The Corporatization of Veterinary Medicine: An Empirical Analysis of Its Impact on Independent Practices

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Abstract

This paper studies the corporatization of veterinary medicine and its implications for independent veterinary practices in the United States. The causal effects of corporate practice entry on the economic outcomes of incumbent independent veterinary practices were estimated by exploiting the spatial and temporal features of a unique practice-level longitudinal dataset covering 2000 to 2021. The main results show that independent practices are 1.9 percent more likely to exit after corporate practice entry, experiencing a 5.7 percent reduction in employment and a 6.9 percent decrease in revenue. The entry effects are more pronounced in urban areas, where they were almost twice as large as those estimated for rural areas. Additionally, an event study analysis revealed that the response of independent practices to corporate entry is delayed. The employment and revenue effects are indifferent from zero one year after a corporate practice entry occurred. However, six years later, the adverse revenue effects were statistically highly significant, reaching -18.7 percent in urban and -13.3 percent in rural census tracts. The treatment effects are more prominent when the corporate practice entry occurs near an independent practice location. Furthermore, while co-location benefits existed before 2010, they have largely disappeared since then, pointing toward higher market power of corporate veterinary practices and increasingly adverse competition effects due to corporate entry in local markets for veterinary services.

Keywords: Corporatization of veterinary medicine, competitive entry, independent veterinary practices, incumbent exit, employment, revenue

JEL Codes: L80, Q19, R10

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1. Introduction

The global market for veterinary services recorded an annualized growth of almost 10 percent and reached about $115 billion in revenue in 2022 (Precedence Research 2022). Particularly in the United States, intensifying consolidation of veterinary services has dramatically shifted the business landscape. Since the first acquisition of a veterinary practice by VCA Animal Hospitals in 1987, the corporatization of veterinary medicine has progressed rapidly. According to a December 2022 snapshot of the veterinary services industry (Zak 2022), 45 incorporated businesses operate almost 11,000 veterinary practices in the United States. Corporate practices make up about 30 percent of the U.S. market for veterinary services, a remarkable increase from about 10 percent in 2017 (American Veterinary Medical Association 2018). A "silver tsunami" that resulted in about 2,500 independent practices being up for sale every year reinforces this unprecedented consolidation (Davidow 2019). The major player in the corporate market for veterinary services is Mars, Incorporated, which acquired VCA Animal Hospitals in 2017, adding to the already sizable portfolio of the veterinary group that includes national brands such as Banfield Pet Hospitals (2007) and Blue Pearl Veterinary Partners (2015). The growing concentration in the veterinary services industry raised concerns about how limited competition could affect the bottom line of incumbent veterinary practices, the prices paid for, and the quality of veterinary services received (Nolan 2018).

A small but growing literature investigates the drivers and implications of corporatization in the veterinary services industry. Nolan (2018) discusses corporatization trends and argues that private equity investors consider veterinary practices a safe investment with respectable returns. The high returns explain the considerable funding provided to corporate businesses for acquiring independent veterinary practices. The ongoing consolidation of veterinary services is a textbook example of strategic entry into an industry traditionally populated by many small firms with local market power (Bresnahan and Reiss 1991; Chevalier-Roignant and Trigeorgis 2011). Bresnahan et al. (1987) argue that entry thresholds in the market for veterinary services are high. Veterinary practices have considerable market power, a particular feature of rural and isolated markets where driving distances are substantial. Due to spatial segmentation, veterinary practitioners in rural markets can exert considerable control over prices for their services but also experience lower income potential (Radke and Lloyd 1996; Villarroel et al. 2010).

Market power allows firms to charge prices above the competitive level, which should lower their probability of exiting a mature industry as they can recoup higher operational costs (Bresnahan 1989; Sexton 2013). In contrast to this feature of market power are the findings of Abdouttalib et al. (2021), who show that the veterinary practice exit probability is higher in rural than urban markets. This pattern is because higher profit margins are not a determining feature of the rural market for veterinary services, though it is less costly to deter new entry in such a market (Eaton and Lipsey 1980; Einav and Levin 2010). Indeed, veterinary practices in urban markets tend to generate larger revenue and enjoy higher markups, likely an important reason for veterinarians to avoid rural markets, representing a major entry deterrence for rural veterinarians (Villarroel et al. 2010; Lee 2006; Henry et al. 2016). The role of veterinarian income and market power are intermingled. Neill et al. (2019) document a negative association between veterinary practice concentration and income, which differs across space and practice formats. This spatial competition pattern is further reinforced by low veterinarian income growth due to the supply of veterinary services outpacing the demand (Neill et al. 2018). Given the growing corporatization of veterinary medicine, new competition formats started to emerge, which are characterized by incorporated businesses serving multiple spatially separated markets and offering differentiated services (Norman 1983; Lloyd 2006; Davidow 2019).

A growing industrial organization literature studies the impact of competitive market entry on the economic outcomes of incumbent firms. Selected areas of inquiry include banking (Berger et al. 2004), craft beer (Fan and Yang 2022), digital services (Calvano and Polo 2021), energy (Koh et al. 2022), food retailing (Basker 2007; Arcidiacono et al. 2020; Richards et al. 2022), hospitality (Mazzeo 2002; Chang and Sokol 2022), pharmaceuticals (Li et al. 2021), religious services (Rennhoff and Owens 2012), and telecommunication (Bourreau et al. 2021). These studies have used various empirical methods and structural economic models to investigate the response of incumbents to competitive market entry. A major challenge faced by those studies is the definition of a market. The common practice is to use administrative spatial units such as census tracts, counties or states to define the market (see, e.g., Berger et al. 2004; Neill et al. 2018; Richards et al. 2022). Others have assessed the impact of market entry using distance bands to measure incumbent exposure to new entrants (see, e.g., Seim 2006; Rennhoff and Owens 2012; Arcidiacono et al. 2020; Caoui et al. 2022).

Both approaches have their merits because actual consumer choices are not observable, implying the need to make assumptions about the nature of spatial competition to study entry patterns. This feature is an important consideration for studying competitive entry by incorporated businesses in the veterinary services industry. One of the few empirical studies concerned about market power in this industry is Neill et al. (2019). Their study defines markets at the county level and provides evidence for spatial correlation in veterinary practice concentration and income.

This paper assesses the impact of corporate practice entry on independent veterinary practices using practice-level data for the entire United States from 2000 to 2021. I constructed a unique panel of veterinary business activities at the census tract level to estimate the causal effects of corporate practice entry on the economic outcomes of incumbent independent veterinary practices. My empirical approach exploits the distinctive spatial and temporal features of th dataset to control for unobserved confounders and assess treatment dynamics. The main results indicate that independent veterinary practices are 1.9 percent more likely to exit the local veterinary service market after a competitive corporate practice entry. The average independent practice experiences an employment reduction of 5.7 percent and lower revenue of 6.9 percent. The treatment effects of corporate practice entry are more pronounced in urban census tracts, where the employment and revenue effects are almost twice as large in magnitude as those observed for independent veterinary practices operating in rural areas. After a corporate practice entry, the employment and revenue of the average independent practice in an urban community decrease by 5.9 percent and 7.3 percent, respectively. Contrary to anecdotal evidence regarding the industry's conduct, these estimates provide considerable support for adverse economic effects for incumbent veterinary practices caused by corporate practice entry.

An event study analysis shows that the response of independent veterinary practices to corporate practice entry is delayed, with the employment and revenue effect being indifferent from zero one year after a corporate practice entry occurred. Six years after the first corporate practice entry into the local veterinary services market, the adverse revenue effects are statistically highly significant, reaching -18.7 percent in urban and -13.3 percent in rural census tracts. These findings hold up to a battery of robustness checks, including proximity entry effects, the fixed effects choice, various concepts of rurality, and different estimators. The estimates provide evidence of intriguing patterns

of treatment heterogeneity. In particular, the adverse treatment effects are most prominent when the corporate practice entry occurs close to the independent practice location. In addition, while I find evidence for co-location benefits in the early 2000s, these effects have largely disappeared over the last two decades, pointing toward higher market power of corporate veterinary practices and increasingly adverse competition effects due to competitive corporate entry in local markets for veterinary services.

My paper provides three distinct contributions to the growing literature on the corporatization of veterinary medicine and its impact on independent veterinary practices. First, the research speaks to the role that corporate veterinary practices play in the provision of veterinary services in the United States. So far, the empirical literature concerned with the competitive effects of market entry on the economic outcomes of incumbent firms in the veterinary services industry is sparse. Based on anecdotal evidence, Nolan (2018) argues that corporate practice entry has no impact on the likelihood of independent practices closing their business. In contrast, my paper provides empirical evidence for a small but statistically significant competitive entry effect of -1.9 percent for the exit probability of independent veterinary practices. Interestingly, the treatment effects of corporate practice entry are even more pronounced for independent practice employment (-5.7 percent) and revenue (-6.9 percent). These differences imply that the marginal surviving independent practice has to be more efficient in smaller markets (Asplund and Nocke 2006). Moreover, the results suggest that corporate veterinary practices have developed substantial market power at the local level, exerting increasing competitive pressure in those horizontally differentiated markets (Edling 2022).

Second, my work contributes to a growing industrial organization literature concerned with the implications of competitive entry in horizontally differentiated industries. A considerable literature studies the impact of competitive market entry in different service sectors, providing evidence of increasingly adverse treatment effects for incumbent economic outcomes and reduced societal welfare (e.g., Daunfeldt et al. 2019; Arcidiacono et al. 2020; Tan and Zhou 2021; Farronato and Fradkin 2022). I contribute to this literature by showing that not only does the entry of new retail formats affects the economic outcomes of incumbent firms in those industries but also that similar patterns exist in the veterinary services industry. Indeed, the national and local market

concentrations for veterinary services have grown considerably since 2000, primarily driven by accelerating industry consolidation and the corporatization of veterinary services. This development is spearheaded by a few highly dominant market players, such as Mars, Incorporated and JAB Consumer Partners, that are increasingly under investigation for limiting competition, which can lead to higher prices for and lower quality of veterinary services (Federal Trade Commission 2017, 2022). Furthermore, my work shows that the corporatization of veterinary medicine has increasingly adverse but differential impacts on independent veterinary practices that are likely to increase with the upcoming retirement wave that the veterinary services industry faces and which will spur further industry consolidation.

Third, this paper speaks to the emerging empirical literature concerned with the mechanisms underlying the response of incumbent firms to competitive market entry. Asplund and Nocke (2006) showed that more intensive price competition drives the employment and revenue effects of competitive market entry. My work provides empirical evidence for such a mechanism underlying the observed treatment heterogeneity of corporate practice entry in the veterinary services industry. I show that the adverse employment and revenue effects are more pronounced than those for the exit probability after a corporate practice entry. In contrast to incorporated veterinary practices, an incumbent independent practice is more likely to adjust prices in response to competitive entry as there is no limitation from uniform pricing across markets (Katz 1984). This pricing mechanism explains the larger revenue effects observed for independent veterinary practices. Notably, the corporate practice entry effects are more prominent and persistent in urban areas, reflected in increased exit rates, higher job losses, and consistently depressed revenue among independent veterinary practices. The probability of new entry of independent practices is lower in urban markets because financial entry thresholds are higher (Adrian and Kissling 1985; Truchet et al. 2017). This pattern also reflects in the differential productivity effects between urban and rural communities caused by competitive market entry (Holmes and Schmitz 2010; Backus 2020).

2. Background and Data

Veterinary practices in the United States provided $12 billion worth of services in 2022 alone, a number projected to grow to more than $23 billion by 2030 (Grand View Research 2022).[1] The veterinary services industry is predominately brick and mortar, although mobile services are offered, and telemedicine has emerged as a new tool for veterinarians (Bishop et al. 2021; Kogan et al. 2021). The veterinary services industry consists of regional and national chains and sole proprietorships, which vary in size from a single practice to several thousand veterinary practices (Davidow 2019). The industry is increasingly dominated by horizontally integrated veterinary chains, which offer a mix of services ranging from general to referral veterinary medicine and surgery (Nolan 2018). According to Zak (2022), the industry comprises almost 50 incorporated national or regional chains that operated almost 11,000 veterinary practices in the United States in 2022. In addition to the larger veterinary chains, there are numerous private practices or private referral practices that operate at a single location. These practices are called independent veterinary practices as they do not belong to a regional or national veterinary chain (Taylor 2021; Loeb 2022).

Veterinary practices offer services that are horizontally and vertically differentiated. Many veterinary practices specialize their services to a particular animal category and location, which implies that they horizontally differentiate their offered services. Such targeting indicates that those veterinary practices are more insulated from direct price competition with rival firms, as they have obtained a degree of local market power that allows them to tolerate higher operational costs (Bresnahan 1989; Sexton 2013). In addition, independent veterinary practices offer vertically differentiated services, as they operate businesses of various sizes that provide consumers a selection of differentiated services in terms of quality and price points (Noe and Alrøe 2012; Poizat et al. 2022). According to the American Veterinary Medical Association (2018), the average companion veterinary practice has a square footage of about 4,400 square feet, employs 2.5 veterinarians, and serves approximately 100 patients per veterinarian. However, the size, employment, and patient

[1] Note that this estimate focuses on veterinary services provided in veterinary practices. When including upstream and downstream services and products, such as animal insurance, pet food, and laboratory and other animal services, the U.S. market for veterinary services is more than five times larger.

numbers vary widely according to the practice format and type of animal services provided. Generally, referral and emergency practices are larger, have more veterinarians, and serve more patients. In contrast, mobile operations tend to have limited space, lower employment, and fewer patients. At the same time, capital and labor costs in the veterinary services industry are high, representing a significant entry barrier for new veterinarians into a career as independent practice owners and operators (Lee 2006; Villarroel et al. 2010).

The corporatization of veterinary medicine has broad implications for the nature of competition and the provision of veterinary services in the United States (Nolan 2018; Edling 2022). Since VCA Animal Hospitals conducted the first corporate acquisition of a veterinary practice in 1987, the corporatization of veterinary medicine has progressed rapidly. Table 1 shows trends in the market concentration for veterinary services. I measured market concentration with the Herfindahl-Hirschman index (HHI) at the national, state, country, and census tract levels (Rhoades et al. 1993). Independent of the market definition, the HHI has grown significantly in the veterinary services industry. The Federal Trade Commission (2010) considers markets in which the HHI is between 1,500 and 2,500 points to be moderately concentrated and those in which the HHI is over 2,500 points to be highly concentrated. At the sub-state level, the veterinary services industry is characterized by considerable market concentration, as the HHI hovers above 5,000 points. Interestingly, market concentration in rural markets is similar to that observed in urban markets, indicating that market segmentation in rural and urban markets is identical, contrary to the common wisdom in the industrial organization literature (Bresnahan 1989; Sexton 2013). The similarity in market concentration between rural and urban areas is likely due to higher financial entry thresholds in urban markets (Adrian and Kissling 1985; Truchet et al. 2017).

The considerable monetary entry barriers in the market for veterinary services are exploited by incorporated chains that have enjoyed enormous growth in their market share since 2010 (American Veterinary Medical Association 2018; Zak 2022). They accounted for about 30 percent of the U.S. market for veterinary services in 2022, up from a mere 10 percent in 2017. The considerable changes are due to private equity investors providing substantial funding to corporate businesses to purchase independent veterinary practices (Nolan 2018). The major player in the corporate market for veterinary services is Mars, Incorporated, which purchased VCA Animal Hospitals in 2017,

adding to its already sizable portfolio of veterinary businesses that includes national brands such as Banfield Pet Hospitals (2007) and Blue Pearl Veterinary Partners (2015). The few highly dominant market players, such as Mars, Incorporated, and JAB Consumer Partners, are increasingly under investigation for limiting competition, which may lead to higher prices for and lower quality of veterinary services (Federal Trade Commission 2017, 2022). The accelerating consolidation of the veterinary services industry has raised concerns about how limited competition could affect the bottom line of incumbent veterinary practices, the prices paid for, and the quality of veterinary services received (Nolan 2018; Edling 2022).

My empirical analysis uses data from the National Establishment Time Series (NETS 2022). NETS is an establishment-level dataset that uses Dun & Bradstreet archival establishment data to construct a historical account of business activities for the United States. The dataset has been widely used to answer empirical research questions related to market structure. Selected studies have looked at business survival (Choi et al. 2017), entrepreneurship (e.g., Echeverri-Carroll and Feldman 2019; Low et al. 2021), job creation (e.g., Neumark et al. 2006, 2011), healthcare access (Kaufman et al. 2015; Tsui et al. 2020), and the local food environment (Schuetz et al. 2012; Berger et al. 2019; Çakir et al. 2020). Although concerns had been raised by Crane and Decker (2019) about the ability of NETS to detect business trends for some industries, Zeballos and Marchesi (2022) showed that NETS is well suited to capture employment patterns similar to those observed in the County Business Patterns (CBP) (Eckert et al. 2020). I use the 2021 NETS dataset, which covers about 82.4 million establishments between 2000 and 2021.[2]

I identify establishments that provide veterinary services based on the 2021 North American Industry Classification System (NAICS) code 541940. I classify veterinary practices as independent if they are standalone with zero related firms and a headquarters DUNS that is the same as the establishment DUNS. To identify corporate veterinary practices, I use regular expression matching

[2] Although NETS data is available before 2000, I discarded this period from the analysis because of reporting issues found for data collection waves in the early 1990s (Cho et al. 2019). Note that when constructing the corporate veterinary practice measure, I account for market entry before 2000.

on the NETS variables *company* and *tradename*, as listed in Appendix Table A.1.[3] Because upstream and downstream veterinary services are also classified under the NAICS code 541940, I use a pre-filter to purge those establishments from the dataset. Among others, such businesses include animal shelters, animal control facilities, consulting businesses, and laboratories.[4] Although NETS provides a county identifier, no further spatial classification is available. Since the census tract is a reasonable representation of the market for veterinary services, I added this spatial information to the dataset.[5] To obtain the census tract, I use the veterinary practice address and match that to the census tract using a spatial matching algorithm based on the longitude and latitude information associated with the address. I use the census tract as the spatial unit of interest because it allows me to model the entry and exit patterns in the veterinary services industry. Lastly, I use the 2010 Rural-Urban Commuting Area (RUCA) codes to distinguish urban from rural census tracts (Economic Research Service 2022).[6] I provide the descriptive statistics in Appendix Table A.3.

3. Empirical Model

I exploit the unique spatial and temporal characteristics of my dataset to investigate the causal impact of corporate practice entry on the economic performance of incumbent independent veterinary practices. The empirical analysis is conducted at the census-tract-year level utilizing the count, employment, and revenue of independent practices as outcomes of interest. For brevity, I represent them with y_{it} in the following generalized regression specification:

$$\text{IVP}_{it} = \exp\left(\alpha_i + \alpha_t + \alpha_{m(i)}(t) + \beta \text{CVP}_{ijt}\right) + \eta_{it}\,, \tag{1}$$

[3] This regular expression match is sensitive to the exact specification of the strings used for matching. Therefore, I add a space after each key term to avoid false matches where the phrase is part of another word construct. In addition, I use the headquarters DUNS as an additional condition to identify corporate veterinary practices.

[4] The number of veterinary practices in my dataset aligns well with other sources. For instance, Nolan (2018) reports that the number of U.S. veterinary practices ranged from 28,000 to 32,000 in 2017. My dataset has about 30,000 veterinary practices in the same year. In addition, the share of corporate veterinary practices in my dataset is similar to other available statistics, putting them at about 10 percent in 2017.

[5] Census tracts are small, relatively permanent statistical subdivisions of a county or an equivalent entity. The primary purpose of census tracts is to provide a stable set of geographic units to present census data. They have a population size of between 1,200 and 8,000 people

[6] Appendix Table A.2 provides the list of RUCA codes. I use RUCA codes 4 to 10 to identify rural census tracts and map them in Appendix Figure A.1.

where I denote the census tract with i, the year with t, and the veterinary service market with m. I utilize an indicator variable, CVP_{ijt}, to denote the presence of the j-th corporate veterinary practice in census tract i at time t. It is important to note that the model implies that the effect of a specific corporate practice entry on the economic outcomes of independent veterinary practices is independent of prior exposure. A correlation between the error term and the corporate entry measure could confound the identification of the treatment effect. This correlation is likely non-trivial and different from zero as corporate veterinary practices may selectively choose their location (see, e.g., Wang et al. 2014; Henry et al. 2016). To account for this potential source of estimation bias, I employ a panel data approach by including fixed effects at the census tract and year levels, denoted by α_i and α_t, respectively. Additionally, following the related industrial organization literature (Arcidiacono et al. 2020), I include market-specific time trends to account for changes in the market attractiveness over time.[7] Finally, the transformed error term in the regression specification is represented by η_{it}.

The central identifying assumption underlying the empirical analysis is that the timing and location of corporate practice entry are independent of the error term η_{it}, conditional on census tract fixed effects, year dummies, and linear market trends. The empirical model is implemented with an indicator variable that takes the value one when census tract i is exposed to a corporate veterinary practice j in year t. This methodology can be understood as a generalization of the difference-in-differences (DiD) model, which compares contemporaneous changes in outcomes between census tracts affected by corporate practice entry with those that did not experience such market entry (Roth et al. 2022). Therefore, the control group for a given census tract consists of those census tracts that have never been exposed, as well as those that have been exposed earlier or later throughout the observation period, following the identification strategy proposed by Arcidiacono et al. (2020).[8]

[7] Note that the veterinary service markets are based on the Census Bureau's metropolitan statistical area (MSA) codes (U.S. Census Bureau 2022). For census tracts not belonging to an MSA, I include state-specific time trends.

[8] I investigate the robustness to the control group choice in the robustness section, where always-treated units are excluded from the analysis (Callaway and Sant'Anna 2021; Baker et al. 2022; de Chaisemartin and D'Haultfoeuille 2022).

The outcome of interest is denoted by IVP_{it}. It represents the non-negative integer count, employment, and revenue of independent veterinary practices in census tract i in year t. One approach to identifying the relationship of interest would be to transform the outcome using a log-linear regression model. However, this approach could induce estimation bias because a linear regression model cannot ensure the positivity of the predicted values of the count outcome (Wooldridge 1999; Cameron and Trivedi 2013). The discrete nature of the outcome makes it difficult to find a conditional mean transformation that is linear in parameters. In addition, heteroskedasticity could further exacerbate this issue as the transformed errors could be correlated with the covariates. The error term correlation could result in an inconsistent identification of the treatment effects. To account for this issue, I directly model the relationship of interest between the outcomes and the corporate veterinary practice entry measure. The positivity of the covariates is ensured by deploying a non-linear regression model that uses an exponential form equation.

I follow common practice in the related empirical literature and rely on the Poisson pseudo-maximum likelihood (PML) estimator to identify the relationship of interest (Gong and Samaniego 1981; Gourieroux et al. 1984). Even if the conditional variance is not proportional to the conditional mean, the estimator is unbiased and robust to heteroskedasticity (Wooldridge 1999). A further advantage of the Poisson PML estimator is that the scale of the dependent variable does not affect the parameter estimates and that the estimator allows me to deal with zero outcomes consistently (Cameron and Trivedi 2013). As shown in Appendix Table A.3, the share of zero observations is considerable at the census tract level. I account for the high-dimensional fixed effects using a modified version of the iteratively re-weighted least-squares algorithm that is robust to statistical separation and convergence issues (Correia et al. 2019, 2020). Because the standard errors could be correlated at the market-year level, I follow standard practice in the related empirical literature and cluster them at this level (Cameron and Miller 2015).

4. Main Results

Table 2 presents estimates of the corporate practice entry effect on the count, employment, and revenue of independent veterinary practices. Panel (a) shows that independent practices are 1.9

percent more likely to exit after a corporate practice entry.[9] These estimates contrast with the anecdotal evidence provided by Nolan (2018), according to which corporate practice entry has no impact on the likelihood of independent veterinary practices ending their business activities. Interestingly, the treatment effect of corporate practice entry is larger for the employment (-5.7 percent) and revenue (-6.9 percent) of independent veterinary practices. The estimates are highly significant at conventional levels of statistical significance. These findings add to earlier work concerned about the corporatization of veterinary medicine (Gyles 2014; Edling 2022). More intensive price competition can explain the stronger employment and revenue effects, implying that the marginal surviving independent practice has to be more efficient in smaller markets (Asplund and Nocke 2006). In contrast to incorporated practices, independent veterinary practices are more likely to adjust prices as they are not limited by uniform pricing across markets (Katz 1984). This pricing pattern could explain the larger revenue effects observed for independent veterinary practices.

Panel (b) of Table 2 compares the estimated treatment effects of corporate practice entry for independent veterinary practices in urban and rural markets. I find that the treatment effects for urban and rural areas are statistically indifferent from one another at conventional levels of statistical significance. The average treatment effects are largely driven by the increased exit of independent veterinary practices that operate in urban census tracts. After a corporate practice entry, I find that the employment and revenue of independent veterinary practices in rural census tracts decrease by 3.4 percent and 3.1 percent, respectively. In contrast, the entry effects are 5.9 percent for employment and 7.3 percent for the revenue of independent practices in urban markets. An explanation for the larger treatment effects in urban markets is the higher profit margins of independent veterinary practices in those markets (Lee 2006). Abdouttalib et al. (2021) document that the veterinary practice exit probability is higher in rural than urban markets. Although this pattern is also observable in my dataset, the entry of corporate practices is not a primary driver of this exodus.

My findings expand on earlier work by Villarroel et al. (2010), who identify factors associated with veterinarians leaving a career in rural veterinary practice. They document a turnover rate of 30.6

[9] I transformed the parameter estimates to percentage effects using the formula $(\exp(\beta) - 1) * 100$.

percent for independent practices operating in rural markets. This turnover is largely driven by migration to urban areas and job opportunities in academia. In addition, the treatment effects of corporate practice entry are larger in urban census tracts as the probability of new entry of independent practices is lower due to financial entry thresholds being higher in urban markets (Adrian and Kissling 1985; Truchet et al. 2017). This pattern also reflects in the differential productivity effects between urban and rural regions caused by the competitive market entry as documented for different industries (Holmes and Schmitz 2010; Backus 2020).

4.1 Treatment Dynamics

A causal interpretation of the estimated treatment effects is only justified under the assumption that the corporate veterinary practice entry timing and location are conditionally exogenous (Roth et al. 2022). Although I cannot directly test the validity of this assumption, the outcome trends in the pre-treatment period can be informative in this regard (Freyaldenhoven et al. 2021). Suppose the observed outcomes in treated census tracts have similar trends in the pre-treatment period to those in untreated census tracts. In that case, I can accept that the "parallel trends" assumption holds and that corporate veterinary practice entry is exogenous to the independent practice outcomes (Freyaldenhoven et al. 2019; Sun and Abraham 2021; Roth 2022). To implement this pre-event test and explore treatment dynamics in the post-treatment period, I rely on an event study design that interacts the treatment measure with a time dummy defined relative to the year of corporate veterinary practice entry:

$$\text{IVP}_{it} = \exp\left(\alpha_i + \alpha_t + \alpha_{m(i)}(t) + \sum_{m=-6}^{6} \beta_m \text{CVP}_{jt,t-m}\right)\eta_{it}\,, \tag{2}$$

where the general notation is the same as in Equation 1. The dynamic treatment model includes six leads and lags relative to the event of interest, which enables me to capture pre-trends and assess post-event treatment dynamics (Freyaldenhoven et al. 2021).[10] I assume that all latent confounders are captured by the census tract fixed effects, year dummies, and market trends. The

[10] I follow common practice in the event study literature and bin the endpoints of the event study window. The binned endpoints allow me to check for long-run pre-trends and leveling-off treatment effects.

term $\sum_{m=-6}^{6} \beta_m \text{CVP}_{jt,t-m}$ measures the treatment dynamics of corporate veterinary practice entry for the corresponding outcomes. The specification allows the magnitude of the treatment effects to vary before and after the corporate practice entry and uncovers how the treatment effects evolve in the post-event period.

I present the event study estimates for corporate veterinary practice and the independent veterinary practice outcomes for urban and rural census tracts in Figure 1. Each subfigure plots the dynamic treatment parameters, 95 percent confidence intervals, and uniform sup-t bands for the event-time of the outcome (Montiel Olea and Plagborg-Møller 2019; Freyaldenhoven et al. 2021).[11] I also overlay estimates from the static model represented by the dashed red line. The figure notes report the corresponding p-value for Wald tests for pre-event trends and anticipatory behavior. Apart from the count of independent veterinary practices in urban census tracts, I find no evidence of significant pre-trends for the independent practice count, employment, and revenue specifications.[12] I also conducted a Wald test for the null hypothesis that the treatment dynamics level off because the treatment effect could be dynamic at the endpoints of the event window. The Wald tests provide statistical support for leveling off treatment effects for urban and rural census tracts that are statistically insignificant at conventional levels for rural census tracts.

The event study estimates reveal intriguing patterns regarding the entry effects of corporate veterinary practices for the count, employment, and revenue of independent practices. First, I find evidence that the response to corporate practice entry is delayed, with the exit probability being indifferent from zero one year after corporate veterinary practice entry in urban census tracts. Afterward, the exit probability increases, reaching -2.7 percent on average in the post-event period and -7.6 percent after six years.[13] In contrast, there is no evidence of significant post-event treatment effects for the count of independent veterinary practices in rural census tracts. Similar

[11] I follow Montiel Olea and Plagborg-Møller (2019) and use a Bayesian sup-t band with exact finite-sample simultaneous credibility.

[12] Since the pre-trend tests are statistically insignificant and the treatment pathways in the pre-treatment period are flat, the research design is validated. The fixed effects can accurately account for unobservables unrelated to the treatment but predictive of the outcome, such as the 2008 recession and the coronavirus pandemic (see, e.g., Hess 2008; Gortázar and de la Fuente 2020).

[13] I transformed the parameter estimates to percentage effects using the formula $\big(\exp(\bar{\beta}_k) - 1\big) * 100$.

patterns are observable for the corporate practice entry effects on the employment and revenue of independent practices. Although there is some evidence of adverse employment and revenue effects in rural markets, these treatment estimates are statistically insignificant at conventional levels. In contrast, the event study estimates lend strong support for adverse entry effects on employment and revenue of independent practices in urban census tracts.

The adverse entry effects peak after six years, reaching -8.9 percent for employment and -13.3 percent for the revenue of independent veterinary practices in urban census tracts with corporate practice entry. Confirmatory bias and motivated reasoning, which causes veterinary practice owners to discount negative performance information, retain overly optimistic beliefs, and delay exit, can explain this delayed exit pattern (Elfenbein et al. 2017). Second, the treatment effects remain negative and statistically significant for urban census tracts, indicating no new entry of independent veterinary practices after a corporate veterinary practice enters these markets. An explanation for this pattern is entry deterrence due to the role of local market power in the veterinary services industry (Salop 1979; Neill et al. 2019). Third, the average post-event treatment effects are statistically indifferent from the static estimates, implying that the corporate veterinary practice entry timing and location are conditionally exogenous, which validates the research design (Freyaldenhoven et al. 2021).

4.2 Competition Bands

So far, I have assumed that corporate veterinary practice entry affects all independent practices equally in the census tract where the entry occurred. A causal interpretation of the main results is justified under the assumption that the corporate market entry does not affect independent veterinary practices that are far from where the entry occurred. Related studies on competitive entry estimate entry effects directly using the business location to calculate the driving distance to the entry location (see for reference, e.g., Arcidiacono et al. 2020; Seim 2006; Rennhoff and Owens 2012; Arcidiacono et al. 2020; Caoui et al. 2022). To test how localized the corporate entry treatment effect is, I use measures of corporate practice entry within 25 miles of the independent practice location as specified in the following regression model:

$$\text{IVP}_{pt} = \exp\left(\alpha_p + \alpha_t + \alpha_{m(p)}(t) + \sum_{b=0}^{B} \beta_b \sum_j (D_{pj})\text{CVP}_{jt}\right)\eta_{pt}\,, \tag{3}$$

where all notations are the same in Equation 1, apart from p and b, which stand for the independent veterinary practice and the driving distance band, respectively. The term $\sum_{b=0}^{B} \beta_b \sum_j (D_{sj})\text{CVP}_{jt}$ approximates the corporate veterinary practice entry effect for six driving distance bands. This specification is implemented with a set of indicator variables that take on a value of one when the independent veterinary practice p is exposed to corporate practice j within distance band b. The use of discrete driving bands lets me determine the distance at which the corporate entry effects on the economic outcomes of incumbent outcomes become zero. I include fixed effects at the practice and year levels and linear market trends defined at the census tract level in the estimation to control for potential confounders. For a given corporate veterinary practice entry, the control includes independent practices never exposed and those exposed earlier or later during the sample period from 2000 to 2021. The distance band specification extends this logic to compare independent practices treated at different driving distances.

Table 3 presents estimates for the corporate veterinary practice entry effect on the economic outcomes of independent veterinary practices by driving distance band. The treatment estimates are statistically significant for the exit probability, employment, and revenue of independent practices in the "less than 1 mile" distance band. The parameter estimates point toward a negative association between corporate practice entry and the economic outcomes of independent veterinary practices. The exit probability increased by 0.9 percent after a competitive corporate entry occurred. The employment and revenue effects are considerably larger, reaching about 1.8 percent and 2.6 percent. At the same time, there is some evidence of co-location benefits with corporate veterinary practices. This pattern can be explained by the fact that corporate veterinary practices tend to specialize in referral services, which offer higher markups and can result in positive spillover effects for referring independent veterinary practices (Nolan 2018). Although these factors can explain the treatment effects observed for corporate practice entry for certain distance bands, the estimates should be taken cautiously due to concerns about the serial correlation between the corporate practice entry measures (Wooldridge 1999; Cameron and Trivedi 2013). Since the estimated treatment effects of

corporate veterinary practice entry within the "less than 1 mile" distance band are qualitatively indifferent from the main results, it can be concluded that the treatment is indeed "exogenous" and the estimated treatment effects are likely causal (Callaway and Sant'Anna 2021).

4.3 Robustness Checks

Fixed Effects — The baseline specification includes census tract fixed effects, time dummies, and linear market trends following related work in the industrial organization literature (Mazzeo 2002; Seim 2006; Caoui et al. 2022). This choice implies that my main results are conditional on those fixed effects absorbing the unobserved correlation at those levels that could potentially bias the treatment estimates. To test the robustness of my main findings to the choice of the fixed effects, I estimate Equation 1 excluding the linear market trends in Model (1) while adding state-year fixed effects in Model (2) and county-year fixed effects in Model (3). As presented in Appendix Table A.4, I find limited evidence for treatment heterogeneity conditional on the fixed effects choice. While the treatment estimates are (sometimes) smaller when accounting for a larger share of variation through the interacted year fixed effects, all treatment estimates are statistically indifferent from the main results at conventional levels of statistical significance. Therefore, the estimated treatment effects of corporate practice entry on the economic outcomes of independent veterinary practices are likely causal and not caused by unobserved correlation due to the exclusion of more stringent fixed effects (Lu and White 2014).

Never-Treated and Not-Yet-Treated Census Tracts — The causal inference of competitive entry effects of corporate veterinary practice depends not only on the parallel trends assumption to hold but also on the use of a credible and transparent comparison group (Roth et al. 2022). Although I observe the corporate veterinary practice entry history at the census tract level for up to ten years before the panel start year, a potential concern is using always-treated units as a control group (Callaway and Sant'Anna 2021; Baker et al. 2022; de Chaisemartin and D'Haultfoeuille 2022). To account for this identification issue, I disregard always-treated census tracts and use never-treated and not-yet-treated census tracts for the regressions presented in Appendix Table A.5. Although the estimated treatment effects are of a larger magnitude for most economic outcomes, they are indifferent to the main results at conventional levels of statistical significance for urban census

tracts. Notable, the employment and revenue effects of corporate practice entry are statistically different from the main results and highly significant. After excluding always-treated units from the analysis, the treatment effect for employment doubles from -3.4 percent to -7.6 percent and that for revenue from -3.1 percent to -7.3 percent. One explanation for this discrepancy is the lower entry rate of corporate veterinary practice in rural census tracts and the likely market power they have in those markets (Salop 1979; Neill et al. 2019). Therefore, the "true" causal treatment effects of corporate practice entry are plausibly between my main results and the estimates that exclude always-treated census tracts.

Linear Regression — Related studies in the industrial organization literature often rely on a log-linear or linear regression model to estimate the treatment effects of competitive entry (see, e.g., Holmes and Schmitz 2010; Arcidiacono et al. 2020; Backus 2020). Although there are drawbacks to this approach because of its inability to deal with the abundance of zeros at the census tract consistently (that have an essential economic meaning), I test for the robustness of my main results using a linear regression model in Appendix Table A.6. The estimated treatment effects of corporate practice entry are similar to the main results for the outcomes of independent veterinary practices in terms of sign and statistical significance but differ in magnitude. This difference between the main and linear regression results is statistically significant for the count and revenue of independent veterinary practices. A potential explanation for this difference is the inability of the standard linear model to deal with treatment heterogeneity (de Chaisemartin and D'Haultfoeuille 2022). In contrast, the Poisson PML estimator is unbiased and robust to heteroskedasticity, implying that the main results represent the "true" treatment effect of corporate veterinary practice on the economic outcomes of independent veterinary practices (Wooldridge 1999; Cameron and Trivedi 2013).

Concepts of Rurality — The applied research and public policy community uses various concepts and definitions of rurality. Nelson et al. (2021) conducted a systematic review of rurality measures and how researchers operationalize them in empirical and quantitative studies. I present estimates for two alternative rurality measures in Appendix Table A.7 to see how robust my main results are to those alternative rurality concepts. Panel (a) identifies rural census tracts based on the Census Bureau's definition of metropolitan statistical areas (U.S. Census Bureau 2022). This rurality definition is less granular than the RUCA classification developed by the Economic Research Service

(2022). I find no evidence for statistically significant differences between the main results and the alternative entry effect estimates. In addition, I assess treatment heterogeneity based on the RUCA classification for metropolitan (codes 1 to 3), micropolitan (codes 4 to 7), and small towns and rural census tracts (codes 8 to 10) in Panel (b).

Although the estimated treatment effects are statistically indifferent from the main results for urban census tracts, I find some intriguing competitive entry effect patterns for micropolitan and small towns and rural areas. While the estimated treatment effects are statistically insignificant for micropolitan areas, there is strong evidence for adverse employment and revenue effects due to corporate entry for independent veterinary practices. The treatment effects for rural census tracts are statistically different from those for urban census tracts and have a considerably larger magnitude. These results imply that the co-location with corporate practices in micropolitan areas is beneficial for independent veterinary practices. In contrast, corporate entry has adverse implications for independent practices in metropolitan and rural areas.

4.4 Treatment Heterogeneity

The competitive corporate practice entry could cause distinct treatment differences for the economic outcomes of independent veterinary practices that vary across time, regions, and practice formats (see, e.g., Hess 2008; Gortázar and de la Fuente 2020; Abdouttalib et al. 2021; Edling 2022). Reduced entry barriers and market power in a spatially differentiated market could result in heterogenous treatment effects over time, as shown in the related industrial organization literature on retail markets (Neumark et al. 2008; Schivardi and Viviano 2010). I test for such treatment heterogeneity in Panel (a) of Appendix Table A.8. The results show that the corporate practice entry effect became more adverse over time. The estimates for 2001 to 2005 are statistically different from those after 2010. However, the estimated treatment effects for periods after 2010 are statistically indifferent from the main results at conventional levels of statistical significance. The estimates provide evidence of co-location benefits in the early 2000s. With the further corporatization of veterinary medicine in the last twenty years, the co-location benefits disappeared, and corporate veterinary practices became a major competitor for independent veterinary practices. Between 2016 to 2021, the entry of a corporate veterinary practice resulted in a 4.9 percent higher exit

probability, 8.3 percent lower employment, and 10.5 percent less revenue for independent practices. These findings imply that corporate veterinary practices have developed substantial market power in relevant markets, exerting increasing competitive pressure in those horizontally differentiated markets (Nolan 2018; Edling 2022).

Next, I study potential treatment heterogeneity across census regions. The U.S. Bureau of Labor Statistics (2022) documents considerable geographic differences in the employment of veterinarians across states and occupation types. A higher density of veterinarians is observable in coastal and livestock-producing states. In addition, employment trends between 2000 and 2021 indicate diverging employment and salary patterns in veterinary medicine across U.S. states. Higher profit margins and lower entry barriers in urban markets may facilitate corporate practice entry in urban markets (Lee 2006). Panel (b) of Appendix Table A.8 shows that the heterogeneous treatment effect estimates of corporate practice entry by census region reflect this expansion pattern. For instance, I find more considerable treatment effects in the Western census region. Corporate practice entry leads to a 5.3 percent higher exit probability, an employment reduction of 11.8 percent, and reduced revenue of 10.5 percent for independent veterinary practices. However, I cannot conclude that those treatment effects are indifferent to the main results at conventional levels of statistical significance. These findings highlight that the underlying mechanisms of entry and exit cause similar economic outcomes for independent practices across census regions (Edling 2022).

Lastly, I explore whether the treatment response varies across practice formats. For the primary analysis, I defined independent veterinary practices as those for which the DUNS number is the same for the practice and headquarters location. This definition is restrictive as it leaves out veterinary operations that offer veterinary services as a standalone doctor of veterinary medicine. Standalone veterinary doctors could be incentivized to accelerate their response to corporate practice entry by adjusting how they provide veterinary services to their clients (Lee 2006; Lloyd 2006). Therefore, standalone doctors of veterinary medicine are more likely to exit shared markets for veterinary services but should face similar adverse employment and revenue effects than independent veterinary practices in such competitive markets (Bimbatti Mattos 2019). The estimates of the corporate veterinary practice effects across practice formats, as presented in Panel (c) of Appendix Table A.8, provide statistical evidence for adverse treatment effects for the exit probability of independent

veterinary practices that are considerably larger than those for the main results. The estimated treatment effect increases from -1.9 percent to -9.7 percent when including standalone doctors of veterinary medicine. At the same time, the estimates for employment and revenue have a larger magnitude than the main results. However, they are statistically indifferent from the main estimates at conventional levels of statistical significance. These findings indicate that corporate practices compete directly with independent practices and standalone doctors of veterinary medicine for local veterinary service markets despite the horizontal differentiation of the veterinary services characterizing independent practices and standalone doctors of veterinary medicine.

5. Conclusion

Veterinary medicine provides essential services that ensure the health of animals and are crucial to protecting public health. The industry is also a notable employer of a highly educated workforce with numerical benefits for society (American Veterinary Medical Association 2018). Particularly in rural areas, independent veterinary practices provide essential services to largely inaccessible communities (Villarroel et al. 2010; Henry et al. 2016; Abdouttalib et al. 2021). However, the tremendous growth of incorporated veterinary businesses has raised concerns about how corporate entry affects the bottom line of incumbent veterinary practices, the prices paid for, and the quality of veterinary services received (Nolan 2018). So far, there has been no systematic understanding of how corporate practice entry affects the economic outcomes of independent veterinary practices.

This paper fills the research gap using practice-level business data for all U.S. veterinary practices from 2000 to 2021. Exploiting the unique spatial and temporal features of my dataset, I estimate the causal effects of corporate practice entry on incumbent independent veterinary practices. The main results indicate that independent practices are 1.9 percent more likely to exit after a corporate practice entry occurs. In addition, incumbent veterinary practices experience an employment reduction of 5.7 percent and lower revenue of 6.9 percent. These estimates contrast with anecdotal evidence regarding the industry's conduct, according to which corporate practice entry causes no adverse effects on incumbent veterinary practices (Nolan 2018). Interestingly, the adverse treatment effects of corporate practice entry are more pronounced in urban areas, where the employment and revenue effects are almost twice as large in magnitude as those observed in rural areas. After a

corporate practice entry, the employment and revenue of independent veterinary practices in urban areas decrease by 5.9 percent and 7.3 percent, respectively.

The response of independent veterinary practices to corporate practice entry is delayed, with the employment and revenue effect being indifferent from zero one year after a corporate practice entry occurred, according to an event study analysis. Six years after the first corporate practice entry into the local veterinary services market, the adverse revenue effects are statistically significant and almost three times larger than the average post-event treatment estimates. The empirical findings hold up to a battery of robustness checks. The results also provide evidence of intriguing patterns of treatment heterogeneity. In particular, the adverse treatment effects are more pronounced when the corporate practice entry occurs in proximity to the independent practice location. In addition, while there is some evidence for co-location benefits between 2000 and 2010, these beneficial effects have largely disappeared since then, pointing toward higher market power of corporate veterinary practices and increasingly adverse competition effects caused by corporate practice entry in markets for veterinary services.

My research expands on previous work concerned with the corporatization of veterinary medicine and its implications for independent veterinary practices (Nolan 2018; Gyles 2014; Edling 2022). First, I show that corporate practice entry can substantially affect incumbent veterinary practices. Corporate practices have developed considerable market power at the local level, exerting increasing competitive pressure in horizontally differentiated markets (Edling 2022). Interestingly, the treatment effects of corporate practice entry are more pronounced for employment and revenue than for the exit probability. These differences imply that independent veterinary practices have to be more efficient in smaller markets (Asplund and Nocke 2006). Second, my work speaks to a growing empirical literature concerned with competition in horizontally differentiated industries (e.g., Daunfeldt et al. 2019; Arcidiacono et al. 2020; Tan and Zhou 2021; Farronato and Fradkin 2022). The veterinary services industry responds to competitive entry similarly to other industries. Third, the paper identifies mechanisms underlying the response of incumbent firms to competitive market entry. Asplund and Nocke (2006) showed that intensive price competition drives the employment and revenue effects of competitive market entry. My work provides empirical support for such a mechanism in the veterinary services industry. In contrast to corporate veterinary practices, the

average incumbent independent practice is more likely to adjust prices in response to competitive entry as there is no limitation from uniform pricing across markets (Katz 1984). A particularly fascinating venue for future research relates to the heterogenous response to corporate market entry according to business format and veterinary practice type and the income effects experienced by independent veterinarians.

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Tables and Figures

Table 1: Trends in the Market Concentration for Veterinary Services.

	National Level		State Level		County Level		Census Tract Level	
	Revenue	Employment	Revenue	Employment	Revenue	Employment	Revenue	Employment
Panel (a): All Census Tracts								
2000	147.7	4.5	544.6	333.8	4,574.7	4,434.3	5,540.5	5,531.9
2005	90.1	11.5	339.9	160.1	4,395.2	4,267.4	5,807.9	5,798.2
2010	164.3	22.5	629.4	348.4	4,262.3	4,156.7	6,172.9	6,163.2
2015	890.8	90.3	955.9	201.9	4,331.0	4,064.0	6,401.3	6,352.4
2020	870.9	67.8	981.1	180.8	4,332.3	3,976.8	6,565.5	6,463.0
Growth Rate (in %)	23.3	66.5	3.8	−2.2	−0.3	−0.5	0.9	0.8
Panel (b): Urban Census Tracts								
2000	204.2	6.3	531.3	245.6	4,394.9	4,240.6	5,381.2	5,373.2
2005	123.8	16.0	486.6	248.0	4,208.4	4,089.5	5,666.8	5,658.2
2010	221.8	31.2	607.4	247.7	4,046.1	3,933.3	6,067.2	6,056.4
2015	1,111.0	123.4	1,236.0	299.0	4,177.6	3,741.6	6,367.8	6,311.8
2020	1,074.6	92.3	1,270.3	262.0	4,124.8	3,573.8	6,597.2	6,479.8
Growth Rate (in %)	20.3	64.9	6.6	0.3	−0.3	−0.7	1.1	1.0
Panel (c): Rural Census Tracts								
2000	4.8	2.7	736.3	681.2	5,946.3	5,848.4	6,100.3	6,087.8
2005	4.3	2.7	506.3	468.6	5,785.3	5,681.6	6,302.0	6,288.5
2010	5.9	2.8	688.4	642.2	5,692.4	5,618.0	6,552.7	6,546.6
2015	14.7	3.0	545.2	417.4	5,580.4	5,489.2	6,517.7	6,494.0
2020	17.9	3.6	528.8	405.8	5,597.6	5,417.1	6,453.3	6,404.4
Growth Rate (in %)	13.0	1.5	−1.3	−1.9	−0.3	−0.4	0.3	0.2

Note. The table shows trends in the market concentration for veterinary services. I compare the Herfindahl-Hirschman index separately for all, urban, and rural tracts. The index is calculated at the national, state, county, and census tract levels for 2000, 2005, 2010, 2015, and 2020. The state, county, and census tract index represent the average over the respective spatial units. The growth rate is the annualized change in the index between 2000 and 2020.

Table 2: Competitive Effects of Corporate Veterinary Practice Entry.

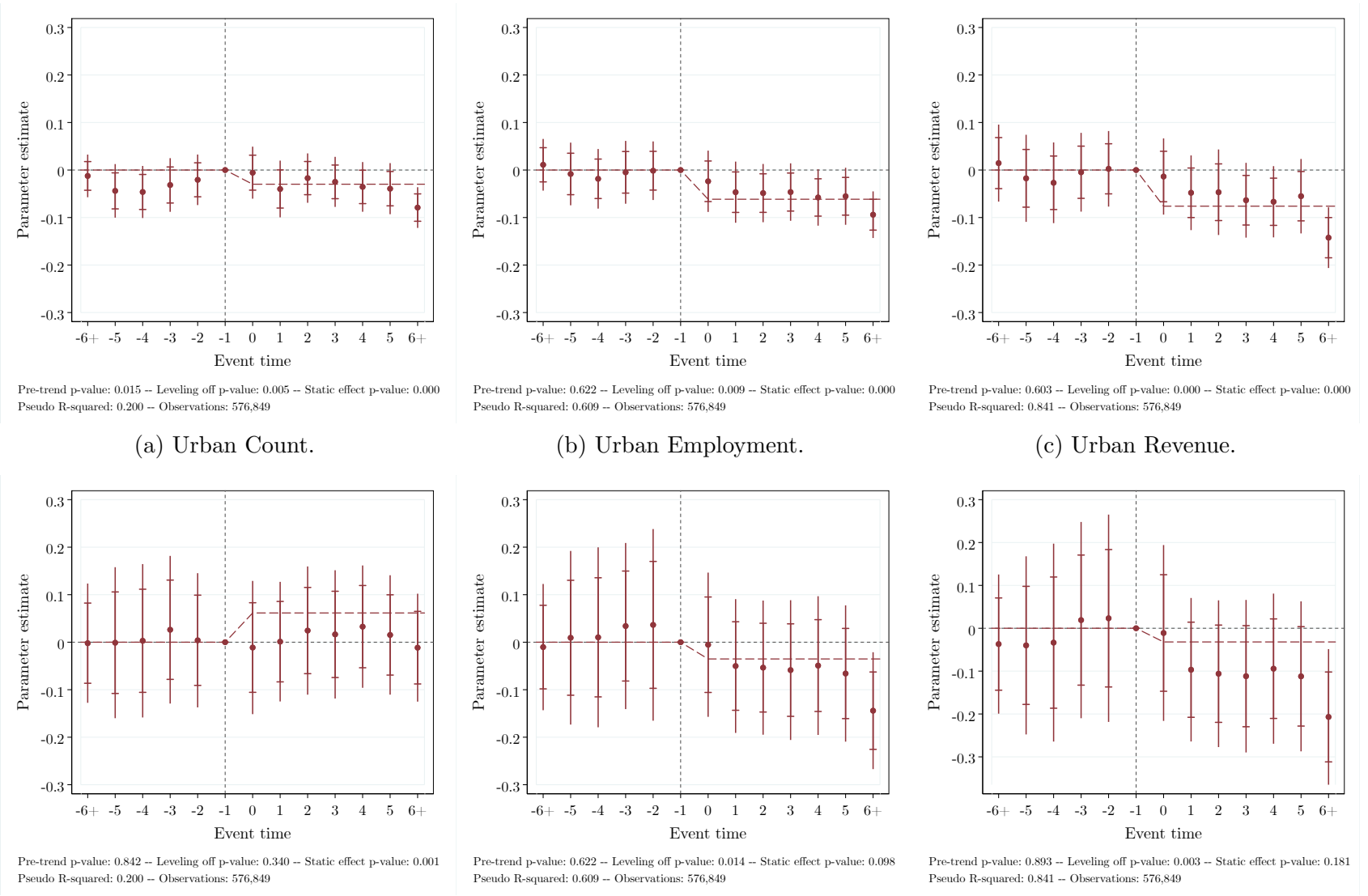
	Count	Employment	Revenue
Panel (a): Average Treatment Effects			
All census tracts	-0.019***	-0.059***	-0.072***
	(0.007)	(0.009)	(0.011)
Pseudo R-squared	0.200	0.609	0.841
Observations	576,849	576,849	576,849
Panel (b): Conditional Average Treatment Effects			
Urban census tracts	-0.030***	-0.061***	-0.076***
	(0.007)	(0.009)	(0.012)
Rural census tracts	0.062***	-0.035*	-0.032
	(0.018)	(0.021)	(0.024)
Pseudo R-squared	0.200	0.609	0.841
Observations	576,849	576,849	576,849

Note. The table shows estimates of the corporate veterinary practice entry effect on the count, employment, and revenue of independent practices. All regressions include census tract fixed effects, year dummies, and linear market trends. Standard errors are adjusted for within-cluster correlation at the market-year level. ***, **, and * indicate statistical significance at the 1 percent, 5 percent, and 10 percent confidence levels, respectively.

Table 3: Corporate Practice Entry Effects by Distance Band.

	Count	Employment	Revenue
Less than 1 mile	-0.009*	-0.018***	-0.026***
	(0.005)	(0.006)	(0.009)
1 to 5 miles	0.012***	0.009***	0.002
	(0.002)	(0.003)	(0.004)
5 to 10 miles	0.005**	0.007**	-0.004
	(0.002)	(0.003)	(0.004)
10 to 15 miles	0.008***	0.012***	0.006
	(0.002)	(0.003)	(0.005)
15 to 20 miles	-0.003	0.005	0.000
	(0.002)	(0.003)	(0.003)
20 to 25 miles	0.002	0.010	0.033
	(0.002)	(0.007)	(0.019)
Pseudo R-squared	0.256	0.627	0.824
Observations	1,486,884	1,486,884	1,486,884

Note. The table shows estimates of the corporate veterinary practice entry effect on the count, employment, and revenue of independent practices by distance band. All regressions include practice fixed effects, year dummies, and linear market trends. Standard errors are adjusted for within-cluster correlation at the practice level. ***, **, and * indicate statistical significance at the 1 percent, 5 percent, and 10 percent confidence levels, respectively.



Pre-trend p-value: 0.015 -- Leveling off p-value: 0.005 -- Static effect p-value: 0.000
Pseudo R-squared: 0.200 -- Observations: 576,849

(a) Urban Count.

Pre-trend p-value: 0.622 -- Leveling off p-value: 0.009 -- Static effect p-value: 0.000
Pseudo R-squared: 0.609 -- Observations: 576,849

(b) Urban Employment.

Pre-trend p-value: 0.603 -- Leveling off p-value: 0.000 -- Static effect p-value: 0.000
Pseudo R-squared: 0.841 -- Observations: 576,849

(c) Urban Revenue.

Pre-trend p-value: 0.842 -- Leveling off p-value: 0.340 -- Static effect p-value: 0.001
Pseudo R-squared: 0.200 -- Observations: 576,849

(d) Rural Count.

Pre-trend p-value: 0.622 -- Leveling off p-value: 0.014 -- Static effect p-value: 0.098
Pseudo R-squared: 0.609 -- Observations: 576,849

(e) Rural Employment.

Pre-trend p-value: 0.893 -- Leveling off p-value: 0.003 -- Static effect p-value: 0.181
Pseudo R-squared: 0.841 -- Observations: 576,849

(f) Rural Revenue.

Figure 1: Event Studies.

Note. The figure shows event study estimates for the corporate practice entry effect on the count, employment, and revenue of independent veterinary practices. All regressions include census tract fixed effects, year dummies, and linear market trends. Standard errors are adjusted for within-cluster correlation at the market-year level. I plot the dynamic treatment parameters, 95 percent confidence intervals, and uniform sup-t bands for the event-time coefficients. Results from a static model are overlaid as a dashed line. I report Wald tests for pre-trends, leveling off dynamic treatment effects, the pseudo R-squared, and the observation number in the figure note.

Appendix Tables and Figures

Table A.1: Corporate Veterinary Businesses.

Alliance Animal Health 2016 160+	Modern Animal 2019 5
American Veterinary Group 2015 100+	My Pet's Vet Group 2017 4
Amerivet Veterinary Partners 2016 187	National Veterinary Associates 1996 1400+
AZ Pet Vet 1984 22	O'Brien Veterinary Group 2009 27
BluePearl Veterinary Partners 1996 100+	Pet Paradise 2002 50+
BlueRiver Pet Care 2009 168	PetVet Care Centers 2012 450+
Bond Vet 2019 31	Rarebreed Veterinary Partners 2018 100
Cara Veterinary 2017 9	Southern Veterinary Partners 2014 330+
CareVet 2018 100+	The Vets Pets 2007 24
CityVet 1999 27	Thrive Pet Healthcare 2012 400+
Community Vet Clinics 1995 3700	United Veterinary Care 2019 115
Community Veterinary Partners 2009 125+	Valley Veterinary Care 2016 22
Curo Pet Care 2015 undisclosed	VCA 1986 1000+
Destination Pet 2017 120+	Veritas Veterinary Partners 2022 100+
Encore Vet Group 2018 62	VetCor 1997 720
EverVet Partners 2020 25	Veterinary Emergency Group 2014 36
GoodVets 2017 16	Veterinary Practice Partners 2011 104
Heart + Paw 2018 28	Veterinary United 1999 22
Heartland Veterinary Partners 2016 100	VetEvolve 2014 30
Innovative PetCare 2015 72	VetnCare 2012 11
Inspire Veterinary Partners 2020 7	VetStrategy 2006 360+
Lakefield Veterinary Group 2014 71	WellHaven PetHealth 2017 45
MedVet 1988 36	Western Veterinary Partners 2019 undisclosed
Mission Veterinary Partners 2017 320+	

Note. The table list the names I used to identify corporate veterinary businesses. The data come from Zak (2022). I report the business name, establishment year, and the number of veterinary practices.

Table A.2: 2010 RUCA Codes.

Code	Classification Description
1	Metropolitan area core: primary flow within an urbanized area (UA)
2	Metropolitan area high commuting: primary flow 30 percent or more to a UA
3	Metropolitan area low commuting: primary flow 10 percent to 30 percent to a UA
4	Micropolitan area core: primary flow within an urban cluster of 10,000 to 49,999 (large UC)
5	Micropolitan high commuting: primary flow 30 percent or more to a large UC
6	Micropolitan low commuting: primary flow 10 percent to 30 percent to a large UC
7	Small town core: primary flow within an urban cluster of 2,500 to 9,999 (small UC)
8	Small town high commuting: primary flow 30 percent or more to a small UC
9	Small town low commuting: primary flow 10 percent to 30 percent to a small UC
10	Rural areas: primary flow to a tract outside a UA or UC
99	Not coded: Census tract has zero population and no rural-urban identifier information

Note. The table describes the 2010 RUCA codes. The data come from the Economic Research Service (2022).

Table A.3: Descriptive Statistics.

	Sum	Mean	Median	SD	Min.	Max.	Obs.
Panel (a): All Census Tracts							
IVP count	554,627	0.30	0	0.62	0	32	1,875,060
IVP employment	4,242,408	2.26	0	6.51	0	696	1,875,060
IVP revenue	230,506,151	122.93	0	1,374.64	0	544,532	1,875,060
CVP count	47,160	0.03	0	0.17	0	7	1,875,060
Panel (b): Urban Census Tracts							
IVP count	422,145	0.28	0	0.61	0	32	1,524,578
IVP employment	3,458,754	2.27	0	6.84	0	696	1,524,578
IVP revenue	187,968,257	123.29	0	1,517.26	0	544,532	1,524,578
CVP count	41,608	0.03	0	0.18	0	7	1,524,578
Panel (c): Rural Census Tracts							
IVP count	132,482	0.38	0	0.67	0	7	350,482
IVP employment	783,654	2.24	0	4.82	0	87	350,482
IVP revenue	42,537,893	121.37	0	308.94	0	17,256	350,482
CVP count	5,552	0.02	0	0.13	0	2	350,482

Note. The table shows the descriptive statistics for all census tracts and separates the outcome and treatment variables by urban and rural census tracts. I calculated the sum, mean, median, standard deviation (SD), minimum (min.), maximum (max.), and observation numbers (obs.) for the three outcome variables (independent veterinary practice count, employment, and revenue) and the treatment variable (corporate veterinary practice count). The revenue descriptive statistics are scaled in $1,000.

Table A.4: Robustness to Fixed Effects Choice.

	Count			Employment			Revenue		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Panel (a): Average Treatment Effects									
All Census Tracts	0.002	-0.019***	-0.015**	-0.050***	-0.061***	-0.049***	-0.068**	-0.074***	-0.065***
	(0.007)	(0.007)	(0.007)	(0.008)	(0.009)	(0.009)	(0.028)	(0.011)	(0.012)
Pseudo R-squared	0.199	0.201	0.206	0.607	0.609	0.618	0.838	0.842	0.853
Observations	576,849	576,823	561,254	576,849	576,823	561,254	576,849	576,823	561,254
Panel (b): Conditional Average Treatment Effects									
Urban Census Tracts	-0.004	-0.030***	-0.025***	-0.050***	-0.063***	-0.053***	-0.070**	-0.078***	-0.070***
	(0.007)	(0.007)	(0.008)	(0.009)	(0.009)	(0.009)	(0.030)	(0.012)	(0.012)
Rural Census Tracts	0.051***	0.061***	0.092***	-0.050**	-0.034	0.010	-0.044	-0.027	0.022
	(0.018)	(0.018)	(0.024)	(0.021)	(0.021)	(0.027)	(0.056)	(0.024)	(0.028)
Pseudo R-squared	0.199	0.201	0.206	0.607	0.609	0.618	0.838	0.842	0.853
Observations	576,849	576,823	561,254	576,849	576,823	561,254	576,849	576,823	561,254

Note. The table shows robustness estimates for the corporate practice entry effect on the count, employment, and revenue of on independent veterinary practices. Model (1) excludes the linear market trends, while I add state-year fixed effects in model (2) and county-year fixed effects in model (3). All regressions include census tract fixed effects, time dummies, and linear market trends. Standard errors are adjusted for within-cluster correlation at the market-year level. ***, **, and * indicate statistical significance at the 1 percent, 5 percent, and 10 percent confidence levels, respectively.

Table A.5: Exclude Always-Treated Census Tracts.

	Count	Employment	Revenue
Panel (a): Average Treatment Effects			
All Census Tracts	-0.026***	-0.064***	-0.084***
	(0.007)	(0.009)	(0.012)
Pseudo R-squared	0.198	0.607	0.842
Observations	562,611	562,611	562,611
Panel (b): Conditional Average Treatment Effects			
Urban Census Tracts	-0.031***	-0.063***	-0.085***
	(0.008)	(0.009)	(0.013)
Rural Census Tracts	0.019	-0.080***	-0.076***
	(0.022)	(0.024)	(0.028)
Pseudo R-squared	0.198	0.607	0.842
Observations	562,611	562,611	562,611

Note. The table shows estimates of the corporate veterinary practice effect on independent veterinary practice count, employment, and revenue when excluding always-treated census tracts. The control group includes not-yet-treated and never-treated units. All regressions include census tract fixed effects, time dummies, and linear market trends. Standard errors are adjusted for within-cluster correlation at the market-year level. ***, **, and * indicate statistical significance at the 1 percent, 5 percent, and 10 percent confidence levels, respectively.

Table A.6: Linear Regression.

	Count	Employment	Revenue
Panel (a): Average Treatment Effects			
All Census Tracts	-0.004	-0.088	-0.021**
	(0.008)	(0.105)	(0.010)
Adjusted R-squared	0.726	0.839	0.859
Observations	399,076	399,076	399,076
Panel (b): Conditional Average Treatment Effects			
Urban Census Tracts	-0.004	-0.065	-0.022**
	(0.009)	(0.116)	(0.011)
Rural Census Tracts	-0.007	-0.257	-0.016
	(0.020)	(0.173)	(0.013)
Adjusted R-squared	0.726	0.839	0.859
Observations	399,076	399,076	399,076

Note. The table shows estimates of the corporate practice entry effect on the count, employment, and revenue of independent veterinary practices using a linear regression model. I scaled the revenue by $1,000,000. All regressions include census tract fixed effects, time dummies, and linear market trends. Standard errors are adjusted for within-cluster correlation at the market-year level. *** , ** , and * indicate statistical significance at the 1 percent, 5 percent, and 10 percent confidence levels, respectively.

Table A.7: Concepts of Rurality.

	Count	Employment	Revenue
Panel (a): Census Bureau Definition of Rurality			
Urban Census Tracts	-0.028***	-0.063***	-0.079***
	(0.007)	(0.009)	(0.012)
Rural Census Tracts	0.043**	-0.019	-0.003
	(0.018)	(0.020)	(0.022)
Pseudo R-squared	0.200	0.609	0.841
Observations	576,849	576,849	576,849
Panel (b): RUCA Codes 4 to 7 and 8 to 10			
Metropolitan Census Tracts	-0.030***	-0.062***	-0.076***
	(0.007)	(0.009)	(0.012)
Micropolitan Census Tracts (RUCA 4 to 7)	0.038*	-0.016	-0.005
	(0.021)	(0.023)	(0.025)
Rural Census Tracts (RUCA 8 to 10)	0.129***	-0.111**	-0.145**
	(0.036)	(0.057)	(0.063)
Pseudo R-squared	0.200	0.609	0.841
Observations	576,849	576,849	576,849

Note. The table shows estimates of the corporate practice entry effect on the count, employment, and revenue of independent veterinary practices for different concepts of rurality. Panel (a) uses the Census Bureau's definition of metropolitan and micropolitan statistical areas (U.S. Census Bureau 2022). I follow their procedure and define all census tracts in non-metropolitan as rural. Panel (b) uses the RUCA codes to distinguish metropolitan from micropolitan and other census tracts (Economic Research Service 2022). All regressions include census tract fixed effects, time dummies, and linear market trends. Standard errors are adjusted for within-cluster correlation at the market-year level. ***, **, and * indicate statistical significance at the 1 percent, 5 percent, and 10 percent confidence levels, respectively.

Table A.8: Treatment Heterogeneity.

	Count	Employment	Revenue
Panel (a): Over Time			
2001 to 2005	0.033***	0.004	0.032**
	(0.012)	(0.015)	(0.016)
2006 to 2010	-0.001	-0.021**	-0.019
	(0.010)	(0.011)	(0.013)
2011 to 2015	0.006	-0.048***	-0.060***
	(0.008)	(0.009)	(0.012)
2016 to 2021	-0.050***	-0.087***	-0.112***
	(0.008)	(0.009)	(0.013)
Pseudo R-squared	0.200	0.609	0.841
Observations	576,849	576,849	576,849
Panel (b): Between Census Regions			
Northeast	0.011	-0.036*	-0.056**
	(0.019)	(0.020)	(0.023)
Midwest	0.039***	-0.011	-0.079***
	(0.014)	(0.013)	(0.017)
South	-0.032***	-0.037***	-0.051***
	(0.010)	(0.013)	(0.019)
West	-0.055***	-0.126***	-0.106***
	(0.015)	(0.019)	(0.024)
Pseudo R-squared	0.200	0.609	0.841
Observations	575,715	575,715	575,715
Panel (c): Across Practice Formats			
Entry Effect	-0.103***	-0.099***	-0.117***
	(0.007)	(0.007)	(0.010)
Pseudo R-squared	0.128	0.591	0.899
Observations	498,978	498,978	498,978

Note. The table shows estimates of treatment heterogeneity for the corporate practice entry effect on the count, employment, and revenue of independent veterinary practices. I present interaction effects by the panel period in Panel (a) and by the census region in Panel (b). Panel (c) shows estimates which include standalone doctors of veterinary medicine. All regressions include census tract fixed effects, time dummies, and linear market trends. Standard errors are adjusted for within-cluster correlation at the market-year level. ***, **, and * indicate statistical significance at the 1 percent, 5 percent, and 10 percent confidence levels, respectively.

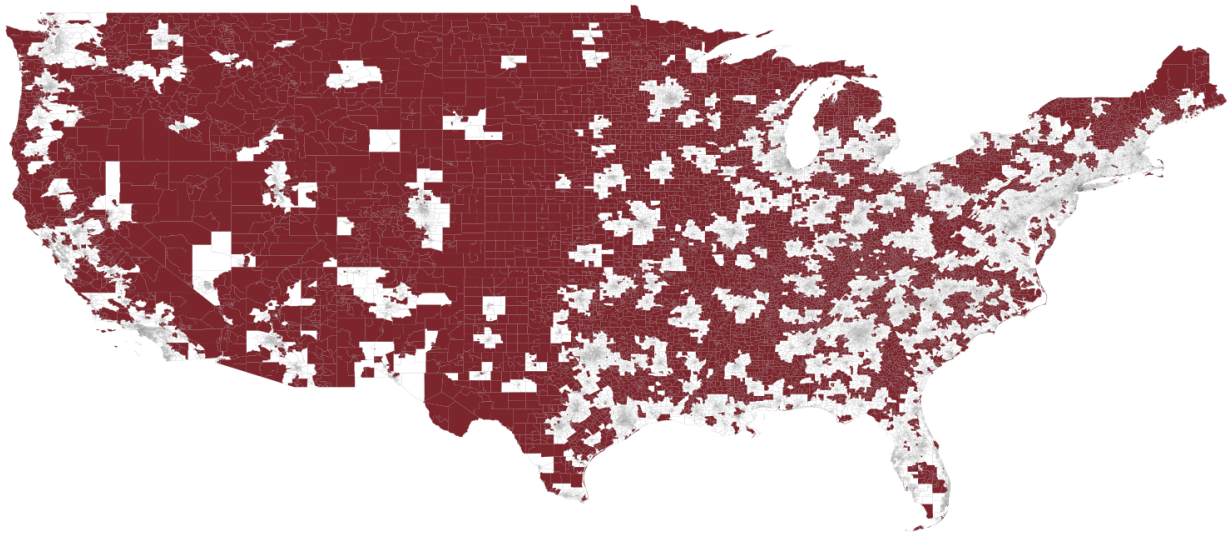


Figure A.1: Rural Census Tracts.

Note. The figure shows rural census tracts in the continental United States. I define rural census tracts based on RUCA codes 4 to 10. Appendix Table A.2 provides a description of these codes. The census tract shapes are simplified.