Getting Down to Business: Chain Ownership and Fertility Clinic Performance

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Acquisitions by corporate entities have fueled the growth of chain organizations in healthcare. A chain is a multiunit firm under the same ownership and management providing similar services in different locations. Chain ownership has been credited with boosting firm performance in the retail and service sectors but has been criticized for prioritizing profits over the well-being of patients in the healthcare sector. This paper finds that chain ownership improves healthcare outcomes in the market for In Vitro Fertilization (IVF). Using novel data on U.S. fertility clinics and difference-in-differences methods, we find that IVF cycles increase by 27.2%, and IVF success rates increase by 13.6% after acquisition by a fertility chain. We provide evidence that fertility chains facilitate resource and knowledge transfers needed to enhance quality and expand the IVF market. For example, acquired clinics change IVF processes and procedures to achieve the IVF gold standard of simultaneously reducing higher-risk multiple births and increasing singleton births. We discuss how the fertility sector's relatively minimal market frictions and information asymmetries may incentivize chain owners to invest in quality.

Keywords: Chain Organizations, Acquisitions, Fertility, Quality, Knowledge Transfer

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1. INTRODUCTION

Over the past several decades, chain organizations have reshaped industries and consumer experiences. For example, by standardizing operations and management and generating reputational incentives, chain ownership has been shown to increase firm productivity and product quality in the retail and service sectors (Jin and Leslie 2009; Bloom, Sadun, and Van Reenen 2012; Kosová and Lafontaine 2012). Acquisitions by retail companies and corporate investors have also contributed to the growth of chain organizations in the healthcare sector. This growth has raised concerns that chain operators will place shareholder financial interests over the health and well-being of patients, supported by recent studies documenting a decline in quality under chain ownership (Eliason et al. 2020; Andreyeva et al. 2023; Gupta et al. 2023).

In contrast, using novel data on US fertility chains, this paper finds that chain ownership improves healthcare outcomes. Several features of the fertility industry make it an especially well-suited setting to study the chain business model in healthcare. First, fertility clinic outcomes are easily measurable and observable: the US Congress passed a law in 1992 requiring clinics' In Vitro Fertilization (IVF) outcomes to be made publicly available.[1] Since the primary goal of IVF is to achieve a live birth, patients can also readily assess the effectiveness of their treatment. Second, fertility clinics operate more like retail settings than traditional healthcare settings. For example, patients typically pay upfront and out-of-pocket for IVF, placing a greater emphasis on consumer choice due to the minimal involvement of third-party payers. Third, corporate entities, attracted by the growing demand for fertility services, have increasingly acquired fertility clinics (Robbins 2017; The Economist 2023a). Lastly, despite the high demand and high costs of IVF, success rates are low and vary considerably across clinics, suggesting that clinics have room for improvement.

To study the impact of chain ownership, we combine hand-collected data on fertility clinic transactions from business intelligence databases with clinic-level data from the Centers for Disease Control (CDC) Fertility Clinic Success Rates Reports. Between 2004 and 2018, the share of clinics in a fertility chain grew from 5% to 20%, with chain clinics now performing over 40% of IVF cycles in the US. Critics caution that chains will treat "fertility medicine as a cash cow," while chains argue they can help clinics "deliver high-quality, convenient care to patients while implementing cost savings, improving processes, and driving growth" (Robbins 2017; Krause 2019). We estimate changes in clinic growth and quality using difference-in-differences methods, which compare clinics before and after chain ownership to a control group of non-chain clinics. We focus on two key outcomes: 1) clinic volume, measured as the number of IVF cycles, and 2) the success of IVF, measured as the live birth rate per transfer.

[1] The Fertility Clinic Success Rate and Certification Act (FCSRCA) of 1992 requires all US clinics that perform IVF to report their outcomes to the CDC. Yearly reports are published with standardized information on IVF success rates and are widely used by patients (Bundorf et al. 2009; Kowitt 2020).

Our results show that after a fertility chain acquires a clinic, IVF cycles increase by 27.2% and live birth rate increases by 13.6%. Qualitative data obtained from press releases, marketing materials, and interviews suggest chains help clinics achieve growth by providing financial resources, such as capital, and managerial resources, such as revenue cycle management and marketing services. These materials also suggest that chains help improve quality by implementing best practices, protocols, and trainings, and facilitating knowledge sharing between clinics through research consortiums and complex case review meetings. We provide empirical evidence that these resource and knowledge transfers drive performance improvements rather than alternative mechanisms such as patient selection.

One way we test for the role of resource and knowledge transfer is by comparing outcomes of acquired clinics with those of affiliated clinics. In acquisitions, the fertility chain's parent company owns the clinic's assets, while in affiliations, a clinic contracts with a fertility chain for management services and access to capital. Because a chain has greater control and ability to direct how resources and knowledge are used in a clinic it owns, we might expect that quality improvements would manifest more strongly in acquired clinics (Grossman and Hart 1986; Bernstein and Sheen 2016). Consistent with this hypothesis, we find that the live birth rate only increases in acquired but not affiliated clinics.

We also provide evidence that chains update clinic processes and procedures in ways that enhance quality. For example, *acquired* clinics achieve the IVF gold standard: they reduce multiple births, which pose significantly higher risks for patients, and increase singleton births by enough to have a net positive increase in the live birth rate. We find that this quality-enhancing result coincides with acquired clinics reducing the number of embryos placed in the uterus per transfer, suggesting that clinics improve techniques and processes when conducting single embryo transfers (Reimundo et al. 2021; Mizrachi and McQueen 2022).[2] We also find that acquired clinics achieve higher IVF success rates among older patients, whose cases are often more complex. One reason for these improvements is that acquired clinics significantly increase the use of preimplantation genetic testing, which can help physicians choose higher-quality embryos (Maxwell and Grifo 2018; ACOG 2020). Lastly, as evidence that clinics learn from their chain, we show that clinics acquired by higher-quality chains experience larger increases in live birth rates than those acquired by lower-quality chains.

In addition to knowledge sharing, chains emphasize providing clinics with resources needed for growth. Consistent with this claim, we find evidence of market expansion rather than business stealing: for every IVF cycle performed by a chain clinic in a market, there is one additional IVF cycle in that market and no reductions for non-

[2] A transfer of multiple embryos at once has a higher initial success rate but has a greater chance of multiple birth. A single embryo transfer has lower initial success rates but less than 1% probability of a multiple birth. Therefore, it is more difficult to increase the live birth rate via single embryo transfers.

chain clinics.[3] In cross-sectional analyses using hand-collected data from clinic websites, we find that acquired clinics are nearly twice as likely to market IVF discounts, which could help attract new patients. As another strategy to illustrate resources being used for expansion, we study how private equity (PE) investment into fertility chains impacts volume. Consistent with PE firms easing financial constraints, we find that the largest increases in clinic volume occur when a fertility chain receives PE funding.[4]

Overall, these results are consistent with fertility chains providing access to resources and knowledge needed to increase clinic volume and IVF success rates. However, rather than improving outcomes, clinics could instead select younger or healthier patients. We do not find evidence of patient selection: results are quantitatively similar whether or not we include controls for patient characteristics and infertility diagnosis, and there are no systematic changes in patient characteristics post-transaction that would influence IVF success. Since maternal age is the single most important predictor of IVF success, we also show that the distribution of patients in younger and older age groups is similar before and after a clinic transaction.

Fertility chains could also be better at selecting clinics that would generate performance improvements. While clinic selection is an inherent feature of this setting, we conduct analyses that mitigate concerns that clinic selection explains our results. In event study analyses adjusted for staggered treatment timing, we find no observable pre-trends before a clinic transaction. Results are also quantitatively similar in specifications using *state* × *year* or *market* × *year* fixed effects, which would help account for state or market-level changes that could impact the demand for fertility services. We also find similar increases in clinic volume and live birth rates for acquired clinics using a matched sample based on pre-transaction clinic characteristics.

This paper contributes to several strands of literature. The first studies the economics of chain organizations. Much of this literature has focused on the productivity and competitiveness of large national chains or franchising decisions in the retail and service sector (see Kosová and Lafontaine (2012) for a review). We extend the literature by estimating the causal impact of chain ownership in an understudied healthcare setting. We find that quality improvements depend on clinic ownership: live birth rates increase in acquisitions but not in affiliations. The influence of ownership and control complements the differences found between chain-owned and franchised restaurants (Bernstein and Sheen 2016) and minority vs. majority-owned power plants (Demirer and Karaduman 2024). The fertility chain's standardization of procedures and processes is also consistent with better management practices contributing to better healthcare outcomes (McConnell et al. 2013; Tsai et al. 2015; Bloom et al. 2020).

[3] Market expansion is likely possible because of the large unmet demand for fertility services (Chambers et al. 2009; Greil et al. 2016). However, fertility chains are a relatively recent phenomenon and may eventually drive out less productive or lower-quality clinics (Foster, Haltiwanger, and Krizan 2006).

[4] The impact of PE on volume is supported by several studies of PE ownership in the finance literature (see Boucly, Sraer, and Thesmar 2011; Bernstein and Sheen 2016; Fracassi, Previtero, and Sheen 2022).

Second, this paper contributes to the related literature on the effects of corporate ownership in healthcare.[5] The positive impact of chain ownership on fertility clinic quality differs considerably from the predominantly negative or null effects on quality found in the recent healthcare literature.[6] For example, Eliason et al. (2020) find that mortality and hospitalization rates increase among dialysis patients after clinics are acquired by large corporate chains. Similar results have been found in the nursing home industry (Harrington et al. 2012; Gupta et al. 2023). There are several possible reasons that outcomes could differ based on the features of these settings. For example, the fertility sector is "a virtually free-market branch of medicine" that relies minimally on third-party payers and heavily on consumer choice (Gabriel 1996). In contrast, the dialysis and nursing home industries rely heavily on Medicare and Medicaid, are more concentrated, and provide longer-term services to a more vulnerable patient population. We discuss additional differences in these settings in our conclusion in Section 6.2.

Third, this research contributes to the literature on the industrial organization of healthcare. There is substantial evidence that as markets become less competitive, prices increase, and quality worsens or remains unchanged (see Gaynor, Ho, and Town (2015) and Gaynor (2020) for reviews). In support of competition incentivizing quality investment, we show that clinics acquired in more competitive markets have larger increases in the live birth rate. We also find limited evidence that fertility chains increase market concentration, likely because they focus on cross-market acquisitions. Beyond changes in market structure, this research also relates to the literature on changes in ownership and outcomes driven by vertical integration (Baker, Bundorf, and Kessler 2014; Saghafian et al. 2023) and non-profit status conversions (Joynt, Orav, and Jha 2014; Lu and Lu 2022). The fertility sector provides an opportunity to study a change in ownership with fewer organizational complexities since there is minimal integration between clinics, most US fertility clinics are for-profit, and there are no non-profit chains.

Lastly, this paper contributes to the research on the fertility industry. Much of the literature has focused on how state fertility coverage mandates impact the utilization of fertility services and treatment choices (Schmidt 2007; Henne and Bundorf 2008; Bitler and Schmidt 2012; Hamilton et al. 2018). Despite expansions in coverage, most of the 1 in 5 women struggling with infertility will never have a baby because of barriers to accessing care and low IVF success rates (CDC 2023). While the fertility industry may be "struggling to keep up with demand" (The Economist 2023b), we provide evidence that US fertility chains expand access to IVF and improve IVF success rates. In the long term, these improvements may enable greater gender equality by allowing more women to delay motherhood and invest in their education and careers (Gershoni and Low 2021).

[5] The corporatization phenomenon in healthcare refers to "corporate investors (e.g., public companies, venture capital/private equity firms, insurance companies, and health systems) acquiring a majority and/or controlling interest" in previously independent organizations (American Medical Association 2019).
[6] Andreyeva et al. (2023) document negative effects on hospital readmissions in chain-acquired hospitals. La Forgia (2022) finds reductions in quality after practices are acquired by physician management chains that focus on financial services. A systematic review of the literature on PE ownership (both chain and non-chain organizations) also found mixed to harmful impacts on patients (Borsa et al. 2023).

2. THE EMPIRICAL SETTING

2.1 The Fertility Industry

The main providers of infertility services are fertility clinics, which assist couples or individuals who wish to conceive but are unable to naturally. The most effective way to treat infertility is through Assisted Reproductive Technology (ART), where In Vitro Fertilization (IVF) represents over 99% of ART procedures. In the US, the vast majority of fertility clinics are for-profit businesses, and treatment costs are remarkably high.[7] The cumulative cost of IVF is estimated to be between $40,000 and $60,000 because the average patient undergoes multiple IVF cycles (Fertility IQ 2022). These costs are either financed privately by patients or subsidized by insurance companies. However, even with some coverage, patients pay for the majority of services out of pocket (Chambers et al. 2009; McLaughlin et al. 2019).[8]

By the end of the century, it is estimated that 3% of the world's population will have been born via IVF (Faddy, Gosden, and Gosden 2018). This growth is mostly driven by heterosexual couples delaying childbirth and more same-sex couples choosing to have biological children. As a result, "the treatment of infertility has become big business around the world" (Patrizio et al. 2022). The projected demand and high margins of fertility clinics have attracted considerable attention from corporate entities such as PE firms, venture capitalists, management companies, and global healthcare chains (Borsa and Bruch 2022; Landi 2022; Pringle 2022). In the US, these investments have fueled further growth of existing fertility chains (e.g., Reproductive Medical Associates) and helped fund new ones (e.g., Spring Fertility). A similar corporatization trend has been well underway in China, India, Australia, and European countries such as Spain and Denmark (Rønning-Andersson 2018; Mellor 2019; Dhanjal 2023).

2.2 The IVF Process

This paper focuses on fertility clinics that provide IVF. While the desired outcome of IVF is straightforward, the process of achieving a live birth is complex. The IVF process consists of several stages that involve over 350 steps performed over 4 to 6 weeks per cycle (McCaffrey, Forman, and Copperman 2022). At a high level, a patient undergoes the five phases of treatment, as shown in Figure 1. Patients often need several cycles to achieve a live birth, with many patients undergoing at least 2 IVF cycles.

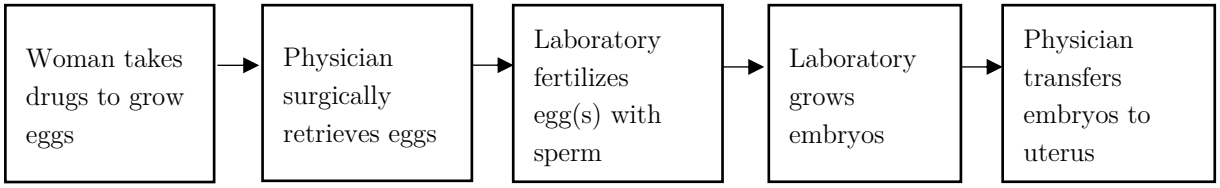
Each step of the IVF process depicted in Figure 1 involves subjective decisions that contribute to variation in fertility outcomes across clinics and physicians (Mizrachi and McQueen 2022; Morin 2022). For example, identifying and grading embryo quality and, therefore, which embryos to transfer to the uterus is considered a subjective

[7] Even for the few clinics that are part of non-profit academic medical centers (Patrizio et al. 2022), the fertility clinic itself may be organized as a for-profit subsidiary. See Section 3.1 for details.

[8] Insurance coverage varies widely by state and employer. State coverage mandates do not apply to self-insured companies and often only cover some costs of care. Still, some coverage can considerably reduce the total out-of-pocket costs associated with IVF and influence treatment decisions (Hamilton et al. 2018). For this reason, our primary specification includes *state* × *year* fixed effects.

assessment (Schoolcraft and Meseguer 2017). Similarly, Mizrachi and McQueen (2022) conclude that differences in physician embryo transfer techniques, but not experience, drive much of the variation in the success of an embryo transfer. Several studies have also found that patient mix and clinic volume only explain a small portion of the variation in outcomes across clinics, suggesting that clinic-specific factors are important determinants of IVF success (Lintsen et al. 2010; Wilkinson et al. 2021).

Figure 1. The Basic IVF Process of a Single Cycle



Note: Author's illustration adapted from Fertility IQ "What is IVF?"

Differences also exist in the core decision made between a reproductive endocrinologist and a patient on whether to transfer a single embryo or multiple embryos: transferring multiple embryos increases the success of pregnancy but also results in multiple births in 30% of pregnancies relative to single embryo transfers (Kissin, Boulet, and Jamieson 2016). Multiple births are associated with significant fetal and maternal risks, such as pre-term delivery, low birth weight, and pre-eclampsia. These worse outcomes led the American Society for Reproductive Medicine (ASRM) to issue changes in recommended IVF guidelines to lower multiple birth rates by encouraging single embryo transfers (ASRM 2013, 2017). Therefore, the embryo transfer decision generates a tension between increasing a clinic's live birth rate through multiple embryo transfers and complying with large-scale efforts to reduce multiple births from IVF.

2.3 Organization of Fertility Chains

This paper focuses on fertility clinics that become part of a fertility chain.[9] A fertility chain is a multiunit organization, where each unit is owned or managed by a single for-profit business entity and shares in centralized management and standardized business practices. The unit is the fertility clinic, which typically consists of a main office and satellite office for patient visits and procedures and a laboratory for creating, testing, and storing eggs and embryos.[10]

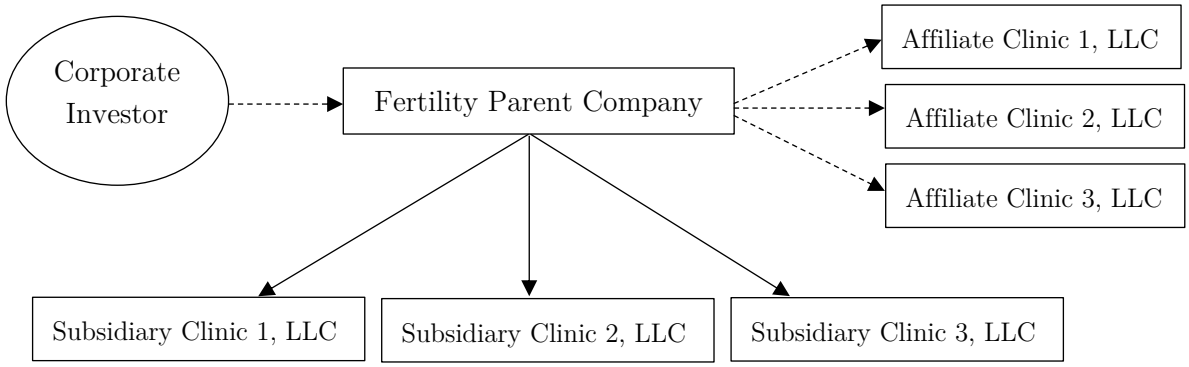
The fertility chain can grow by acquiring a clinic, affiliating with a clinic, or building a new clinic (Figure 2). Most chains pursue a mix of growth strategies. Like other chain organizations in the retail and service sector, fertility chains can be privately

[9] In general, healthcare providers are often reluctant to use business terms such as "chain" and use terms such as "network." Similarly, instead of big box-style rebranding, clinics typically signal chain status through websites and marketing materials.

[10] Like many office-based specialties, fertility clinics often have satellite office locations within a geographic area for patient convenience. The CDC ART data is at the clinic level and not the office level.

held or publicly traded corporations. Therefore, the chains can be sold to or receive funding from other corporations or PE firms. See Appendix A for additional details.

Figure 2. Organization of a Fertility Chain



2.4 Value Proposition of Fertility Chains

Press releases, company websites, news articles, and industry reports provide insights into the strategies and service offerings of fertility chains. For example, most press releases mention that chains promote growth by providing clinics with managerial capabilities and capital and improve quality by updating clinical processes and developing protocols (see Appendix Table B1 for press release text analysis). Below we provide additional qualitative evidence on these resource and knowledge transfers. All sources and documentation of quotes are reported in Appendix Table B2.

Financial Resources and Managerial Capabilities. One reason fertility clinics join fertility chains is to gain access to resources. For example, several chains emphasize providing clinics with long-term "financial stability and growth opportunities" and "strong financial support." These resources can help clinics hire new physicians and build new locations: "[Fertility chain] plans for continued growth through the addition of physicians and satellite offices." Similarly, another chain advertises that they apply "business and operations strategies that expand [clinic] markets and their market share. This may involve the development of new practice locations, embryology laboratories or ambulatory surgery centers, in order to […] achieve strategic growth objectives." Ultimately, these investments can help increase clinic profitability: one chain advertises that "clinics practices' patient revenues increased 21% from 2007 to 2009."

Marketing materials also highlight that fertility chains provide managerial resources to streamline back-office administration. Since fertility clinics are typically run by physicians focused on clinical medicine and not trained in business practices, clinics may benefit from better management practices. For example, one chain advertises providing "operational and financial management, revenue cycle management, patient marketing and sales, information systems support, and various other services, including patient support." One managerial capability that is particularly highlighted by various

chains is marketing, where one chain suggests its clinics should expect "increased patient volume as a result of [the Fertility Chain's] marketing efforts."

Chains also attract patients by offering and heavily marketing new pricing models that help patients finance treatment. For example, one fertility chain has its own subsidiary fertility financing company where "the company's Fertility Loan Specialists will work closely with [the Fertility Chain] to ensure the funds are secured prior to the commencement of [patient] treatment." Similarly, one chain launched "IVF Refund and Multi-Cycle Programs [that] offer patients the assurance that if multiple IVF cycles are necessary, they will not need to expend additional financial resources to receive them."

Clinical Knowledge. A second cited benefit of joining a chain is the ability to share and generate clinical knowledge with other clinics. For instance, a fertility chain advertises that it was "created to break down barriers to idea-sharing and collaborative care." This sentiment is echoed by a fertility clinic citing "access to […] the most advanced on-going research in the field of reproductive medicine" as a reason for joining a chain. Similarly, one clinic suggests their patients will benefit from "improved access to the best treatment protocols and unique programs for specific conditions, […] increased access to clinical trials and research initiatives […] access to an expanded network of […] experts who will come together to review and assist in complex cases." Multiple physicians echo that chains help standardize clinics' practices via treatment protocols.

Fertility chains also create internal processes to facilitate knowledge sharing and establish best practices within the chain. Many chains create committees with physicians across clinics who meet regularly to discuss clinical research and patient cases and, in some instances, conduct their own research and clinical trials. For example, one chain states that when "research proves that techniques improve conception rates, [Fertility Chain] incorporates those techniques into their standard care wherever possible." Another chain says that "treatment breakthroughs are quickly applied to multiple centers, thereby furthering the positive impact for patients." Chains also advertise using "proprietary platforms, applications, and data and analytics" to track clinic performance and help clinics improve their clinical processes. Lastly, some chains implement continued medical education and training programs to improve IVF success rates. For example, the CEO of one chain shared: "We'll look at pregnancy per transfer by physician with a blinded letter for each physician. And we'll be able to see how everybody stacks up. And if people fall below a standard deviation, we have that doctor go work with somebody who is above a standard deviation to get retrained."

Fertility chains also advertise strategic goals for the organization that are in line with the latest medical research. For example, many chains advertise increasing single embryo transfers: "Striving for One Embryo-One Baby. [Fertility Chain's] founding philosophy to achieve successful pregnancy one healthy baby at a time." This goal is likely motivated by the ongoing efforts from professional associations to reduce multiple births, leading fertility chains to advertise achieving lower multiple birth rates as both

a marketing and reputation tool. Additionally, the chains want to attract employers who offer fertility benefits but are sensitive to the much higher costs associated with multiple births.[11] Chains can leverage their outcomes to negotiate with fertility benefits managers to be in an employer's preferred network of providers. Altogether, the available documentation suggests that when clinics become part of a fertility chain, they receive access to resources and knowledge meant to improve financial and clinical performance.

3. DATA AND DESCRIPTIVE STATISTICS

3.1 Data Description

We construct a panel dataset of fertility clinic transactions to estimate the impact of chain ownership on clinic performance. We combine data from several sources to create a novel dataset of clinics acquired by or affiliated with a fertility chain between 2004 to 2018. See Appendix A for additional details on data construction.

Clinic Characteristics. All clinics that perform Assisted Reproductive Technology (ART) must submit data to the CDC annually under the Fertility Clinic Success Rate and Certification Act (FCSRCA) of 1992.[12] ART includes all fertility treatments in which either eggs or embryos are handled; over 99% of ART is IVF. The CDC then compiles and publishes Fertility Clinic Success Reports (download here: https://www.cdc.gov/art/artdata/index.html), which are meant to inform prospective patients of their probability of achieving a live birth. We will refer to these data as the CDC ART data. While the data are consistent within a year, the variables collected have undergone changes over time, limiting which variables can be studied in a panel framework. After extensive data cleaning, we create a consistent clinic identification number and identify each clinic's patient infertility diagnoses, number of IVF cycles and transfers, and IVF success rates. We also use PDF versions of the CDC ART data to extract information on clinic addresses and laboratories.

Market Characteristics. We define a market as a clinic's Core Based Statistical Area (CBSA), which consists of one or more counties with an urban center of at least 10,000 people plus adjacent counties that are socioeconomically tied to the urban center by commuting.[13] Fertility clinics in the sample are present in 145 out of 927 CBSAs.[14] Past

[11] A multiple birth can cost up to 20 times more than a singleton birth. Therefore, self-insured employers have an incentive to reduce multiple births to reduce the birth costs they would incur from offering fertility benefits (Lemos et al. 2013). In fact, several fertility benefits management companies advertise only partnering with clinics with low multiple birth rates to attract employers (Winfertility 2022).

[12] To ensure data quality, the medical director of a clinic must verify by signature that the success rates are accurate. Additionally, a random sample of clinics is audited each year.

[13] A patient's choice of fertility clinic is not typically related to distance in areas with multiple clinics. Patients are often "willing and able to travel long distances to use the provider of their choice regardless of distance, time, or expense" (Harris et al. 2017).

[14] One fertility clinic in Alaska is not located in a CBSA and was assigned its county-level market characteristics. Clinics in Puerto Rico are excluded from analyses with market-level controls because several variables are unavailable during the sample period.

research on fertility clinic competition has defined the market for fertility services as a metropolitan statistical area (Bundorf et al. 2009; Hamilton and McManus 2012). However, CBSAs, which include both metropolitan and micropolitan statistical areas, help capture additional clinics located in smaller urban areas. We use data from the US Census Bureau and the Bureau of Labor Statistics to obtain market-level population estimates, the median household income, and the unemployment rate. We also calculate the Herfindahl-Hirschman Index (HHI) based on a clinic's total IVF cycles to measure the competitiveness of the market.

Patient Characteristics. The CDC ART data are aggregated to the clinic level and do not contain patient-level information. For secondary analyses, we use National Center for Health Statistics (NCHS) Vital Statistics Data to account for market-level patient demographics for women who gave birth after receiving any infertility treatment. The NCHS data include a mother's race/ethnicity, educational attainment, insurance, and clinical conditions such as hypertension and diabetes, but are only available from 2009-2018 with an indicator for receiving infertility treatment.

Chain Ownership. We identify clinic transactions through press releases, archived versions of clinic and fertility chain websites, the CDC ART data, and the following business intelligence databases: Levin Associates, SDC Platinum, and Pitchbook data. These business sources often provide the date and the terms of the transaction. Based on their ownership structure, we classify fertility clinics into four main categories (we provide more description on these ownership structures in Appendix A):

1) Acquisition: some or all of the clinic's assets are acquired and owned by the chain's corporate parent.
2) Affiliation: a clinic contracts with a fertility chain for selected management services and capital or financing options.
3) De Novo: a new fertility clinic built and opened as part of the chain.
4) Non-Chain: a clinic that is never acquired by or affiliated with a fertility chain and never receives funding from corporate investors during the sample period.

To estimate the impact of chain ownership, our primary analysis examines the outcomes of fertility clinics before and after becoming part of chain (i.e., the fertility clinic, not the chain, is the unit of analysis). The control group includes non-chain clinics, and the treatment group includes clinics acquired by or affiliated with a chain.

Both non-chain and chain clinics may be hospital-based. This is because even when clinics are part of "nonprofit hospitals or academic institutions, the fertility center itself is often a professionally managed, for-profit, private corporation" (Krawiec 2009). Consequently, most fertility clinics in the US are for-profit. Additionally, even fertility clinics that are part of academic institutions are considered "lucrative profit centers" (Noah 2003; Jacoby 2009). For these reasons, we include hospital-based clinics in the treatment and control groups. In our empirical analysis, clinic fixed effects account for

time-invariant factors associated with being hospital-based, and we show robustness to excluding any clinic that was part of an academic medical center (AMC).

We identify 11 fertility chains in operation in the US between 2004 and 2018 (see Appendix Table A1 for details on each chain), which match those identified in industry reports and articles studying fertility clinic business models (Dresner Partners 2018; Borsa and Bruch 2022; Patrizio et al. 2022). During the sample period, ten chains were privately held, and one chain was publicly traded. Most of these chains received PE funding between 2004 and 2018: five of the chains were acquired via leveraged buyouts by PE firms, and three chains received growth equity investments through joint venture agreements with PE firms.[15] This means a fertility clinic could be acquired by a chain *before* the chain itself is acquired by a PE firm. In secondary analyses, we decompose the effect of chain ownership on fertility clinics into chain ownership with PE funding and chain ownership without PE funding.

3.2 Outcome Variables

We focus on two outcomes that measure clinic performance: 1) clinic volume and 2) success of IVF. Clinic volume is measured as the total number of IVF cycles (including donor and non-donor cycles) performed by a clinic in a year. A cycle starts with the intent of retrieving an egg for immediate fertilization or to be frozen for future use. As a secondary volume measure, we also use total transfers. A transfer represents the part of an IVF cycle when one or more embryos are transferred into the uterus of a woman with the intent to establish a pregnancy (SART 2021a). Not all cycles become transfers because eggs may not develop, the patient may become ill, or the fertilization of the egg may not be successful, among other reasons (Bedrick et al. 2019). In regression analyses, we log volume variables to better fit the data (Appendix Figure C1).

The success of IVF is measured by the live birth rate per transfer. The live birth rate represents the number of live births divided by the number of transfers using fresh or frozen non-donor eggs (i.e., the patient's own eggs).[16] The CDC ART data reports the live birth rate in patient age bins (under 35, 35-37, 38-40, and 41-42). While we present live birth rates separately by age bin, for most analyses, we present a single live birth rate as an age-bin weighted average. We also show results separating the live birth rate into singleton birth rate and multiple birth rate (i.e., twin births are counted as one live birth). Unfortunately, changes in how the CDC reports data limit our ability to study alternative live birth outcomes within a panel framework. See Appendix A for more details on variable construction and Section 4.6 for further discussion of data limitations and additional analyses to account for data reporting changes.

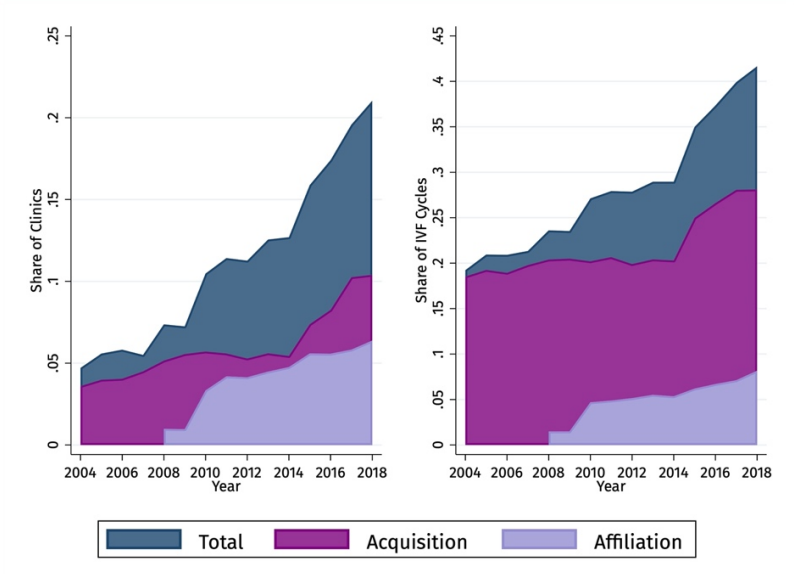
[15] One chain is acquired by a PE firm in December 2018, the last month of our sample period. Therefore, we do not include it as PE-funded in descriptions or analyses.

[16] An IVF cycle may result in only one or multiple embryos. With multiple viable embryos, one or more embryos may be transferred within a few days of creation, with the remainder frozen. If the fresh embryo transfer is unsuccessful, the frozen embryos can be thawed and transferred subsequently.

3.3 Descriptive Statistics

The final analytic sample includes 527 clinics and 6,271 clinic years. To construct this sample, we 1) exclude data reported for patients over the age of 42 because of changes in data availability over the sample period, 2) exclude clinics that perform fewer than 20 cycles a year on average, and 3) exclude clinics that are in the sample for less than 3 years (except for de novo clinics).[17] Figure 3 shows that by 2018, over 20% of clinics are in a fertility chain and perform over 40% of IVF cycles in the US. In total, there are 61 transactions: 33 clinics are structured as acquisitions, and 28 clinics are structured as affiliations. Additionally, 23 clinics are newly built by a chain, 15 clinics are always in a chain, and 428 are never part of a chain (i.e., non-chain clinics). However, in most analyses, we exclude 13 non-chain clinics with multi-year gaps in reporting to the CDC, resulting in 415 non-chain clinics in our analytic sample.[18]

Figure 3. Share of Clinics and IVF Cycles in a Fertility Chain



Note: The left-hand figure shows the share of clinics in a fertility chain each year, and the right-hand figure shows the share of IVF cycles performed by chain clinics. "Total" includes all clinics ever part of a fertility chain, including those always in the chain or that were newly built by the chain.

Table 1 provides additional fertility clinic and market-level characteristics. Prior to a transaction, clinics perform more cycles and transfers and have higher live birth rates than non-chain clinics, suggesting that chains may target better-performing clinics. De novo clinics also provide evidence of the role of chain ownership as they also experience greater volume and IVF success compared to non-chain clinics. Despite differences in these outcomes, patients do not appear to be inherently different across

[17] We also exclude 19 clinic-years when a clinic has fewer than 10 IVF cycles in their first or last year of data, as this signals a clinic opening or closure and may not accurately reflect a clinic's fertility program.
[18] Multi-year gaps can occur if a clinic pauses IVF cycles to restructure or fails to adhere to FCSRCA reporting requirements. Including these clinics yields slightly larger effect sizes than those in Table 2.

clinics: there are similar distributions of patients under 35 and of patient diagnoses for infertility. Similarly, a mother's reported education, race/ethnicity, insurance type, and health factors are comparable across clinic categories (Appendix Table C2).

Table 1. Fertility Clinic Summary Statistics, 2004-2018

	Fertility Chain			Non-Chain
	Acquisition	**Affiliation**	**De Novo**	
	Pre-transaction mean	Pre-transaction mean	Mean of all years	Mean of all years
Clinic Volume				
IVF Cycles	510.55	454.98	522.41	282.82
IVF Transfers	448.86	385.63	366.59	222.71
Log(IVF Cycles)	5.98	5.77	5.88	5.15
Log(IVF Transfers)	5.85	5.62	5.48	4.93
Birth Rates (%)				
Live Birth Rate	40.40	39.49	42.05	36.76
Singleton Birth Rate	28.21	27.88	31.82	26.84
Multiple Birth Rate	12.16	11.59	10.23	9.85
Patient Characteristics (%)				
Share of Patients < 35	50.96	51.59	51.36	51.29
Share of Patients 35-37	24.23	23.16	22.72	23.53
Share of Patients ≥ 38	24.81	25.25	25.91	25.18
Diagnosis, Tubal Factor	10.49	9.75	8.49	12.91
Diagnosis, Ovulatory Dysfunction	9.35	8.24	10.90	12.38
Diagnosis, Diminished Ov. Reserve	21.28	17.14	23.62	21.33
Diagnosis, Endometriosis	7.28	6.03	7.21	8.00
Diagnosis, Uterine Factor	2.96	2.36	2.50	4.01
Diagnosis, Male Factor	22.68	17.01	24.21	26.91
Diagnosis, Other	10.47	8.62	21.31	11.03
Diagnosis, Unknown	10.19	10.59	11.97	9.73
Market Characteristics (CBSA)				
Total Population (Age 20-49)	1,530,623	1,782,535	2,721,922	1,910,789
Unemployment Rate (%)	6.28	5.93	5.65	6.08
Median Household Income ($)	55008.84	54207.96	62843.02	58461.18
Market Concentration (HHI)	4281.12	3812.82	4058.80	4410.92
Observations				
Number of Clinics	33	28	23	415
Clinic-Years	289	175	138	4962

Notes: All summary statistics are at the clinic-year level. Patient age shares are calculated as share of total transfers. See Appendix Table C1 for year-adjusted summary statistics.

In Appendix Table C3, we present the results of a targeting regression to understand the probability of a clinic acquisition or affiliation based on pre-transaction characteristics. The results suggest chains target clinics that perform more IVF cycles, have a higher live birth rate, and are located in more competitive markets with larger populations aged 20-49. Additionally, chains are less likely to target clinics in markets with a greater share of patients on Medicaid or other insurance.

Overall, these descriptive statistics help inform potential empirical challenges. While there are differences in the types of clinics selected by fertility chains, there do not appear to be observable differences in the types of patients treated by clinics before the transaction. This pattern is consistent with the homogenous nature of patients treated by fertility clinics. Still, in the empirical analyses that follow, we use several strategies to account for differences between chain and non-chain clinics.

4. THE EFFECT OF CHAIN OWNERSHIP

4.1 Empirical Approach

Our empirical strategy aims to identify the causal effects of chain ownership on fertility clinic volume and clinical performance. Our primary strategy utilizes a difference-in-differences (DiD) specification to compare changes in outcomes before and after a fertility clinic becomes part of a fertility chain (treated) with concurrent changes for clinics that were never part of a fertility chain (control). De novo clinics and clinics always in a chain are excluded from DiD analyses. We estimate extensions of this DiD model using an event study framework and a matching estimator, among other analyses, that together provide compelling evidence that chain ownership positively impacts clinic volume and IVF success.

The preferred specification includes clinic fixed effects (θ_c) to adjust for time-invariant clinic characteristics and calendar *state* × *year* fixed effects (θ_{st}) to flexibly allow for time-varying factors that are common to all clinics in a state. We also include a vector of controls ($\boldsymbol{X}_{ct}$) that include an indicator for whether two clinics combined their data reporting to the CDC (i.e., had reported as two separate clinics but then began reporting as a single clinic) and an indicator for the first year a clinic was in the sample to account for partial year reporting when a clinic first enters the data.[19] Each estimation uses cluster-robust standard errors at the clinic level.

Eq. 1: $$Y_{ct} = \beta Post_{ct} + \gamma \boldsymbol{X}_{ct} + \theta_c + \theta_{st} + \epsilon_{ct}$$

Equation 1 is a within-clinic regression, where $Post_{ct}$ is a binary variable equal to one if clinic c is acquired by or affiliated with a fertility chain in year t. The coefficient of interest, β, captures the relationship between becoming part of the chain and Y_{ct}. Since there may be differences in clinic outcomes by ownership structure, we use interactions between $Post_{ct}$ and whether a clinic transaction was structured as an acquisition or affiliation, as seen in Equation 2.

Eq. 2: $$Y_{ct} = \beta_1(Post \times Acquisition)_{ct} + \beta_2(Post \times Affiliation)_{ct} + \gamma \boldsymbol{X}_{ct} + \theta_c + \theta_{st} + \epsilon_{ct}$$

The identifying variation is primarily based on the staggered timing of clinic transactions and the comparison of treatment and control clinics in their overlapping periods. To interpret the β coefficients as the causal effect of the transaction, we must assume that the trends in outcomes of these chain clinics would have been similar to the trends in outcomes of non-chain clinics in the absence of the transaction. The concern

[19] For the 7 clinics in our analytic sample that merged, we combine their data to create a single clinic by taking the weighted average of their outcome variables in each year. We create an indicator variable equal to 1 post-merger and include this as a control variable. Results are robust to dropping all clinics that merged (Appendix Table E6).

with this identification strategy is that the timing of the transaction may be correlated with other contemporaneous factors that impact the outcomes, such as changes in the patient population and the non-random selection of clinics. Additionally, recent literature in econometrics has shown the biases that can arise from DiD with staggered treatment timing because of comparisons not only between treated and control units but between already treated and eventually treated units (see Baker et al. (2022) and Roth et al. (2022) for reviews). We conduct a series of diagnostic and robustness checks that help mitigate these concerns.

4.2 Main Effect on Clinic Volume and IVF Success Rates

Table 2 Panel A shows the estimates of the pooled regression from Equation 1 using both *state* × *year* (the preferred specification) and year fixed effects. After a clinic becomes part of a fertility chain, IVF cycles increase by 25.6%, and IVF transfers increase by 21.4%. Note that data reporting changes in 2017 may lead us to underestimate the true effect of chain ownership on transfers. We provide a discussion and additional analyses in Section 4.6 and Appendix F that suggest acquired clinics increase cycles and transfers by similar amounts.

Table 2. Effect of Chain Ownership on Fertility Clinic Outcomes

	(1)	(2)	(3)	(4)	(5)	(6)
	Log(Cycles)		**Log(Transfers)**		**Live Birth Rate**	
Panel A: Pooled						
Post	0.256***	0.281***	0.214***	0.238***	0.027**	0.019*
	(0.071)	(0.063)	(0.071)	(0.063)	(0.012)	(0.010)
Panel B: Ownership Structure						
Post × Acquisition	0.272***	0.296***	0.214**	0.225***	0.051***	0.041***
	(0.093)	(0.084)	(0.093)	(0.085)	(0.015)	(0.014)
Post × Affiliation	0.240**	0.268***	0.215**	0.251***	0.006	-0.001
	(0.104)	(0.091)	(0.103)	(0.090)	(0.017)	(0.014)
Clinic FE	X	X	X	X	X	X
State × Year FE	X		X		X	
Year FE		X		X		X
Dep. Var. Mean	5.250	5.254	5.033	5.038	0.374	0.375
Clinic-Years	5676	5818	5676	5818	5676	5818
R^2	0.896	0.881	0.895	0.880	0.623	0.574

Notes: Panel A shows the β estimates of Equation 1, and Panel B shows the β_1 and β_2 estimates of Equation 2. The dependent variable mean captures the predicted mean for control clinics and treatment clinics before the transaction. Standard errors are clustered at the clinic level. Statistical interpretations are similar when using wild bootstrap standard errors to adjust for small sample sizes (Appendix Table D1). See Appendix Figure D1 for power calculations. Significance levels: *p<0.1, **p<0.05, ***p<0.01

There are also significant changes to IVF treatment success: the live birth rate increases by 2.7 percentage points (7.2% of the mean). However, pooling together clinics

masks the heterogeneity in outcomes by ownership type. Table 2 Panel B reveals that both acquired and affiliated clinics increase clinic volume, but only acquired clinics increase the live birth rate. After an acquisition, the live birth rate increases by 5.1 percentage points (13.6%), and we fail to find evidence of changes in the live birth rate of affiliated clinics. Table 2 also shows that effect sizes are similar when accounting for time-invariant differences across states rather than within states over time.

Do these improvements in IVF outcomes increase clinic profits? In Appendix Table D2 we show results of a back-of-the-envelope calculation for acquired clinics. Assuming a static profit margin of 37.5%, we estimate that the average clinic makes $2.4 million in profit per year before acquisition and $3.2 million post-acquisition, representing a 33% increase in clinic profits.

4.3 Treatment Effect Timing

Goodman-Bacon Decomposition. Using a DiD research design with multiple periods and treatment times could result in "bad" comparisons between clinics treated earlier and clinics treated later in the sample. The diagnostic test developed by Goodman-Bacon (2021) decomposes treatment effects into multiple, weighted, two-by-two DiD estimators.[20] In Appendix Table D3, for acquired clinics, we show that approximately 91.5% of the weight is attributable to "good" comparisons of treated to never-treated clinics, and only 5% of the weight is attributed to comparisons between early vs. later treated clinics and 3.5% to within clinic variation.

Event Study Analyses. Next, we use an event study framework to evaluate whether the treatment and control clinics had differential trends before acquisition or affiliation. The event study is an extension of Equation 2, where instead of aggregating years before and after a transaction, indicators are included for each year relative to the transaction year. In addition to implementing "original" two-way fixed effects, in Figure 4 we include estimates from the interaction weighted estimator developed by Sun and Abraham (2021) and estimates from a stacked regression as in Cengiz et al. (2019).[21] Together, these estimators further assuage concerns of bias arising from staggered adoption and treatment effect heterogeneity within the DiD framework.

Figure 4 shows event study estimates for the 6 years before and after acquisition for IVF cycles, IVF transfers, and the live birth rate (see Appendix Figure D2 for affiliated clinics). We observe no significant pre-trends before the transaction for IVF cycles and transfers: F-tests of joint significance show that the pre-transaction years are not statistically different from zero for all estimators. After transaction, the cycles and transfers start to increase steadily, achieving large volume increases 6 years post-

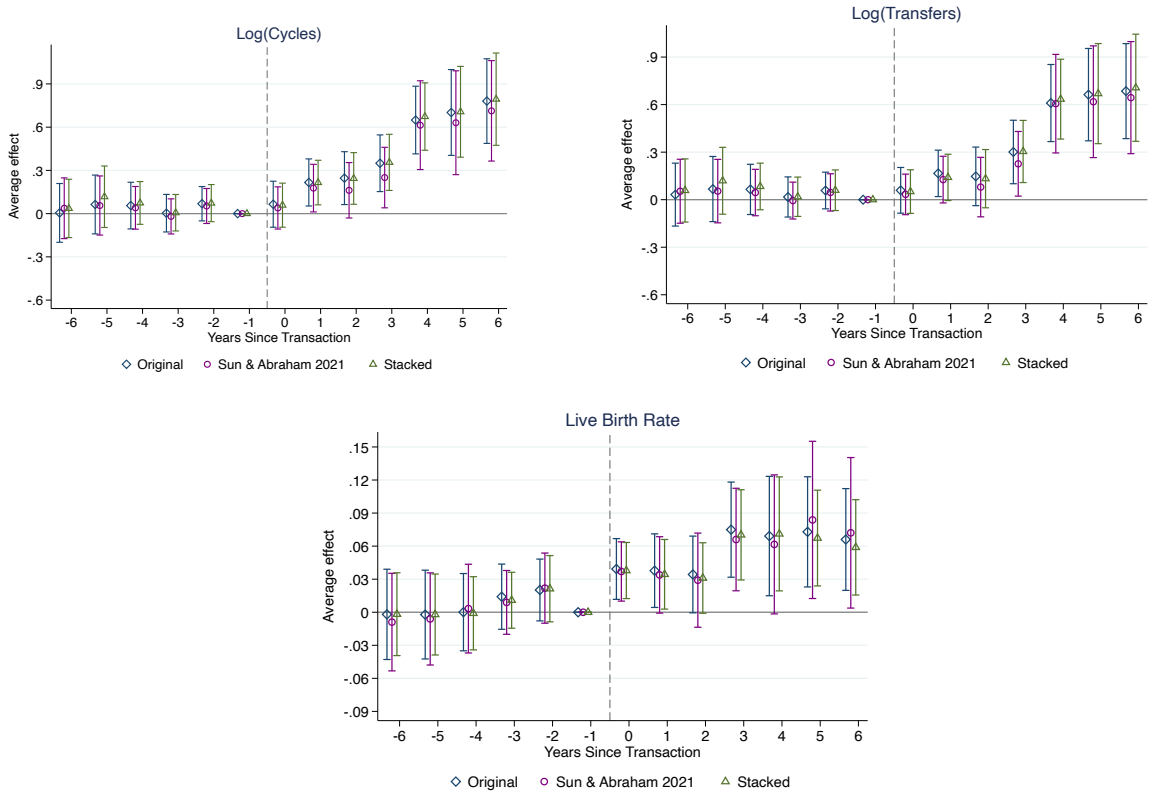
[20] The Goodman-Bacon decomposition requires a balanced panel, which limits this analysis to clinics with 15 years of data (52% of clinics and 64% of observations). However, 82% of acquired clinics (85% of observations) have a balanced panel. In Appendix Table E5, we show results of our primary specification in Table 2 are quantitatively similar in the balanced panel.

[21] We use the Stata command *eventstudyinteract* by Sun (2021) and *stackedev* by Bleiberg (2021).

transaction. Patterns are similar for affiliated clinics (Appendix Figure D2). This pattern is consistent with the time it would take for chains to influence both demand and supply-side channels. For example, volume-enhancing changes, such as investments in new office space and laboratories, hiring and training new staff, and attracting new patients through marketing campaigns will likely take time to implement. Demand for IVF also increased substantially during our sample period, with total cycles increasing by 139% between 2004 and 2018 in the U.S. To the extent that chains are driving or capturing much of this growth, the large volume effects appear plausible.

With respect to the live birth rate, before acquisition, pre-trends are relatively flat and not statistically different from zero. After acquisition, there is evidence that the live birth rate increases in the year of acquisition and remains above 3 percentage points in all post-period years. The immediate change in the live birth rate could result from accessing chain-wide protocols, while the additional increases in the live birth rate observed after year two could result from continued efforts to standardize care and learning from peers. For affiliated clinics, the live birth rate remains close to zero before and after affiliation (Appendix Figure D2).

Figure 4. Event Study Results for Acquired Clinics



Notes: This figure shows the β_1 and β_2 estimates of Equation 2 interacted with indicators for the year relative to the transaction year. Bands indicate 95% confidence intervals constructed from clinic-level clustered standard errors. The p-value from an F-test of joint significance on the original TWFE estimates are as follows: 0.533 for log(cycles), 0.780 for log(transfers), and 0.364 for the live birth rate.

Aggregating Dynamic Effects. In Appendix Figure D3 we plot the aggregate event study estimates in the six post-treatment years for all the main outcomes in this manuscript using alternative estimators. This figure further assuages concerns surrounding the bias in the size or direction of the coefficients since the estimators continue to show similarly sized increases in IVF cycles and the live birth rate.

4.4 The Role of Patient Selection

One way chains could influence performance outcomes is by changing the patient population treated by the clinic. Such patient selection could result from patients of higher or lower risk selecting certain clinics or from clinics potentially "cherry-picking" patients that would have more successful IVF outcomes, such as younger patients. Below we provide evidence that changes in patient characteristics do not appear to drive changes in the live birth rate.

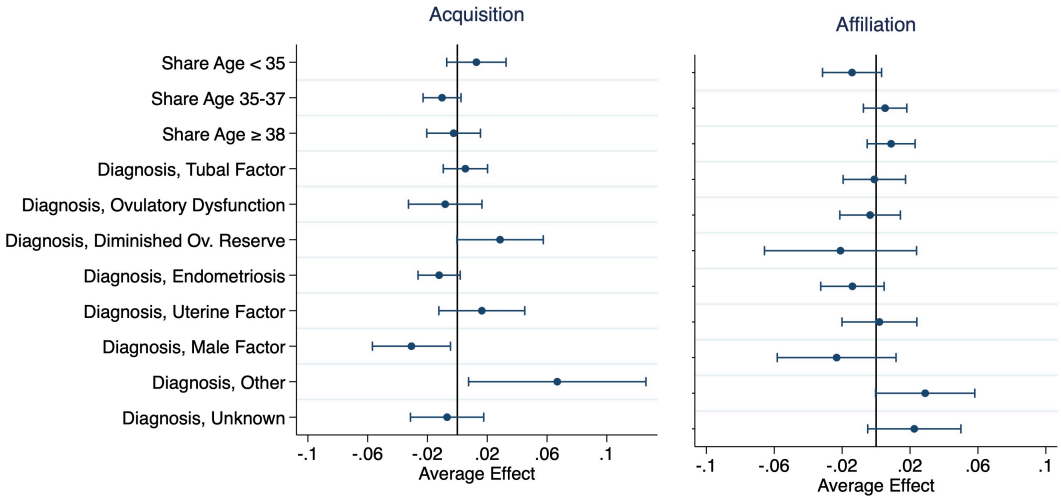
Similar Patient Age Distributions. The homogenous patient population mitigates concerns about patient differences across clinics. IVF patients are predominantly white, high-income, and highly educated (Chandra, Copen, and Stephen 2014; Galic et al. 2021). Furthermore, the largest predictor of IVF success is a patient's age (SART 2021b). Predictive models based on pre-treatment patient characteristics find that patient age explains 85% of the total variation in the live birth rate and that patient infertility diagnosis, race/ethnicity, and body mass index are not strongly predictive of IVF success (Xu et al. 2022). In Appendix Figure E1, we show that the distribution of the share of patients in younger and older age groups is similar before and after a clinic transaction.

No Systematic Patient Selection. We also do not find evidence that clinics systematically treat patients that could be more or less likely to experience IVF success. Figure 5 presents changes in the share of patients in different age groups and patient infertility diagnosis as the outcome variable of Equation 2. For acquired clinics, there is a small reduction in the share of patients aged 35-37 but no statistically significant changes for other age groups, which suggests no clear pattern of patient selection based on age. For affiliated clinics, there is a small reduction in the share of patients under 35. However, in Figure 6 and Appendix Table F3, we show that 1) increases in clinic volume are similar across all age categories, 2) acquired clinics increase the live birth rate across all age categories, especially among patients over 38, and 3) affiliated clinics do not increase the live birth rate, even among patients under 35. These results further minimize concerns that outcomes are driven by selection on patient age.

Patient diagnosis patterns are largely similar in acquired and affiliated clinics, and the changes are unlikely to influence IVF success. For example, even though there are significantly lower rates of patients with male factor infertility, there is limited evidence that male factor infertility impacts IVF outcomes (Shamonki et al. 2004; Vaegter et al. 2017). One study found that among the diagnosis categories, a tubal factor diagnosis is associated with the lowest live birth rate, and ovulatory dysfunction is

associated with the highest (Vaegter et al. 2017). Figure 5 shows limited evidence of post-transaction changes for these diagnosis categories.

Figure 5. Effect of Chain Ownership on Clinic-Level Patient Characteristics



Notes: This figure displays β_1 and β_2 estimates of Equation 2 using patient characteristics as the outcome variables. Bars are 95% confidence bands. Standard errors are clustered at the clinic level.

Robust to Controls for Patient Characteristics. We find quantitatively similar effects to our primary estimates on live birth rates when including patient diagnoses in Figure 5 as controls, confirming that patient infertility diagnoses have minimal influence on live birth rates (Appendix Table E1 Panel A). We also find quantitatively similar results when including controls for market-level maternal characteristics such as a mother's race, level of education, insurance status, and health factors, for patients who delivered a baby and reported using infertility treatment (Appendix Table E1 Panel B).

4.5 The Role of Clinic Selection

Selection is an inherent feature of this setting: fertility chains select the clinics they want in their chain, and clinics select the chain they want to join. Since being part of a fertility chain is not randomly assigned, we cannot unambiguously conclude that chain ownership causes changes in clinic volume and IVF success. For example, chains may acquire clinics that they believe will achieve the best outcomes in the future. Below we provide additional discussion and analysis that helps mitigate but does not eliminate the role of clinic selection in explaining our results.

Robust to Alternative Fixed Effects. The primary specification helps account for potential differences between the treatment and control groups by including clinic fixed effects, which adjust for time-invariant clinic characteristics such as location and reputation. Including *state* × *year* fixed effects accounts for time-varying factors common to all clinics in a state. For example, these fixed effects would account for increases in demand for IVF if changes in insurance coverage laws increase the affordability of care.

However, results are quantitatively similar when only using year fixed effects (Table 2) and *CBSA* × *year* fixed effects which would account for market-level changes that could impact the demand for fertility services (Appendix Table E2).

Robust to Using Matched Control Groups. A standard approach to address the endogeneity due to selection is to match treated units with similar characteristics in the pre-transaction period to untreated units. In Appendix Table E3 Panel A, we use 1-1 coarsened exact matching based on a clinic's mean pre-transaction IVF cycles and in Panel B also match on a clinic's live birth rate and the share of patients under 35. In both cases, we continue to find large and statistically significant increases in clinic volume and live birth rate for acquired clinics. For affiliated clinics the point estimates on the volume outcomes are also positive and statistically significant in Panel A, but in Panel B are no longer statistically significant. See Appendix Table E4 for matched sample summary statistics.

Matching on outcome variables within a DiD framework is susceptible to regression to the mean bias (Daw and Hatfield 2018). As an alternative strategy, we drop clinics in the bottom 25% of the distribution of cycles per year (Appendix Table E3 Panel C). We continue to find a statistically significant increase in volume and live birth rates among acquired clinics. For affiliated clinics, point estimates are positive but not statistically significant. The matched sample and sample dropping lower-volume clinics suggest that effects for *acquired* clinics are not driven by differential selection of clinics based on size. For *affiliated* clinics, conclusions are less definitive because the volume point estimates become less precise.

Robust to Alternative Samples. Several features of the data, sample, and context also warrant additional robustness checks. For example, results are robust to limiting the sample to clinics present in all 15 years of data and dropping all chain and non-chain clinics that were ever part of an AMC (Appendix Table E5). We discuss these and additional analyses in Appendix Table E5 and E6.

4.6 Data Limitations and Alternative Outcome Measures

A limitation of this study is that we can only consistently observe IVF success rates per transfer rather than per patient. This means that the same patient may undergo multiple transfers during the year. Still, this is a commonly used success rate in IVF research and provides the most granular level to estimate success (Abdalla, Bhattacharya, and Khalaf 2010; Wilkinson et al. 2016; Mizrachi and McQueen 2022). Specifically, the occurrence of a transfer requires the creation of a viable embryo and, therefore, precludes patients with failed cycles. This measure allows for a more "apples to apples" comparison of patients across clinics but provides a narrower view of a clinic's performance over the course of a full IVF cycle. Below, we consider additional outcomes that can provide a broader view of IVF treatment.

One concern is that a chain clinic could be performing worse on the steps that occur before embryo transfer, leading a patient to undergo more egg retrieval cycles than needed. For example, clinics may cancel a cycle before eggs are retrieved if no or not enough eggs were produced, which could indicate that a clinic was performing worse on ovarian stimulation. However, as seen in Appendix Table F1 Panel A, we find no change in cancelled cycles for acquired clinics. Starting in 2017, we also have data on the percent of cycles stopped after retrieval and before transfer, which often occurs because of failure to create a viable embryo. In a cross-sectional analysis, we find no evidence that chains had different stoppage rates than non-chain clinics (Appendix Table F1 Panel B). These results suggest chain clinics are performing as well as non-chain clinics on IVF steps that occur before an embryo transfer.

Additionally, starting in 2017, the CDC began to report live birth rates for new patients with no prior ART treatment for their first retrieval and their cumulative retrievals (i.e., a per patient measure). In a cross-sectional analysis using 2017 and 2018 data, we show that acquired clinics have significantly higher live birth rates per patient than non-chain clinics and achieve comparable live birth rates between the first retrieval and the cumulative retrieval rate (Appendix Table F2). This result provides additional evidence that chains have higher live birth rates than non-chain clinics.

Another limitation of this study is the lack of data available on complications related to IVF. For example, ectopic pregnancy, miscarriage, pre-eclampsia, premature birth, and low birth weight are all significantly higher among IVF patients (ACOG 2016). In Figure 6, discussed in Section 5.2, we show chains increase live births by increasing singleton births rather than multiple births, which is a sign of quality improvement. Additionally, using data from 2016, we can show that chain clinics have comparable rates of singleton births and term, normal weight, singleton live births (Appendix Table F2). This provides suggestive evidence that clinics are increasing live birth rates without increasing some birth-related complications.

Lastly, in Table 2, we are likely underestimating the true effect of chain ownership on embryo transfers. This is because of a change in how transfers were reported in 2017 that differentially impacts chain clinics and is, therefore, not fully accounted for by year-fixed effects (Appendix Figure F1). In Appendix Table F3, we provide evidence that acquired clinics increase cycles and transfers by nearly the same amount. This is an important finding as it suggests that chains are not being inefficient in ways that would lead them to perform more cycles that do not proceed to a transfer.

4.7 The Role of Insurance Coverage

In the US, some states mandate insurance coverage of infertility treatment in private insurance plans. These laws could influence demand for IVF services. While our main specification includes *state x year* FE to help account for these differences, in Appendix Table G1, we show whether outcomes differ between clinics located in states that did and did not have mandates. The point estimates on IVF volume are larger in

mandate states, but they are not statistically different from non-mandate states. One possible reason for the lack of difference is that the mandates do not apply to self-insured employers, require patients to meet strict definitions of demonstrated infertility, and place limits on cycles and benefits (Weigel et al. 2020).

Another demand-side channel that could influence clinic volume is the increase in large employers providing fertility benefits (Dowling 2021). While we cannot directly examine this possibility, our results are robust to the inclusion of *CBSA x year* FE, which would account for market-specific secular demand shifts, such as Bay Area technology companies beginning to cover fertility services (Carrns 2017). Still, chain clinics may be more adept at capturing this demand through their management services, which often includes marketing to bring in new patients and negotiating agreements with insurers and fertility benefits managers to be in-network. Chain clinics may also have greater capacity to meet this growing IVF demand by building satellite office locations and hiring more administrative and clinical staff.

4.8 The Role of Market Concentration

By consolidating clinics, chains may impact the competitiveness of fertility markets and, therefore, the behavior of fertility clinics. In particular, more concentrated markets may have less incentive to invest in quality than less concentrated (i.e., more competitive) markets (Matsa 2011). We find that only 3 CBSAs became more concentrated because of chain ownership as measured by an increase in HHI, likely because most acquisitions or affiliations occur across markets. Accordingly, outcomes are quantitatively similar when excluding these markets (Appendix Table G2). We also find that clinics acquired by chains in more competitive markets increase live birth rates three times more than those acquired in less competitive markets (Appendix Table G3). These results emphasize the importance of competition for quality promotion in healthcare markets.

5. MECHANISMS

The previous analyses find that chain ownership significantly increases clinic volume and IVF success rates and provide evidence that patient and clinic selection do not drive results. In this section, we provide suggestive evidence that the transfer of resources and knowledge following chain ownership most likely explains the changes in clinic volume and IVF success rates. Resource transfers include any transfer of financial resources (e.g., capital) or managerial capabilities (e.g., marketing) from the chain's corporate parent to the target clinic. Knowledge transfers include the sharing of new clinical information. Chains can transfer knowledge through top-down clinical directives (i.e., protocols, monitoring, and mandatory trainings) and by facilitating knowledge sharing among clinics through the creation of research consortiums and case review meetings. The following analyses are collectively intended to show patterns consistent with resource and knowledge transfers leading to improvement in outcomes.

5.1 Only Acquired Clinics Increase IVF Success Rates

Whether a transaction is structured as an acquisition or an affiliation can influence a parent firm's incentive and ability to improve the target firm's performance. Greater ownership typically confers more control over the target firm's operations and helps align incentives (Grossman and Hart 1986; Hart and Moore 1990). Because the chain owns the clinic's assets and becomes the residual claimant in an acquisition, it may have more incentive to improve outcomes such as quality, which influence the reputation of the chain. Additionally, a chain may be reluctant to share clinical resources or knowledge with an affiliated clinic if they are "free to walk away at any time with the acquired knowledge" (Garicano and Rayo 2017).[22]

A chain and an affiliated clinic may also have more alignment over volume-enhancing than quality-enhancing changes. Physicians typically enter an affiliation because they wish to retain clinical autonomy while still accessing financial resources and management services needed for growth. Investing in quality can be costly, and affiliated clinics may have less incentive to invest in quality if they believe they already have superior outcomes (as seen in Table 1). Affiliated clinics may also free-ride on the reputation of the chain, reducing incentives to improve their own quality (Jin and Leslie 2009). Conversely, if an affiliated clinic is explicitly seeking a chain's resources and managerial expertise, they may be more receptive to adopting practices that increase clinic capacity and have a more direct impact on their bottom line.

Altogether, a chain may have stronger incentives and ability to direct resources and knowledge towards quality improvement in an acquisition than an affiliation. The finding that only acquired clinics increase the live birth rate supports this argument (in Table 2). Bernstein and Sheen (2016) develop a similar framework when studying the impact of PE buyouts on restaurant chains. They find that quality improvements are concentrated among directly owned compared to franchised restaurants, whereas franchisees were just as likely to adopt initiatives that would have more direct effects on store profits. The latter result is consistent with our finding that affiliated clinics significantly increase volume, and therefore, may be more receptive to utilizing a chain's resources and knowledge for expansion-related activities.

5.2 Evidence that Chains Change Procedures and Technology to Increase Quality

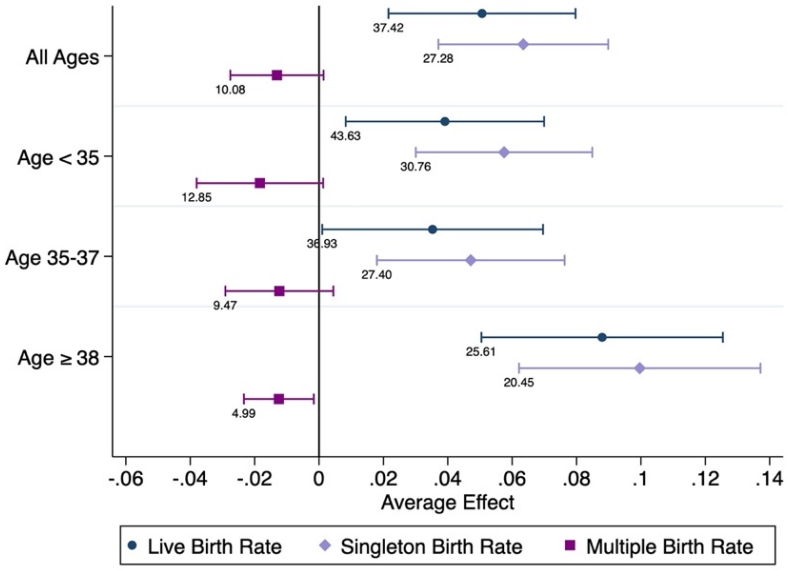
Acquired Clinics Increase Singleton Births and Reduce Multiple Births. Improving IVF success rates is a major challenge for fertility clinics. The "gold standard" is to simultaneously decrease multiple births and increase singleton births by enough to have a net positive effect on the live birth rate. Reducing multiple births is quality-enhancing because multiple births have a greater incidence of obstetric and neonatal

[22] For example, in an internal document from a chain, the chain says one affiliate planned to "walk-away" in 2021, prompting them to focus exclusively on "majority-only acquisitions (e.g., acquire 51%+ of target entity)" going forward.

complications (Kissin, Boulet, and Jamieson 2016). However, transferring multiple embryos (30% probability of a multiple birth) is associated with a greater probability of IVF success than a single embryo transfer (less than 1% probability of a multiple birth). Since the live birth rate is the key metric published by the CDC, this may create an incentive to transfer multiple embryos at once to increase IVF success rates.[23]

Transferring multiple embryos allows more room for error in the embryos chosen for transfer, whereas a single embryo transfer requires more precision and expertise to identify the highest quality embryo to transfer (Reimundo et al. 2021). If the chain were sharing resources and knowledge to improve IVF processes and quality, we would expect increases in the live birth rate to be driven by increases in singleton births large enough to compensate for reductions in multiple births. In Figure 6, we graphically present results from Equation 2 by the overall live birth rate, multiple birth rate, and singleton birth rate for acquired clinics. For overall IVF success rates, singleton births increase by 6.3 percentage points, and multiple births decrease by 1.3 percentage points. A similar pattern is observed within each patient age group.

Figure 6. The Effect of Chain Ownership on IVF Success Rates by Patient Age and Birth Type, Acquired Clinics



Notes: This figure displays β_1 estimates of Equation 2 by patient age category (i.e., only displays results for acquired clinics). The dependent variable mean based on the predicted mean for control clinics and treatment clinics before the transaction is displayed under each 95% confidence bar. Standard errors are clustered at the clinic level. See Appendix Table H1 for the full regression results.

Acquired Clinics Increase Genetic Testing, Reduce Embryos Per Transfer, and Update Laboratories.[24] The increase in the live birth rate driven by singleton

[23] While some patients may prefer twins, research suggests they may not comprehend the associated risks. Patient education can be an effective strategy in reducing desire for twins and increasing the use of single embryo transfers (Shenoy et al. 2017; Mendoza et al. 2018; Sunderam et al. 2018)

[24] See Appendix Table B2 for quote sources in this section. Note that new procedures or techniques are often referred to as technological advancements by fertility specialists.

births is consistent with new resources or knowledge enabling greater success of single embryo transfers. For example, chains emphasize adopting new procedures that improve embryo selection, such as preimplantation genetic testing (PGT) and intracytoplasmic sperm injection (ICSI): "cutting edge technology enables embryologists and fertility specialists to assess the genetic and chromosomal makeup of an embryo prior to its transfer into a woman's uterus." As shown in Table 3, we find strong evidence that acquired clinics increase the use of PGT but find no changes in ICSI use (potentially because ICSI was introduced in 1991 and experienced rapid adoption). One chain also describes implementing the use of day 5 blastocyst embryos because "this advanced IVF lab technique allows the embryo to mature as far as it can outside the human body, again allowing embryologists and physicians an enhanced ability to select the best single embryo for transfer." While we are unable to measure this outcome, we find that, per transfer, acquired clinics reduce the average number of embryos transferred to the uterus (Table 3). In contrast, we find a small, marginally significant increase in the average number of embryos transferred in affiliated clinics, suggesting they are not adhering to the same clinical practices as the acquired clinics in the chain.

Table 3. The Effect of Chain Ownership on Procedure and Lab Changes

	(1) **PGT Rate**	(2) **ICSI Rate**	(3) **Avg. # of Embryos Transferred**	(4) **Prob. Lab Name Change (Any)**	(5) **Prob. Lab Name Change (Single)**
Post × Acquisition	0.069***	-0.002	-0.275***	0.399***	0.344***
	(0.025)	(0.026)	(0.053)	(0.079)	(0.102)
Post × Affiliation	0.015	0.004	0.076*	0.233***	0.172*
	(0.011)	(0.034)	(0.039)	(0.086)	(0.091)
Dep. Var. Mean	0.059	0.676	2.233	0.118	0.080
Clinic-Years	3868	4897	4902	5676	5250
R^2	0.699	0.765	0.844	0.729	0.680

Notes: This table shows the β_1 and β_2 estimates of Equation 2. The dependent variable mean captures the predicted mean for control clinics and treatment clinics before the transaction. The CDC ART data does not report PGT until 2007 and changes how the data on PGT, ICSI and the number of embryos transferred are collected in 2017 and 2018. Therefore, PGT rate uses data from 2007-2016, and ICSI rate and number of embryos transferred from 2004-2016. Column 4 includes all clinics and column 5 limits the sample to clinics that only had a single change in the lab name during the sample period. Standard errors are clustered at the clinic level. Significance levels: *p<0.1, **p<0.05, ***p<0.01

Fertility chains can also provide resources to help modernize a clinic's laboratory and implement protocols to standardize laboratory processes. For example, one chain emphasizes that "continuous improvement in laboratory processes and patient care protocols have to lead to increased success rates." While we cannot directly measure whether a clinic changes or makes updates to its laboratory, the CDC ART data publishes the name of the laboratory used by each clinic each year. The name change may indicate a significant overhaul or signal a rebranding with no meaningful changes

to the laboratory. In Table 3 Column 4, the outcome variable is zero for all clinics before a name change and 1 after the first time a clinic changes its laboratory name. In Table 3 Column 5, we limit the sample to clinics that only experience 1 name change, as this may best capture a real change. We find that post-transaction, the probability a laboratory changes for acquired clinics increases between 34.4 and 39.9 percentage points. These results provide evidence that fertility chains may update clinic laboratories and facilitate the use of new technology and techniques that enhance the quality of IVF.

Acquired Clinics Increase Live Birth Rates for Complex Patients. As an additional strategy to explore the role of resource and knowledge transfer, we consider whether IVF success rates change for patients of different complexity (Stan and Vermeulen 2013). One of the most important predictors of IVF success is a patient's age, with patients of older age representing more complex cases. If accessing new or superior knowledge contributes to improved techniques and processes, we would expect the largest improvements for older patients, as they have the most to benefit. Figure 6 provides empirical support for this argument: patients aged 38 and older experience increases in the live birth rate at almost double the rates of patients under 35 or patients ages 35-37. One potential reason for these improvements is the increased use of PGT (Table 3) because studies have found that PGT particularly increases the success of single embryo transfers among older women (Maxwell and Grifo 2018; ACOG 2020).

5.3 Evidence that Chains Facilitate Learning

Lower Performing Clinics Experience Larger Improvements. If resources and knowledge are being shared within the chain, we may expect clinics with lower performance before joining the chain to benefit the most from accessing the resources and knowledge of the chain. Appendix Table H2 provides evidence that all acquired clinics experience improvements, but that the largest increases in clinic volume and live birth rates occur among initially lower-performing clinics relative to those that were higher-performing. These results suggest that joining a fertility chain creates a "rising tide lifts all boats" effect, in which all clinics improve, but especially lower-performing clinics. Appendix H provides additional details on the empirical analysis in this section.

Clinics Acquired by High-Performing Chains Experience Larger Improvements. If clinics are learning from their chain, we would expect clinics acquired by high-performing chains to experience larger increases in the live birth rate than those acquired by lower-performing chains. We provide evidence consistent with this argument in Appendix Table H3: live birth rates increase two and half times more in clinics acquired by high-performing chains than those acquired by low-performing chains. These findings suggest that fertility chains with pre-existing superior knowledge can facilitate larger increases in live birth rates.

Improvements in the Live Birth Rate Are Not Driven by Volume Increases. Rather than improving by accessing new resources and knowledge, physicians may improve their outcomes by performing more IVF cycles. A study by Wilkinson et al. (2022) did not find a significant association between a clinic's volume and its live birth rates. Similarly, a review by Mizrachi and McQueen (2022) finds no evidence of differences in IVF success rates based on physician experience: even among fellows, outcomes were stable throughout their training. The authors conclude that because embryo transfer is "performed by a single operator on their own, and thus, after initial training, there is limited opportunity for physicians to compare their technique to other colleagues and improve" (Mizrachi and McQueen 2022, p. 816). Therefore, rather than within-physician learning from increased volume, physicians may be more likely to improve from resource and knowledge sharing within the chain.

The event study results provide insights into the volume-outcome relationship (Figure 4). For example, we find immediate increases in live birth rates without a commensurate increase in volume. Additionally, affiliated clinics see increases in volume but no changes to the live birth rate. We also re-estimate the terciles in Table 3 Column 1 based on pre-transaction IVF cycles but use live birth rate as the outcome (Appendix Table H4). The estimates of this regression show that acquired clinics in the top tercile of volume pre-transaction (which saw no significant increases in volume) still significantly increase the live birth rate. Together, these results suggest the volume-outcome relationship does not appear to drive the increase in the live birth rate.

5.4 Chain Clinics Expand IVF Market

The marketing materials of fertility chains place a large emphasis on growth. For example, chains advertise providing clinics with financial resources to fund add-on locations and hire new clinical and administrative staff. Additionally, chains advertise providing clinics with managerial capabilities such as marketing services and patient engagement programs to attract and retain patients throughout their IVF journey. Clinic growth could help increase access to IVF given the unmet demand for fertility services driven by the scarcity of clinics and cost of IVF (Chambers et al. 2009; Greil et al. 2016).

However, rather than expand the market, chain clinics may instead be capturing the market share of non-chain clinics. We use an instrumental variables strategy to study market expansion vs. business stealing (see Appendix H for empirical details). We instrument for the number of IVF cycles provided by chains in a market-year using the number of clinics in a chain in that market-year. To test for business stealing, we use IVF cycles performed by non-chain clinics as the outcome variable in the second stage. If for every 1 IVF cycle performed by a chain clinic, there is 1 less IVF cycle performed by non-chain clinics, then this would provide evidence of business stealing. To test for market expansion, we instead use the total number of IVF cycles performed by *all* clinics as the outcome variable in the second stage. If for every 1 IVF cycle performed by a

chain clinic there is 1 additional IVF cycle in that market, then this would provide evidence of market expansion.

As seen in Table 4, we find no support for business stealing and strong evidence in support of market expansion. We observe no reduction in cycles for non-chain clinics (Column 1), and for every additional cycle performed by a chain clinic, there is one additional cycle at the market level (Column 2). These results are consistent with chains providing resources needed to ease clinic capacity constraints and expand the set of patients utilizing IVF. Given the large unmet demand for fertility services, chain clinics likely increase access to IVF.[25] There are also similar patterns observed for the number of live births (Columns 3 and 4), providing evidence that the entry of chain clinics does not significantly impact the IVF outcomes of non-chain clinics.

Table 4. Market Expansion Analysis, IV Estimates

	(1)	(2)	(3)	(4)
	Total Market Cycles		**Total Market Live Births**	
	Non-Chain Clinics	All Clinics	Non-Chain Clinics	All Clinics
Total Chain Cycles	-0.005	0.995***		
	(0.150)	(0.150)		
Total Chain Live Births			-0.207	0.793***
			(0.132)	(0.132)
First Stage: F-Stat	79.450	79.450	63.622	63.622
Market-Years	1930	1930	1930	1930

Notes: This table displays the δ estimates of the second stage Equation 4 (shown in Appendix H). The market is defined as the CBSA of the clinic. *Total Chain Cycles* and *Total Chain Live Births* represent the total number of IVF cycles and live births performed by chain clinics each year in a CBSA, instrumented using the number of chain clinics each year in a CBSA. The first stage F-stat shows the Kleibergen-Paap Wald rk F statistics. We cannot reject that the estimates in Columns 2 and 4 are statistically different from 1 (the p-value from F-tests are 0.892 and 0.134, respectively). The sample includes all clinics in a CBSA that ever had a non-chain clinic. Standard errors are clustered at the market level. Significance levels: *p<0.1, **p<0.05, ***p<0.01

5.5 Chain Clinics More Likely to Advertise IVF Financing Options

Fertility clinics often describe investing in quality improvements and marketing as strategies to bring new patients into the fertility market. However, the demand effects from quality increases could take time to manifest because of lags in the publication of CDC reports: data for a given year is typically published 2-3 years later since clinics need to wait 9-10 months to allow for births to occur before the CDC can compile and verify the data. A complementary and more immediate way to attract patients is through

[25] An increase in cycles may also be the result of supplier-induced demand: physicians pressure patients into IVF instead of alternative treatments. However, this does not necessarily make patients worse-off. Alternative treatments, such as intrauterine insemination, have a higher incidence of multiple birth and can often take longer to achieve pregnancy than IVF.

marketing, where one popular strategy is to advertise IVF financing options meant to signal the affordability of care (Yu, Ghosh, and Viswanathan 2022).

Using the Internet Archive to collect advertising information in 2018, we find that clinics acquired by fertility chains are more than twice as likely to advertise money-back guarantees or multiple-cycle discount programs compared to the matched sample of non-chain clinics (Appendix Table H6). This cross-sectional analysis provides suggestive evidence that chains may attract patients to their clinics by marketing IVF discounts and financing options.

5.6 Private Equity Investment into Chains Increases Clinic Volume

Private equity (PE) firms can enable significant growth among acquired firms by alleviating financial constraints relative to other types of ownership. Therefore, we may expect that the financial resources provided by PE firms would have more salient effects on clinic growth and volume (Braun et al. 2021; Singh et al. 2022). As described in Section 2, eight fertility chains received PE funding during the sample period, creating variation in ownership and timing needed to decompose the effect of PE funding on outcomes.[26]

Appendix Table H7 shows the results of Equation 2 decomposing the effect between post-transaction years when a clinic was part of a chain with and without PE funding. We find almost all the volume effect for acquired clinics occurs because of PE funding (13.3% increase in cycles without PE and 30.4% increase with PE). Importantly, PE funding does not influence the live birth rate: live birth rates increase by 5.8 percentage points without PE funding and 5.0 percentage points with PE funding. This result suggests quality improvements occur because of the chain, not the PE funding, whereas clinic growth is more reliant on PE funding.

6. CONCLUSION

6.1 Summary of Results

This paper studies how chain ownership impacts firm performance in the fertility industry. By 2018, over 20% of fertility clinics (performing 40% of IVF cycles) were part of a fertility chain. Our results show that both affiliated and acquired clinics increase the volume of IVF cycles by over 25%, whereas only acquired clinics significantly increase the live birth rate. The 5.1 percentage point increase observed after a clinic acquisition represents a statistically and economically meaningful increase of 13.6% in the live birth rate. We provide compelling qualitative and quantitative evidence that resource and knowledge transfers driven by chain ownership are the most likely explanation for the improvement in clinic performance.

[26] Of these eight chains, three chains enter joint ventures or receive growth equity from PE firms and five chains are acquired via leveraged buyouts by PE firms (in some of these cases, the chain itself is created through the buyout of a flagship clinic with add-on acquisitions). Since we are interested in measuring access to additional financial resources, we treat both types of deals as receiving PE funding.

Acquired clinics increase the quality of care by simultaneously reducing multiple births and increasing singleton births and achieve the greatest increase in live births among older patients. These improvements coincide with decreases in the number of embryos transferred and a significant increase in preimplantation genetic testing, which has been found to improve IVF success rates among older patients. These results are consistent with the marketing materials and press releases of fertility chains that argue that by facilitating resource and knowledge sharing, they can improve IVF success rates. We also find that chain clinics increase volume mainly through market expansion rather than business stealing and that PE investment into fertility chains largely drives increases in clinic volume. These results are consistent with access to new resources facilitating clinic growth. Lastly, we do not find evidence that results are driven by changes in patient characteristics that could influence IVF success, differences in the types of clinics selected for acquisition or affiliation, or market-level changes.

6.2 Discussion and Broader Implications

This paper provides evidence that chain organizations can improve healthcare outcomes. The "free market" features of the fertility sector may help explain why we observe positive outcomes compared to settings with regulated prices and larger information asymmetries between patients and providers (Arrow 1963; Dranove and Satterthwaite 1992; Gaynor 2006). For example, in settings such as dialysis and nursing homes where government "plays an outsize role in subsidizing care and in which patients may find it difficult to observe their facilities' quality, competition may be unlikely to discipline providers' behavior" (Eliason et al. 2020). Reliance on Medicare and Medicaid payments can also lead chain owners to engage in cost-cutting measures that can negatively impact quality. Patients in these settings also have less choice and face higher switching and travel costs given the long-term nature of treatment.[27]

By contrast, the business model of fertility clinics better resembles that of the retail and service sectors, which emphasize price and quality transparency and rely on consumer choice and self-paying patients. Given that the CDC publishes clinic outcomes, the salience and transparency of the live birth rate may motivate chain operators to invest in quality to attract patients (Jin and Leslie 2003; Dranove and Jin 2010). In support of this argument, Bundorf et al. (2009) found that the introduction of fertility clinic report cards led consumers to alter their choice of clinics. The limited role of third-party payers may also lead chains to engage in more price competition to gain market share (Brown 2019; Sinaiko 2019). We provide evidence that chain clinics are twice as likely to advertise fertility discounts and money-back guarantees, which patients may interpret as a signal of affordability.

[27] Through mergers and acquisitions, nursing home, dialysis clinics, and hospital markets have become increasingly more concentrated, further limiting incentives to invest in quality. By contrast, the fertility sector is still relatively fragmented. Additionally, the patients of nursing homes, dialysis clinics, and hospitals are substantially more diverse in age, risk factors, and demographics than those of fertility clinics.

Studying fertility clinics also offers insights into other consumer-centric healthcare settings. For instance, the chain business model has become more prevalent in behavioral and mental health, dermatology, dental care, physical therapy, and urgent care following high-profile acquisitions by retail giants such as Walmart, Walgreens, and Amazon, as well as PE firms (Jain, Martin, and Murphy 2018; Reed 2023). Like fertility clinics, these are office-based patient-facing settings that can rely more on self-paying patients and increasingly focus on convenience and the patient experience. Therefore, even if chain ownership is not quality-enhancing, patients may be willing to pay for convenience and other service amenities (Leive, David, and Candon 2023).

However, government agencies and other stakeholders have raised several legitimate concerns surrounding the growth of healthcare chains, particularly those backed by PE firms (Cumming 2022). A key concern, as stated by Deputy Assistant Attorney General Andrew Foreman, is that rather than "function as a maverick or a disruptor in health care markets," investors will "cause the target company to focus solely on short-term financial gain and not on advancing innovation or quality" (Foreman 2022). Though we focus on chains and not PE firms specifically, we find that fertility chains can facilitate knowledge and resource sharing needed to improve outcomes. Previously independent clinics had limited means and incentives to collaborate and learn from each other. Joining a fertility chain could help reduce barriers to collaboration, and a centralized management system allows for the distribution of information and standardization of care. We also find limited evidence that fertility clinic acquisitions or affiliations lead to changes in market concentration. However, the ongoing consolidation of fertility clinics could eventually generate anti-competitive effects.

Ultimately, the findings of this paper are societally important and shed light on the future of the fertility industry. The "the fertility sector is booming" but at the same time, "IVF is failing most women," which has generated increased scrutiny of fertility clinic performance (Walsh 2021; The Economist 2023a). Even though the live birth rate has increased considerably in the past two decades, most patients still have less than a 40% chance of delivering a baby, and rates vary considerably across clinics. New technologies are currently being developed that utilize artificial intelligence to standardize care and improve success rates, raising questions about which clinics and patients will receive access to these technologies (Kesari 2022). More broadly, the striking improvement in IVF success rates within fertility chains highlights the tension between clinical knowledge as a competitive advantage versus a public good that could collectively improve fertility outcomes. Future research must consider implications for equity in access and outcomes.

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APPENDIX

Appendix A. Data Collection and Sample

A.1 CDC ART Data

We downloaded both Excel files of the data and PDF files from the CDC directly: https://www.cdc.gov/art/artdata/index.html. The PDF files contain additional information about whether a clinic restructured or failed to report data, as well as address information and laboratory information. For almost each year of data, there are changes in how the CDC reports the data. For this reason, not all variables can be consistently identified over the sample period, and it is necessary to include year fixed effects to account for year-to-year changes in reporting. Below we describe two additional data issues and our data-cleaning approach.

- Changes in 2018: In the year 2018, when there were fewer than 4 observations reported for an outcome, the number was obscured by a "star" value (e.g., if there were 3 transfers performed by a clinic, this value would be reported as a "*"). We replace "star" equal to 1 in one dataset (the main dataset used in the analysis) and equal to 4 in another dataset (as a robustness check) and find minimal differences between these two extremes. Additionally, since our analytic sample excludes clinics with fewer than 20 cycles a year over the sample, this removes most of these missing data cases regardless of the 1 or 4 replacement strategy. Lastly, we show that results are quantitatively similar when excluding the year 2018 altogether (Appendix Table E6).
- Non-reporting clinic: Every year, the CDC ART data lists clinics that conducted IVF cycles but failed to report their outcomes (approximately 8% of fertility clinics each year). In most cases, this is because a clinic is about to close or is restructuring, which are both indicators provided in the CDC data (these are not mutually exclusive – clinics can close or restructure and still report data to the CDC in the year they are closing or restructuring). In our empirical analyses, we exclude all clinics with less than 3 years of data and with gaps of 2 years or more in reporting to the CDC since these clinics are likely undergoing substantial changes to their IVF program (effect sizes are slightly larger but not statistically different if we include these clinics). This restriction removes most of the clinics with non-reporting years. However, in robustness checks, we also show that results are robust to excluding clinics that ever closed or ever restructured, as well as to limiting the sample to clinics present in all 15 years of data (Appendix Table E5). Altogether, the consistency of results, whether or not we exclude clinics based on reporting criteria, mitigates concerns that reporting bias is affecting our results.

The main variables in the data are constructed as follows:

- IVF Cycles. Total number of cycles using fresh or frozen embryos from both donor or non-donor eggs.
    - ART data changes and adjustments: From 2004-2016 fresh and frozen cycles were reported separately, so we added them together to create a single consistent variable because they were reported together starting in 2017. In addition, in

2017 and 2018, reporting of total cycles changed to be more comprehensive and include donor cycles by age cohort, cycles started using previously frozen eggs, and fertility preservation cycles (which we can partly remove based on percent estimates provided). Additionally, from 2004-2010, the total number of frozen cycles and donor cycles were not reported, so we approximated using frozen transfers and donor transfers. During this period, these cycles represented a small fraction of total cycles and the inclusion of year FE in regression analyses would account for the uniform mismeasurement. We discuss and provide robustness for our measurement of total cycles in Appendix Table F3.

    - In any analysis reported or weighted by age category, we only include non-donor cycles because donor cycles are not reported by age.

- IVF Transfers. Total number of transfers using fresh or frozen embryos from both donor or non-donor eggs.
    - From 2004-2016, fresh and frozen transfers were reported separately, so we added them together to create a single consistent variable because they were reported together starting in 2017. In 2017 and 2018, the aforementioned reporting change also led to a decrease in reported transfers per clinic. We explore how this change impacts our analysis in Appendix Table F3.
    - In any analysis reported or weighted by age, we only include non-donor transfers because donor transfers are not reported by age.
- Live Birth Rate. This is the percentage of fresh or frozen embryo transfers from non-donor eggs that resulted in a live birth.
    - The rate is provided directly by the CDC and remains unaffected by the changes in total transfers reported, as we are not constructing this measure from those transfers.
    - In most analyses, the live birth rate is a weighted average of four patient age categories: under 35, 35-37, 38-40, and 41-42. In analyses by age group, we take the weighted average of patients aged 38-40 and 41-42 to have a more proportional number of patients in each group (under 35, 35-37, and over 38). As for cycles and transfers, from 2004-2016, we combine live birth rates from fresh and frozen embryo transfers to create a single consistent variable because they were reported together starting in 2017.
- Singleton Birth Rate. This is the percentage of fresh or frozen embryo transfers from non-donor eggs that resulted in the live birth of a single baby (i.e., not twins, triplets, or more).
    - The same comments for the live birth rate above apply to the singleton birth rate. Additionally, from 2004-2010, the singleton live birth rate was only provided for fresh embryo but not frozen embryo transfers. Under the assumption that a clinic would apply the same strategy to both fresh and frozen embryo transfers, we impute what a clinic's singleton birth rate for frozen embryo transfers would be based on the proportion of singleton births achieved for fresh embryo transfers within the same age cohort-clinic-year. We show robustness to excluding years 2004-2010 in Appendix Table H1.
- Multiple Birth Rate. This is the percentage of fresh or frozen embryo transfers from non-donor eggs that resulted in the live birth of twins, triplets, or more.

- We calculate the multiple birth rate as the live birth rate minus the singleton birth rate. This is the only option for the difference between total live births and singleton births.

A.2 Clinic Classification

Clinic Transaction Year. We define the transaction year as the year the clinic became part of a fertility chain. Some chains are newly created during the sample period, in which case the transaction year is the first year the chain was formed.

Chain Ownership.[1] Clinics can become part of a chain in the following three ways:
1) Acquisition: An acquisition refers to an event where some or all of the assets of the clinic (office, lab, or both) are acquired by the parent company of the fertility chain. To comply with corporate practice of medicine laws, which prohibit non-physician-owned business entities from practicing medicine, these acquisitions typically follow what is referred to as a "friendly PC" model.[2] In this model, the chain typically has a subsidiary management company that acquires the seller's assets, and the selling physician serves as the owner of a separate professional corporation (PC). A long-term management service agreement is then signed between the friendly PC and the management company for the company to manage the operations of the clinic. These agreements may include restrictive covenants and non-compete agreements (for example, physicians often enter 5-year employment agreements and are restricted from opening a geographically proximate competitor clinic), productivity thresholds, and capital commitments to fund clinic growth. While many acquisitions involve a buyout, others can involve acquiring a controlling interest. Either way, the parent company exerts control over clinic operations.
2) Affiliation: An affiliation refers to any interorganizational partnership, alliance, or collaboration between a clinic and a fertility chain where the clinic contracts with the chain for selected management services and capital or financing options. For example, a clinic may contract with a chain to receive access to marketing and patient engagement services. These affiliations often resemble outsourcing agreements in which the parent company has no ownership stake. However, in other cases, the chain applies a "partnership model" which resembles a joint venture agreement. The terms of these contracts can vary widely and are, unfortunately, often not observable. The key distinction and assumption for our research

[1] See Patrizio et al. (2022) for an overview of new companies and business models that have emerged among fertility clinics.
[2] A more comprehensive legal description can be found here: https://www.chapman.com/publication-Health-Care-Management-Service-Organizations. CPOM has been heavily criticized for not being effective, given the legal workarounds and lack of state enforcement. There have also been several high-profile lawsuits by physicians against PE-backed firms for "profound and pervasive direct and indirect control over the physicians' practice of medicine" (see https://www.lifesciencesperspectives.com/2022/01/26/california-physicians-allege-pe-backed-provider-violates-corporate-practice-law/). Note that CPOM would only apply to cases where a clinic is acquired by a publicly traded or PE-backed firm and not when a clinic is acquired by another clinic in a chain (before the chain received external investment). Clinic to clinic acquisitions are sometimes referred to as mergers in press releases, but usually, the clinics remain physically separate entities that are part of the same chain.

purposes is that in an affiliation, the corporate parent exerts less control over clinic operations than in an acquisition.
3) De novo: De novo growth refers to a new fertility clinic built and opened as part of the chain and is, therefore, owned and managed by the chain.

Data Collection Process. Below we explain how we determine which clinics are part of a fertility chain and their ownership structure.

Create List of Fertility Chains: We used documents published by consultants and legal firms outlining fertility clinic mergers and acquisitions (for example, www.dresnerpartners.com%2Face-files%2FFertility_June_2018.pdf) and used business intelligence databases such as Irvin Levin, SDC Platinum, and Pitchbook to identify fertility chains that existed during the sample period (some chains no longer exist by name because they were acquired by other chains). In addition, since many times the name of a clinic includes the name of the chain, we were able to use CDC Fertility Clinic Success Reports (referred to as the CDC ART data) to identify chains. A recent publication by reproductive endocrinologists also helped confirm the identification of chains (Patrizio et al. 2022). Details on the specific chains are provided in Section A.3.

Identify Clinics in Fertility Chains: We focused on one chain at a time to identify clinics in that chain. In addition to the business intelligence databases, we used archived and current versions of chain websites and clinic websites, the EDGAR database for SEC filings for those that are part of a publicly traded company, searched for press releases using the name of the chain, and searched for whether the name of the clinic or the clinic's laboratory included the name of the fertility chain in the CDC ART data. We then manually searched for each clinic in the data to ensure we did not miss any clinics through the above process and ensure that none of our non-chain clinics were under chain or corporate ownership. Specifically, we searched the business intelligence databases for the clinic names and we used www.google.com to search the name of the clinic in combination with any of the following terms: "management company", "private equity", "acquired", "acquisition", "merger", "partnership", "alliance" and "affiliation."

1) **Clinic Transaction Year.** The year of transaction was recorded as the year of the announcement date as reported in a business intelligence databased such as PitchBook or the date provided in an SEC filing. If this was not available, we used the date of a press release announcement (if available) or the date the clinic appeared on a chain website using the Internet Archive (www.archive.org). However, if the CDC reports showed a clinic changed names in a year different than the sources above, we used the ART data year and noted this choice. The CDC reports can help identify a change in ownership through a change in the clinic's name to include the chain name and provide an indicator for whether a clinic is restructured, which often coincides with an acquisition or affiliation. When there was a discrepancy between a press release and the CDC ART data, the CDC ART data typically reported the change the year before the announced date in a press release, especially if the press release is from early in the year. For example, if a press release is from January 1, 2017, but the clinic changed its name to a chain name in 2016, then we record the year of transaction as 2016.

2) **Clinic Ownership Structure.** In addition to collecting data on the transaction year, we also classify clinics into the previously described ownership structures.
    a) When available, we use the description of the financial terms of the transaction as provided in the business intelligence databases or the SEC filings to determine whether a clinic was an acquisition or affiliation.
        i. Note that contracts for acquisitions and affiliations are complex. Acquisitions are easier to identify because of legal filing requirements and recording in business intelligence databases. The exact type of affiliation, and particularly the terms of an affiliation, are not possible to determine unless the information has been explicitly reported. For this reason, affiliations include a variety of different arrangements, from contracts for services to partnership agreements. Our assumption is that a fertility chain exerts greater control over clinical operations in an acquisition than in an affiliation.
    b) If this information was not available, we used press releases and information provided on chain websites in combination with state corporate filing data to deduce the nature of the transaction. For example, a press release using the term "partnership" could reflect either an acquisition or affiliation. We, therefore, search for the clinic's corporate filing records (using OpenCorporates.com or state corporate filing websites) to see if a clinic filed to become a subsidiary of a chain (likely signals an acquisition) or remained an independent legal entity (likely signals an affiliation). However, this is not always the case, and depending on the state, corporate filing details may not be available.
        i. From the chain websites, we were also able to deduce their typical organizational model. For example, one chain's internal marketing materials emphasize that all its member clinics follow a partnership model. Another chain's website lists the clinics it owns separately from affiliate clinics. In combination with the steps above, we were able to make an informed decision about a clinic's classification based on the chain's strategy.
        ii. Additionally, if there is evidence of a merger – the clinic's operations or reporting were merged with another clinic in the chain – then we used this as evidence of an acquisition (i.e., one clinic acquires another clinic and then "merges" their data reporting). In the ART data, merged clinics typically stop reporting outcomes under their own name and start reporting under the clinic that acquired them. We record, combine and control for these mergers in the analysis.
    c) Each clinic's classification is recorded/checked by 4 different individuals (two Research Assistants with experience working in finance and the two authors of the paper), and cases that are not clear are discussed. If consensus cannot be reached, we provide the most likely classification given the nature of the chain and the classification of other clinics in the chain. These clinics are also flagged to be removed during robustness checks. Any error in the classification is not likely to be systematic and instead would introduce noise rather than bias into the estimates.

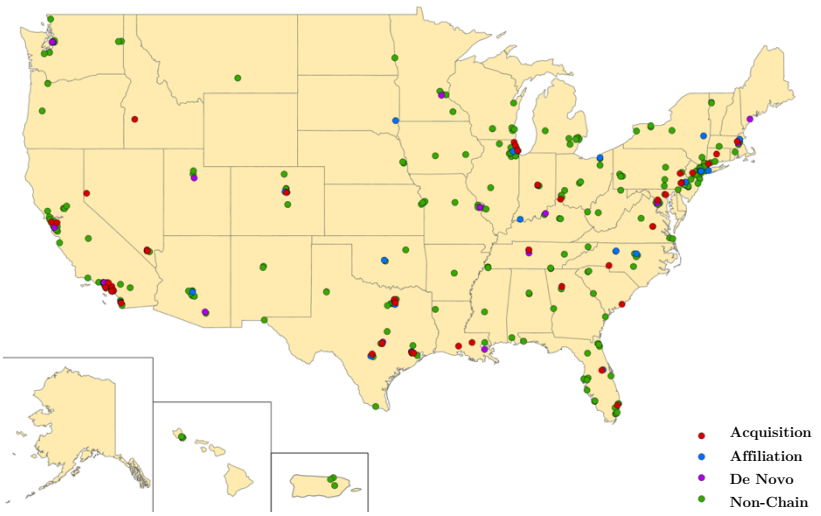
We also follow the additional rules:

a) When a clinic is a "founding" clinic of a chain, it is always recorded as an acquisition since this is the central clinic owned by the parent company.
   i. For chains that were newly formed, the date of transaction for a founding clinic is the date the chain formed.
   ii. For founding clinics that started as a single independent practice that then began acquiring or affiliating with other clinics before external investment, their date of transaction is their date of founding. In other words, these clinics are always considered as treated in the sample because there is no official chain creation date. For any clinics acquired or affiliated with that clinic in the future, we use the date they joined the founding clinic's chain.

b) If a clinic had multiple transactions (i.e., the chain was acquired by another chain or company), we only record the date of the first transaction under the assumption that the clinic has already received treatment. However, in robustness checks, we control for the second transaction. If a clinic leaves a chain, the post-transaction indicator turns to zero. Results are robust to dropping the years after a clinic left a chain.

A.3 Fertility Clinic Chains

Figure A1. Location of US Fertility Clinics, 2018



Note: Locations are based on the coordinates of the address provided by the clinic to the CDC in the Fertility Clinic Success Reports. "De Novo" refers to a newly built clinic that is part of a chain.

We identify 11 fertility chains active from 2004 to 2018. Information about each chain is provided in Table A1 below, and a map of the distribution of chain clinics is provided in Figure A1. As seen in Table A1, the fertility chains were acquired by a variety of firms, including PE firms and international healthcare chains by the end of the sample period. In total, 9 of the chains received PE funding during the sample period. However, since one chain was not acquired until December

2018, the last month in our sample, we do not include it as a PE-backed chain. Also note that some chains were established via a joint venture or buyout by a PE firm, while other chains existed before buyout.

Table A1. Characteristics of Fertility Chains

Chain Name	Year Founded	Deal Mon/Year	Investing/ Acquiring Firm	Deal Type	Additional Details
Boston IVF	1986	Dec 2018	NMC Health (Publicly traded international health care chain)	Acquisition (NMC owns 70% of the company)	Growth initially focused on New England but now has a national presence.
Huntington Reproductive Center (HRC) Fertility	1988	Dec 2018	Jinxin Fertility (formerly PE-backed international fertility chain)	Acquisition (Details not disclosed)	Started with two founding partners that expanded through Southern California. Jinxin was taken public in 2019.
Reproductive Medicine Associates of New Jersey (RMANJ)	1999	Feb 2017	The Valencian Infertility Institute (Privately held international fertility chain)	Acquisition (IVI owns 70% of the company)	The merger with IVI led to rebranding to the "RMA Chain" to capture its national presence.
InVitro Sciences (IVS)	1998	Aug 2017	Sverica Capital Management (PE firm)	Acquisition (Buyout/LBO 100%)	IVS was a subsidiary of the practice management company Women's Health USA – was spun out by Sverica in 2019 and rebranded as First Fertility.
Prelude Fertility Network	2016	Oct 2016	Lee Equity Partners (PE firm)	Joint Venture ($200 million growth equity)	Started as a joint venture with Lee Equity in 2016. Prelude went on to acquire Vivere Health in 2017 and was acquired by Inception Fertility in 2019.
Inception Fertility	2015	Mar 2016	Lee Equity Partners (PE firm)	Growth Equity (Details not disclosed)	Acquired by WayPoint Capital Partners in Jan 2018 in a buyout/LBO.
Colorado Center for Reproductive Medicine (CCRM)	2015*	Aug 2015	TA Associates (PE firm)	Acquisition (Buyout/LBO 100%)	*CCRM's first clinic was founded in 1987. The chain did not exist until 2015. In 2021 was acquired by Unified Women's Healthcare.

Ovation Fertility	2015	Jun 2015	MTS Health Investors (PE firm, name has changed to WindRose)	Acquisition (Buyout/LBO 100%)	Focuses more on lab management than clinics, though provides both services. Sold to Morgan Stanley Capital Partners in 2019.
Sher Institute for Reproductive Medicine (SIRM)	1982	Jan 2015	Integramed (backed by PE firm Sagard Capital Partners)	Acquisition (Buyout/LBO 100%)	First private IVF practice. Bi-coastal growth focus. Many locations closed or rebranded post buyout.
Integramed	1985	Sept 2012	Sagard Capital Partners (PE firm)	Acquisition (Buyout/LBO 96.30%)	Integramed owned Shady Grove Fertility until Shady Grove was acquired by Amulet Partners to form a new chain called US fertility. Integramed declared bankruptcy in 2020.
Vivere Health	2010	May 2010	LLR Partners (PE firm)	Joint Venture ($23 million growth equity)	LLR partners initially acquired a flagship clinic and invested to create the platform. Acquired by Prelude in 2017.

Appendix B. Qualitative Data

This appendix provides a text analysis of press releases from fertility clinic transactions (Table B1) and quotes compiled from fertility clinic and chain press releases, websites, and marketing materials to understand the stated purpose of the fertility chains and the reasons clinics would join a chain (Table B2). When possible, we use archived websites to reflect the materials during the sample period and use quotes from most of the chains in the sample. See the endnotes of the appendix for links to the sources.

We also conducted unstructured interviews with reproductive endocrinologists, corporate investors in fertility clinics, and fertility chain operators. We received IRB approval to conduct interviews with clinicians from The Committee for Protection of Human Subjects (CPHS) of the University of California Berkeley. Information from interviews was used on background, and no direct quotes are provided from these interviews.

Table B1. Press Release Text Analysis

Concept	Identification	Number of Deals	Percentage
Expansion/Growth	(mentioning "growth" or "expand")	27	75%
Knowledge	(mentioning any of the below)	29	81%
	"knowledge"	7	19%
	"research"	20	56%
	"standard"	14	39%
	"protocols"	5	14%
	"process"	4	11%
Resources	(mentioning any of the below)	29	81%
	"resources"	14	39%
	"financial"	19	53%
	"capital"	8	22%
	"management"	11	31%
	"marketing"	10	28%
	"technology"	17	47%

Notes: We find informative press releases on 36 transactions. Many times, a single press release serves to announce multiple transactions, resulting in fewer press releases than transactions.

Table B2. Selected Quotes from Archival Material Reflecting Fertility Clinic Motives for Chain Affiliation or Acquisition

	Examples	
Resource transfer	Financial Resources and Growth Strategies	"We […] develop new practices or strengthen existing ones by applying business and operations strategies that expand their markets and their market share. This may involve the development of new practice locations, embryology laboratories or ambulatory surgery centers, in order to strengthen the performance of a practice and achieve strategic growth objectives."[1] "Our partner practices' patient revenues increased 21% from 2007 to 2009. Customers that chose partner relationships with us gain access to capital and best-in-class business and clinical services. The combination of expertise and economies of scale offers them a unique formula for profitable growth."[2] "Joining us allows you to continue improving people's lives by helping them make the family of their dreams while enjoying the financial stability and growth opportunities you're looking for in the long term."[3] "Strong financial support from a leading New York–based private equity firm. For REs, [Fertility Chain] provides higher success rates, access to the first multi-center network of fertility centers offering cryogenic egg vitrification, world-class marketing and lead generation, more patients, new revenue streams, and strong financial support."[4] "[Fertility Chain] partners to offer strategic opportunities for independent practices, including: implementing creative growth strategies supporting streamlined operational costs, payer alignment, merger and acquisition plans, marketing, and risk management services."[5] "Internationally recognized for its extensive clinical experience, advanced technologies, and groundbreaking research within the field of reproductive endocrinology [Fertility Chain] will reinvest in and enhance every aspect of clinical care."[6] "Joining […] [Fertility Chain] will enable our patients and patients throughout Dallas-Fort Worth access to its leading fertility services, innovative technology and cutting-edge labs"[7] "[Fertility Chain] plans for continued growth through the addition of physicians and satellite offices"[8]
	Managerial Capabilities	"We feel very strongly about the benefits that the full complement of management support, patient sales and marketing, electronic patient information systems, and one-of-a-kind [the clinic's] IVF programs will bring to our faculty, students and patients."[9] "[The clinic] will receive [Fertility Chain's] full complement of support services, including operational and financial management, revenue cycle management, patient marketing and sales, information systems support, and various other services, including patient support […]."[10]

		"[Fertility Chain's] primary focus is to improve quality outcomes by enabling the strategic expansion of growing fertility practices by providing capital and operational support including marketing services, pharmacy services and back office services."[11] "Under the agreement, the newly formed LLC will receive [the Fertility Chain's] full complement of support services, including operational and financial management, revenue cycle management, patient marketing and sales, information systems support, and various other services, including patient support"[12] "Increased patient volume as a result of [Fertility Chain's] marketing efforts to educate men and women in their 20s and 30s about the benefits of preserving their fertility at its peak, as well as to target potential gamete donors.[13] "At [Fertility Chain], we make the following commitments to our patients: […] • Offer transparent pricing with no out-of-network fees or hidden costs • Use the most advanced technology to increase the odds of a successful pregnancy • Simplify the treatment process, meeting critical timelines, avoiding missed medications, and reducing travel time • Streamline communications between you and your clinicians, eliminating the frustration of missed calls • Use advanced digital technologies to help you easily manage all aspects of your fertility journey • Clearly explain the fertility treatment process, empowering you to make decisions that are right for you"[14] "Each loan program is designed to fit your individual circumstances and, once approved, the company's Fertility Loan Specialists will work closely with [Fertility Chain] to ensure the funds are secured prior to the commencement of your treatment."[15] "[Fertility Chain] announced the launch of two new programs designed to help ease the financial burdens for fertility patients that may need multiple in vitro fertilization (IVF) cycles. The [Fertility Chain's] IVF Refund and Multi-Cycle Programs offer patients the assurance that if multiple IVF cycles are necessary, they will not need to expend additional financial resources to receive them."[16]
Knowledge transfer	Access to Protocols, Best Practices and New Knowledge	"Patients seeking treatment at their fertility center […] will receive improved access to the best treatment protocols and unique programs for specific conditions, new technologies that improve clinical success rates, and increased access to clinical trials and research initiatives, which often offer significant discounts on treatments and medications."[17] "Partnering with [Fertility Chain] allows us to greatly expand our work with other top-tier centers, and to leverage the strengths of this national network to further revolutionize patient care with new access to proven treatment protocols and an expanded focus on fertility preservation."[18] "Our collaboration with [Fertility Chain] will give us access to the most advanced research in the field of reproductive medicine, and will further enable us to deliver leading care to our patients"[19]

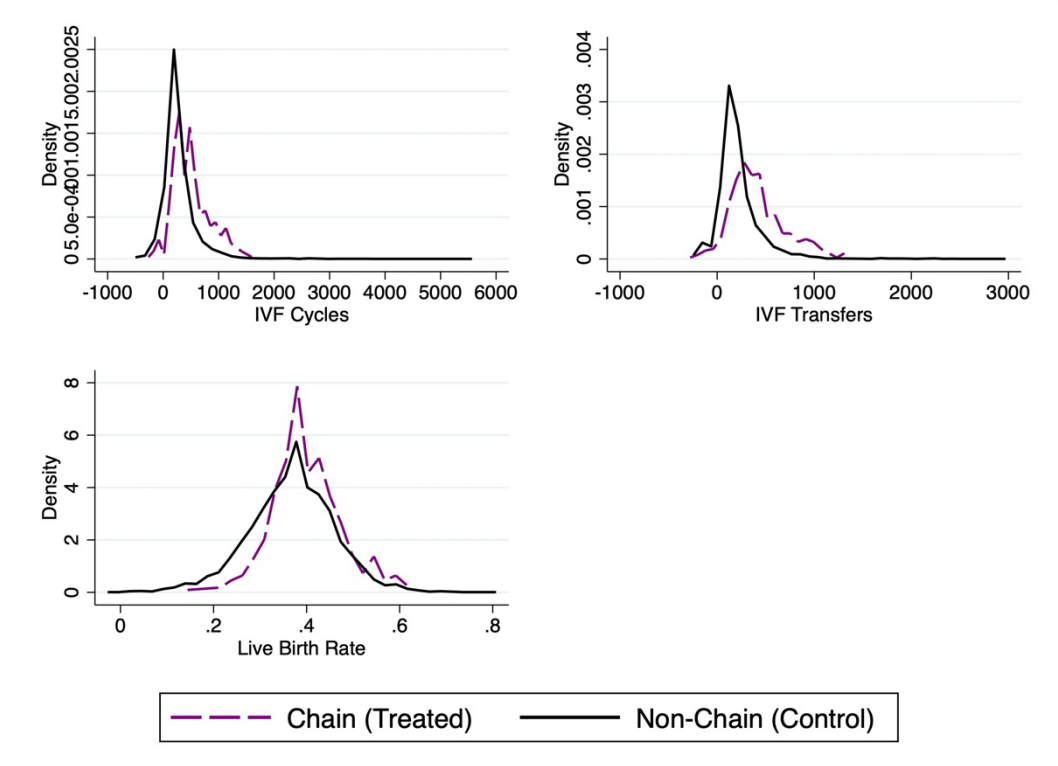
		"[Fertility Chain's] mission is to shift the paradigm of the IVF market by raising the standard of care, streamlining fragmented components into an integrated system, and enhancing the overall patient experience."[20] "Our collaboration with [Fertility Chain] will give us access to the most advanced research in the field of reproductive medicine, and will further enable us to deliver leading care to our patients."[21] "Best Practices Are Standard Care. [Fertility Chain] believes that patients should not have to pay more for best practices. Therefore, when research proves that techniques improve conception rates, [Fertility Chain] incorporates those techniques into their standard care wherever possible."[22] "[Fertility Chain] will give our embryologists access to a broader base of knowledge drawn from all […] labs […] and because of [Fertility Chain's] size, we will be able to take advantage of the latest techniques and equipment for services offerings we don't currently provide in house, including long-term storage, egg donation and genetic testing. By bringing these services in house, we can better control our patients' experience."[23]
	Information Sharing Process	"[Fertility Chain] was created to break down barriers to idea-sharing and collaborative care. "At its best, reproductive medicine is a tightly woven community working side by side on research, clinical trials and educational efforts. The [Fertility Chain] umbrella gives us the freedom to explore clinical and laboratory breakthroughs together, and that is exciting news for the future of infertility care."[24] "Patients will also have access to an expanded network of [Fertility Chain] experts who will come together to review and assist in complex cases."[25] "The successes at [Fertility Chain] led to the desire to share these techniques with additional clinics, thereby providing patients increased geographical access to top-quality infertility care. [Fertility Chain] is in a unique position where treatment breakthroughs are quickly applied to multiple centers, thereby furthering the positive impact for patients."[26] "The [Fertility Chain] is also a tech-enabled organization leading the industry in proprietary platforms, applications, and data and analytics. By using these purpose-built applications with other flagship technologies, we are improving patient experience and outcomes. Our proprietary […] tool keeps our network seamlessly connected when it comes to data and analytics, financial services, staff workflow automation, and hybrid workforce productivity."[27] "We'll look at pregnancy per transfer by physician with a blinded letter for each physician. And we'll be able to see how everybody stacks up. And if people fall below a standard deviation, we have that doctor go work with somebody who is above a standard deviation to get retrained."[28] "Under the terms of the agreement, [Fertility Chain] purchased the assets of [the clinic] and will provide a variety of services, including marketing, treatment programs for women who wish to get pregnant and a sophisticated electronic medical records system."[29] "Collaborative innovation – [Fertility Chain] scientists and physician partners share data and best practices, improving outcomes for patients and partner physician

		practices. Research – [Fertility Chain] is one of America's most prolific producers of IVF research, with collaborative studies continuously under way to advance the state of the art in IVF."[30]
	Single Embryo Transfer Strategy	"Striving for One Embryo-One Baby. [Fertility Chain's] founding philosophy to achieve successful pregnancy one healthy baby at a time. Although advanced embryo culturing has led to favorable pregnancy results using fresh embryo transfers, they often were the result of multiple embryo transfers, resulting in high-risk pregnancies with twins and triplets. Through elective vitrification and the adoption of blastocyst biopsy/PGS, [Fertility Chain] has improved the quality of patient care by transferring fewer embryos, reducing miscarriages and increasing healthy singleton live births."[31] "[Fertility Chain] reported a significant increase in the number of IVF cycles employing pre-implantation genetic testing. This cutting edge technology enables embryologists and fertility specialists to assess the genetic and chromosomal makeup of an embryo prior to its transfer into a woman's uterus. [Fertility Chain] now also performs almost exclusively Day 5 embryo transfers (at the blastocyst stage of development) for those patients who request or need a fresh embryo transfer. This advanced IVF lab technique allows the embryo to mature as far as it can outside the human body, again allowing embryologists and physicians an enhanced ability to select the best single embryo for transfer into the patient's uterus."[32] "The One Healthy Baby at a Time Promise. Reducing Risk for Mom and Baby. By routinely practicing Single Embryo Transfer (SET), [Fertility Chain] has drastically reduced the risk for the mother and child." "Our rate of single embryo transfer [and subsequently our low multiple pregnancy rate] is higher than the national average, with no difference in the number of embryos transferred in fee for service versus Shared Risk patients,' comments [physician]. With advances in technology, eSET has allowed patients to have a healthy singleton pregnancy while significantly lowering the risks associated with multiple pregnancies without comprising chances of success."[33]

Appendix C. Additional Descriptive Statistics

This appendix provides additional summary statistics of the data and sample. Figure C1 shows the distribution of clinic volume and IVF success rates between chain clinics and non-chain clinics before the transaction, Table C1 provides summary statistics adjusted for year fixed effects, Table C2 provides descriptive statistics based on CBSA-level patient characteristics, and Table C3 provides a targeting regression of the probability that a clinic becomes acquired or affiliated with a chain using characteristics at the CBSA-level (estimation details shown before the table).

Figure C1. Distribution of Clinic Volume and IVF Success Rates for Clinics Before the Chain Transaction and Non-Chain Clinics



Note: This histogram shows the distribution of clinic volume (IVF cycles and IVF transfers) and of IVF success rates (Live Birth Rate) in the pre-transaction period for chain clinics and over the full sample period for non-chain clinics. The regression includes *state* × *year* fixed effects, with robust standard errors clustered at the clinic-level.

Table C1. Fertility Clinic Summary Statistics with Year Adjustment, 2009-2018

	Fertility Chain			Non-Chain
	Acquisition	**Affiliation**	**De Novo**	
	Pre-transaction mean	Pre-transaction mean	Mean of all years	Mean of all years
Clinic Volume				
IVF Cycles	596.91	545.17	547.15	336.41
IVF Transfers	493.21	432.51	403.09	263.08
Log(IVF Cycles)	6.12	5.91	5.88	5.22
Log(IVF Transfers)	5.91	5.69	5.53	4.99
Birth Rates (%)				
Live Birth Rate	41.80	41.48	40.88	36.80
Singleton Birth Rate	30.35	30.90	30.03	26.94
Multiple Birth Rate	11.44	10.62	10.82	9.80
Patient Characteristics (%)				
Share of Patients < 35	51.25	51.89	50.86	51.18
Share of Patients 35-37	24.30	23.12	22.65	23.55
Share of Patients ≥ 38	24.45	25.00	26.50	25.27
Diagnosis, Tubal Factor	10.96	11.37	7.56	12.75
Diagnosis, Ovulatory Dysfunction	11.25	11.90	9.07	12.39
Diagnosis, Diminished Ov. Reserve	24.28	23.31	20.57	21.26
Diagnosis, Endometriosis	7.88	7.73	6.39	7.94
Diagnosis, Uterine Factor	3.82	4.08	1.57	3.98
Diagnosis, Male Factor	25.28	23.10	21.32	26.79
Diagnosis, Other	13.20	12.72	19.61	11.51
Diagnosis, Unknown	10.80	11.48	11.88	9.97
Market Characteristics (CBSA)				
Total Population (Age 20-49)	1,530,623	1,782,535	2,721,922	1,910,789
Unemployment Rate (%)	6.28	5.93	5.65	6.08
Median Household Income ($)	55008.84	54207.96	62843.02	58461.18
Market Concentration (HHI)	4281.12	3812.82	4058.80	4410.92
Observations				
Number of Clinics	33	28	23	415
Clinic-Years	289	175	138	4962

Notes: All summary statistics are at the clinic-year level. Clinic volume, birth rates, and patient characteristics include adjustment for year effects to account for changes in reporting in the CDC ART data. Patient age shares are calculated as share of total transfers. Market concentration is calculated using a clinic's total IVF cycles. 15 clinics are excluded because they are in a chain before the sample period, and 13 non-chain clinics are excluded because of multi-year reporting gaps. In total, there are 527 clinics and 6,271 clinic years.

Table C2. CBSA-Level Characteristics of Patients Reporting Using Infertility Treatment, 2009-2018

	Fertility Chain			Non-Chain
	Acquisition	**Affiliation**	**De Novo**	
	Pre-transaction mean	Pre-transaction mean	Mean of all years	Mean of all years
Education (%)				
Less than High School	1.10	1.45	1.35	1.37
High School	5.65	6.54	5.85	6.72
Some College	11.56	9.42	10.58	11.07
Associate or Bachelor's Degree	47.45	46.14	45.70	44.61
Graduate Degree	34.24	36.45	36.53	36.24
Race/Ethnicity (%)				
White	71.19	75.63	71.41	71.69
Black	6.13	6.22	4.89	5.70
Hispanic/Latina	9.93	7.50	9.62	9.78
Other Race	12.76	10.66	14.09	12.83
Insurance (%)				
Private	89.92	92.08	90.37	89.00
Medicaid	3.64	3.99	5.65	5.30
Self Pay	3.48	2.04	1.56	2.34
Other	2.97	1.89	2.42	3.37
Clinical Factors				
Body Mass Index	25.2692	25.7562	25.4328	25.7387
Pre-Pregnancy Diabetes	0.81	0.76	0.90	1.20
Pre-Pregnancy Hypertension	2.36	2.53	2.09	2.76
Previous Birth	28.43	28.92	30.61	30.08
Observations				
Number of Clinics	23	24	21	401
Clinic-Years	147	66	112	3258

Note: This data is from the NCHS natality data for patients reporting using any infertility treatment to deliver a baby. This reporting flag was only available starting in 2009, therefore, the data represent years 2009-2018. Since the NCHS data are reported at the county level, we created a CBSA-level average using the county data weighted by the population in the county that was female. Clinics that experienced a chain transaction prior to 2009 are removed because they are now always considered part of a chain.

Targeting Regression (Table C3, below). To explore what types of fertility clinics are targeted, we estimate the probability that a clinic is acquired or affiliated with a chain for the years before the transaction:

Appendix Eq. 1: $$Prob(Chain)_{ct} = \alpha_s + \alpha_t + \beta \boldsymbol{X}_{ct} + \epsilon_{ct}$$

Here, *Prob(Chain)* is set to 100 in the year before acquisition or affiliation (and zero otherwise) and all years post-transaction are dropped. We include state and year fixed effects, and $\boldsymbol{X}_{ct}$ is a vector of different clinic and market characteristics. The results are presented in Appendix Table C3, where each column groups different combinations of characteristics. Because the listed patient characteristics are only available between 2009-2018, we do not present them in combination with the market-level characteristics. The characteristics most predictive of acquisition or affiliation are total IVF cycles and the live birth rate. At the same time, clinics are much less likely to be targeted in markets with higher proportions of patients on Medicaid or other government insurance. Larger population aged 20-49 and more competitive markets are also somewhat predictive of being targeted, though become insignificant once we simultaneously control for clinic volume and IVF success rates.

Table C3. Probability Clinic Becomes Part of a Fertility Chain, CBSA Level Characteristics

	Mean	(1)	(2)	(3)	(4)	(5)
Clinic Outcomes						
Log(IVF Cycles)	5.217	0.653***			0.637***	
		(0.161)			(0.160)	
Live Birth Rate	37.054	5.224***			5.249***	
		(1.507)			(1.494)	
Market Characteristics (CBSA)						
Log(Total Population)	13.617		0.300*		0.078	
			(0.153)		(0.201)	
Log(Median Household Income)	10.948		0.391		-0.371	
			(1.148)		(1.156)	
Market Concentration						
HHI (tercile = 1)				0.993**	0.713	
				(0.474)	(0.627)	
HHI (tercile = 2)				0.698**	0.466	
				(0.338)	(0.411)	
Patient Characteristics (CBSA)						
Education (reference=Graduate School)						
Less than High School	1.362					7.477
						(12.950)
High School	6.673					-3.195
						(2.408)
Some College	11.062					-4.045
						(2.622)
Associate or Bachelor's Degree	44.756					-0.324
						(2.017)
Race/Ethnicity (reference=White)						
Black	5.726					5.055*
						(2.770)
Hispanic/Latina	9.730					-2.506
						(2.135)
Other Race	12.778					-3.749
						(2.585)
Insurance (reference=Private)						
Medicaid	5.217					-5.426**
						(2.480)
Self Pay	2.374					1.684
						(4.074)
Other	3.315					-5.984***
						(1.965)
Clinic-Years		5433	5394	5433	5394	3478
R^2		0.030	0.024	0.025	0.031	0.040
Ymean		1.123	1.131	1.123	1.131	1.294

Note: This table shows the estimates of Appendix Equation 1, which estimates the probability a clinic becomes part of a fertility chain. The dependent variable is an indicator for a clinic transaction in the following year (100 if yes, 0 otherwise). The sample is restricted to non-chain clinics and acquired or affiliated clinics for the years before the transaction.

Appendix D. Robustness and Diagnostic Checks of Main Effects on Fertility Clinic Outcomes

This appendix provides robustness and diagnostic checks to the primary results presented in Table 2 of the manuscript. Table D1 replicates Table 2 showing p-values derived from wild bootstrap standard errors, Figure D1 shows power curves for the main outcomes, Table D2 provides a back-of-the-envelope profit calculation post-chain ownership, Table D3 shows results of the Goodman-Bacon (2021) decomposition, Figure D2 shows event studies for affiliated clinics, Figure D3 shows aggregate event study estimates for all outcomes in the manuscript using alternative estimators, and Table D4 decomposes the effect of chain ownership between early and late transactions.

Table D1. Effect of Chain Ownership on Fertility Clinic Outcomes, Wild Bootstrap Standard Errors

	(1)	(2)	(3)	(4)	(5)	(6)
	Log(Cycles)		**Log(Transfers)**		**Live Birth Rate**	
	b/wild p-val		b/wild p-val		b/wild p-val	
Panel A: Pooled						
Post	0.256***	0.281***	0.214***	0.238***	0.027**	0.019*
	0.000	0.000	0.003	0.000	0.024	0.075
Panel B: Ownership Structure						
Post × Acquisition	0.272***	0.296***	0.214**	0.225**	0.051***	0.041***
	0.010	0.000	0.034	0.012	0.001	0.002
Post × Affiliation	0.240**	0.268***	0.215**	0.251**	0.006	-0.001
	0.017	0.008	0.040	0.011	0.748	0.949
Clinic FE	X	X	X	X	X	X
State × Year FE	X		X		X	
Year FE		X		X		X
Dep. Var. Mean	5.250	5.254	5.033	5.038	0.374	0.375
Clinic-Years	5676	5818	5676	5818	5676	5818
R^2	0.896	0.881	0.895	0.880	0.623	0.574

Notes: Panel A shows the estimates of Equation 1, and Panel B shows the estimates of Equation 2. The dependent variable mean captures the predicted mean for control clinics and treatment clinics before the transaction. Standard errors are clustered at the clinic level. Significance levels: *$p<0.1$, **$p<0.05$, ***$p<0.01$

Power Calculations (Figure D1 below). In this section we show power curves based on simulation analysis to assess to what extent we are powered to detect different effect sizes. For both clinic volume and IVF success rates, we simulate power to assess our ability to statistically reject the null hypothesis that $\beta_1 = 0$ and $\beta_2 = 0$ in Appendix Equation 2. We calculate power for a range of values, allowing for a type I error rate of 5%. We implement this procedure in three steps:

1) Calculate the parameters of Appendix Equation 2 (shown below as a reminder) for the control variables and fixed effects using only data from non-chain clinics and chain clinics before transaction.

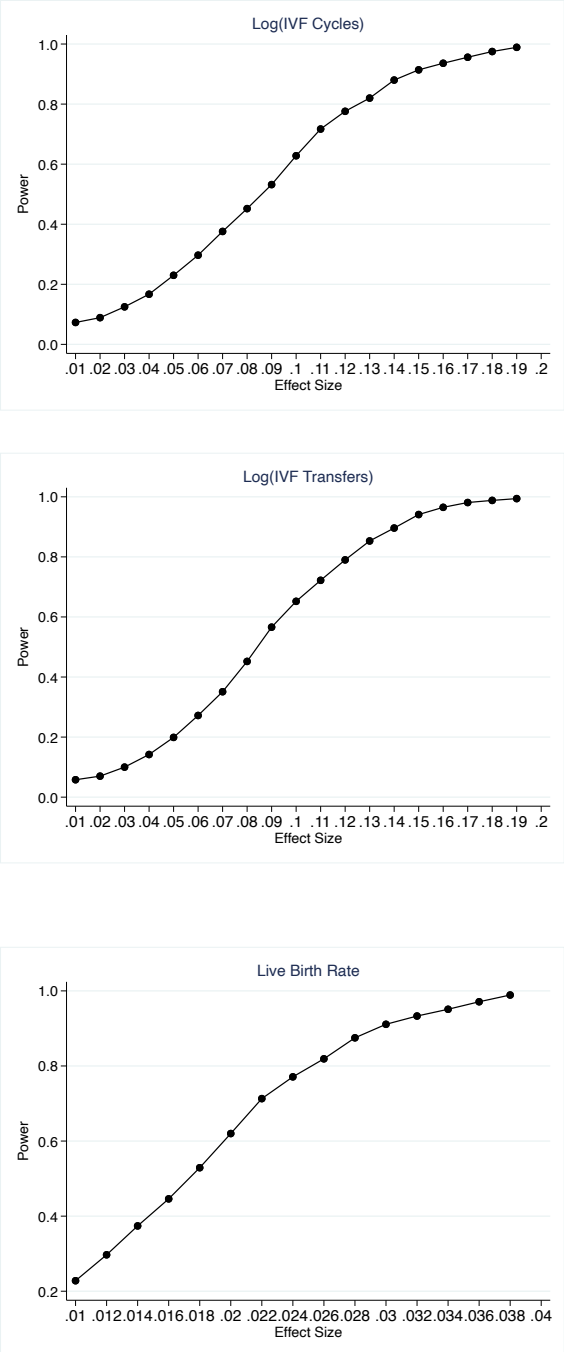
Appendix Eq. 2: $$Y_{ct} = \beta_1(Post \times Acquisition)_{ct} + \beta_2(Post \times Affiliation)_{ct} + \gamma \boldsymbol{X}_{ct} + \theta_c + \theta_{st} + \epsilon_{ct}$$

2) For each clinic, simulate outcomes based on the proposed true effect size of β_1 and β_2 and a random error, drawn from a normal distribution with mean zero and standard deviation calculated from the residuals from step 1. Repeat this process 1000 times to construct 1000 simulated samples.
3) Estimate Appendix Equation 2, clustering standard errors at the clinic level, in each of the 1000 simulated samples, and record the percentage of cases in which the *p-value* when testing $\beta_1 = 0$ and $\beta_2 = 0$ is below 0.05.

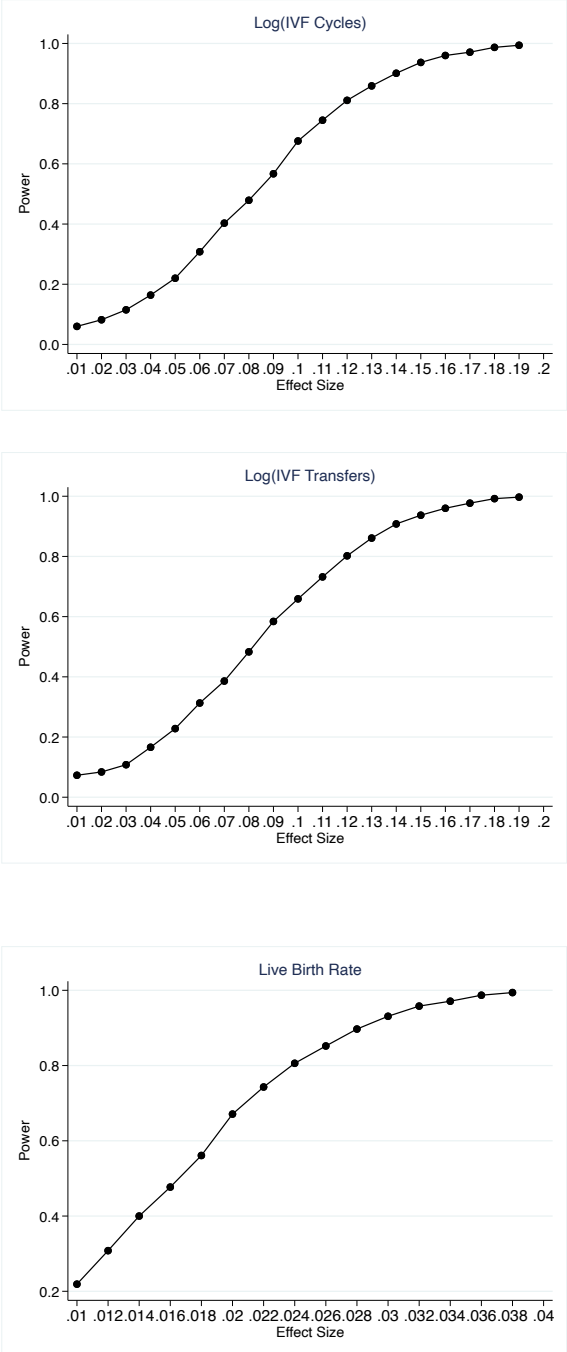
As seen in Figure D1, the simulations suggest the difference-in-differences regressions are well powered. For example, at 80% power, we can detect a 12.5% and 12.0% change in total cycles for acquired and affiliated clinics respectively, which is roughly half of the observed increase seen in most analyses. For the live birth rate, at 80% power we can detect a 2.5 pp and 2.4 pp change for acquired and affiliated clinics, respectively. While these are meaningful effect sizes, acquired clinic effect sizes are more than 1pp above this value in all regressions and affiliated clinic effect sizes are often close to zero.

Figure D1. Power Curve for Fertility Clinic Outcomes by Ownership Structure

(a) Acquisition



(b) Affiliation



Notes: Figures plot power against hypothesized effect sizes assuming a type I error rate of 0.05.

Back-of-the-Envelope Profit Calculation (Table D2 below). An assumption of our paper is that increases in clinic volume driven by chain ownership would lead to an increase in profit. There is no publicly available data on clinic financials. Therefore, we provide a back-of-the-envelope calculation on how profits could be affected by chain ownership, focusing on acquired practices.

In our difference-in-differences analysis, we find that on average, chain acquisition increases the volume of IVF cycles by 27.2%. We also find that the usage of pre-implantation genetic testing increased by 6.9pp, representing an 107.5% increase for acquired clinic from the pre-transaction period. For simplicity, we assume that an IVF cycle without PGT is $12,000 and that an IVF cycle with PGT is $20,000. We make this assumption because PGT can cost thousands more and often signals usage of other add-on services. Industry reports often suggest fertility clinics have high profit margins, with one clinic reporting a profit margin of 37.5% in 1996.[3] In 2022, we asked one fertility chain investor what the typical profit margin of a fertility clinic was, and they provided the range of 30-47.5%, depending on the clinic's size. They said small clinics sometimes had lower profit margins than this range.

In the simplest example in which there are no changes to a clinic's prices or operating costs, the average clinic makes between $2.40 million in profit per year before chain acquisition and $3.18 million per year after chain acquisition, just from IVF cycles. Through chain ownership, there may initially be capital expenditures that increase costs, whereas managerial efficiencies and economies of scale may contribute to lower operating costs in the future. Given the significant increases in volume, it would take large reductions in prices and increases in costs for clinics to not experience an increase in profits post-acquisition.

Anecdotally, one fertility chain advertises that "clinics practices' patient revenues increased 21% from 2007 to 2009," which is consistent with our finding.[4] Other news articles have reported clinics' "generating a $2 million annual surplus" in 1996. The aforementioned investor shared that their chain's most lucrative clinic had an EBITDA of over $9 million. Given that this clinic is likely extremely large, our estimates seem consistent with the average profit of a clinic in a fertility chain.

[3] https://www.nytimes.com/1996/01/07/us/high-tech-pregnancies-test-hope-s-limit.html

[4] https://web.archive.org/web/20110314151145/http:/attainfertilitycenters.com/success/index.html

Table D2. Back-of-the-Envelope Profit Calculation

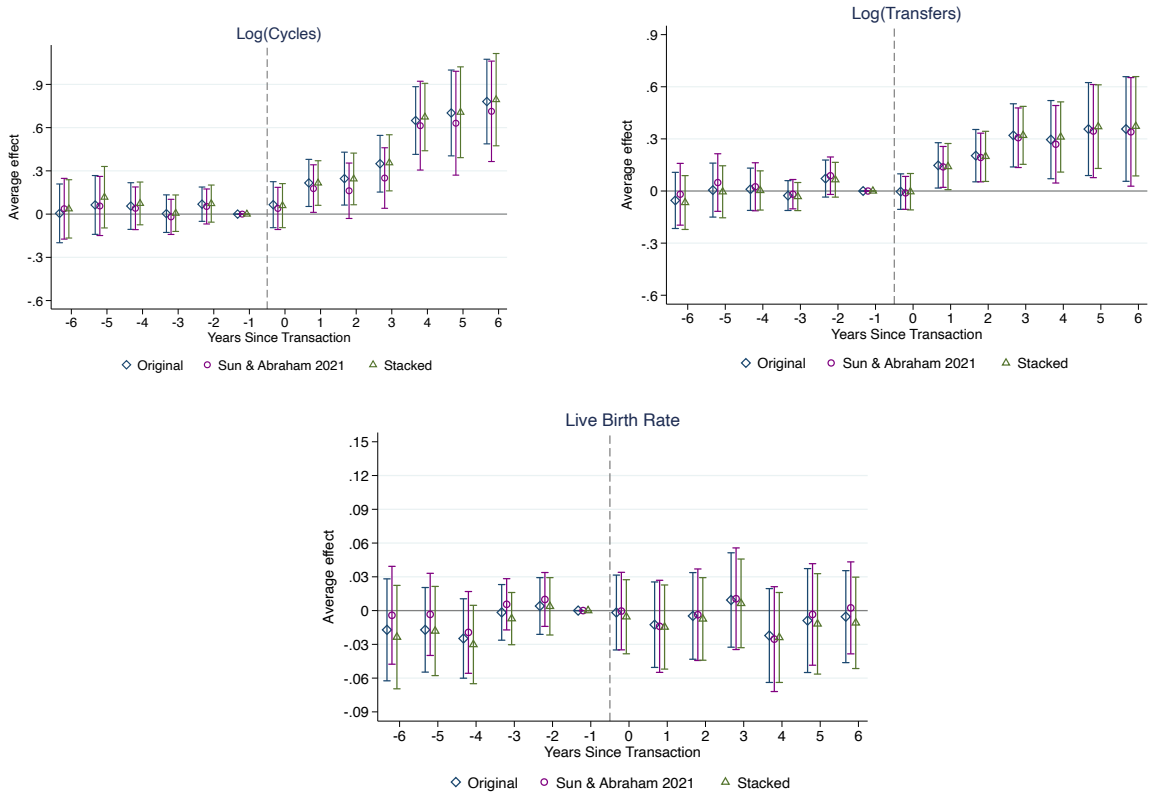
	Before Chain Ownership	After Chain Ownership	Percent Difference	Total Difference
Average IVF Cycles	510.55	649.42	27.20%	
Average PGT Rate	6.42%	13.32%	107.48%	
Cycles w/PGT	32.78	86.50		
Cycles w/o PGT	477.77	562.92		
Average Price w/PGT	20,000	20,000		
Average Price w/o PGT	12,000	12,000		
Revenue from IVF Cycles	6,388,818	8,485,057	32.81%	2,096,238
Estimated Profit Margin	37.50%	37.50%		
Estimated Profits	2,395,807	3,181,896		786,089

Table D3. Goodman-Bacon Decomposition of Treatment Effects

		(1)	(2)	(3)
	Weight	**Log(Cycles)**	**Log(Transfers)**	**Live Birth Rate**
Panel A: Pooled				
Post		0.263***	0.222***	0.021*
		(0.076)	(0.076)	(0.011)
Timing groups	0.092	0.105	0.106	-0.002
Never_v_timing	0.885	0.293	0.242	0.023
Within	0.024	-0.215	-0.061	0.027
Panel B: Ownership Structure				
Post × Acquisition		0.306***	0.238**	0.037***
		(0.093)	(0.096)	(0.013)
Timing groups	0.050	0.130	0.137	0.011
Never_v_timing	0.915	0.326	0.246	0.038
Within	0.035	0.044	0.163	0.057
Post × Affiliation		0.215**	0.202*	0.000
		(0.108)	(0.107)	(0.017)
Timing groups	0.027	0.144	0.135	-0.011
Never_v_timing	0.968	0.206	0.194	-0.001
Within	0.005	2.414	2.124	0.425

Notes: Panel A shows the estimates of the Goodman-Bacon decomposition when pooling together both ownership structures, and Panel B shows the decomposition by ownership structure. The decomposition requires a balanced panel, in this setting, that represents 248 clinics and 3720 clinic-years that had 15 years of data. Among our treated sample, 82% of acquired clinics had a balanced panel and 68% of affiliated clinics had a balanced panel. Standard errors are clustered at the clinic level. Significance levels: *p<0.1, **p<0.05, ***p<0.01

Figure D2. Event Study Results for Affiliated Clinics

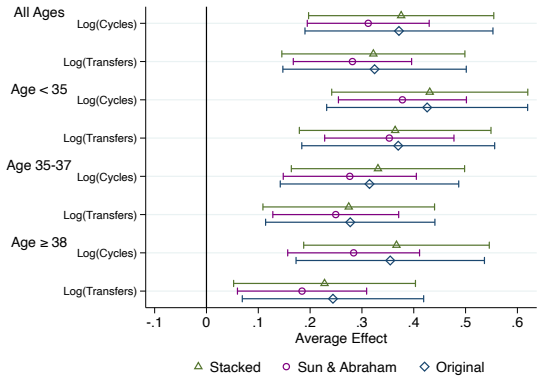


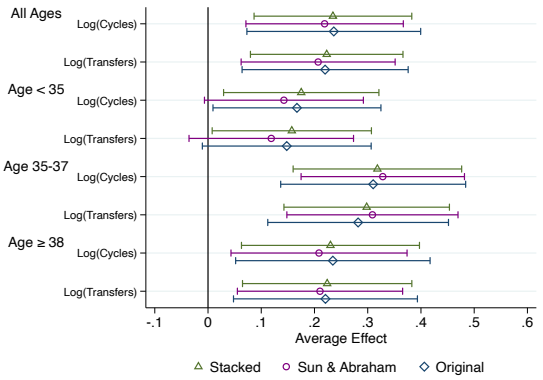
Notes: This figure shows the β_1 and β_2 estimates of Equation 2 interacted with indicators for the year relative to the transaction year. The reference period is two years before the transaction. Bands indicate 95% confidence intervals constructed from clinic-level clustered standard errors. The p-value from an F-test of joint significance on the original estimates are as follows: 0.511 for log(cycles), 0.311 for log(transfers), and 0.600 for the live birth rate.

Figure D3. Aggregated Dynamic Effects Using Alternative Estimators

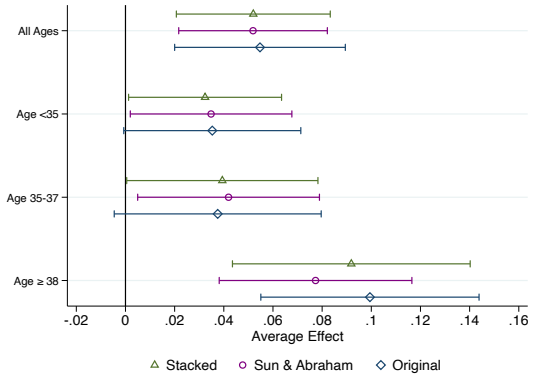
(a) Acquisition **(b) Affiliation**

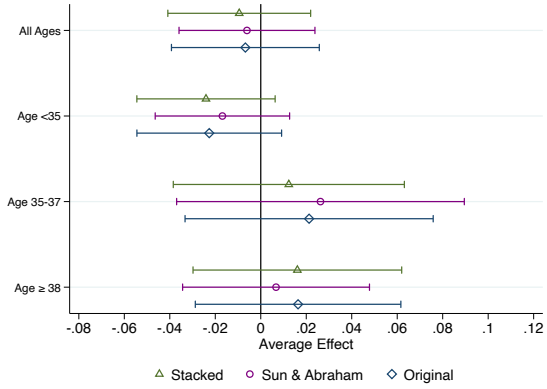
Clinic Volume



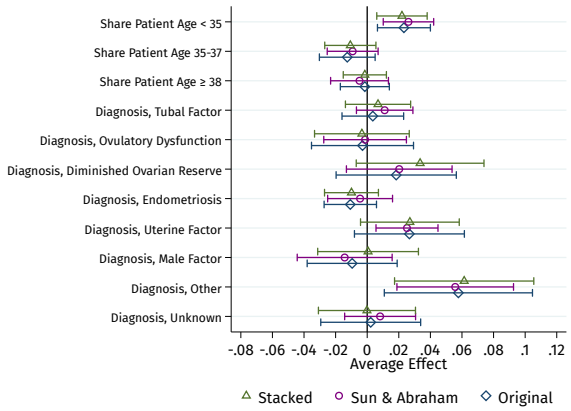


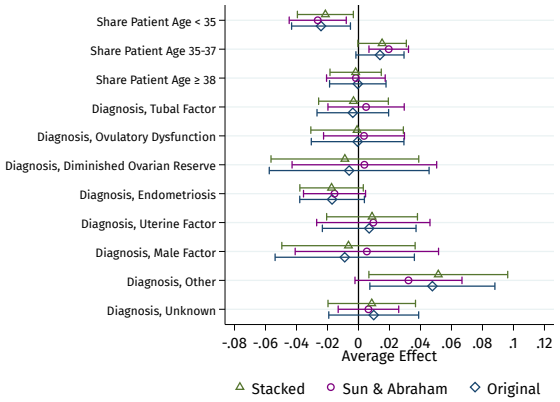
IVF Success Rates



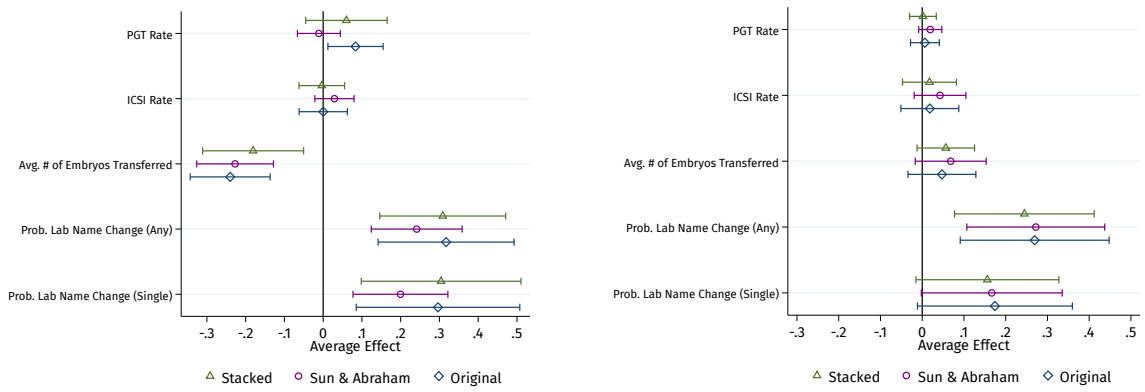


Patient Characteristics





Procedure and Lab Changes



Notes: This figure shows the β_1 and β_2 estimates of Equation 2 interacted with indicators for the year relative to the transaction year in Column (a) and (b), respectively. Bands indicate 95% confidence intervals constructed from clinic-level clustered standard errors. All estimates are obtained after running an event study specification in Stata using 1) Classic TWFE OLS, 2) *Eventstudyinteract* as developed by Sun (2021) following Sun and Abraham (2021), and 3) *Stackedev* as developed by Bleiberg (2021) following Cengiz et al. (2019). Specifically, we use the post-estimation command *lincom* to estimate the average effect and standard errors over the first six years after clinic transaction.

Table D4. Effect of Chain Ownership on Fertility Clinic Outcomes, Early Vs. Late Transactions

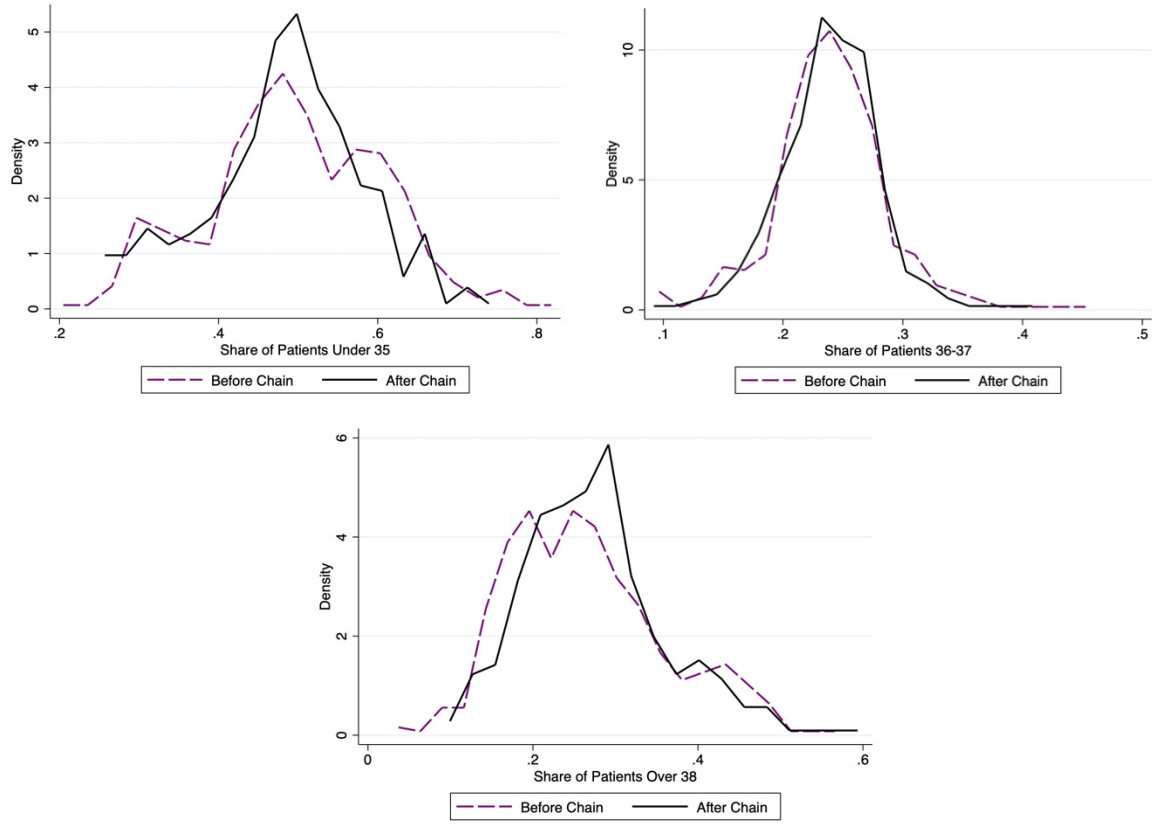
	(1)	(2)	(3)
	Log(Cycles)	**Log(Transfers)**	**Live Birth Rate**
Post × Acquisition (Early=1)	0.296	0.303*	0.048
	(0.181)	(0.173)	(0.033)
Post × Acquisition (Late=1)	0.147**	0.074	0.023**
	(0.065)	(0.063)	(0.011)
Post × Affiliation (Early=1)	0.196**	0.219**	0.003
	(0.099)	(0.094)	(0.017)
Post × Affiliation (Late=1)	0.163*	0.046	-0.014
	(0.098)	(0.090)	(0.024)
Dep. Var. Mean	5.198	4.980	0.373
Clinic-Years	5294	5294	5294
R^2	0.896	0.896	0.625

Notes: This table provides an extension of Equation 2 where the post-transaction indicators are interacted with an indicator for whether the clinic is acquired by or affiliates with a fertility chain before 2011 (Early=1) or after (and including) 2011 (Late=1). We exclude observations greater than 4 years pre or post transaction to allow for more accurate comparisons while limiting data loss. However, the event windows are still different for the early and late transactions. For example, a clinic acquired in 2016 would have 4 years of pre-period data and three years of post-period data (including 2016). The dependent variable mean captures the predicted mean for control clinics and treatment clinics before the transaction. Standard errors are clustered at the clinic level. Significance levels: *p<0.1, **p<0.05, ***p<0.01

Appendix E. Assessing the Role of Patient and Clinic Selection

This appendix provides robustness checks to the main DiD that mitigate concerns of patient selection and the non-random selection of clinics into fertility chains. Figure E1 shows the distribution of patients in different age bins before and after chain ownership in the raw data. Table E1 shows results of the live birth rate using different patient controls, Table E2 shows results using *CBSA* × *year* fixed effects, Table E3 shows results using different matched control groups, Table E4 shows the summary statistics for the matched samples, Table E5 shows results using alternative samples, and Table E6 shows additional robustness that accounts for unique features of the data.

Figure E1. Distribution of Share of Patients by Age Bin Before and After Transaction, Unadjusted Data



Notes: This figure shows histograms of the share of patient in each age bin (as a fraction total IVF cycles) before and after chain ownership using the raw data.

Table E1. Effect of Chain Ownership on Live Birth Rates, Patient Robustness

	Live Birth Rate
Panel A: Controlling for Clinic-Level Patient Diagnosis	
Post × Acquisition	0.051***
	(0.014)
Post × Affiliation	0.008
	(0.016)
Dep. Var. Mean	0.374
Clinic-Years	5676
R^2	0.624
Panel B: Controlling for CBSA-Level Patient Characteristics	
Post × Acquisition	0.032**
	(0.013)
Post × Affiliation	0.016
	(0.015)
Dep. Var. Mean	0.389
Clinic-Years	3746
R^2	0.654

Notes: This table shows the estimates of Equation 2, including different sets of patient controls. In Panel B, the sample excludes years before 2009 because the NCHS data did not report whether a patient used infertility treatment until 2009, and, therefore, includes a smaller sample of chain clinics. For the same sample period (2009-2018) without including vital statistics controls, the b/se for the live birth rate in acquired and affiliated clinics are 0.031 (0.012) and 0.006 (0.016), respectively. The dependent variable mean captures the predicted mean for control clinics and treatment clinics before the transaction. Standard errors are clustered at the clinic level. Significance levels: *p<0.1, **p< 0.05, ***p<0.01

Table E2. Effect of Chain Ownership on Fertility Clinic Outcomes, Including CBSA × Year Fixed Effects

	(1)	(2)	(3)	(4)	(5)	(6)
	Log(Cycles)		**Log(Transfers)**		**Live Birth Rate**	
Post × Acquisition	0.387***	0.351***	0.353***	0.298***	0.044***	0.050***
	(0.095)	(0.096)	(0.090)	(0.096)	(0.015)	(0.016)
Post × Affiliation	0.244*	0.240**	0.223*	0.233**	0.004	-0.002
	(0.130)	(0.104)	(0.126)	(0.104)	(0.019)	(0.016)
Clinic FE	X	X	X	X	X	X
CBSA × Year FE	X		X		X	
Year FE		X		X		X
Dep. Var. Mean	5.284	5.285	5.062	5.063	0.373	0.373
Clinic-Years	4776	4776	4776	4776	4776	4776
R^2	0.903	0.879	0.903	0.879	0.680	0.596

Notes: This table shows the estimates of Equation 2 using different fixed effects. To compare estimates in the same markets, we restrict columns 2, 4 and 6 to the same sample in columns 1, 2 and 3 (which drops observations when there is only one clinic in a CBSA-year). The dependent variable mean captures the predicted mean for control clinics and treatment clinics before the transaction. Standard errors are clustered at the clinic level. Significance levels: *p<0.1, **p<0.05, ***p<0.01

Table E3. Effect of Chain Ownership on Fertility Clinic Outcomes, Matched Sample and Volume Restricted Sample

	(1) Log(Cycles)	(2) Log(Transfers)	(3) Live Birth Rate
Panel A: Matched Sample (Cycles Only)			
Post × Acquisition	0.271**	0.255**	0.039**
	(0.110)	(0.105)	(0.018)
Post × Affiliation	0.231**	0.234**	-0.013
	(0.115)	(0.115)	(0.019)
Dep. Var. Mean	5.814	5.591	0.396
Clinic-Years	1473	1473	1473
R^2	0.908	0.907	0.724
Panel B: Matched Sample (Cycles, Live Birth Rate, Share of Patients<35)			
Post × Acquisition	0.298**	0.263**	0.047***
	(0.127)	(0.118)	(0.016)
Post × Affiliation	0.242	0.229	-0.029
	(0.153)	(0.151)	(0.021)
Dep. Var. Mean	5.772	5.566	0.405
Clinic-Years	1238	1238	1238
R^2	0.902	0.904	0.688
Panel C: Clinics with at Least 110 Cycles a Year (Drop Bottom 25%)			
Post × Acquisition	0.197**	0.155*	0.049***
	(0.090)	(0.090)	(0.015)
Post × Affiliation	0.164	0.139	0.002
	(0.123)	(0.118)	(0.019)
Dep. Var. Mean	5.646	5.421	0.381
Clinic-Years	4208	4208	4208
R^2	0.852	0.852	0.687

Notes: This table shows the estimates of Equation 2 using matched control groups. Panel A includes non-chain clinics matched based on 1-1 coarsened exact matching on a clinic's mean IVF cycles in the pre-transaction period (60 treated and 60 control clinics), Panel B matches on a clinic's mean IVF cycles, mean live birth rate, and mean share of patients under 35 (49 treated and 49 control clinics) in the pre-transaction period, and Panel C drops clinics in the bottom 25% of cycles per year (i.e., only clinics performing at least 110 cycles per year over the sample period are included). The dependent variable mean captures the predicted mean for control clinics and treatment clinics before the transaction. Standard errors are clustered at the clinic level. Significance levels: *p<0.1, **p<0.05, ***p<0.01

Table E4. Fertility Clinic Summary Statistics: Matched Sample, 2004-2018

	Matched (IVF Cycles)			Matched (IVF Cycles, Live Birth Rate, Share Under 35)		
	Fertility Chain		**Non-Chain**	**Fertility Chain**		**Non-Chain**
	Acquisition	**Affiliation**		**Acquisition**	**Affiliation**	
	Pre-transaction mean	Pre-transaction mean	Mean of all years	Pre-transaction mean	Pre-transaction mean	Mean of all years
Clinic Volume						
IVF Cycles	484.95	454.98	479.66	439.21	452.95	411.55
IVF Transfers	426.41	385.63	375.91	383.27	381.52	333.21
Birth Rates (%)						
Live Birth Rate	40.41	39.49	37.32	39.71	39.30	40.60
Singleton Birth Rate	28.12	27.88	27.55	27.74	27.75	29.88
Multiple Birth Rate	12.25	11.59	9.74	11.93	11.53	10.68
Patient Characteristics (%)						
Share of Patients < 35 (transfers)	51.21	51.59	49.52	52.06	52.43	52.15
Share of Patients 35-37 (transfers)	24.15	23.16	23.71	23.95	23.06	23.53
Share of Patients ≥ 38 (transfers)	24.64	25.25	26.77	23.99	24.50	24.32
Diagnosis, Tubal Factor	10.61	9.75	11.27	10.92	10.07	12.83
Diagnosis, Ovulatory Dysfunction	9.26	8.24	10.90	9.47	8.59	12.14
Diagnosis, Diminished Ovarian	20.80	17.14	22.70	20.25	16.07	19.48
Diagnosis, Endometriosis	7.30	6.03	6.23	6.95	6.22	7.93
Diagnosis, Uterine Factor	2.99	2.36	3.56	2.68	2.10	4.10
Diagnosis, Male Factor	22.80	17.01	26.35	23.25	17.32	28.81
Diagnosis, Other	10.48	8.62	12.07	10.17	8.88	10.81
Diagnosis, Unknown	10.41	10.59	11.25	10.40	10.02	10.76
Observations						
Number of Clinics	32	28	60	29	20	49
Clinic-Years	277	175	819	254	142	681

Notes: All summary statistics are at the clinic-year level. The samples are constructed using 1-1 coarsened exact matching on a clinic's mean IVF cycles in the pre-transaction period or using a clinic's mean IVF cycles, mean live birth rates and mean share of patients under 35 years of age in the pre-transaction period. Not all treated clinics were matched to a control clinic in these matched samples.

Robustness to Alternative Samples (Table E5, below). In this table, we provide additional robustness to different samples. We conduct robustness checks for the years a clinic was in the sample. Clinics open and close during the sample period and so may not be present in the data for all years between 2004 and 2018. We find that effects are quantitatively similar when limiting the sample to clinics present in all 15 years of data (Appendix Table E5 Panel A). The CDC ART data also includes a flag for whether a clinic self-reported restructuring, defined as a change in at least two of the three key staff positions (practice director, medical director, or laboratory director), or if the clinic was on the verge of closing. Non-chain clinics may experience a restructuring unrelated to joining a chain because of retirement, expansion, general changes in leadership, or impending closure. To ensure these changes are not inadvertently leading to a pseudo-treatment effect, we show that results are quantitatively similar when excluding non-chain clinics that are ever restructured or closed (Appendix Table E5 Panel B). Given concerns that clinics that are part of an academic medical center (AMC) may be exposed to different patients, and have different treatment strategies because of resident training, we show results are robust to dropping all chain and non-chain clinics (49 clinics) that are part of an AMC (Appendix Table E5 Panel C).

Table E5. Effect of Chain Ownership on Fertility Clinic Outcomes, Alternative Clinic Samples

	(1) Log(Cycles)	(2) Log(Transfers)	(3) Live Birth Rate
Panel A: Balanced Panel (15 Years)			
Post × Acquisition	0.314***	0.258**	0.047***
	(0.101)	(0.102)	(0.013)
Post × Affiliation	0.214*	0.191	0.014
	(0.129)	(0.127)	(0.020)
Dep. Var. Mean	5.545	5.334	0.374
Clinic-Years	3585	3585	3585
R^2	0.891	0.893	0.638
Panel B: Excluding Non-Chain Clinics that Restructured or Closed			
Post × Acquisition	0.242**	0.192*	0.044***
	(0.099)	(0.097)	(0.015)
Post × Affiliation	0.198*	0.175	0.004
	(0.108)	(0.107)	(0.017)
Dep. Var. Mean	5.364	5.142	0.380
Clinic-Years	4131	4131	4131
R^2	0.906	0.908	0.628
Panel C: Excluding all Academic Medical Center Fertility Clinics			
Post × Acquisition	0.304***	0.239**	0.057***
	(0.094)	(0.094)	(0.015)
Post × Affiliation	0.291**	0.261**	0.005
	(0.118)	(0.116)	(0.019)
Dep. Var. Mean	5.166	4.951	0.374
Clinic-Years	4992	4992	4992
R^2	0.886	0.885	0.625

Notes: This table shows the estimates of Equation 2 for different samples. Panel A includes clinics present in all years of data from 2004 to 2015, Panel B excludes non-chain clinics that ever restructured or closed, and Panel C excludes any clinic that is part of an academic medical center. The dependent variable mean captures the predicted mean for control clinics and treatment clinics before the transaction. Standard errors are clustered at the clinic level. Significance levels: *p<0.1, **p<0.05, ***p<0.01

Data-Specific Robustness Checks (Table E6, below). Unique features of the data also warrant additional robustness checks. For example, CDC made a data reporting change in 2018. While data cleaning efforts were made to homogenize data, we show results are robust to dropping the year 2018 (Appendix Table E6 Panel A). In our preferred specification, we assume that once a clinic is treated, it remains treated. However, in some cases, a fertility chain experiences a second acquisition event (i.e., a larger chain acquires a smaller chain). Our results are robust to controlling for the second acquisition event (Appendix Table E6 Panel B). We show that results are robust to excluding cases in which it was less clear whether the clinic was an acquisition or an affiliation (Appendix Table E6 Panel C). Lastly, we show robustness to dropping all clinics that ever merged and therefore, merged their data reporting (Appendix Table E6 Panel D).

Table E6. Effect of Chain Ownership on Fertility Clinic Outcomes, Additional Robustness

	(1) Log(Cycles)	(2) Log(Transfers)	(3) Live Birth Rate
Panel A: Excluding the Year 2018			
Post × Acquisition	0.271***	0.234**	0.045***
	(0.098)	(0.098)	(0.016)
Post × Affiliation	0.213**	0.196*	-0.003
	(0.105)	(0.102)	(0.017)
Dep. Var. Mean	5.219	5.035	0.372
Clinic-Years	5298	5298	5298
R^2	0.899	0.900	0.643
Panel B: Controlling for a Second Acquisition			
Post × Acquisition	0.257***	0.200**	0.050***
	(0.090)	(0.089)	(0.015)
Post × Affiliation	0.234**	0.210**	0.005
	(0.105)	(0.104)	(0.017)
Dep. Var. Mean	5.250	5.033	0.374
Clinic-Years	5676	5676	5676
R^2	0.896	0.895	0.623
Panel C: Removing Clinics with Uncertain Classification			
Post × Acquisition	0.285***	0.218**	0.046***
	(0.102)	(0.103)	(0.013)
Post × Affiliation	0.255**	0.234**	0.011
	(0.115)	(0.114)	(0.018)
Dep. Var. Mean	5585	5585	5585
Clinic-Years	0.896	0.896	0.623
R^2	5.247	5.030	0.374
Panel D: Removing Clinics that Merged Data			
Post × Acquisition	0.256**	0.208**	0.052***
	(0.104)	(0.104)	(0.017)
Post × Affiliation	0.257**	0.228**	0.008
	(0.107)	(0.106)	(0.017)
Dep. Var. Mean	0.892	0.892	0.621
Clinic-Years	5575	5575	5575
R^2	0.892	0.892	0.621

Notes: This table shows the estimates of Equation 2 for different samples and use of alternative control variables. Panel A includes an additional indicator for whether a clinic experienced a second acquisition event (1 for the second acquisition, 0 otherwise); Panel B removes the year 2018 to assess robustness to changes in data reporting in that year; Panel C removes clinics for which there was potential uncertainty in clinic ownership and removes chains that did not receive external funding until 2018 and Panel D removes clinics that ever merged (and therefore merged data reporting) during the sample period. The dependent variable mean captures the predicted mean for control clinics and treatment clinics before the transaction. Standard errors are clustered at the clinic level. Significance levels: *p<0.1, **p<0.05, ***p<0.01

Appendix F. Data Limitations and Alternative Outcome Measures.

This appendix focuses on the limitations of the CDC data used in this analysis (Section 4.6 of the manuscript). Tables discussed below and presented at the end of this appendix.

Additional Performance Indicators. The first limitation centers around which outcome variables we can measure during our sample period. In particular, we are limited to measuring live birth rate per transfer, which may fail to provide a complete view of the quality of the IVF process before embryo transfer (though it was still the standard measure of quality during our study timeframe). We provide suggestive evidence using alternative measures, when available, that chain clinics are performing as well as non-chain clinics on IVF steps that occur before an embryo transfer (Table F1) and performing better than chain clinics regardless of how the live birth rate is measured (Table F2). Note that for some of these analyses, we run a cross-sectional regression using data from either 2016, or 2017 and 2018 as follows:

$$\text{Appendix Eq. 3:} \qquad Y_{ct} = \alpha_{st} + \beta_1 Acquisition_c + \beta_2 Affiliation_c + \epsilon_{ct}$$

The independent variables $Acquisition_c$ and $Affiliation_c$ are binary variables equal to 1 if the clinic was acquired by a fertility chain or affiliated with a fertility chain, respectively. We also include *state* × *year* fixed effects. Standard errors are clustered at the clinic level.

Addressing Data Reporting Change. The second limitation is that changes in data reporting influence our volume measures. In 2017 and 2018, a more comprehensive version of total cycles was reported which led to a steep increase in total cycles for both chain and non-chain clinics (Figure F1 shows this increase in the raw data). However, the relative changes are nearly equal: they increase by 35% and 34%, respectively. This would suggest the inclusion of year FE would account for this year-specific reporting change. By contrast, total transfers reported decrease for all clinics in 2017 and 2018, with a steeper decline for chain clinics than for non-chain clinics: transfers decrease by 14% and 8% for chain and non-chain clinics, respectively. We believe that this is because chains do more frozen embryo transfers and so they are more negatively impacted by this reporting change that combined fresh and frozen embryo transfers. Still, this differential decline could be driven by a treatment effect of chain clinics suddenly reducing transfers.

We will provide evidence in Table F3 that this differential decline is likely driven by the reporting change, and not a treatment effect. First, we show results for all outcomes dropping the years 2017 and 2018 compared to the full sample. Focusing on acquired clinics, we find that cycles increase by 27.2% and 28.4% in the full sample and dropping 2017-2018, respectively (Columns 1 and 2). The similarity in these estimates minimizes concerns of measurement bias for cycles. Furthermore, cycles and transfers increase by similar amounts when dropping 2017-2018: cycles increase by 28.4% and transfers increase by 29.2% (Columns 2 and 4). Second, in Column 5, we take an additional strategy. We impute what transfers would have been for a clinic in 2017 and 2018 using their ratio of transfers to cycles in 2016. In other words, we take the ratio of transfers to cycles for each age group for each clinic in 2016, and using the cycle data in 2017 and 2018, impute what that clinic's transfers would have been. Based on imputed transfers, we find that clinics increase transfers by 28.8% after being acquired by a chain, which provides a more comparable increase to cycles.

Overall, this exploration suggests that our results in Table 2 are underestimating the effect of chain acquisitions on transfers and that chains increase cycles and transfers by similar amounts. This is an important finding as it suggests that chains are not performing worse on retrievals or being inefficient in ways that would lead them to perform more cycles that do not proceed to a transfer. Lastly, note that our live birth rate measure is unaffected by this reporting change because the live birth rate is reported as a rate in all years. We do not calculate this rate ourselves because the data does not include the number of live births in levels (i.e., it does not include the numerator of the live birth rate). In other words, the live birth rate estimates do not rely on the total transfers reported per clinic.

Table F1. Differences in Cycle Cancellation Rates and Post-Retrieval Stoppage Rates for Chain and Non-Chain Clinics

	(1) **All Ages**	(2) **Patients Under 35**	(3) **Patients 35-37**	(4) **Patients 38 and Over**
Panel A: Pre-Retrieval Cycle Cancellation				
Rate				
Post × Acquisition	0.000	-0.007	0.015	-0.001
	(0.012)	(0.009)	(0.016)	(0.015)
Post × Affiliation	-0.014	-0.015**	-0.007	-0.012
	(0.010)	(0.008)	(0.010)	(0.018)
Dep. Var. Mean	0.092	0.067	0.095	0.134
Clinic-Years	5676	5674	5666	5670
R^2	0.564	0.453	0.431	0.446
Panel B: Post-Retrieval Cycle Stoppage Rate (2017 and 2018 data)				
Acquisition=1	-0.009	-0.007	-0.002	-0.012
	(0.013)	(0.015)	(0.013)	(0.014)
Affiliation=1	-0.020*	-0.022*	-0.016	-0.019
	(0.011)	(0.011)	(0.010)	(0.015)
Dep. Var. Mean	0.089	0.082	0.077	0.105
Clinic-Years	764	764	764	764
R^2	0.108	0.100	0.088	0.132

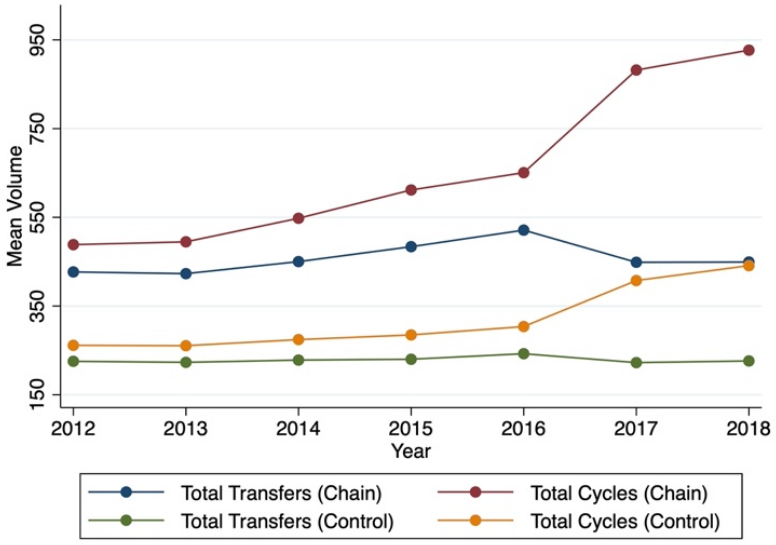
Note: Panel A shows the estimates of Equation 2 using the cycle cancellation rate as the outcome variable. This number captures the percent of all cycles that a clinic started that were cancelled before eggs were retrieved. Panel B shows a cross-sectional regression using data from 2017 and 2018 to estimate differences in the post-retrieval stop rate between chain and non-chain clinics. Rather than post-transaction indicators, "Acquisition=1" is equal to 1 for acquired clinics and zero otherwise and "Affiliation=1" is equal to 1 for affiliated clinics and zero otherwise. The post-retrieval stop rate captures the percent of cycles stopped between retrieval and transfer as well as between retrieval and freezing of the egg or embryo if that was the intention. In Panel A, the dependent variable mean captures the predicted mean for control clinics and treatment clinics before the transaction and in Panel B, it captures the predicted mean for control clinics in 2017 and 2018. Standard errors are clustered at the clinic level. Significance levels: *p<0.1, **p< 0.05, ***p<0.01

Table F2. Cross-Sectional Analyses of Alternative Live Birth Rate Measures

	All Patients Data from 2016		New Patients (No Prior IVF Cycles) Data from 2017 and 2018	
	(1)	(2)	(3)	(4)
	Singleton Live Birth Rate per Transfer	**Term, Normal Weight, Singleton Live Birth Rate Per Transfer**	**Live Birth Rate First Intended Retrieval**	**Live Birth Rate All Intended Retrievals**
Panel A: Patients All Ages				
Acquisition=1	0.090***	0.089***	0.085***	0.091***
	(0.017)	(0.017)	(0.018)	(0.017)
Affiliation=1	0.056***	0.057***	0.051***	0.065***
	(0.017)	(0.015)	(0.014)	(0.016)
Dep. Var. Mean	0.329	0.271	0.360	0.417
Clinic-Years	402	402	764	764
R^2	0.227	0.227	0.260	0.236
Panel B: Patients Under 35				
Acquisition=1	0.083***	0.094***	0.098***	0.098***
	(0.022)	(0.020)	(0.021)	(0.020)
Affiliation=1	0.042**	0.050***	0.070***	0.070***
	(0.018)	(0.018)	(0.015)	(0.016)
Dep. Var. Mean.	0.359	0.297	0.495	0.551
Clinic-Years	402	402	764	764
R^2	0.166	0.190	0.170	0.162
Panel C: Patients 35-37				
Acquisition=1	0.082***	0.078***	0.097***	0.102***
	(0.020)	(0.019)	(0.020)	(0.020)
Affiliation=1	0.080***	0.082***	0.063***	0.077***
	(0.021)	(0.017)	(0.018)	(0.018)
Dep. Var. Mean	0.331	0.273	0.345	0.408
Clinic-Years	401	401	763	763
R^2	0.190	0.196	0.200	0.204
Panel D: Patients 38 and Over				
Acquisition=1	0.109***	0.097***	0.085***	0.105***
	(0.023)	(0.023)	(0.017)	(0.020)
Affiliation=1	0.053*	0.048**	0.036**	0.075***
	(0.028)	(0.023)	(0.015)	(0.023)
Dep. Var. Mean	0.267	0.218	0.165	0.214
Clinic-Years	402	402	763	763
R^2	0.180	0.162	0.210	0.200

Note: This table shows results of a cross-sectional analysis using data from 2016 or 2017 and 2018 to estimate differences in outcomes between chain and non-chain clinics. Rather than post-transaction indicators, "Acquisition=1" is equal to 1 for acquired clinics and zero otherwise and "Affiliation=1" is equal to 1 for affiliated clinics and zero otherwise. In column 1, the outcome measures the percentage of embryo transfers that resulted in the live birth of a single baby, and column 2 limits this rate to births of normal weight and at term (i.e., 37 full weeks gestation or more and normal weight if at least 2,500 grams). In column 3, the live birth rate represents the percentage of patients with no prior ART cycles that had a live birth after their first intended retrieval and in column 4, the live birth rate represents the percentage of patients with no prior ART cycles that had a live birth after all intended retrievals. The dependent variable mean captures the predicted mean for control clinics in either 2016 or 2017 and 2018. Standard errors are clustered at the clinic level. Significance levels: *p<0.1, **p< 0.05, ***p<0.01

Figure F1. Raw Data Trends for Total Cycles and Total Transfers between Chain and Non-Chain Clinics



Notes: This figure presents raw data trends in the mean total cycles and total transfers between chain and non-chain (control) clinics. This figure demonstrates the impact of reporting changes on the volume measures that occurred in 2017 and 2018.

Table F3. Sensitivity of Key Results to Data Reporting Changes

	Log(Cycles)		Log(Transfers)		
	(1)	(2)	(3)	(4)	(5)
	Full Sample	**Drop 2017-2018**	**Full Sample**	**Drop 2017-2018**	**Full Sample w/Imputed Transfers**
Panel A: Patients All Ages					
Post × Acquisition	0.272***	0.284**	0.214**	0.292***	0.288***
	(0.093)	(0.114)	(0.093)	(0.110)	(0.090)
Post × Affiliation	0.240**	0.176*	0.215**	0.186*	0.243**
	(0.104)	(0.103)	(0.103)	(0.100)	(0.104)
Dep. Var. Mean	5.250	5.190	5.033	5.034	5.085
Clinic-Years	5676	4902	5676	4902	5676
R^2	0.896	0.903	0.895	0.903	0.894
Panel B: Patients Under 35					
Post × Acquisition	0.270***	0.282**	0.203**	0.293**	0.289***
	(0.099)	(0.125)	(0.098)	(0.120)	(0.095)
Post × Affiliation	0.193**	0.117	0.166*	0.118	0.188*
	(0.097)	(0.094)	(0.094)	(0.093)	(0.097)
Dep. Var. Mean.	4.379	4.313	4.179	4.175	4.232
Clinic-Years	5674	4900	5674	4900	5674
R^2	0.884	0.889	0.881	0.888	0.882
Panel C: Patients 35-37					
Post × Acquisition	0.216**	0.229*	0.146	0.240**	0.238**
	(0.103)	(0.123)	(0.099)	(0.115)	(0.098)
Post × Affiliation	0.263**	0.201*	0.218**	0.194*	0.246**
	(0.105)	(0.104)	(0.103)	(0.102)	(0.104)
Dep. Var. Mean	3.664	3.576	3.404	3.405	3.485
Clinic-Years	5666	4892	5663	4890	5663
R^2	0.868	0.870	0.858	0.870	0.866
Panel D: Patients 38 and Over					
Post × Acquisition	0.261***	0.230*	0.131	0.239**	0.276***
	(0.098)	(0.125)	(0.107)	(0.120)	(0.098)
Post × Affiliation	0.272**	0.209*	0.252**	0.234**	0.291**
	(0.117)	(0.117)	(0.119)	(0.116)	(0.119)
Dep. Var. Mean	3.784	3.690	3.419	3.446	3.479
Clinic-Years	5670	4896	5663	4893	5666
R^2	0.879	0.884	0.865	0.880	0.867

Notes: This table shows the estimates of Equation 2. Columns 1, 3 and 6 use all the years of data, Columns 2, 4, and 7 exclude data from 2017 and 2018 and Column 5 replaces the number of transfers in 2017 and 2018 with estimates of what the transfers would have been based on a clinic's ratio of transfers to cycles in 2016. The dependent variable mean captures the predicted mean for control clinics and treatment clinics before the transaction. Standard errors are clustered at the clinic level. Significance levels: *p<0.1, **p<0.05, ***p<0.01

Appendix G. Assessing the Role of Insurance Coverage and Market Concentration

This appendix focuses on analyses related to insurance expansion (Section 4.7 of the manuscript) and market concentration (Section 4.8 of the manuscript). Table G1 and Figure G1 show the static DiD and event studies from a subsample analysis by whether the clinic was in a state with an infertility coverage mandate, Table G2 assesses robustness to changes in market concentration and Table G3 and Figure G2 show the static DiD and event studies from a subsample analysis by a clinic's baseline levels of market concentration.

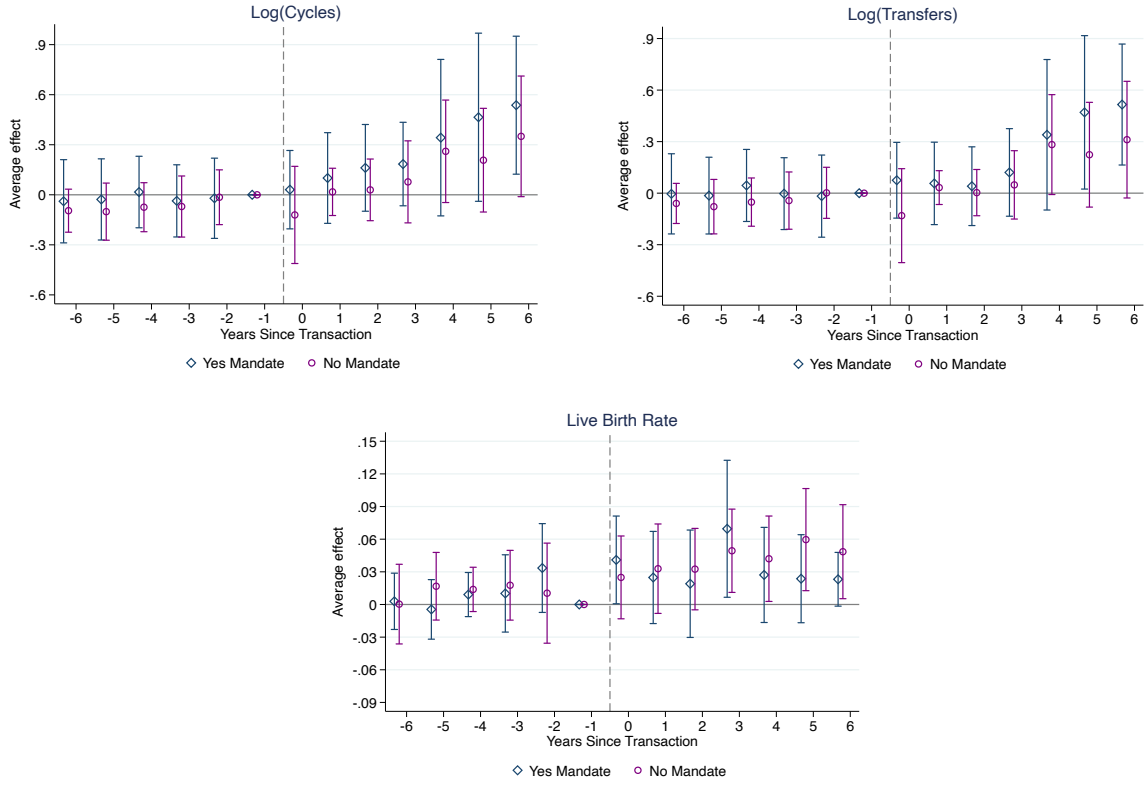
Insurance Coverage (Table G1 and Figure G1, below). In this regression, we create an indicator equal to 1 if a clinic is in a state with an infertility coverage mandate during our sample period and 0 otherwise. We interact this indicator with our post-transaction indicator for acquired and affiliated clinics to analyze if outcomes differ by whether a clinic is located in a state with or without a mandate. In Figure G1, we present the corresponding event study plot.

Table G1. Effect of Chain Ownership on Fertility Clinic Outcomes by State Insurance Coverage Mandate

	(1)	(2)	(3)
	Log(Cycles)	Log(Transfers)	Live Birth Rate
Post × Acquisition(Mandate=1)	0.360***	0.284**	0.036*
	(0.130)	(0.135)	(0.020)
Post × Acquisition(Mandate=0)	0.231**	0.167*	0.046***
	(0.098)	(0.098)	(0.018)
Post × Affiliation(Mandate=1)	0.320**	0.295*	-0.009
	(0.156)	(0.152)	(0.018)
Post × Affiliation(Mandate=0)	0.218**	0.207**	0.006
	(0.089)	(0.094)	(0.021)
Dep. Var. Mean	5.254	5.038	0.375
Clinic-Years	5818	5818	5818
R^2	0.881	0.880	0.574

Notes: This table shows the estimates of Equation 2 between clinics in states with and without infertility coverage laws (states with mandates during our sample period include: Arkansas, California, Connecticut, Hawaii, Illinois, Massachusetts, Maryland, Montana, New Jersey, New York, Ohio, Louisiana, Rhode Island, Texas and West Virginia). *Mandate=1* means a clinic was acquired by or affiliated with a chain in a state with an infertility coverage mandate. Rather than *state × year* FE we include year FE to allow comparisons between rather than within states. The dependent variable mean captures the predicted mean for control clinics and treatment clinics before the transaction. Standard errors are clustered at the clinic level. Significance levels: *p<0.1, **p<0.05, ***p<0.01

Figure G1. Event Study Results for Acquired Clinics by State Insurance Coverage Mandate



Notes: This figure shows the β_1 and β_2 estimates of Equation 2 interacted with indicators for the year relative to the transaction year (traditional TWFE OLS estimates) for clinics in states with insurance mandates (Yes Mandate) or without (No Mandate). See Table G1 for more details. Bands indicate 95% confidence intervals constructed from clinic-level clustered standard errors.

Market Concentration Analysis (Table G2, below). Like many healthcare markets, US fertility markets are highly concentrated. One reason is that reproductive endocrinology is a relatively new field of medicine having started in the 1970s, with the first IVF baby born in the US in 1981. While there has been much progress and growth, in 2014, for example, only 441 fertility clinics provided IVF services in the US, and the average HHI was 4346. The HHI is calculated using the share of total IVF cycles by year for each parent organization (the parent is the corporate parent of the chain for chain clinics and the clinic itself for non-chain clinics) in a CBSA. By comparison, the mean HHI for hospitals at the MSA-level was around 5500 for hospitals and 3300 for specialist physicians in 2014 (Fulton 2017). While fertility markets are concentrated on average, 28% of clinics were in CBSAs with 1-2 clinics, whereas 50% are in CBSAs with 6 or more clinics in 2014.

As mentioned in the manuscript, fertility chains are more likely to target clinics in more competitive markets, and most chain transactions occur across markets rather than within markets. To confirm this, we calculate the number of markets where an acquisition or an affiliation increased the number of clinics belonging to the same chain. For example, if there were three non-chain clinics in a CBSA before an acquisition, and one clinic was acquired, then there would be no consolidation at the chain level in that market. However, if a second clinic in that CBSA was acquired by the same chain, then that CBSA would become more consolidated as a result of the acquisition. We identify 5 CBSAs (out of 147) where an acquisition or affiliation led to chain-level consolidation (the 5 CBSAs include Boston-Cambridge-Newton, Chicago-Naperville-Elgin, Dallas-Fort Worth-Arlington, Los Angeles-Long Beach-Anaheim, and New York-Newark-Jersey City).

We then calculate whether a market became more *concentrated* because of an affiliation or an acquisition. Defining a market as a CBSA, we locate market years where an acquisition or affiliation occurs in the following year. Next, we calculate a counterfactual HHI based on a chain's pre-transaction shares but post-transaction ownership within a market. This counterfactual HHI represents the post-transaction change in HHI only driven by the clinic acquisition or affiliation in that market. Using this methodology, we identify 3 CBSAs as having transactions that induce increases in HHI. In Appendix Table G2, we provide evidence that results are robust to excluding these markets, suggesting that the impact of chain ownership on fertility clinic outcomes is not driven by changes in market concentration.

Table G2. Effect of Chain Ownership on Fertility Clinic Outcomes, Robustness to Changes in Market Concentration

	(1) Log(Cycles)	(2) Log(Transfers)	(3) Live Birth Rate
Panel A: Exclude Markets Where Chain Transaction Increased HHI			
Post × Acquisition	0.248***	0.185**	0.051***
	(0.090)	(0.090)	(0.015)
Post × Affiliation	0.243**	0.210**	0.003
	(0.104)	(0.103)	(0.016)
Dep. Var. Mean	5.265	5.042	0.376
Clinic-Years	5280	5280	5280
R^2	0.902	0.901	0.633
Panel B: Exclude Markets With Any Chain-Level Consolidation			
Post × Acquisition	0.263**	0.193*	0.040**
	(0.110)	(0.108)	(0.017)
Post × Affiliation	0.111	0.097	0.005
	(0.087)	(0.089)	(0.023)
Dep. Var. Mean	5.231	5.014	0.379
Clinic-Years	4100	4100	4100
R^2	0.905	0.906	0.624

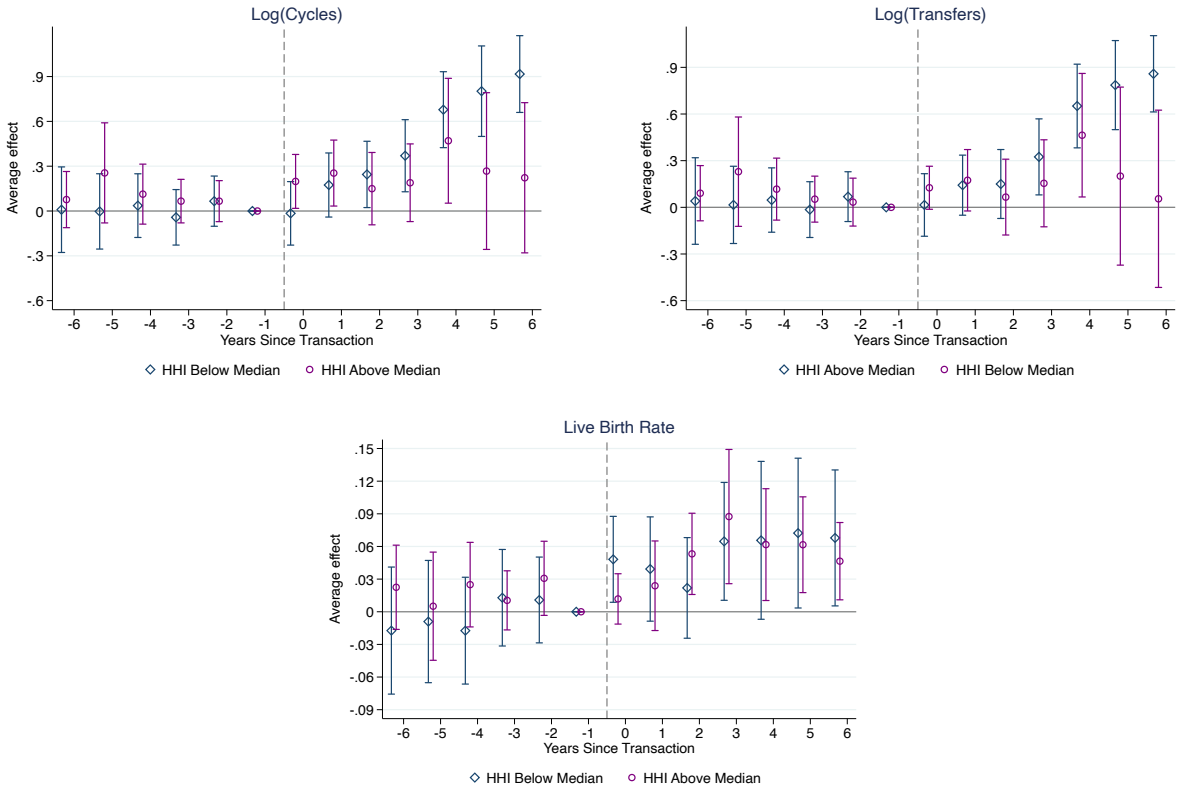
Notes: This table shows the estimates of Equation 2 run on samples excluding different markets. Panel A excludes data from 3 CBSAs where a clinic transaction increased the HHI in that market. Panel B excludes data from 5 CBSAs where a clinic transaction increased the number of clinics under the same ownership in the same market. The dependent variable mean captures the predicted mean for control clinics and treatment clinics before the transaction. Standard errors are clustered at the clinic level. Significance levels: *p<0.1, **p<0.05, ***p<0.01

Table G3. Effect of Chain Ownership on Fertility Clinic Outcomes by Baseline Levels of Market Concentration

	(1)	(2)	(3)
	Log(Cycles)	**Log(Transfers)**	**Live Birth Rate**
Post × Acquisition(HHI_Above=1)	0.235*	0.138	0.021
	(0.120)	(0.120)	(0.016)
Post × Acquisition(HHI_Below=1)	0.285**	0.242**	0.064***
	(0.118)	(0.120)	(0.018)
Post × Affiliation(HHI_Above=1)	0.333	0.335	-0.012
	(0.210)	(0.204)	(0.019)
Post × Affiliation(HHI_Below=1)	0.181*	0.140	0.018
	(0.102)	(0.104)	(0.024)
Dep. Var. Mean	5.250	5.033	0.374
Clinic-Years	5676	5676	5676
R^2	0.896	0.895	0.623

Notes: This table shows the estimates of Equation 2 interacted with a binary indicator for whether a clinic was in a market with below or above median HHI (calculated using the HHI of the CBSA for the first year the clinic is in the sample). Specifically, HHI_Above means the market is more concentrated and therefore, less competitive (mean HHI of 6557) and HHI_Below means the market is less concentrated and therefore, more competitive (mean HHI of 2035). The dependent variable mean captures the predicted mean for control clinics and treatment clinics before the transaction. Standard errors are clustered at the clinic level. Significance levels: *p<0.1, **p<0.05, ***p<0.01

Figure G2. Event Study Results for Acquired Clinics by Baseline Levels of Market Concentration



Notes: This figure shows the β_1 and β_2 estimates of Equation 2 interacted with indicators for the year relative to the transaction year (traditional TWFE OLS estimates) for clinics with baseline HHI below or above the median. See Table G3 for more details. Bands indicate 95% confidence intervals constructed from clinic-level clustered standard errors.

Appendix H. Mechanisms

This appendix uses alternative specifications and outcomes to explore underlying mechanisms driving the observed changes in fertility clinic volume and IVF success rates. Table H1 shows improvements in outcomes for patients of different ages as well as decomposes the live birth rate into multiple and singleton births, Table H2 and Figure H1 show changes in each cycles, transfers, and live birth rates by terciles of a clinic's pre-transaction performance on each outcome, Table H3 and Figure 2 show changes in the live birth rate by whether the fertility chain has below or above average live birth rates before the first clinic transaction, Table H4 and Figure 3 shows changes in the live birth rate by terciles of a clinic's pre-transaction clinic volume, Table H5 shows whether clinics engage in market expansion or business stealing using commuting zones as markets, Table H6 shows the association between chain ownership and advertising fertility financing options, and Table H7 and Figure 4 explore the role of private equity investment into fertility chains.

Table H1. Effect of Chain Ownership on Fertility Clinic IVF Success Rates by Patient Age Category

	Full Sample			Post-2010	
	(1)	(2)	(3)	(4)	(5)
	Live Birth Rate	**Singleton Birth Rate**	**Multiple Birth Rate**	**Singleton Birth Rate**	**Multiple Birth Rate**
Panel A: Patients All Ages					
Post × Acquisition	0.051***	0.063***	-0.013*	0.050***	-0.023***
	(0.015)	(0.013)	(0.007)	(0.012)	(0.006)
Post × Affiliation	0.006	0.012	-0.007	0.009	-0.020
	(0.017)	(0.015)	(0.007)	(0.017)	(0.015)
Dep. Var. Mean	0.374	0.273	0.101	0.303	0.091
Clinic-Years	5676	5676	5676	3145	3145
R^2	0.623	0.617	0.507	0.658	0.581
Panel B: Patients Under 35					
Post × Acquisition	0.039**	0.057***	-0.018*	0.043***	-0.028***
	(0.016)	(0.014)	(0.010)	(0.014)	(0.009)
Post × Affiliation	-0.002	0.009	-0.011	-0.023	-0.027
	(0.016)	(0.015)	(0.008)	(0.018)	(0.018)
Dep. Var. Mean.	0.436	0.308	0.129	0.343	0.113
Clinic-Years	5674	5674	5674	3144	3144
R^2	0.519	0.507	0.431	0.545	0.494
Panel C: Patients 35-37					
Post × Acquisition	0.035**	0.047***	-0.012	0.045***	-0.022***
	(0.017)	(0.015)	(0.009)	(0.015)	(0.008)
Post × Affiliation	0.016	0.024	-0.009	0.047**	-0.000
	(0.022)	(0.020)	(0.010)	(0.024)	(0.028)
Dep. Var. Mean	0.369	0.274	0.095	0.303	0.086
Clinic-Years	5663	5663	5663	3136	3136
R^2	0.404	0.413	0.263	0.453	0.346
Panel D: Patients 38 and Over					
Post × Acquisition	0.088***	0.100***	-0.012**	0.080***	-0.015***
	(0.019)	(0.019)	(0.006)	(0.018)	(0.005)
Post × Affiliation	0.027	0.014	0.011*	0.057	-0.010
	(0.019)	(0.019)	(0.006)	(0.039)	(0.010)
Dep. Var. Mean	0.256	0.205	0.050	0.226	0.050
Clinic-Years	5663	5663	5663	3134	3134
R^2	0.415	0.404	0.232	0.476	0.302

Notes: This table shows the estimates of Equation 2 run for three separate age categories: all patients with results weighted by patient age group (Panel A), patients under the age of 35 (Panel B), patients between the ages of 35 and 37 (Panel C) and patients of age 38 or older (Panel D). Note that because of changes in data reporting, the oldest patients included in the sample are 42 years old. In Columns 2 and 3, the singleton birth rate is partially imputed because the singleton rate was only provided for fresh but not frozen embryo transfers before 2011 (see Appendix A1 for description). Therefore, Columns 4 and 5 show robustness to only including data from 2011-2018. The dependent variable mean captures the predicted mean for control clinics and treatment clinics before the transaction. Standard errors are clustered at the clinic level. Significance levels: *$p<0.1$, **$p<0.05$, ***$p<0.01$

Evidence that Chains Facilitate Learning (Tables H2-H4 and Figures H1-H3). In Table H2, we divide acquired and affiliated clinics into three terciles based on their pre-transaction IVF cycles, IVF transfers, and the live birth rate, and interact an indicator for each category with the post-transaction indicators in Equation 2. Specifically, all acquired clinics are divided into terciles, and separately, all affiliated clinics are divided into terciles based on their pre-transaction means for each outcome. This strategy allows a clinic to potentially be initially high performing on live birth rate but low performing on clinic volume. Additionally, to account for mean reversion, we include tercile-specific time trends by creating a "stack" of control clinics for each tercile for acquired and affiliated clinics (6 total stacks). Therefore, each stack contains the full set of control clinics and the treated clinics within the tercile. Each stack is assigned the binary indicator for the tercile of the acquired or affiliated clinic, and that indicator is interacted with (year-2003) to create the tercile-specific time trend. Our regression includes the post-transaction interactions with the 3 terciles for acquired and affiliated clinics, and the 6 tercile-specific time trends.

In Table H3, we create an indicator for whether a *fertility chain* is relatively high-performing (above median), or low-performing (below median) based on the average live birth rate of the clinics in the chain before the first chain transaction occurs. We then interact these high and low-performing chain indicators with the post-transaction indicators in Equation 2. This analysis reveals whether differences in live birth rates exist dependent on whether clinics get acquired by chains that have better practices or knowledge before the clinic was acquired.

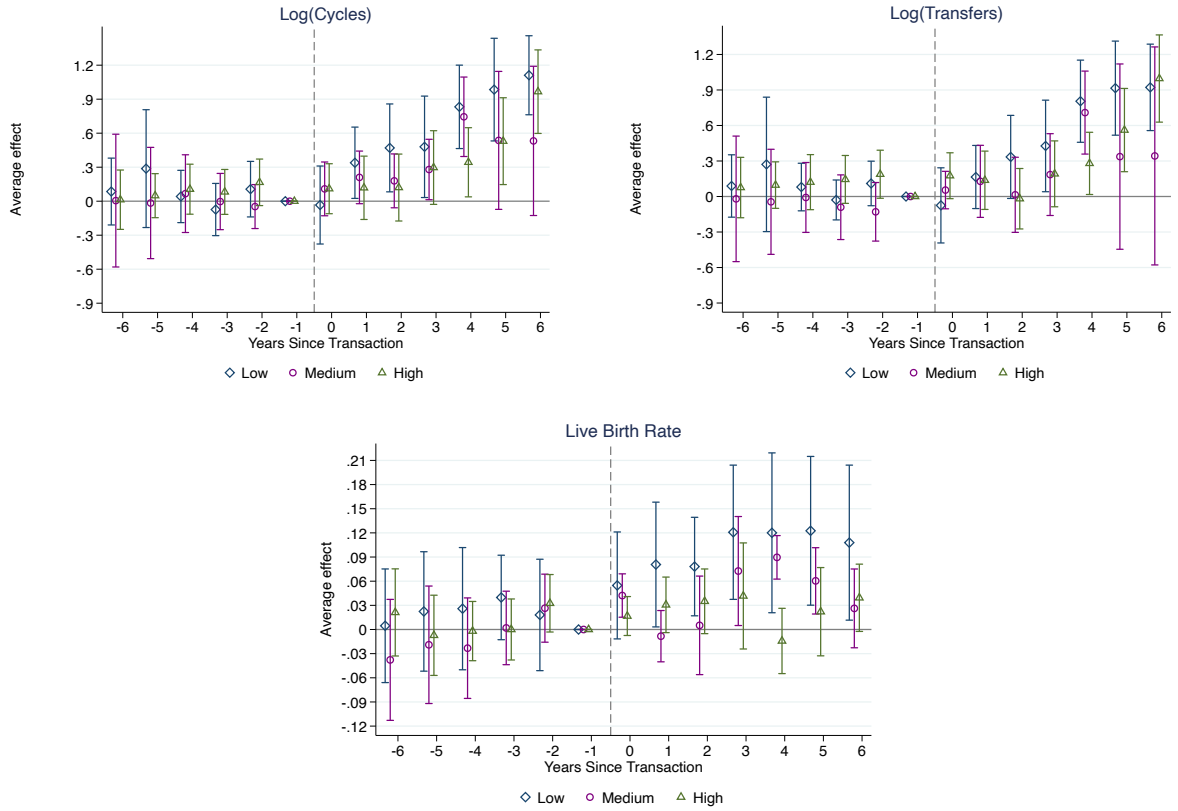
In Table H4, we repeat the analysis in Table H2, but include terciles of a clinic's pre-transaction cycles as the independent variables and the live birth rate as the dependent variable. This analysis shows that even clinics that had high volume pre-transaction (and did not have large increases in volume post-transaction) experience increases in the live birth rate.

Table H2. The Effect of Chain Ownership on Fertility Clinic Outcomes by Pre-Transaction *Clinic* Performance

	(1) **Log(Cycles)**	(2) **Log(Transfers)**	(3) **Live Birth Rate**
Post × Acquisition(Low=1)	0.387***	0.318**	0.070**
	(0.149)	(0.152)	(0.030)
Post × Acquisition(Med=1)	0.261	0.165	0.052*
	(0.212)	(0.236)	(0.028)
Post × Acquisition(High=1)	0.176	0.131	0.034**
	(0.124)	(0.117)	(0.013)
Post × Affiliation(Low=1)	0.603***	0.592***	0.003
	(0.196)	(0.200)	(0.015)
Post × Affiliation(Med=1)	0.244*	0.137	0.029
	(0.134)	(0.100)	(0.019)
Post × Affiliation(High=1)	-0.031	0.031	-0.001
	(0.063)	(0.133)	(0.043)
Dep. Var. Mean	5.173	4.955	0.369
Clinic-Years (Stacked)	30598	30598	30598
R^2	0.891	0.891	0.616

Notes: This table displays β_1 and β_2 estimates of Equation 2 with clinics divided into terciles based on their pre-transaction averages for each outcome variable (these categories are mutually exclusive). For example, *Acquisition(Low=1)* is an indicator equal to 1 if an acquired clinic was in the bottom tercile of acquired clinics based on its pre-transaction mean. The dependent variable mean captures the predicted mean for control clinics and treatment clinics before the transaction. Standard errors are clustered at the clinic level. Significance levels: *p<0.1, **p<0.05, ***p<0.01

Figure H1. Event Study Results for Acquired Clinics by Pre-Transaction Clinic Performance



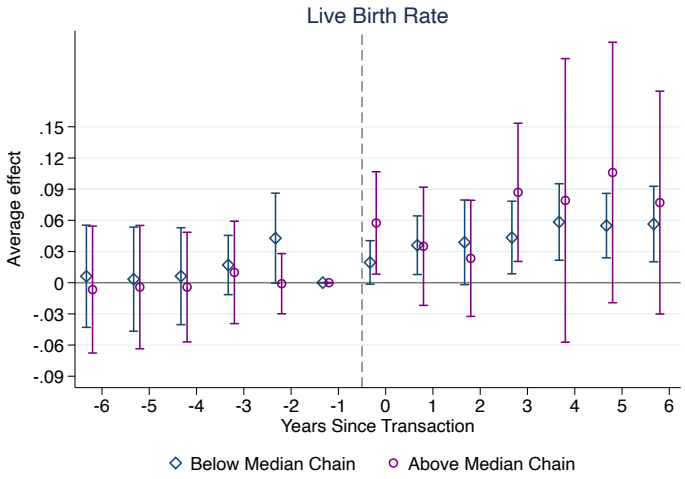
Notes: This figure shows the β_1 and β_2 estimates of Equation 2 interacted with indicators for the year relative to the transaction year (traditional TWFE OLS estimates). Bands indicate 95% confidence intervals constructed from clinic-level clustered standard errors. "Low" represents the first tercile, "medium" represents the second tercile, and "high" represents the third tercile constructed by taking the set of acquired clinics and dividing them into terciles based on the mean of their pre-transaction performance for cycles, transfers and live birth rates, respectively. See Table H2 for details.

Table H3. The Effect of Chain Ownership on the Live Birth Rate by Fertility *Chain* Pre-Transaction Live Birth Rates

	Live Birth Rate
Post × Acquisition(ChainBelow=1)	0.027**
	(0.012)
Post × Acquisition(ChainAbove=1)	0.069***
	(0.023)
Post × Affiliation(ChainBelow=1)	-0.006
	(0.021)
Post × Affiliation(ChainAbove=1)	0.038**
	(0.016)
Dep. Var. Mean	0.374
Clinic-Years	5676
R^2	0.623

Notes: This table provides an extension of Equation 2 where the post-transaction indicators are interacted with an indicator for whether the clinic is acquired by or affiliates with a fertility chain with below or above median live birth rates. To calculate each chain's live birth rate, we take the average live birth rate of the clinics that are already in the chain before the first transaction takes place in our sample. However, since some chains are newly created by PE firms during our sample period (i.e., had no clinics already in the chain), for these chains we use the average live birth rate of the flagship clinic(s) first acquired to create the chain in the years before the transaction occurs. Using these pre-transaction chain-level live birth rates, we then divide chains into those with below or above the median live birth rates. The dependent variable mean captures the predicted mean for control clinics and treatment clinics before the transaction. Standard errors are clustered at the clinic level. Significance levels: *p<0.1, **p<0.05, ***p<0.01

Figure H2. Event Study Results for Acquired Clinics by Fertility *Chain* Pre-Transaction Live Birth Rates



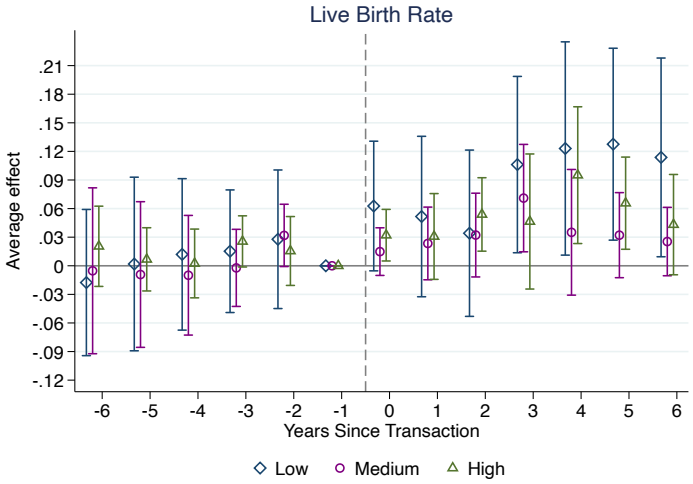
Notes: This figure shows the β_1 and β_2 estimates of Equation 2 interacted with indicators for the year relative to the transaction year (traditional TWFE OLS estimates). Bands indicate 95% confidence intervals constructed from clinic-level clustered standard errors. See Table H3 for details.

Table H4. The Effect of Chain Ownership on the Live Birth Rate by Terciles of Clinic Pre-Transaction IVF Cycles

	Live Birth Rate
Post × Acquisition(Low=1)	0.069**
	(0.031)
Post × Acquisition(Med=1)	0.043**
	(0.022)
Post × Acquisition(High=1)	0.043**
	(0.019)
Post × Affiliation(Low=1)	-0.003
	(0.022)
Post × Affiliation(Med=1)	0.015
	(0.040)
Post × Affiliation(High=1)	0.018
	(0.018)
Dep. Var. Mean	0.002
Clinic-Years	0.002
R^2	(0.001)

Notes: This table provides an extension of Equation 2 with clinics divided into terciles based on their pre-transaction average of IVF cycles. For example, *Acquisition(Low=1)* is an indicator equal to 1 if an acquired clinic was in the bottom tercile of acquired clinics based on its pre-transaction average of IVF cycles. The dependent variable mean captures the predicted mean for control clinics and treatment clinics before the transaction. Standard errors are clustered at the clinic level. Significance levels: *p<0.1, **p<0.05, ***p<0.01

Figure H3. Event Study Results for Acquired Clinics by Terciles of Clinic Pre-Transaction IVF Cycles



Notes: This figure shows the β_1 and β_2 estimates of Equation 2 interacted with indicators for the year relative to the transaction year (traditional TWFE OLS estimates). Bands indicate 95% confidence intervals constructed from clinic-level clustered standard errors. "Low" represents the first tercile, "medium" represents the second tercile, and "high" represents the third tercile constructed by taking the set of acquired clinics and dividing them into terciles based on the mean of their pre-transaction performance for cycles. See Table H4 for details.

Market Expansion Analysis (Table 4 in the manuscript and Table H5 below). To study market expansion vs. business stealing, we use an instrumental variables strategy as follows:

Appendix Eq. 3: $$Total\_Chain_{jy} = \gamma Chain\_Clinics_{jy} + \zeta \boldsymbol{X}_{jy} + \theta_j + \theta_y + \nu_{jy}$$

Appendix Eq. 4: $$M_{jy} = \delta Total\_Chain_{jy} + \phi \boldsymbol{X}_{jy} + \theta_j + \theta_y + \epsilon_{jy}$$

We implement this approach to account for multiple transactions by different clinic chains in the same market and because it provides an intuitive test of market expansion. The first stage in Equation 3 instruments for the total number of IVF cycles ($Total\_Chain_{jy}$) performed by chain clinics in market j in year y using the number of chain clinics ($Chain\_Clinics_{jy}$) in market j in year y. As before, the market is defined as a clinic's CBSA (Appendix Table H5 shows robustness to using commuting zone markets). We control for market (θ_m) and year fixed effects (θ_y), and market-level controls ($\boldsymbol{X}_{jy}$) including median household income and total population aged 20-49. To test whether chain ownership leads to business stealing, we estimate the second stage (Equation 4) using the total IVF cycles performed by non-chain clinics in a market as outcome M_{jy}. By construction, the instrument is strongly predictive of total IVF cycles and live births by chain clinics because as the number of chain clinics in a market increases, so will chain cycles and live births. In other words, the number of chain clinics is assumed to only impact total market cycles and live births through the increase in total chain cycles and live births.

If an increase in IVF cycles by chain clinics is the result of business stealing, then we would expect $\delta = -1$. To test whether chain ownership leads to market expansion, we instead use the total number of IVF cycles performed by *all* clinics in a market as outcome M_{jy}. If fertility chain growth is market expanding, then we would expect $\delta = 1$. In other words, for every 1 IVF cycle performed by a chain clinic, there is 1 additional IVF cycle in that market.

Table H5. Market Expansion Analysis, IV Estimates Based on Commuting Zones

	(1)	(2)	(3)	(4)
	Total Market Cycles		**Total Market Live Births**	
	Non-Chain Clinics	All Clinics	Non-Chain Clinics	All Clinics
Total Chain Cycles	0.002	1.002***		
	(0.179)	(0.179)		
Total Chain Live Births			-0.258*	0.742***
			(0.136)	(0.136)
First Stage: F-Stat	62.504	62.504	59.973	59.973
Market-Years	1876	1876	1876	1876

Notes: This table displays the δ estimates of Appendix Equation 4. The market is defined as the commuting zone of the clinic based on ERS 2000 delineations. *Total Chain Cycles* and *Total Chain Live Births* represent the total number of IVF cycles and total number of live births performed by chain clinics each year in a commuting zone, instrumented using the number of chain clinics each year in a commuting zone. The first stage F-stat shows the Kleibergen-Paap Wald rk F statistics. The sample includes all clinics (including clinics always in a chain and newly opened by a chain) in a commuting zone that ever had a non-chain clinic. Standard errors are clustered at the market level. Significance levels: *p<0.1, **p<0.05, ***p<0.01

Advertised Fertility Financing Options Analysis (Table H6, below). The cost of IVF is often cited as a barrier to take-up. As a strategy to attract new patients and ostensibly make care more affordable, many fertility clinics advertise financing options or IVF discount programs. To examine whether chain clinics are more likely than non-chain clinics to provide and advertise IVF financing options, we hand-collect data from clinic websites using the Internet Archive (https://archive.org/). We collect a cross-section of data for the year 2018 (the last year in our sample) for clinics in our matched sample (60 treated and 60 control clinics).[5] This sample is matched on pre-transaction clinic volume and, therefore, represents the largest non-chain fertility clinics in our sample.

We collect information on whether a clinic advertised any of the programs listed below (a clinic could offer none or all these options).[6]

1) **Money-Back Guarantees** (also called shared risk or refund programs): A patient typically pays a large, all-inclusive upfront sum for 2-3 cycles before starting treatment. If their cycles are unsuccessful, then they are refunded between 50-80% of the original amount. These programs can be provided directly by the clinic or in collaboration with a fertility benefits manager (examples include WinFertility and ARC Fertility).
2) **Multiple-Cycle Discount Plans:** There is no refund, and instead, a patient typically pays a reduced price for multiple cycles or, if they pay for two cycles, then they receive a third cycle free. These programs can be provided directly by the clinic or in collaboration with a fertility benefits manager (examples include WinFertility and ARC Fertility).
3) **Lending Program:** Fertility clinics often partner with fertility-specific lenders that provide loans and payment plans for patients (examples include Lending Club and CapExMD).
4) **IVF Discounts:** Fertility clinics can also advertise cash discounts, price matching, sliding scale payments, or grants to help patients cover IVF treatment. We excluded medication discounts because many patients can independently seek medication discounts, and medications are more likely to be covered by insurers.

In Table H6, we show the results from estimating Appendix Equation 5 with and without state (α_s) and year (α_t) fixed effects:

$$\text{Appendix Eq. 5:} \quad Prob(Advertise)_{ct} = \alpha_s + \alpha_t + \beta_1 Acquisition_c + \beta_2 Affiliation_c + \epsilon_{ct}$$

[5] We were unable to find websites or sufficient website data for 4 control clinics. These were typically hospital-based clinics where the Internet Archive did not save the fertility-specific web page embedded within the hospital's website.

[6] Initially, we also sought to collect data on advertised prices. However, clinics vary considerably in what they include in the advertised price of IVF and often do not provide detailed information. For example, one clinic may say they provide an all-inclusive price of $12,000 and another clinic will say they offer "low-cost IVF" at $4500. Most clinics ask patients to call for more price information.

The dependent variable $Prob(Advertise)_{ct}$ is a binary variable equal to 1 if the fertility clinic advertises 1) A money back guarantee or multiple cycle discount program (these are typically offered together), 2) a partnership with a lender, or 3) IVF-specific discounts. The independent variables $Acquisition_c$ and $Affiliation_c$ are binary variables equal to 1 if the clinic was acquired by a fertility chain or affiliated with a fertility chain, respectively. While we make efforts to collect data only from the year 2018, in some instances, the Internet Archive does not have a webpage in the year 2018 for a clinic. In those cases, we assume that if the information was the same in any year before and any year after 2018, then the information would be the same in 2018. If there was only information available in a single year, we record data from the closest year to 2018. As robustness, we include year fixed effects to account for any differences in the year the data was collected.

Table H6. Association Between Chain Ownership and Advertising Fertility Financing Options

	(1)	(2)	(3)	(4)	(5)	(6)
	Money Back Guarantee or Multi Cycle Discount		**Lending Program**		**Other IVF Discount Program**	
Acquisition=1	0.437***	0.364***	0.402***	0.328***	0.094	0.055
	(0.096)	(0.127)	(0.080)	(0.111)	(0.103)	(0.123)
Affiliation=1	0.161	0.188	0.321***	0.344***	-0.071	-0.058
	(0.116)	(0.143)	(0.095)	(0.128)	(0.094)	(0.113)
Constant	0.375***	0.416***	0.536***	0.550***	0.250***	0.274***
	(0.066)	(0.078)	(0.068)	(0.077)	(0.059)	(0.070)
Year FE		X		X		X
State FE		X		X		X
Clinic-Years	116	98	116	98	116	98
R^2	0.135	0.342	0.170	0.359	0.019	0.292

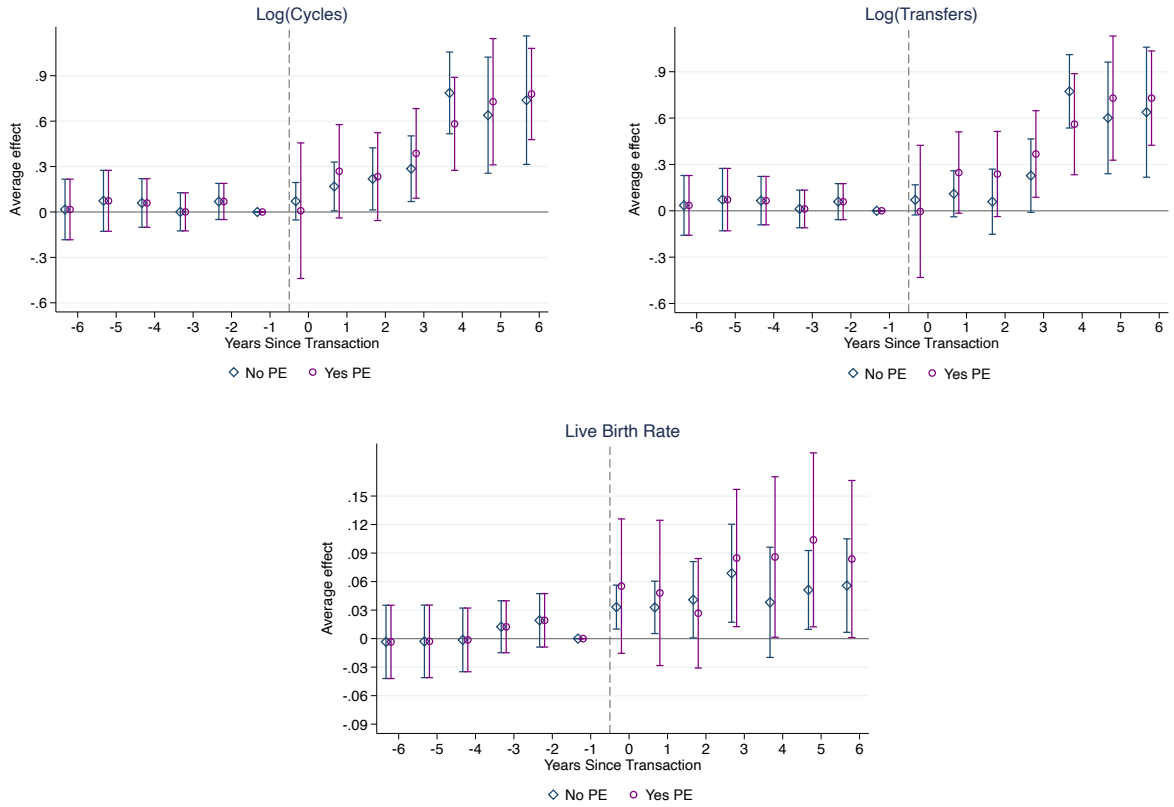
Notes: This table displays the β estimates of Appendix Equation 5. The constant represents the mean of the dependent variable for control clinics. Standard errors are clustered at the clinic level. Significance levels: *p<0.1, **p<0.05, ***p<0.01

Table H7. The Effect of Chain Ownership on Fertility Clinic Outcomes by Whether or Not the Chain Received PE Funding

	(1)	(2)	(3)
	Log(Cycles)	**Log(Transfers)**	**Live Birth Rate**
Post_NoPE × Acquisition	0.133	0.157	0.058**
	(0.156)	(0.140)	(0.028)
Post_YesPE × Acquisition	0.304***	0.226**	0.050***
	(0.098)	(0.099)	(0.014)
Post_NoPE × Affiliation	0.228**	0.219**	-0.008
	(0.104)	(0.100)	(0.019)
Post_YesPE × Affiliation	0.260**	0.211*	0.024
	(0.123)	(0.126)	(0.015)
Dep. Var. Mean	5.251	5.034	0.374
Clinic-Years	5676	5676	5676
R^2	0.896	0.895	0.623

Notes: This table shows the estimates of Equation 2 with treatment times based on private equity investment into a chain. *Post_NoPE* is a post-transaction indicator equal to 1 for the years a clinic is in a chain without PE funding and 0 for the years the clinic is in the chain with PE funding. *Post_YesPE* is a post-transaction indicator equal to 1 for the years a clinic is in the chain with PE funding and 0 for the years the clinic is in the chain without PE funding (these are mutually exclusive). The dependent variable mean captures the predicted mean for control clinics and treatment clinics before the transaction. Standard errors are clustered at the clinic level. Significance levels: *p<0.1, **p<0.05, ***p<0.01

Figure H4. Event Study Results for Acquired Clinics with and without PE Funding



Notes: This figure shows the β_1 and β_2 estimates of Equation 2 interacted with indicators for the year relative to the transaction year (traditional TWFE OLS estimates). Bands indicate 95% confidence intervals constructed from clinic-level clustered standard errors.

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