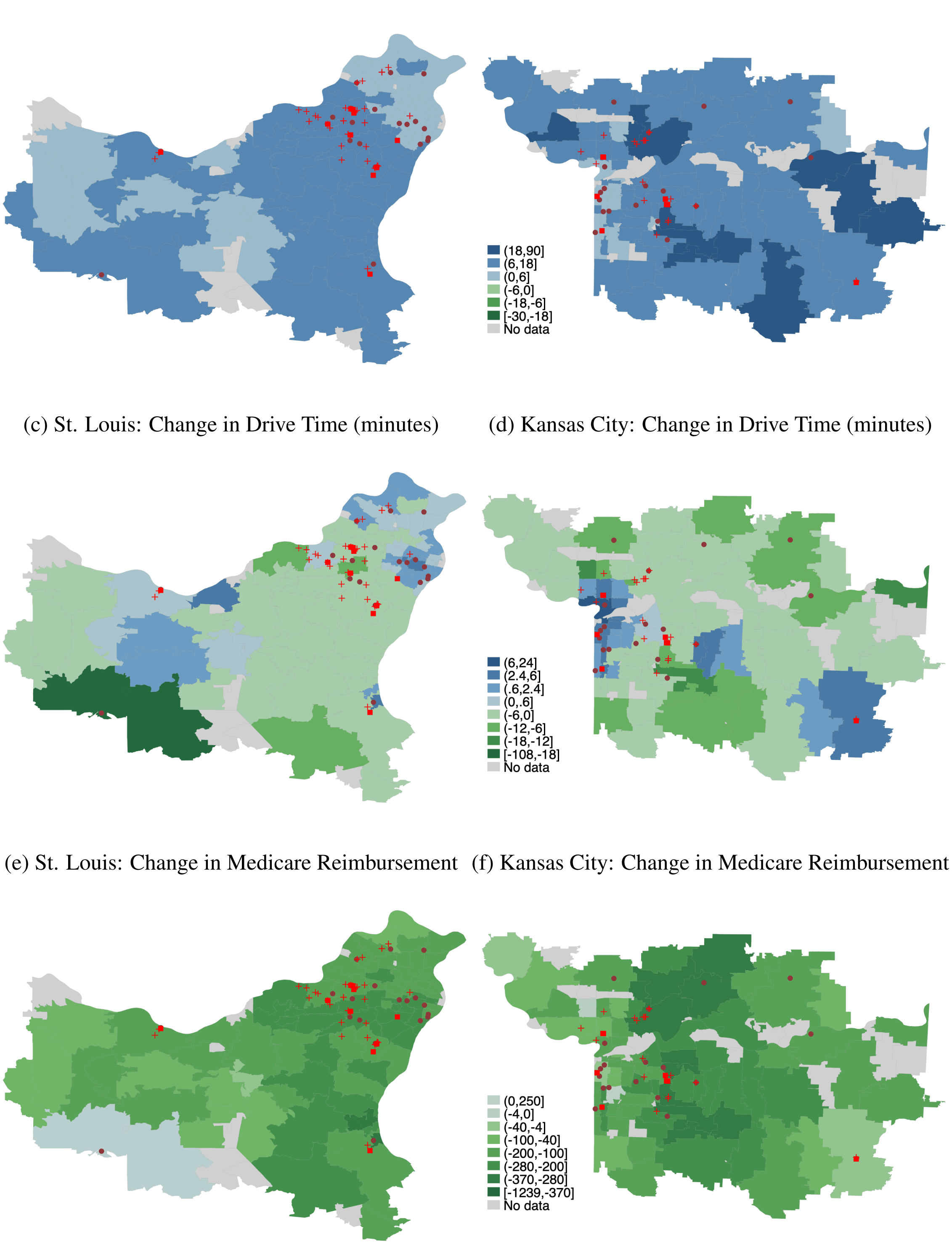


(c) Upper GI Endoscopies



NOTE: These figures plot difference-in-difference coefficients and 95% confidence intervals of the impact of the CON repeal on utilization per 1000 Medicare enrollees. The coefficients are normalized by the 2001 mean in Missouri, so the y-axis can be interpreted as a percentage point gain relative to baseline. Standard errors are clustered at the zip code level. All regressions control for year and zip code fixed effects.

Figure B.5: Distributional Effects of CON Deregulation in Border Cities



(a) St. Louis: Compensating Variation (b) Kansas City: Compensating Variation

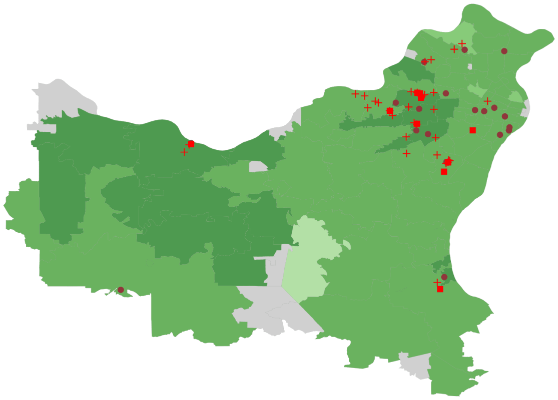
(c) St. Louis: Change in Drive Time (minutes) (d) Kansas City: Change in Drive Time (minutes)

(e) St. Louis: Change in Medicare Reimbursement (f) Kansas City: Change in Medicare Reimbursement

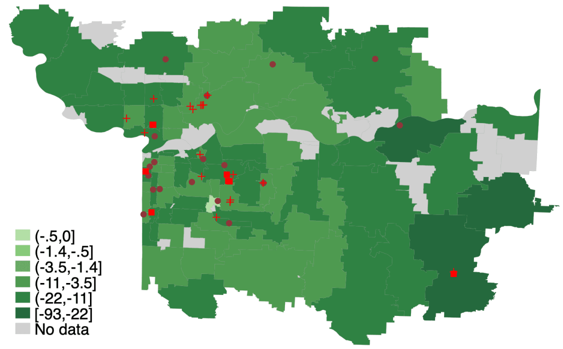
NOTE: The panels plot the change associated with moving from the second counterfactual choice set to the baseline choice set $J_i^2 \to J_i$ for Kansas City and St. Louis. Maroon dots are the hospitals, red dots are pre-reform ASCs, and red crosses are ASC entrants.

Figure B.6: Value of surgeon relocation in Border cities

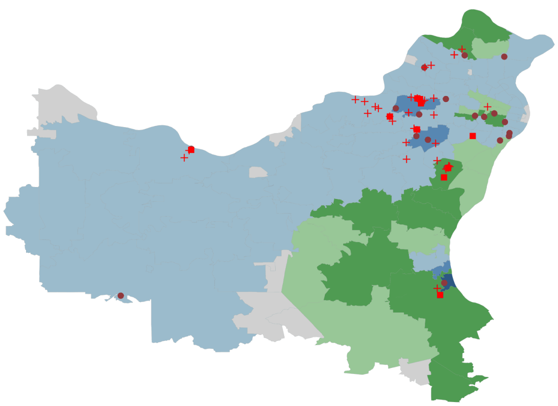
(a) St. Louis: Compensating Variation



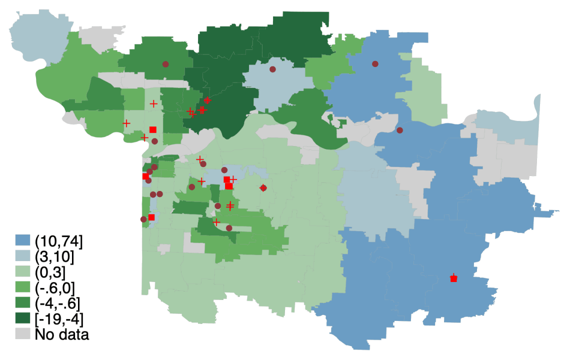
(b) Kansas City: Compensating Variation



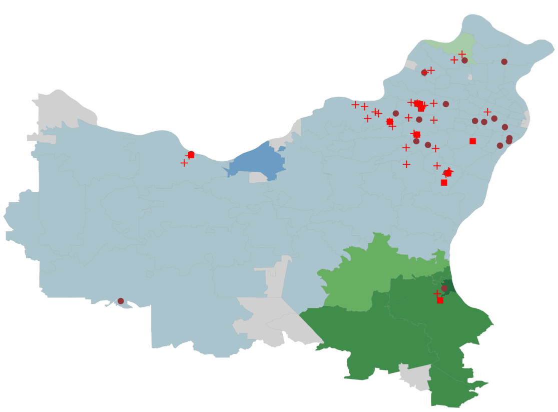
(c) St. Louis: Change in Drive Time (minutes)



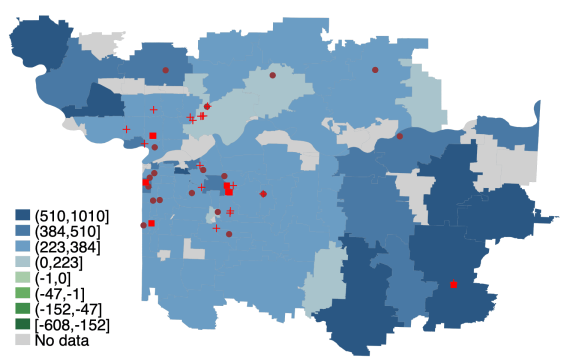
(d) Kansas City: Change in Drive Time (minutes)



(e) St. Louis: Change in Medicare Reimbursement

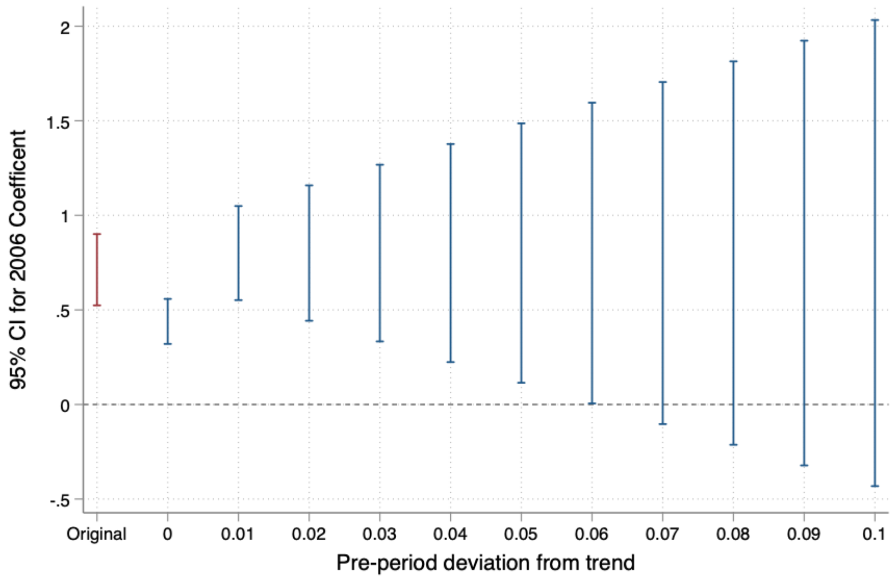


(f) Kansas City: Change in Medicare Reimbursement



NOTE: The panels plot the change associated with moving from the second counterfactual choice set to the first counterfactual choice set $J_i^2 \to J_i^1$ for Kansas City and St. Louis. Maroon dots are the hospitals, red dots are pre-reform ASCs, and red crosses are ASC entrants.

Figure C.1: Honest DiD for Number of ASCs



C Additional Analyses and Derivations

C.1 'Honest' Difference-in-Differences

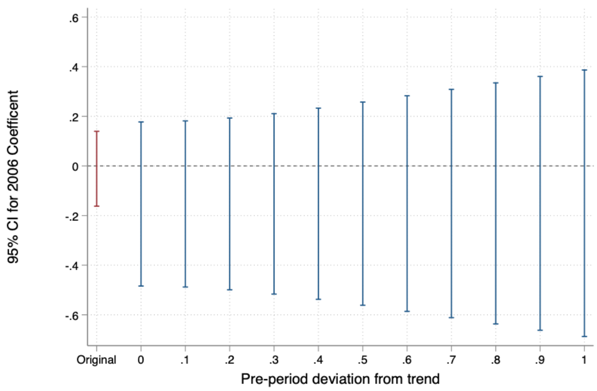
I perform a further robustness check of the main findings using the method in Rambachan and Roth (2022) to quantify how much the post-trend could diverge from the pre-trend per year before I can no longer reject the null hypothesis that the coefficient is equal to zero. I perform this test on the results in Figure 5b and Figure 6: average ASC count in 15 miles and outpatient utilization for the selected procedures, focusing on the 2006 coefficient.

Figure C.1 shows the 95% confidence intervals for the average post-reform effect on ASCs in 15 miles for different amounts of the per-period deviation from the pre-trend. Allowing for a per-period deviation of 0 is the same as including a linear time trend for each ZIP code. At 0.06-0.07 percentage points, the significance breaks down. Therefore, we can reject a null effect unless we are willing to allow for the linear extrapolation across consecutive periods to be off by more than 0.06-0.07 percentage points.

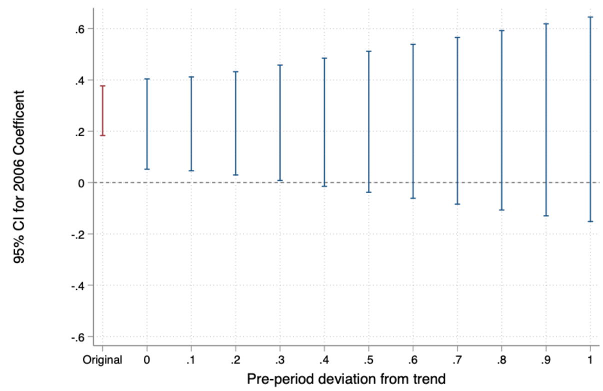
Figure C.2 shows the 95% confidence intervals for the average post-reform effect on utilization for different amounts of the per-period deviation from the pre-trend. Because the ASC data starts in 1998, a linear time trend for each ZIP code is estimated only off of 3 data points, which leads to much noisier estimates. We can see this phenomenon in the hospital volume regression. When I include a longer pre-trend from 1992 to 2001, the confidence intervals are much narrower and never close to zero below a deviation $< .1$. On the other hand, dropping data from 1992 to 1997 and estimating the same regression substantially reduces power. Significance for ASC utilization per capita breaks down around a 0.4 percentage point deviation. Significance for hospital outpatient per capita breaks down at either 0.6 or 0.7, depending on the length of the pre-period.

Figure C.2: Honest DiD for Average Utilization

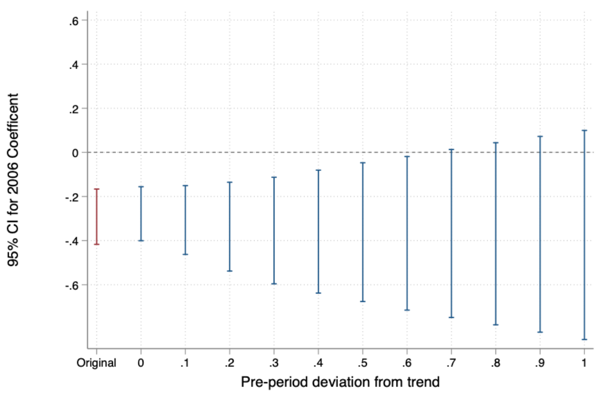
(a) ASC and Hospital Outpatient



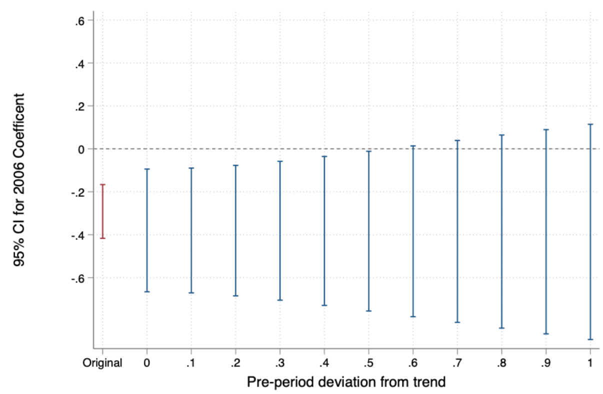
(b) ASC



(c) Hospital outpatient (1992-2001 as pre-period)



(d) Hospital outpatient (1998-2001 as pre-period)



C.2 Quantile Regressions of Surgeon Volume

Due to the volume-outcome relationship for cataract surgeries and endoscopies, changes in surgeon volume have implications for the equilibrium complication rate. To recover a counterfactual distribution of surgeon volumes, I run quantile regressions where the θth conditional quantile is:

$$Q_{v|X}(\theta) = \alpha^{\theta}_{MO} + \beta^{\theta}_{Post} + \delta^{\theta}_{DD} MO_z \cdot Post_t + \gamma^{\theta} X_i \tag{13}$$

δ^{θ}_{DD} is the effect of the reform on the θth quantile of v_{ist}, or Medicare surgeon volume in the prior 12 months per surgery. Identification of quantile treatment effects requires an analogous assumption to the parallel trends assumption for mean effects: the copula between the change in untreated potential outcomes and the initial level of untreated potential outcomes for the treated group does not change over time conditional on X_i (Callaway and Li, 2019). For these quantile regressions, I use data from 1999-2001 as the pre-period, and 2006-2009 as the post-period.

Figure C.3 plots the quantile regression coefficients alongside the counterfactual probability density function when pooling across all Medicare episodes and geographies. In general, the effect on the higher quantiles are much more negative than the those for the lower quantiles, suggesting redistribution from the high-volume surgeons. The redistribution to middle volume surgeons is most apparent for cataract surgeries.

Figures C.4 and C.5 present quantile regressions and counterfactual densities for Medicare surgeon volume by procedure and by patient geography. For cataract surgery, redistribution to lower-volume surgeons occurs for all patient groups. The point estimates for rural areas appear smaller compared to metropolitan areas. However, for GI procedures, redistribution to lower-volume surgeons is mostly in metropolitan areas rather than micropolitan or rural areas.

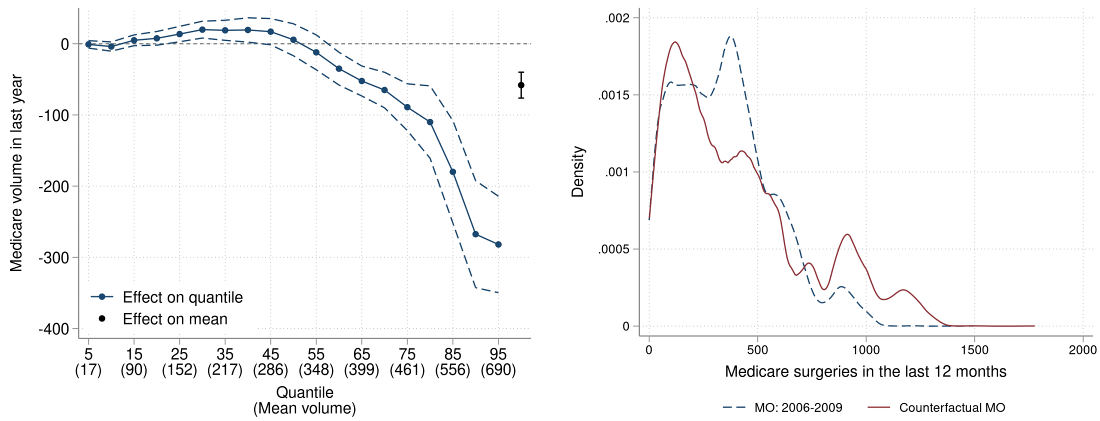
C.3 Demographic differences across patient groups

Demand side factors, such as demographics may also rationalize the differential responses across geography and income groups. Appendix Table C.1 tests whether substitution towards ASCs differs by demographic characteristics. People are more likely to use ASCs, but nonwhite, Medicaid, and older individuals are less likely to use ASCs compared to their complement. The differences are only statistically significant for Medicaid and patient age.

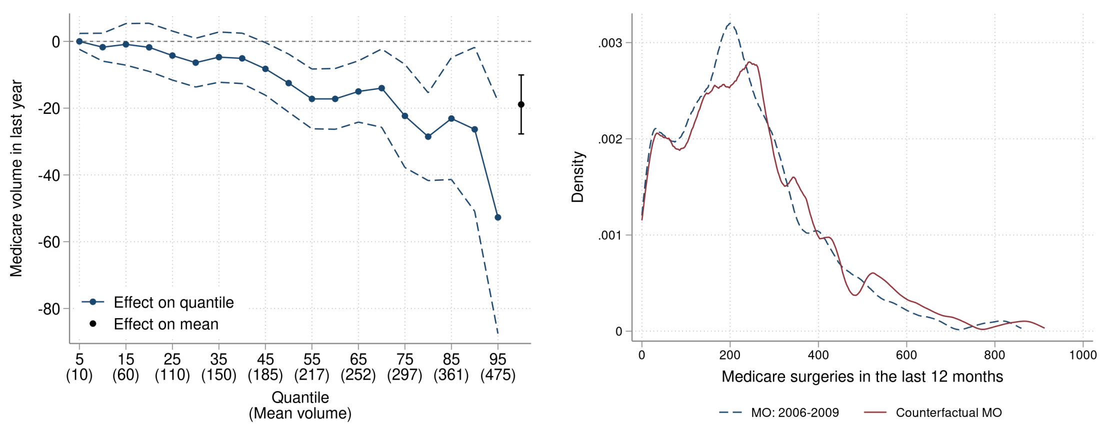
Appendix Table C.2 presents the baseline means for demographics by patient group. Except for the nonwhite share in urban and low-income areas, demographic characteristics are similar across subgroups. These results suggest that demographics are unlikely to be the explanation for differences in substitution patterns for rural areas. low-income metropolitan areas disproportionately are Medicaid and nonwhite, so demographics may be partly at play. In the structural model, I do allow preferences for ASCs to vary across these demographic groups.

Figure C.3: Quantile Regression Coefficients on and Counterfactual Distributions of Medicare Surgeon Volume

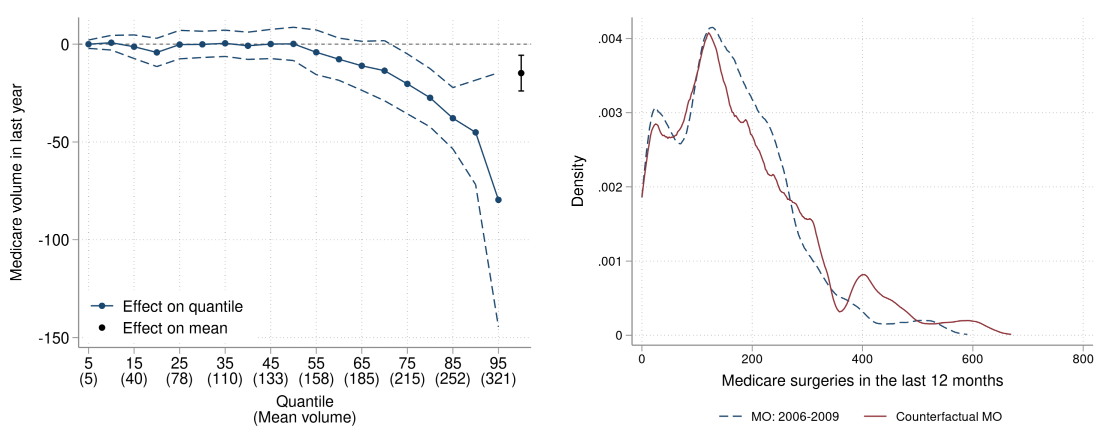
(a) Cataract surgery



(b) Colonoscopy

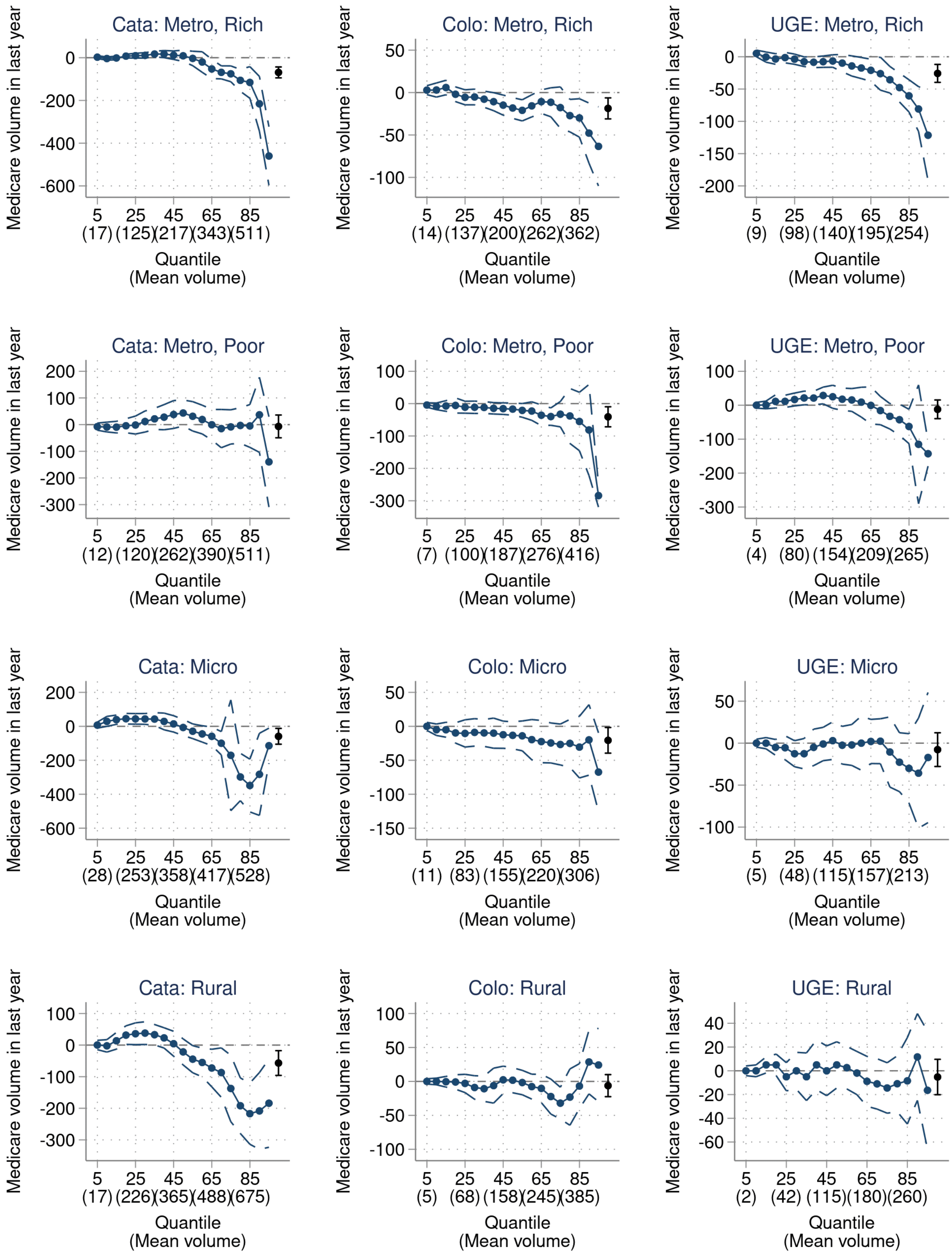


(c) Upper GI Endoscopy



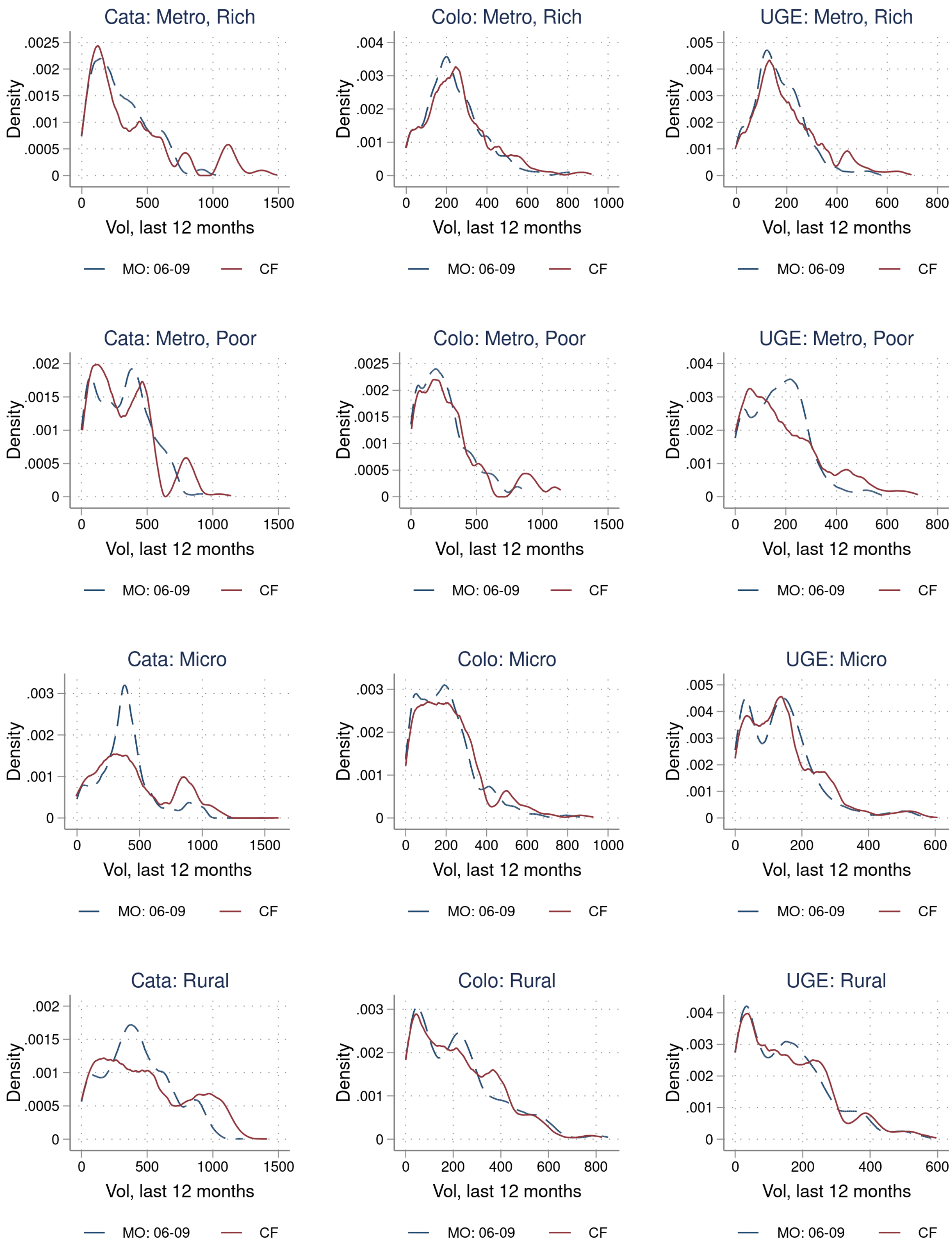
NOTE: The data used for the quantile regression are 1999-2001 and 2006-2009 cross sections of episodes of care in Missouri and matched control zip codes. All regressions control for demographics, age, risk score, and race and cluster standard errors at the zip code level.

Figure C.4: Quantile regressions by procedure and patient group



NOTE: The data used for the quantile regression are 1999-2001 and 2006-2009 cross sections of episodes of care in Missouri and matched control zip codes. All regressions control for demographics, age, risk score, and race and cluster standard errors at the zip code level. The estimate in black farthest to the right is the average effect.

Figure C.5: Counterfactual surgeon volume distributions by procedure and patient group



NOTE: The data used for the quantile regression are 1999-2001 and 2006-2009 cross sections of episodes of care in Missouri and matched control zip codes. All regressions control for demographics, age, risk score, and race and cluster standard errors at the zip code level.

Table C.1: Heterogeneous Effects of Reform on ASC Utilization

	Medium-run effect (2006-2009)		
	(1)	(2)	(3)
Heterogeneity	Yes	No	Difference
Nonwhite	0.051	0.070***	-0.019
	(0.032)	(0.014)	(0.033)
	[0.174]	[0.244]	
Medicaid	0.046**	0.071***	-0.025*
	(0.019)	(0.014)	(0.014)
	[0.195]	[0.245]	
>= Avg. Elixhauser (3)	0.072***	0.068***	0.004
	(0.015)	(0.014)	(0.010)
	[0.212]	[0.265]	
Age 80+	0.055***	0.074***	-0.019**
	(0.015)	(0.014)	(0.008)
	[0.254]	[0.237]	
Female	0.072***	0.067***	0.005
	(0.015)	(0.015)	(0.011)
	[0.248]	[0.231]	

NOTE: This table reports medium-run (2006-2009) diff-in-diff regression coefficients of the effect of the reform on probability of ASC utilization. Standard errors, clustered at zip code level, are reported in parentheses. Baseline means in Missouri are reported in brackets. All regressions control for demographics by procedure code fixed effects, zip code by procedure code fixed effects, and heterogeneity by procedure code by year fixed effects.
* p <.1 ** p<.05 *** p<.01

Table C.2: Baseline demographic characteristics in Missouri by geography

Variable	Metropolitan & Above Median HH Income	Metropolitan & Below Median HH Income	Micropolitan	Rural
Female	0.62	0.64	0.64	0.62
Elixhauser Risk Score	2.76	2.83	2.83	2.60
Nonwhite	0.03	0.14	0.02	0.02
Age	75.95	76.42	76.10	76.29
Medicaid	0.03	0.09	0.09	0.10

NOTE: This table shows means by patient group for Missouri episodes prior to 2002.

C.4 Change in social welfare

In this section, I derive (12).

Suppose in the pre-reform period, everyone goes to the hospital. Social welfare is:

$$\begin{aligned} W_i =& (CS_i^{hosp} - p_i^{Medicare} - p_i^{Medigap}) \\ &+ \eta(p_i^{Medicare} - 0.8reimb_i^{hosp}) + (p_i^{Medigap} - 0.2reimb_i^{hosp}) \\ &+ \eta^{SV}(reimb_i^{hosp} - cost_i^{hosp}) \end{aligned}$$

In the post period, consumers go to new ASCs. Social welfare is:

$$\begin{aligned} W_i' =& (CS_i^a - p_i^{Medicare} - p_i^{Medigap}) \\ &+ \eta(p_i^{Medicare} - 0.8r_i^a) + (p_i^{Medigap} - 0.2r_i^a) \\ &+ (r_i^a - c_i^a) - EC_i \end{aligned}$$

Taking differences:

$$\begin{aligned} W_i' - W_i =& (CS_i^a - CS_i^{hosp}) + 0.8(1-\eta)(reimb_i^a - reimb_i^{hosp}) \\ &+ (1-\eta^{SV})(reimb_i^{hosp} - cost_i^{hosp}) - (cost_i^a - cost_i^{hosp}) - EC_i \\ \rightsquigarrow \Delta W_i =& \Delta CS_i + 0.8(1-\eta)\Delta reimb_i + (1-\eta^{SV})\Delta\pi_i^{hosp} - \Delta cost_i - EC_i \end{aligned}$$

D Data appendix

D.1 Procedure codes used to flag procedures

I compiled Current Procedural Terminology (CPT) procedure codes from BETOS Public Use files and manual review to flag the top four surgeries at ASCs:

- Cataract surgery
  - 66830,66840,66850,66852,66920,66930,66940,66982,66983,66984,66985,66986
- Upper gastrointestinal endoscopies
  - 0008T, 43191, 43192, 43193, 43194, 43195,43196, 43197, 43198, 43200, 43201, 43202, 43204, 43205, 43206, 43211, 43212, 43213, 43214, 43215, 43216, 43217, 43219, 43220, 43226, 43227, 43228, 43229, 43231, 43232, 43233, 43234, 43235, 43236, 43237, 43238, 43239, 43240, 43241, 43242, 43243, 43244, 43245, 43247, 43248, 43249, 43250, 43251, 43252, 43253, 43254, 43255, 43258, 43259, 43260, 43261, 43262, 43263, 43264, 43265, 43266, 43267, 43268, 43269, 43270, 43271, 43272, 43274, 43275, 43276, 43277, 43278, 96570, 96571
- Colonoscopies

- Preventative: G0105, G0121, any diagnostic colonoscopy code below with modifier PT
- Diagnostic: 44388, 44389, 44390, 44391, 44392, 44393, 44394, 44397, 45355, 45378, 45379, 45380, 45381, 45382, 45383, 45384, 45385, 45386, 45387, 45391, 45392, A4270.

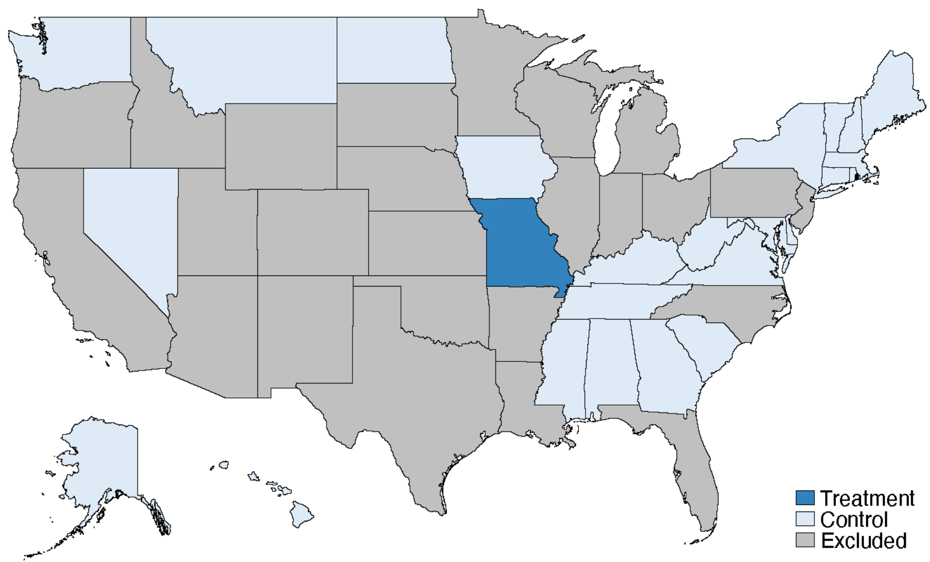
D.2 Diagnoses codes used to flag complications

- Cataract surgeries
  - Endophthalmitis: 360.0x
  - Suprachoroidal hemorrhage: 363.6x, 363.72
  - Tractional retinal detachment: 361.81
  - Rhegmatogenous retinal detachment: 361.0, 361.0x
  - Choroidal detachment: 363.7, 363.70, 363.71
  - Vitreous hemorrhage: 362.81
  - Retinal edema: 362.07, 362.53, 362.83
  - Glaucoma: 365.x
  - Retinal tear: 361.30, 361.31, 361.32, 361.33
  - Hypotony: 360.3, 360.30, 363.31, 363.32, 360.34
  - Corneal edema: 371.20, 371.21, 371.22, 371.23
  - Recurrent corneal abrasion / erosion: 371.42
- Upper gastrointestinal endoscopies
  - Bleeding esophageal varices: 456.0, 456.2, 456.20
  - Bleeding peptic ulcer (gastric or duodenal): 531.0x, 531.2x, 531.4x, 531.6x, 532.0x, 532.2x, 532.4x, 532.6x, 533.0x, 533.2x, 533.4x, 533.6x, 534.0x, 534.2x, 534.4x, 534.6x
  - Mallory-Weiss 530.7 Gastritis with hemorrhage 535.01, 535.11, 535.21, 535.41, 535.51, 535.61
  - Dieulafoy's lesion of stomach or duodenum, 537.84
  - Angiodysplasia of stomach or duodenum with hemorrhage, 537.83
- Colonoscopies
  - Perforation: 569.83, 998.2
  - Lower gastrointestinal bleeding: 558.9, 578.1, 995.2, 995.89, 998.1-998.13, 286.5, 459, 562.02-562.03, 562.12, 562.13, 569.3, 569.84-569.86, 578.9, 792.1

D.3 ZIP code matching

I match ZIP codes in Missouri to control ZIP codes in states with ASC-CON laws throughout the study period. I match exactly on urban status and wealth quartile (income x population) quartile and nearest neighborhood match on a propensity score. I require that the propensity score is within 0.2 standard deviations of the treatment ZIP code. Before matching, I trim the upper and lower tails of the propensity score by treatment and control to ensure a common support. I keep 3 control ZIP codes for each treatment ZIP code, ensuring a sufficiently large sample for the thousand ZIP codes in Missouri. I construct the propensity score using a logistic regression. Table D.1 reports the coefficients from the logistic regression. Figure D.1 plots which states' ZIP codes were included in the control group.

Figure D.1: Matched ZIP code States



NOTE: States that contain control ZIP codes are shaded a light blue.

Table D.1: Logistic regression of Missouri on pre-reform characteristics

Variable	Coefficient	S.E.
Medicare FFS Demographics		
1998: Total cataract surgery per 1000 enrollees	0.00112	(0.000577)
1999: Total cataract surgery per 1000 enrollees	0.000752	(0.000467)
2000: Total cataract surgery per 1000 enrollees	0.00251***	(0.000601)
1998: Total colonoscopies per 1000 enrollees	-0.00542	(0.00279)
1999: Total colonoscopies per 1000 enrollees	0.00142*	(0.000556)
2000: Total colonoscopies per 1000 enrollees	-0.00617*	(0.00273)
1998: Total upper GI endoscopies per 1000 enrollees	0.00220	(0.00331)
1999: Total upper GI endoscopies per 1000 enrollees	0.000467	(0.000561)
2000: Total upper GI endoscopies per 1000 enrollees	-0.00695	(0.00368)
Census Demographics		
Median household income (10,000)	-0.0423*	(0.0180)
Market Structure		
1998: Number of endoscopy ASCs (15 mi)	-1.150***	(0.210)
2000: Number of endoscopy ASCs (15 mi)	0.763***	(0.192)
1998: Number of ophthalmology ASCs (15 mi)	-0.192	(0.116)
2000: Number of ophthalmology ASCs (15 mi)	0.571***	(0.113)
1998: Number of ASCs (15 mi)	0.946***	(0.115)
2000: Number of ASCs (15 mi)	-0.966***	(0.120)
1998: Number of short-term hospitals (15 mi)	-0.165*	(0.0771)
2000: Number of short-term hospitals (15 mi)	0.160*	(0.0806)
Constant	-3.148***	(0.174)
Other matching variables		
Total hospital episodes per capita for cataracts 1992, 1994, 1996, 1998, 2000	Yes	
Total hospital episodes per capita for colonoscopy 1992, 1994, 1996, 1998, 2000	Yes	
Total hospital episodes per capita for upper GI endoscopies 1992, 1994, 1996, 1998, 2000	Yes	
Rural-urban commuting area fixed effects	Yes	
Income by Population quantile fixed effects	Yes	
Number of observations	13510	
Pseudo-R2	0.0816	

NOTE: This table presents estimates for from a logistic regression of treatment status (Missouri) on zip code characteristics. The predictions from this regression are the propensity scores used to match zip codes. Robust standard errors are reported in parentheses. * p<.1, ** p<.05, *** p<.01.