The Impacts of Private Equity Acquisition on Clinical Practice for Medicare-serving Physicians in Group Practice

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Abstract. Private Equity (PE) involvement in healthcare has accelerated in the last decade and as of 2022, 4.5% of all physicians in the U.S. worked in a private equity-owned practice. Acquisition has been associated with increased income, charges, and spending at the entity-level, as well as mixed effects on quality measures like mortality that vary by the institutional setting. However, less of the literature has discussed outcomes at the physician-level – at the level of the service provider. This paper finds that PE acquisition of physician practices increases the likelihood that a Medicare-serving physician exits corporate practice to become a sole proprietor by nearly 7%. In addition, I report evidence that acquisition leads to physicians treating a relatively younger and less risky Medicare beneficiary patient cohort within the first two years after acquisition. This effects occurs concurrently with a reduction in the amount a physician charges to Medicare and subsequently receives in payments.

Key words: Private Equity, Acquisition, Physicians, Medicare, Clinical Practice

1 Introduction and Related Literature

While estimates of deal volume vary, both academics and those in industry agree that in recent years Private Equity (PE) deal activity in the U.S. healthcare sector has surged. Researchers at the Petris Center at the University of California Berkeley estimate that in 2020 there were 937 deals compared to just 352 in 2010 (Scheffler et al. (2021)). A 2024 release by Boston Consulting Group[1] reports that deal volume peaked in 2021 and has since declined, though the outlook for PE activity remains strong as PE funds have seen their ”dry powder” (or uncommitted cash reserves) increase by 7% since 2022. Indeed, much of the extant literature surrounding PE activity in healthcare concurs that the trend has been increasing and in fact, accelerating in the last decade (Borsa et al. (2023); NIHCM (2023)). Why is this case? The PE value proposition in healthcare centers around efficiency and growth. Proponents of PE involvement in healthcare argue that PE funds that are backed by large amounts of private capital and extensive managerial expertise have the scope to ”eliminate waste and fragmentation, fuel innovation, improve quality, and generate substantial returns for providers

[1] Available at: https://www.bcg.com/publications/2024/private-equity-in-health-care-2024

and investors in a relatively short time frame[2]". With the drastic rise in National Health Expenditure and the advent of managed care, this proposition has seen considerable take-up in the healthcare market, especially among physician group practices who will be the entities under consideration in this paper.

As PE activity has grown in the healthcare sector, so too has the empirical literature that aims to evaluate the impacts of PE acquisition on a plethora of operational, clinical, financial, and health outcomes for acquired entities. Hospitals have received much attention and in an early study, Bruch et al. (2020) studies hospital acquisitions and finds that as a result of PE acquisition, hospitals saw larger increases in net income, charges, and case mix index, with some improvement in quality metrics compared to non-acquired peer hospitals. In addition, Liu (2021) finds that acquired hospitals charge higher prices resulting in an 11% increase in healthcare spending. In a case study of the 2006 acquisition of the Hospital Corporation of America, Richards et al. (2024) finds that over the life cycle of acquisition, affected hospitals saw a permanent improvement in both volumes and revenues, reflected in improved operating margins. Nursing homes have also seen considerable PE activity and Braun et al. (2021) finds increases in costs as well as emergency department visits and hospitalizations for residents. Further, Gupta et al. (2024) examines PE activity in nursing homes and finds that acquisition leads to a lower risk patient cohort and significant adverse consequences for a subset of patients; the authors observe an 11% increase in mortality. In the Ambulatory Surgery Center (ASC) market, Lin et al. (2023) observes a service-mix-adjusted increase in charges and an increase in Medicare volume for acquired centers.

While much of the work surrounding PE acquisition in healthcare has focused on outcomes at the entity-level, more recent work has shifted towards an analysis of outcomes at the provider and physician level. An interesting area of study is physician group practices. In this setting, physicians often act as both service providers and administrators, with the autonomy and agency to influence patient-care at the organizational level. The decision to sell a practice to a PE partner or fund, or any private acquirer for that matter, relinquishes this administrative and therefore operational agency to the acquiring firm and its stakeholders. While there is little to no theoretical literature evaluating the principal-agent problem in this setting or the direct effect of shocks to agency at the provider-level on provider or patient outcomes, anecdotal evidence points to provider dissatisfaction, burnout, and increased administrative burden, all of which can plausibly impact patient care (Hoffer (2024); Kim and Novinson (2022); Corrigan (2023)). This "feed-through" mechanism hypothesis has been

[2] healthcareexecutive.org

given some evidentiary basis in recent years. Singh et al. (2022) looked at PE-acquired physician practices in dermatology, gastroenterology, and ophthalmology between 2016 and 2020 and found that compared to non-acquired practices, acquired practices saw an increase in charges per claim and the number of unique patients seen. While these results mirror prior work, the authors further observe that much of the increase in the number of unique patients is attributed to an increase visits by new patients. These results hint at increasing physician load post-acquisition and beg the question: how does workforce composition change post-acquisition? Bruch et al. (2023) addresses this question for the same subset of physician group practices as in Singh et al. (2022) between 2014 and 2019. The authors observe a higher clinician replacement ratio for acquired practices compared to non-acquired practices (1.75 vs 1.37), calculated as the ratio of entering to exiting clinicians.

Taken together, the literature on PE acquisition supports the assertion that PE firms aim to increase profitability through increased charges and volume, though the evidence relating to payer-mix, patient cohort risk level, and health outcomes is less certain. A nascent subset of the literature focused on outcomes at the provider-level in physician group practice settings has corroborated the aforementioned general impacts of PE acquisition on healthcare operations but has also shed light on provider-side effects notably in regard to workforce composition.

This paper looks to contribute to this growing literature focused on evaluating the impacts of private acquisition at the provider-level and does so on two fronts. Firstly, I restrict my attention to physicians in group practices. This restriction allows me to (weakly) pick-up the baked-in impact of the hypothesized shock to agency experienced by physician-administrators turned physician-employees and their subsequent practice decisions. Secondly, I further restrict my attention to Medicare participating physicians such that my outcomes are observed for Medicare beneficiaries served by acquired and non-acquired physicians. This restriction not only allows for improved data availability but also gives me the ability to contribute to the understanding of the changes to payer-mix upon acquisition. The Medicare population is an interesting population in the context of PE activity for a variety of reasons. Notably, Medicare reimbursements lag behind those of private payers (White and Whaley (2019); Mann and Striar (2022); McMorrow et al. (2021); MedPAC (2023)) and so PE firms may be incentivized to substitute away from the Medicare population and towards the privately insured. Further, the Medicare population is large and growing (Guadette et al. (2015); CMS (2025)) and so practices that capture a larger share of these beneficiaries may be able to boost financial metrics through volume.

Numerous studies have evaluated the impact of acquisition in the Medicare setting. Nie et al. (2022) considers urology practices and observes increased Medicare payments and volume; Singh et al. (2024) considers ophthalmology practices and finds increased spending; Braun et al. (2024) corroborates the findings from Singh et al. (2024) and further finds that the number of unique patients per optometrists increased; in the hospital setting, Cerullo et al. (2022) finds that acquisition was associated with reduced inpatient mortality among patients with Acute Myocardial Infraction (AMI) and Kannan et al. (2023) finds that acquisition was associated with an increase in Hospital Acquired Conditions (HACs). Notably however, these studies do not address provider-level practice decisions, a crucial component of my analysis.

The rest of the paper proceeds as follows. Section 2 discusses the empirical setting of the paper and specifically the set-up of the physician group practice as well as the PE approach and business-model. Section 3 outlines the data used and provides descriptive statistics on the deals considered and the physicians studied. Section 4 reports empirical results from econometric models and discusses data limitations. Section 5 concludes, contextualizes the main results, and provides general discussion.

2 The Empirical Setting

2.1 Physician Group Practices

Specialty physician group practices refer to the practice environment in which two or more physicians of the same or differing specialty collaborate to provide care. There are several types of this kind of practice that differ by ownership. In the physician-owned setting, the physicians are responsible for managing the practice and share in the profits – often referred to as ”private practice”. Hospital-owned practices are physician practices that are vertically integrated into a hospital and are often managed by health systems. Lastly, corporate-owned practices are practices not owned by the physicians or a larger health system but by a corporate entity – private equity ownership has grown in this area. In the current study, no differentiation is made between the above practice types.

According to the American Medical Association, between 2012 and 2022 the share of physicians in private-practice declined from 60% to roughly 47% while the share of physicians working in a practice at least partially-owned by a hospital or health system increased from 23% to 31% over the same time period. The AMA further reports that in 2022, 4.5% of physicians worked in a practice owned by private equity. These trends have continued concurrently with the rise in practice consolidation in the last decade, fueled by financial pressures, decreases in government funding, and technologies that facilitate the vertical integration of physician groups (Appelbaum and Batt

(2017)). In 2024, more than 75% of physicians were employed by hospitals, heath insurers, or corporations including private equity firms[3].

2.2 The Private Equity Business Model

Before considering what makes physician group practices attractive to private equity, it is important to note the general model of a PE "buyout". To begin, private equity firms are investment firms that acquire ownership stakes in privately held companies with the goal of increasing their value and eventually earning a return upon the sale of the entity ("exit") – typically after 3-5 years on average. PE firms raise capital from institutional investors like hedge funds or pension funds or even individual, high net worth investors. These investors are called Limited Partners (LPs) and typically contribute up to 98% of the fund's equity while the PE firm managers are referred to as the General Partners (GPs) and commit the remaining 2%. The LPs commit equity to the fund which then the GPs manage and use to finance investments. When a target entity is found, the PE firm finances the purchase with some of the capital committed by the LPs. However, what defines the private equity business model is the large amounts of debt financing that PE firms use. When purchasing a company, the PE firm will use that company's assets as collateral for the debt (leverage) used to acquire it. Typically, PE firms finance roughly 70% of the purchase price with debt. This financing structure and the ensuing management practices that PE firms employ at the new portfolio company gives rise to the term "leveraged buyout" or "LBO". This leverage magnifies both the risk and return for the PE firm; post-acquisition, the firm must improve the value of the portfolio company in the short-run while also returning cash flows to its debt holders. This incentivizes risk-taking by the firm in order exit with a positive return for the GPs and LPs while also meeting its debt obligations.

One way PE firms earn outsized returns is through the "buy and build" business model, also referred to as a "roll-up" model. In this model, the first acquisition target is the "platform" company – acquired with the financing structure above. The PE firm then targets several other companies for horizontal mergers and "adds-on" these companies to the platform company. This practice of building or rolling-up multiple companies into one entity is widely prevalent in PE buyouts. As a proportion of all buy-out activity, add-ons accounted for 68% in 2019, up from 57% in 2009 (Appelbaum and Batt (2020)). Thus, it is clear why physician group practices are attractive PE targets: they serve as potential platform acquisitions that can then be built upon, rolled-up, and sold at a profit to another PE firm, hospital, or insurance company. The fragmented nature of

[3] Available at: https://www.healthcaredive.com/news/doctor-corporate-ownership-growing-hospital-insurer-pai-avalere/712988/

physician group practices gives rise to considerable opportunity for PE firms. In addition to the scope for add-ons, PE firms tend to target entities with recurring and predictable revenue streams, opportunities for operational improvement, and strong market positions. Physician group practices, often with entrenched patient and referral networks and with physician-managers who may be less efficient in administration, are prime targets.

The empirical setting examined in this paper is interesting as it is an example of how financial engineering practices, honed by pure market forces and economic incentives interact with the provision of medical care, an area where altruistic preferences of physicians become laden with organizational pressures and practices.

3 Data and Descriptive Statistics

3.1 Data Description

I construct a panel data set of Medicare-serving physicians linked to private equity acquisitions of physician group practices from 2018 to 2022 to estimate the impact of acquisition on physicians' clinical practice decisions and the characteristics of the Medicare beneficiaries they serve. I gather data from several sources to construct this panel and provide detailed information about each below.

3.1.1 Deals

I access my private equity deal data via Preqin, an investment data company primarily providing financial data on alternative assets. Preqin provided deal data for just over 1000 U.S.-based transactions in healthcare and after excluding deals not in the "Healthcare" or "Healthcare Specialists" industries and dropping deals in Veterinary services, I had an initial sample of 758 deals from 1983 to 2024. Further, after only keeping deals closed between 2018 and 2022 and deals considered "buyouts" (not secondary buyouts or recapitalizations), I arrived at a sample of 141 private equity buyouts in healthcare between 2018 and 2022. For each deal, the following relevant variables were available:

- The name of the acquired entity (ex: Tri Valley Medical Group)
- The name of the buyer, typically the PE fund (ex: Webster Equity Partners)
- The date of the acquisition (ex: "2022-06-01")

From this sample of 141 deals, I further applied exclusion criteria with the first being a restriction of my sample to include only acquired entities with specialties commonly acquired by PE, following from Abdelhadi et al. (2024). These specialties include: Family Medicine, Pediatrics, Internal Medicine, Dermatology, Obstetrics and Gynecology, Gastroenterology, Ophthalmology, Oncology, Urology, Radiation Oncology, Orthopedic Surgery, and Cardiology. I carry out this exclusion in an

attempt to minimize any unobserved heterogeneity and facilitate an ”apples to apples” comparison in my comparison of physicians – reducing the likelihood that any observed effects are due to specialty differences between providers. Further, this exclusion aligns my study with prior empirical work in the field. As practice specialty was not available in the Preqin deal data, I manually matched each acquired entity to a clinical specialty using a combination of text-based data analysis (ex: keyword matching) and manual methods including web searches [4]. Applying this criteria, I dropped 103 entities from my sample, resulting in 38 remaining deals.

The second exclusion criteria I applied was to limit my sample of deals to physician group practices, removing healthcare facilities from consideration. ”Facilities” are entities that provide inpatient or outpatient care at a physical site and differ from physician practices where physicians deliver care in an office-based setting. This distinction is noted in the literature and indeed many studies have focused primarily on physician practices while others on facilities as previously noted in Section 1. As practice type was not available in the Preqin deal data, I again matched practice type (Physician group practice vs. Facility) manually through web searches to each of the 38 remaining deals[5]. Applying this criteria, I dropped 20 entities from my sample, resulting in a final analytic sample of 18 private equity buyout transactions of physician group practices from 2018 to 2022.

3.1.2 Physician Data

I collect physician-level data from three main sources. First, I download NPPES data dissemination files from the National Bureau of Economic Research (NBER) [6]. In 2007, the Centers for Medicare & Medicaid Services (CMS) developed the National Plan and Provider Enumeration System (NPPES) to assign unique identifiers to healthcare providers; since this time, The National Provider Identifier (NPI) has been the standard identifier for all providers. NBER provides pre-processed NPPES files from CMS at the monthly level. I make use of the monthly files from December of each year from 2018 through 2022. Each file contains roughly 5 million records of providers (individuals and entities) and contains the following relevant information for each provider:

- The unique NPI identifier for each provider (ex: 1922052265)
- The entity type code of the provider (1 for individuals and 2 for organizations)

[4] Web searches were commonly of the form: ”entity name” + ”buyer name” + ”acquisition year” and often returned press releases and other news information that identified the entity and its website, after which I could investigate in more detail to discern the specialty and practice type.

[5] See footnote 1.

[6] Available at: https://data.nber.org/npi/zip/

- The first and last name of the provider
- The credential of the provider (ex: ”M.D.”)
- The provider gender code (”M” for male and ”F” for female)
- Indicator for ownership/practice status (”Y” if the provider is a sole proprietor or ”N” if not)

Second, I download ”The Doctors and Clinicians National Downloadable Files” from CMS which contain further provider-level information. These data are similarly available at the monthly level and I make use the archived snapshots from December of each year from 2018 though 2022[7]. Each row of data is unique at the clinician/enrollment record/group/address level and contains the following supplemental provider information:

- The unique NPI identifier for each provider
- The provider’s medical school graduation year (ex: 1983)
- The provider’s primary specialty (ex: Internal Medicine)
- The provider’s affiliated organization name (ex: Allergy and Asthma Specialists P.C.)
- The number of clinicians affiliated with the organization
- The provider’s state (ex: NJ)

Lastly, I make use of ”The Medicare Physician & Other Practitioners - by Provider” datasets provided by CMS. These data collect information on services and procedures provided to Original Medicare Part B beneficiaries by physicians and other clinicians and is aggregated at the provider-level. Specifically, the data contains information on use, payments, submitted charges, and beneficiary demographic and health characteristics. This data is available at the annual level and so I download the files for the years 2018 through 2022 [8]. From this data I can observe the number of beneficiaries served, the amount of services provided, the amount charged to Medicare, the amount paid by Medicare, and numerous beneficiary demographics like average age, race, and risk score.

3.1.3 The Panel

Given the above deal and provider data, I construct my panel in the following way. To begin, I merge all three of the provider-level data sets on the common NPI identifier for each year. I then concatenate these five datasets (which contain all provider-level information for each year in my sample) into one panel such that each observation is indexed by the provider i and the time t where $t \in \{2018, 2019, 2020, 2021, 2022\}$. Next I impose a series of filters to restrict my sample of

[7] Available at: https://data.cms.gov/provider-data/archived-data/doctors-clinicians

[8] Available at: https://data.cms.gov/provider-summary-by-type-of-service/medicare-physician-other-practitioners/medicare-physician-other-practitioners-by-provider

providers. I use the entity type code to keep only individual providers and exclude organizations. I then de-duplicate my data by dropping duplicate provider observations within each year (duplicates arise from the National Downloadable Files in which clinicians with multiple Medicare enrollment records or single enrollments linked to different practice locations are listed on multiple lines). At this point, I flag providers as ”acquired” or ”non-acquired”. To do this, I manually match providers to deals based on the name of their associated organization using the entity name from the Preqin deal data and the organization name from the National Downloadable File. Starting with the entity name from the deal data, I use a combination of provider look-ups (where I find a provider that I know works at a given acquired practice – through web searches – and then look up this provider in my provider-level data to find their associated organization name), entity look-ups (where I use the NPPES NPI registry[9] to look up the entity name and find its associated organization name as it appears in NPPES data), and ad-hoc manual methods to match providers to deals based on their organizations. I include an illustrative example based on a real deal in my sample below.

Preqin reports that in 2018, an entity named ”United Digestive MSO Parent” was formed as a partnership between Atlanta Gastroenterology Associates (the practice) and Frazier Healthcare Partners (the PE firm). However, ”United Digestive MSO Parent” was not the acquired organization but rather it was Atlanta Gastroenterology Associates. Therefore, any providers who worked at this practice in 2018 would be considered ”acquired”. In order to flag these providers, I had to find the organization name associated with Atlanta Gastroenterology Associates. After using the NPPES NPI registry, I found the practice name listed in the NPPES data to be ”AGA, LLC”. I then flagged any provider who worked at AGA, LLC in 2018 as ”acquired”. I repeated a similar process for all 18 deals to flag all ”acquired” providers in my sample.

After flagging the initial set of acquired providers in my panel, I continued to whittle down my sample. I first only kept physicians in my sample by removing any provider without ”MD” in their credential field. I then kept only physicians who participated in Medicare by dropping physicians with a value of ”N” in their medicare participation field. Next, I dropped physicians with specialties not included in the subset of specialties among the acquired physicians in my sample. As previously mentioned, this allows for improved comparison between acquired and non-acquired physicians and potentially mitigates some bias arising from specialty differences across physicians. I then created a variable that measures a provider’s years from graduation, constructed as the difference between the year the provider is observed and year the provider graduated from medical school; I

[9] Available at: https://npiregistry.cms.hhs.gov/search

drop providers for whom this value is at most one year so as to not consider fresh graduates who may still be training as a part of residency or are under the supervision of a more senior MD. Next, I drop physicians practicing in states that are not states where the acquired physicians in my sample practice. Similarly to restricting the subset of specialties I consider, restricting the subset of states further allows for more valid comparison between acquired and non-acquired physicians – especially given the literature surrounding geographic variation in medical care (Newhouse and Garber (2013); Finklestein et al. (2016)). Lastly, I drop physicians for whom the field regarding sole proprietorship is not answered.

My panel contains 931,575 (NPI, year) observations consisting of 250,615 non-acquired and 643 acquired medicare-serving physicians respectively between 2018 and 2022 from which I begin my empirical analysis, beginning with propensity score matching described in Section 3.3.

3.2 Outcome Variables

My main outcomes of interest fall into three areas. I look first at the physician's decision to practice in a sole proprietorship. This is data collected in each NPPES file and the physician reports that they are either a sole proprietor ("Y") or not ("N"). Sole proprietorship refers to the situation in which the physician owns an unincorporated business by themselves; the physician and the business are legally the same. In this case, the physician is most often practicing under their own name and is personally responsible for all business liabilities – in stark contrast to the PE model where physicians are most often employees post-acquisition. The potential impact of acquisition on the propensity for a physician to become a sole proprietor is interesting as it shows how PE acquisition may induce practice style changes at the physician-level.

Second, I consider operational and financial outcomes in the Medicare setting. This includes the total number of unique HCPCS codes that a physician is responsible for (standardized codes that represent procedures, supplies, products, and services), the total amount of physician services rendered, the total amount of charges a physician submits to Medicare, the Medicare allowed amount for physician services (the amount Medicare pays plus the amount the beneficiary pays in deductibles and/or coinsurance plus the amount any third party pays), and the total standardized amount that Medicare paid for a physician's services. Taken together, these variables provide a picture of how PE acquisition changes the nature of clinical care with respect to the financial incentives in the Medicare setting.

I finally look at demographic outcomes for the beneficiaries served by the physicians in my sample. Specifically I observe the total number of beneficiaries receiving services from the physician; their average age; the number of beneficiaries younger than 65, between the ages 65 and 74,

between the ages 75 and 84, and over the age of 84; the number of beneficiaries who identify as White, Black, Hispanic, and Asian Pacific Islander; the percentage of beneficiaries with Diabetes, Anxiety, Cancer, Hypertension, and other chronic conditions; and beneficiaries' average risk score. These demographic outcome variables are especially interesting in the context of PE acquisition. PE owners can exercise control over the population that an acquired practice serves, and evidence has been found supporting the claim that acquired Hospitals may shift towards a relatively less risky patient cohort, though the same finding may not hold for physician practices (Kannan et al. (2023); Singh et al. (2022)). This can be achieved by serving younger, more healthy patients and also by changing the distribution of patients served across payers.

3.3 Propensity Score Matching

In an ideal world for the econometrician, PE acquisition or the "treatment" of physicians would be random so that the comparison of treated versus non-treated (or control) physicians would yield an unbiased estimate of the treatment effect. However, in practice PE acquisition is non-random and acquired practices – and consequently their physicians – may share characteristics and differ systematically from their non-acquired peers. In order to account for the non-randomness in acquisition and potential selection bias, I carry out a propensity score matching procedure using the *psmatch2* algorithm in STATA that matches each acquired physician in my sample to control physicians with similar propensities for treatment with respect to several observable control variables.

The goal of propensity score matching is to create a control group that is similar to the treatment group on a set of observable characteristics that predict the propensity of treatment. First, propensity scores reflecting the likelihood of treatment must be generated for each physician. Then, using these scores, treated physicians are matched with non-treated physicians so that the resulting treated and matched control groups have similar propensity scores. The *psmatch2* algorithm in stata generates propensity scores for each physician by running a logistic regression model that regresses a treatment indicator on a vector of controls. I include the following as controls: years post graduation, an indicator for if a physician is in a surgical specialty, an indicator if a physician practices in a large group (defined as having more than 50 clinicians, following Kane (2022)), the gender of the physician, and the physician's practice state. Once the propensity scores are generated, I match each treated physician to three controls using a k-nearest neighbors algorithm with a caliper of 0.05, implemented within the same *psmatch2* call. The caliper is the specified maximum distance

(measured in terms of propensity scores) at which two physicians can be considered a match; this effectively ensures that only physicians with similar scores are matched.

Ultimately, after running my propensity score matching algorithm in STATA, I recover a final analytic sample of 1713 physicians, 643 of which are acquired and 1070 which are controls. Further, I recover the following propensity matching results.

Table 1 Propensity Score Matching Results

	Mean Bias	Median Bias	B	R
Unmatched	9.6	6.8	36.4	1.05
Matched	0.1	0.0	0.9	1.02

Table 1 shows the mean bias, median bias, the overall normalized differences in means of the propensity score (B), and the variance ratio of the scores (R) before and after matching. We see that both the mean and median bias (the standardized mean difference in scores between covariates) fall to near zero indicating low bias in the matched sample. Moreover, both B and R fall indicating that prior to matching there was poor overlap or systematic differences between the treated and untreated group. A rule-of-thumb is that a value B$>25\%$ and an R value outside $[0.5, 2]$ are unfavorable in terms of balance. After matching, both B and R fall into favorable ranges and so we can be confident that the matched sample is better balanced prior to empirical analysis.

We can also observe the effect of propensity score matching graphically as in Figure 1 below. Prior to matching, many physicians have a near zero propensity and so the non-treated control group's propensity distribution is markedly different from that of the treated group. However, after matching, the distributions are very similar indicating that the treatment and matched-control group have similar propensities, the original goal of propensity score matching.

It is on this sample of acquired and matched-control physicians that I perform my empirical analysis in the remainder of this paper.

3.4 Descriptive Statistics

In this section I provide summary statistics for both the deals and providers in my sample with Table 2 providing descriptive statistics for the deals in my sample and Table 3 providing statistics for the physicians in my sample.

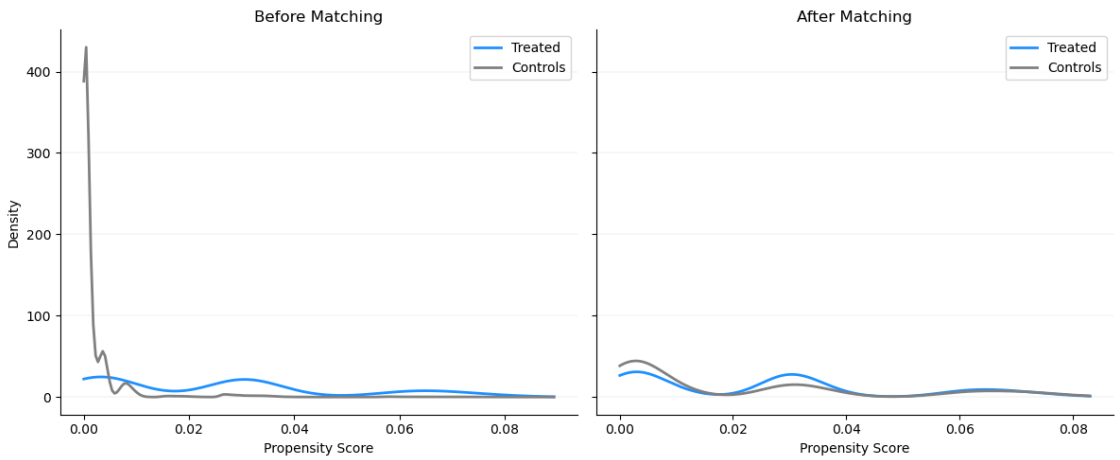


Figure 1 Propensity Score Distributions Before and After Matching

3.4.1 Deals

Table 2 presents descriptive statistics for the PE deals in my sample. Deal activity was highest in 2018 with 7 deals being completed, in which 196 physicians were acquired. In 2019, only 2 deals are observed however 380 physicians were acquired (a notable deal in 2019 was Warburg Pincus' partnership with Summit Medical Group – a large New Jersey-based multi-specialty practice that had 379 practicing physicians at the time). Because of this, over 50% of the acquired physicians in my sample were involved in the Summit Medical deal. This issue will be addressed in more detail in Section 4.4.

Table 2 Number of Deals and Acquired Physicians by Year

	2018	2019	2020	2021	2022
Deals	7	2	3	3	3
Physicians	196	380	37	15	15

3.4.2 Physicians

Table 3 provides descriptive statistics for both acquired and control physicians. I report summary statistics in four sections. First is physician ownership and practice style, which refers to the proprietorship of the physicians. We see that a smaller share of acquired physicians were practicing in a sole proprietorship pre-acquisition compared to their not-acquired peers. Next, I report statistics for my operational and financial outcome variables. Acquired physicians, prior to being acquired, billed more unique HCPCS codes, were responsible for more services, had higher submitted charges, greater Medicare allowed amounts, and received more Medicare payments. These data may indicate

some selection criteria by PE firms who target companies that have high recurring revenues and cash flows.

In the next section of variables, we observe means and percentages for the characteristics of the Medicare beneficiaries served by the physicians in my sample. We notice that pre-acquisition, eventually-acquired physicians each serve more beneficiaries, a much lower number of beneficiaries below the age of 65, and much more between the ages of 65 and 74 on average. Further, each physician is serving a patient cohort that contains more men than their non-acquired peers and significantly more whites – alongside a lower average number of minority beneficiaries (Black, Hispanic, Asian pacific islander). Lastly, acquired physicians treat patients with lower risk on average (risk scores as reported by CMS are based on HCC – Hierarchical Condition Category codes – with higher numbers reflecting greater risk based on the expected future costs associated with a patient). There do seem to be differences in the types of patients treated by physicians prior to acquisition, a feature of my analysis that will be discussed in Section 4.4.

Finally, I report statistics for physician demographic variables. The data show that acquired physicians are less likely to be male, practicing in a large practice prior to acquisition, and practicing in a surgical specialty.

4 The Effect of Acquisition

4.1 Empirical Approach

My empirical strategy aims to identify the causal effects of private equity acquisition on Medicare-serving physicians, their ownership and practice style, their clinical operations, and the characteristics of their beneficiaries. My primary identification strategy uses a Two-way fixed effects, Differences-in-differences (TWFE DiD) specification to compare changes in outcomes before and after a physician is acquired (treated) with concurrent changes for physicians that were never acquired (control). I estimate an extension of this TWFE DiD model in an event study setting to further assess the impacts in each year post-acquisition.

My preferred specification includes physician fixed-effects (θ_i) to control for persistent physician characteristics and state×year fixed effects (θ_{st}) to allow for time-varying factors common to all physicians in a state. I include a vector of controls ($\mathbf{X}_{it}$) that includes an indicator for the gender of the provider (though this is dropped when running regressions as it is perfectly collinear with the physician fixed-effects), the number of years since a physician has graduated medical school (to control for level of experience), an indicator for if a physician works in a large practice, and an

Table 3 Physician Summary Statistics, 2018–2022

	All Physicians	Acquired (Pre-acquisition)	Control
Acquired (%)	42.07	100	0
Physician Ownership/Practice Style:			
Is Sole Proprietor (%)	15.13	14.29	15.53
Operational/Financial Outcomes:			
Total Unique HCPCS codes	50.23	63.45	43.16
Total Services (000's)	3.77	5.41	2.81
Total Submitted Charges (000's)	608.20	655.44	562.00
Total Medicare Allowed Amount (000's)	229.90	228.92	176.58
Total Medicare Standardized Payment (000's)	172.81	175.74	132.82
Medicare Beneficiary Characteristics:			
Total Beneficiaries	465.06	477.34	421.53
Average Age	72.88	73.75	71.96
Under 65	51.97	38.18	64.47
65–74	215.19	219.98	190.76
75–84	174.93	171.52	161.93
Over 84	87.67	92.74	84.46
Female	264.35	260.58	245.07
Male	213.80	222.90	192.98
White	426.36	424.94	393.22
Black	67.34	44.50	83.33
API	28.36	21.57	33.12
Hispanic	39.54	35.51	46.23
Diabetes (%)	33.71	29.62	37.45
Anxiety (%)	26.79	23.06	29.51
Hypertension (%)	71.96	71.32	72.65
Cancer (%)	20.63	21.37	20.87
Average Risk Score	1.50	1.31	1.68
Physician Characteristics:			
Male (%)	69.21	63.32	70.91
Years Post-Graduation	24.77	23.02	25.26
Large Practice (%)	77.56	66.99	73.70
Surgery (%)	42.05	34.02	44.52
N	1713	421	1070
Physician-Years	6992	518	4050

Note: Descriptive statistics for acquired physicians are based on 421 observations as pre-acquisition data is not available for physicians acquired in 2018.

indicator for if a physician is in a surgical specialty. Each regression uses cluster-robust standard errors at the physician level:

$$Y_{it} = \beta Post_{it} + \delta \mathbf{X}_{it} + \theta_i + \theta_{st} + \epsilon_{it} \tag{1}$$

Equation 1 is a within-physician regression where $Post_{it}$ is a binary variable equal to one if physician i worked at a practice that was acquired in time t – this variable stays "on" in every period post-acquisition to estimate the average post-acquisition effect. The variation used in identification

arises from the staggered timing of practice acquisition and the within-year comparison of treated and control physicians. In order to interpret β as the causal effect of acquisition, I must assume that trends in outcomes for acquired physicians would have been the same as trends in outcomes for non-acquired physicians in the absence of acquisition. Threats to identification arise from correlations between contemporaneous factors that impact outcomes with the timing of acquisition; these can include beneficiary characteristics and non-random selection of practices by PE firms. With respect to pre-trends in the outcomes, I address these concerns in Section 4.3 with an event study analysis that estimates effects in each year pre- and post-acquisition.

4.2 Main Effect on Outcomes

4.2.1 Ownership/Practice Style

Table 4 shows the estimates of the regression from Equation 1 using both state×year and year FEs when the indicator for sole proprietorship is the outcome variable. I find that the probability that a physician becomes a sole proprietor increases by 0.95pp as a result of acquisition according to main specification in column 1. Relative to a mean of 14.3% for acquired physicians pre-acquisition, this represents a 6.7% increase in the likelihood ($0.0095/0.1413 = 0.067$). This estimate is lower when using only year FEs – at 0.57pp. However, in both specifications, the estimate is significant at the 10% level.

Table 4 Effect of Acquisition on Physician Ownership/Practice Style

	Is Sole Proprietor	
	(1)	(2)
Post	0.0095*	0.0057*
	(0.005)	(0.003)
Physician FEs	X	X
State × Year FEs	X	
Year FEs		X
Observations	6,825	
Adjusted R^2	0.9807	0.9808

$^{*}p < 0.10$; $^{**}p < 0.05$; $^{***}p < 0.01$

4.2.2 Operations/Finances

Turning to my operational and financial outcomes as they relate to Medicare, in Table 5 I find no significant impact of acquisition on operational outcomes. While my results indicate that the number of unique HCPCS codes that physicians bill increases by one and the number of services

physicians render declines by at least 100, I fail to reject the null hypothesis of no effect for these outcomes in either specification. Given the observed, yet insignificant, impact to total services, how do the financial metrics associated with Medicare respond? In Table 6, I report coefficient estimates for financial outcomes including the total charges a physician submitted, the total Medicare allowed amount (which is the sum of the amount Medicare, the beneficiary, and any third parties pay), and the total amount Medicare paid after standardizing based on geographical differences in payment rates. I find that while the impact of acquisition on the Medicare allowed amount and total payment is null, total submitted charges (intuitively, the "full price" a physician asks for services) fall by over $66,000 dollars in my second specification that includes year FEs. However, the significance of this estimate may be picking up state-specific time trends in submitted charges rather than the purely causal effect of acqusition on charges.

Table 5 Effect of Acquisition on Operational Outcomes

	Total Unique HCPCS Codes		Total Services	
	(1)	(2)	(1)	(2)
Post	0.9813	1.0038	−101.909	−241.141
	(0.9630)	(0.7887)	(420.046)	(389.762)
Physician FEs	X	X	X	X
State × Year FEs	X		X	
Year FEs		X		X
Observations	6,825		6,825	
Adjusted R^2	0.922	0.921	0.902	0.903

$^{*}p < 0.10$; $^{**}p < 0.05$; $^{***}p < 0.01$

Table 6 Effect of Acquisition on Medicare Financial Outcome

	Total Submitted Charges		Total Medicare Allowed Amount		Total Medicare Std. Payment	
	(1)	(2)	(1)	(2)	(1)	(2)
Post	−53,873	−66,106**	−7,440	−14,487	−6,832	−12,066
	(35,065)	(27,604)	(10,727)	(9,242)	(8,465)	(7,328)
Physician FEs	X	X	X	X	X	X
State × Year FEs	X		X		X	
Year FEs		X		X		X
Observations	6,825		6,825		6,825	
Adjusted R^2	0.850	0.846	0.909	0.909	0.908	0.908

$^{*}p < 0.10$; $^{**}p < 0.05$; $^{***}p < 0.01$

4.2.3 Beneficiary Characteristics

The above results hint at changes in how much a physician charges to Medicare as a result of acquisition, but what might be driving this at the beneficiary level? Charges may fall plausibly as a result of seeing fewer beneficiaries or by caring for relatively more healthy beneficiaries who require fewer services or intensity of care. In Table 7, I report coefficient estimates for the impact of acquisition on the total number of beneficiaries a physician treats, the average age of these beneficiaries, and their average risk score. I find a significant reduction in beneficiary average age of 0.23 years while finding no impact to total beneficiaries or risk score. While this impact is small (and only observable for my second specification), it is averaged over the post-acquisition treatment. Table 8 provides more clear evidence of what may be driving the effect on the average age of beneficiaries cared for by physicians. The number of beneficiaries treated under the age of 65, per-physician, increases by more than 8 as a result of acquisition – the estimates in both specifications are significant at the 1% level. In the context of Medicare, beneficiaries under 65 (those with disabilities) can be considered relatively "young" and therefore may serve to bring down the average age of beneficiaries treated. In addition, I find that the number of beneficiaries between the ages of 65 and 74 increases by just over 11, with this estimate only significant at the 10% level.

Table 7 Effect of Acquisition on Beneficiary Aggregate Metrics

	Total Benes.		Average Age		Average Risk Score	
	(1)	(2)	(1)	(2)	(1)	(2)
Post	18.99	3.96	−0.14	−0.23***	−0.01	−0.01
	(15.74)	(11.34)	(0.10)	(0.07)	(0.02)	(0.01)
Physician FEs	X	X	X	X	X	X
State × Year FEs	X		X		X	
Year FEs		X		X		X
Observations	6,825		6,825		6,825	
Adjusted R^2	0.903	0.902	0.899	0.898	0.919	0.918

*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$

Next, I consider the impacts of acquisition on the demographics of the beneficiaries served by acquired physicians in Table 9. While I observe no change in the number of white beneficiaries served, I observe significant effect on the number of minority beneficiaries served. Specifically, after acquisition, a physician treats roughly 8 more Black, 4 more Asian, and 12 more Hispanic Medicare patients. This is striking, given that minority patients suffer from more comorbidities and report

Table 8 Effect of Acquisition on Beneficiary Age

	Under 65		65–74		75–84		Over 84	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Post	8.64***	8.44***	11.19*	4.23	6.93	−0.69	5.38	−0.86
	(2.64)	(1.75)	(6.60)	(4.88)	(5.84)	(4.23)	(4.30)	(2.99)
Physician FEs	X	X	X	X	X	X	X	X
State × Year FEs	X		X		X		X	
Year FEs		X		X		X		X
Observations	4,921		6,452		5,904		4,739	
Adjusted R^2	0.880	0.877	0.903	0.899	0.899	0.899	0.878	0.878

*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$

lower health status than their white peers (Wolf et al. (2008); Baciu et al. (2017); Balasubrmanian et al. (2017); O'Laughlin et al. (2024); Hackl et al. (2024)).

Table 9 Effect of Acquisition on Beneficiary Demographics

	Female		Male		White		Black		API		Hispanic	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Post	12.14	3.33	11.79	3.60	17.53	3.65	8.04**	5.64**	4.61*	3.76**	12.01***	7.93***
	(9.15)	(6.62)	(7.56)	(5.35)	(14.22)	(10.23)	(3.30)	(2.60)	(2.69)	(1.70)	(3.49)	(2.40)
Physician FEs	X	X	X	X	X	X	X	X	X	X	X	X
State × Year FEs	X		X		X		X		X		X	
Year FEs		X		X		X		X		X		X
Observations	6,579		6,579		5,905		3,718		1,480		1,495	
Adjusted R^2	0.895	0.894	0.920	0.919	0.908	0.907	0.911	0.908	0.597	0.609	0.842	0.842

*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$

Finally, I report my results for the effects of acquisition on the relative mix of medical conditions that a given physician's beneficiaries suffer from in Table 10. I find that the share of beneficiaries suffering from anxiety decreases by 0.78pp – or roughly 3.4% from baseline ($0.78/23.06 = 3.4$) – while the case-mix with regard to Diabetes, Hypertension, and Cancer remains unchanged.

4.3 Treatment Timing

4.3.1 Event Study Analysis

Next I use an event study framework to test whether acquired and control physicians had differing trends in their outcomes prior to acquisition. The event study is an extension of Equation 1, but rather than aggregating the effects over the years before and after acquisition, dummy variables are

Table 10 Effect of Acquisition on Beneficiary Conditions

	Diabetes (%)		Anxiety (%)		Hypertension (%)		Cancer (%)	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Post	0.39	0.04	−0.78***	−0.13	−0.08	−0.03	0.30	0.15
	(0.29)	(0.23)	(0.27)	(0.24)	(0.19)	(0.15)	(0.26)	(0.18)
Physician FEs	X	X	X	X	X	X	X	X
State × Year FEs	X		X		X		X	
Year FEs		X		X		X		X
Observations	6,486		6,434		6,753		6,028	
Adjusted R^2	0.910	0.910	0.891	0.884	0.812	0.811	0.947	0.947

*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$

included for each year relative to the year of acquisition (since my sample spans from 2018 through 2022, the longest pre- and post-acquisition period for any deal is four years). The results from this analysis seek to mitigate concerns about the potential pre-existing differences in trends between acquired and non-acquired physicians aforementioned.

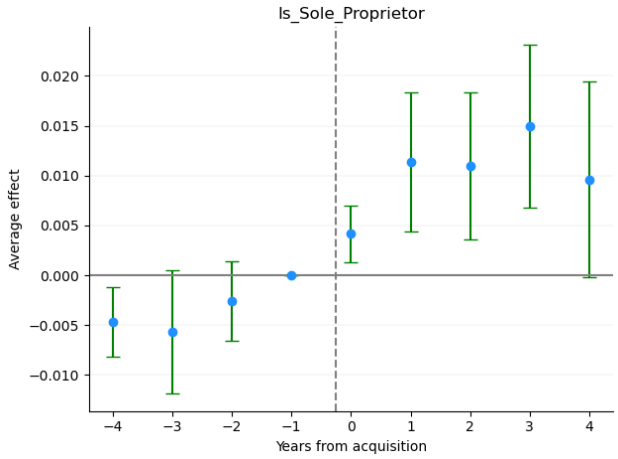
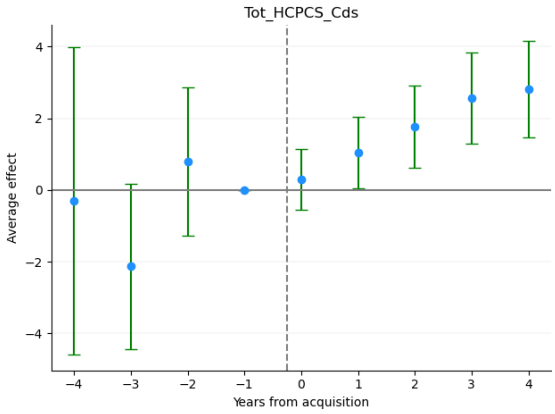


Figure 2 Event Study Results - Sole Proprietorship

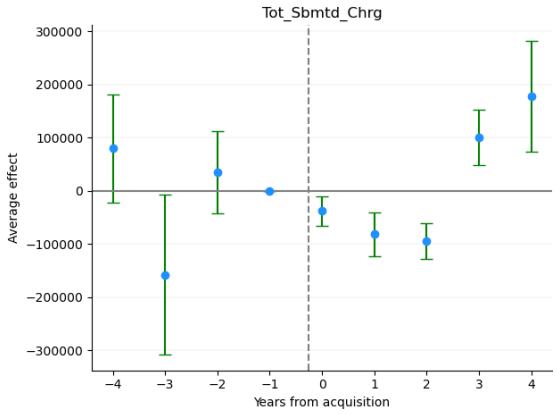
In Figure 2 I present event study results for the impact of acquisition on the likelihood a physician becomes a sole proprietor. In the three years pre-acqusition, the estimates are not significantly different from zero. However, upon acquisition, the effect size increases to roughly 1pp and stays above that level for three years post-acquisition. This confirms the TWFE DiD estimates in section 4.2.1.

Figure 3 shows the event study results for full treatment period effects of acquisition on the number of unique HCPCS codes that a physician bills, the total submitted charged to Medicare,

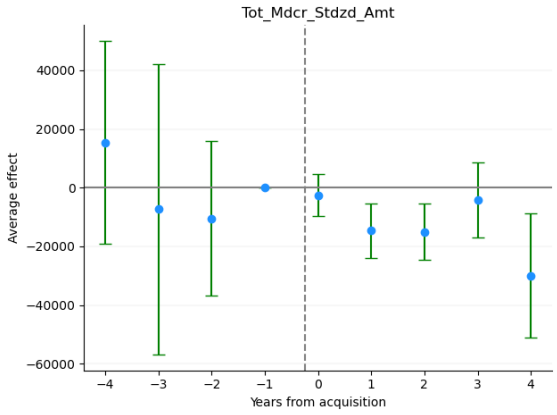
and the Medicare standardized payment amount. In panel (a) we observe that the effects are not statistically different from zero in the pre-acquisition period, yet they increase upon acquisition and in the fourth year post-acquisition, the total number of unique HCPCS codes increases by nearly 3. In panel (b), the pre-trends are not as flat though the results indicate that the total submitted charges decrease through the first two years after acquisition and then begin to increase in the third and fourth year. Panel (c) shows pre-trends for Medicare payment amounts that are not significantly difference from zero; these effect sizes are then negative a year post-acquisition and continue to be so two years after acquisition.



(a) Total Unique HCPCS Codes



(b) Total Submitted Charges

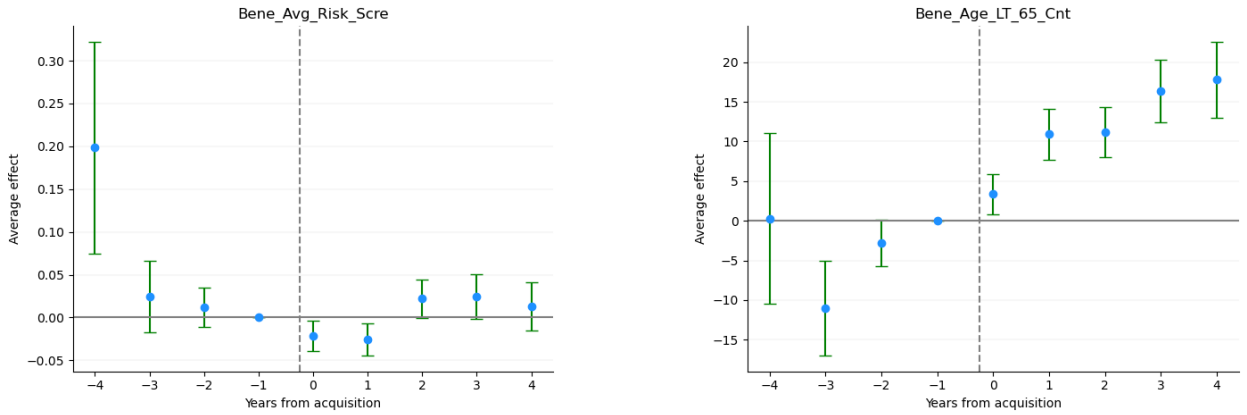


(c) Total Medicare Std. Payment Amount

Figure 3 Event Study Results - Operational/Financial Outcomes

Lastly, I present event study results for the effect of acquisition on the risk level of beneficiaries served by acquired physicians and the age of beneficiaries served. Panel (a) of Figure 4 shows relatively flat pre-acquisition trends in the average risk score of treated beneficiaries that are not significantly different from zero. Moreover, after acquisition the effect on average risk score falls

slightly in the first year – though it rebounds in all subsequent years. Panel (b) confirms the findings from the DiD regression and shows that the number of beneficiaries served under the age of 65 increases post-acquisition, and increases in all years. While the trends prior to acquisition are increasing three years prior, not every effect is significantly different from zero.



(a) Bene. Average Risk Score

(b) Number of Benes. under 65

Figure 4 Event Study Results - Beneficiary Characteristics

4.4 Data and Empirical Limitations and Future Work

My empirical approach has several limitations, first of which have to do with my data. The deal data from Preqin is limited in its purview over the universe of deals during the years studied in my sample. For example, it is estimated that in 2020 there 937 deals completed in the healthcare sector; in my sample I observe three. This under representation of PE activity in my sample means that I only pick up effects for a subset of the physicians exposed to PE acquisition. Notably, a large proportion of my acquired physicians were acquired through the same deal (Summit Medical in NJ in 2019) and so my results may reflect the effects of this specific acquisition on the physicians at Summit Medical.

In addition, the density of observations for variables such as deal size, the amount of equity used to finance the deal, and the relative amount of debt per deal, as reported by Preqin was simply too low to include in my analysis. Had these observations been available for each deal, a relationship between deal financials (specifically the amounts of leverage used) and the resulting clinical outcomes could have been evaluated. Nonetheless, the Preqin deal data allowed me to match physicians to deals, a critical component of my analysis that enables all of my empirical work.

With respect to my data on outcomes for Medicare part B physicians and their beneficiaries, I acknowledge that I can only estimate effects for this subset of physicians and patients. While this

provides me internal validity, I am unable to compare the effects of acquisition in the Medicare setting to the Medicaid or Private insurance setting. Moreover, I am unable to determine if, for example, the observed reduction in submitted charges is being substituted through increased physician charges to private payers – a plausible avenue for a PE firm to increase revenues given the reimbursement rate disparity between Medicare and Private insurance.

My identification strategy was also limited in this study by the scope of analyses feasible. Given more time, I would carry out the following robustness checks. First, I would include the specialty of the physician as a control in my TWFE DiD estimation procedure to control for differences between physicians across specialties. Second, I would augment my event study analysis by including estimates from the interaction weighted estimator developed by Sun and Abraham (2021) and estimates from a stacked regression as in Cengiz et al. (2019) – this follows from LaForgia and Bodner (2024). Lastly, I would adjust my use of the *psmatch2* command in STATA to accommodate differing caliper sizes and a probit, rather than logit, prediction function to generate propensity scores prior to matching.

Importantly, more analysis could be done to more robustly assuage concerns about bias arising from staggered adoption and treatment effect heterogeneity within the TWFE DiD estimation, aside from presenting event study plots. A potential path to overcome these concerns would be to use estimators that recover group-time average treatment effects as in Callaway and Sant'Anna (2021).

5 Conclusion

5.1 Summary of results

This paper studies how Private Equity acquisition of physician practices effects clinical practice for Medicare-serving physicians on three fronts: the physician's ownership and practice style, the operational and financial outcomes relating to Medicare billing and payment, and the characteristics of the beneficiaries that physicians serve.

By 2022, nearly 5% of all physicians in the U.S. worked in a practice owned by private equity, and given the trends in PE deal activity in healthcare, this proportion could continue to rise. My results show that PE acquisition induces practice style changes; I observe a 6.7% increase in the likelihood that a physician becomes a sole proprietor (i.e. exits corporate practice and operates as a sole legal entity) as a result of being acquired. I find evidence that in the post-acquisition period, physicians bill to a larger number of unique HCPCS codes, submit lower charges to Medicare (roughly $66,000 lower on average) and in turn, receive lower payments in the first two years after acquisition. Further, I find that physicians in my sample treat a larger number of younger

beneficiaries (those under the age of 65), a larger number of minority beneficiaries (roughly 24 more minority patients on average over the sample period), and a relatively lower risk Medicare patient cohort in the first year post-acquisition. These results contribute to a rapidly growing body of literature focused on evaluating the impact of ”corporitization” in healthcare on outcomes for providers (Beck et al. (2022); Brown and Hall (2024); Fox (2024)).

5.2 Discussion

This paper provides confirmatory evidence that private equity seeks to optimize the revenue streams of its targets, and does so regardless of industry. I observe a shift, at the physician-level, towards relatively younger and less risky Medicare beneficiaries. These beneficiaries tend to be less costly and therefore may increase a PE-acquired practice's profitability. On the other hand, this shift towards potentially lower cost beneficiaries occurs concurrently with decreased charges submitted by physicians to Medicare and amounts paid to physicians by Medicare. These results support the claim that PE firms may be strategically altering the operations of practices to simultaneously lower the costs associated with Medicare patients while also weening down cash-flows between themselves and Medicare as a payer in the face of reimbursement disparities.

The benefit of analyzing PE acquisition at the provider-level is that it offers an interesting window into how PE incentives are operationalized at the point of care. For example, the observed positive impact to the number of unique HCPCS codes billed may indicate that acquired physicians are increasing the intensity of their care for their Medicare patient cohort. In addition, the shift towards more minority beneficiaries might indicate that physicians are dealing with patients with higher levels of comorbidities or increased barriers to managing chronic conditions (Shadmi (2013); Koch et al. (2014); Caraballo et al. (2022); Town et al. (2024)), all of which can weigh on the physician. While I do not observe a change in the proportions of beneficiaries with conditions like Diabetes and Hypertension, and so therefore cannot conclude that physician patient-management load increases as a result of acquisition, I do find that physicians are more likely to exit and practice on their own. This is a striking result as it contributes to the understanding of how medical providers make decisions about their practice format and level of ownership in the face of a shock to corporate structure and governance.

Ultimately, the findings of this paper are important as they highlight how PE firms operationalize much of their financial incentives through physicians, who then decide on how to best employ their labor. In the context of the ”Direct Primary Care” or ”DPC” movement (where patients

pay their physicians directly and replace traditional FFS billing to a third-party like Medicare[10]), the inducement of sole proprietorship by PE acquisition may be pushing physicians into this DPC model that has increased in popularity alongside higher healthcare costs (Shryock (2022)). There is evidence showing that physicians benefit from DPC through heightened autonomy and compensation[11]. This relationship is something for PE managers to keep in mind while optimizing a practice's balance sheet and deciding on its preferred mix of patients, physicians, and payers.

Acknowledgment

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