Entry, Growth, and Exit Patterns in the Home Healthcare Industry*

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Abstract

The expansion of home healthcare could allow the elderly to gain easy access to medical services in rural areas. Although most of the previous studies focus on the impact of the use of home healthcare on hospital discharge or the determinants of geographical variation, we examine the entry, growth, and exit patterns of home healthcare providers using detailed establishment-level data from Texas. Our results indicate that the number of home care providers almost doubled in Texas between 2000 and 2006; hence, the average distance between households and home care establishments decreased by more than 50 percent. We also find that entrants can enjoy localized economies in the presence of firms that provide complementary medical services, while they tend to avoid areas with more competing institutions, such as hospitals, that provide alternative medical services. Our results also provide strong evidence for the spatial persistence of employment in the home care industry.

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Keywords: Home healthcare, thin markets, entry, growth, exit.

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1 Introduction

Growth and spatial proliferation of home healthcare entrepreneurs (agencies) has been impressive over the last 20-30 years. The home healthcare model for seriously ill individuals has been a means of reducing the length of hospital stays and providing care in a more congenial setting of the person's home or that of a caregiver. This is an extension of traditional healthcare settings such as hospitals, nursing homes, and, to some extent, out-patient clinics.

However, it is not difficult to understand the appeal of spending less time in either the hospital or nursing home setting, home healthcare offers third-party payers a relatively low-cost option for ensuring recovery, rehabilitation, and palliative care. Indeed, in 2015, the average cost per episode for home healthcare services was on the order of $3,000 as compared to $18,000 for skilled nursing, $19,000 for in-patient rehab, and nearly $41,000 for long-term acute care hospitals; however, it is unclear whether the severity of episodes were controlled for (Livingston, 2018).

It would be interesting to conduct a spatial analysis of the expanding spatial distribution of home healthcare agencies (HHAs) in early stages of the industry evolution or representative sample years. In this study, we treat HHAs as substitutes for and lower-cost extensions of traditional acute care hospitals. In both cases, we analyse the geographic spread of HHAs as a function of localized demographic characteristics and existing healthcare providers. We quantify the average reduction in the distance between population centres and HHAs at small levels of spatial disaggregation as increased spatial dispersion of HHAs takes place. Indeed, reduction in the distance between household concentrations and HHAs has two important effects. This implies both enhanced access to home healthcare for individuals, and shorter travel times for providers, which lowers the cost of services in a setting with minimal economies of scale in the production of healthcare services. Furthermore, if home healthcare is to be accessible and competitive, then firm entries and growth should occur.

Our study analyses the entry, growth, and exit in the home healthcare industry. We specifically examine (i) entry decisions, (ii) exit decisions, and (iii) growth, conditional on no exits. Furthermore, our study focuses on the home healthcare industry in Texas for the years

2000-2006. We select these years for two reasons. First, this was an expansionary period, at least in Texas. Second, we have detailed data from the Quarterly Census of Employment and Wages for all Texas. This enables us to identify all establishments in the given six-digit NAICS of the healthcare services industry and pinpoint their exact geographical locations.[1] Working at the census tract level, we can view the entry of HHAs and surrounding competition and demographic characteristics at a relatively small geographic scale. Limiting the analysis to the state of Texas is, in fact, not overly limiting, given its size and industrial diversity.[2] Perhaps of equal value is the structural homogeneity that a single jurisdiction affords both in terms of the regulatory and insurance environment, as well as Medicare reimbursement allowances. Moreover, the state has experienced high rates of economic growth, and thus provides a dynamic environment in which to conduct the analysis.

According to Ellenbecker (1995), the growth rate of government expenditure on home healthcare increased at an annual average rate of 30% since 1974. This growth rate is expected to continue to increase owing to the aging population and advances in medical technology. In addition, Medicare beneficiaries' use of home healthcare significantly increased (Mauser and Miller, 1994). Ellenbecker (1995) finds that an increase in competition improves patient access to most health services and increases the costs of home healthcare services.

Welch et al. (1996) investigate whether home healthcare replaces hospital care, using 1993 data from Medicare's National Claims History. They find no strong evidence that home health visits substitute for hospital services in terms of hospital days and hospital admissions. Kenney and Dubay (1992) examine factors associated with geographic variations in the use of Medicare home health services. Their empirical results show that Medicare enrolees are likely to use more home healthcare in urban areas with a limited supply of nursing home beds, high discharge rates, short hospital stay, and more home health agency services. Similarly, Mauser and Miller (1994) report a negative relationship between the number of nursing home beds

[1]This dataset was used by De Silva et al. (2012a, 2012b, 2017, 2021). A detailed description and the source of this dataset are provided in Section 2.

[2]Texas is an attractive setting to consider given its size. It is the second largest state in the U.S., both geographically and economically (with a gross state product of $1.6 trillion dollars in 2016). Its economy would rank 14^{th} in the world in terms of its gross state product relative to national gross domestic product. It contains significant geo-physical diversity and is home to 25 separate Metropolitan Statistical Areas (MSAs).

and home health utilization, implying that they are substitutes. Through their analysis, they expected Medicare beneficiaries to receive more home healthcare with advances in medical technology. Consistent with the findings of the present study, Johnston et al. (2000) find empirical evidence that remote video technology ensures high-quality home healthcare with the potential for cost-effectiveness.[3]

This study also contributes to the *thin market* literature. Specifically, the overall access to home healthcare in local markets is determined by whether the supply is sufficiently thick or thin. The effective supply could be quite thin, with few providers, which affects the level of home healthcare in the given areas. Therefore, individuals pay high transportation costs to access health services. In addition, we speculate that there will be very low competition, but high market power, in which individual providers have a significant influence on the market price. Therefore, policymakers should encourage the entry of other providers to compete. Only a few studies consider thin healthcare markets, but, unlike our study, they focus on markets with thinner demand. For example, Cleveland and Krashinsky (2009) find that nonprofit childcare centres provide higher quality than commercial childcare centres only when the demand is sufficiently high. They also argue that financial support for nonprofit centres should be considered to improve quality in thin markets. Lewis et al. (2012) report that information communication technology is increasingly employed in low- and middle-income countries to extend geographic access to healthcare and provide high-quality care. Meagher et al. (2016) investigate how the Swedish market for children's residential care was transformed into a thin but highly profitable market by promoting privatization.

In this study, we find empirical evidence that home care providers enjoy localized economies from neighbouring home care establishments in the census tract. That is, potential home healthcare providers are likely to enter locations with more home care suppliers, whereas incumbents are less likely to exit the market. By contrast, our empirical results support the spatial persistence of employment in the home healthcare industry.

The remainder of this article is organized as follows. The next section describes the data

[3]Thune and Mina (2016) comprehensively review the literature on the role of hospitals in generating innovation in the healthcare sector.

and economic models for our empirical analysis. Section 3 discusses the empirical results, and Section 4 offers concluding remarks.

2 Data and Economic Model

2.1 Data

We identify home care firms in Texas using the six-digit North American Industrial Classification System (NAICS). Firm-level data are from the Quarterly Census of Employment and Wages (QCEW) of the Texas Workforce Commission. This dataset provides detailed information on each establishment in the state between 1999 and 2006. Specifically, our dataset covers each firm's physical address, startup date, monthly employment, and wages. Each establishment was uniquely identified by its employer identification number (EIN).[4] We define the market entry and exit of an establishment by observing the first appearance and disappearance of EIN in the QCEW data. This method of identifying entries and exits has been used elsewhere. For example, Dunne et al. (1988, 1989) and De Silva and McComb (2012a, 2012b) use this definition of entry and/or exit in their analyses of firm entry and/or exit. Identifying the geographical extent to which agglomeration or local competition effects occur is crucial. City or county divisions are not well-defined because of their its different geographic scale across areas. Therefore, we use the U.S. census tracts in this study. This definition is also beneficial as we can easily obtain tract-level demographic data.

[4]The authors obtained these data under an agreement of confidentiality, and the disclosure of the actual data is subject to certain restrictions.

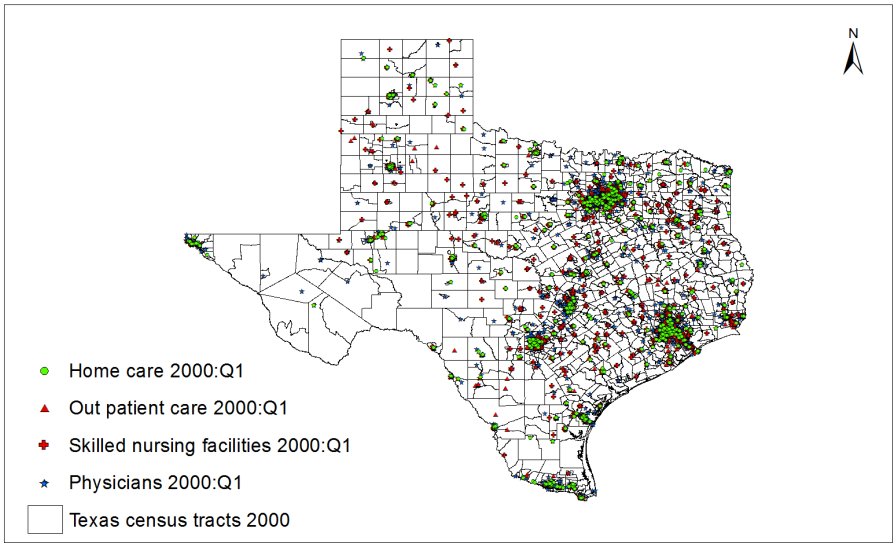
Table 1: Summary statistics for healthcare services

Year	Tracts with at least one establishment	Population in 100,000	Establishment per population	Average distance (in miles)	Average number of employees	Average wage in $
Panel A: Home healthcare providers						
2000	709	208.518	5.227	2.447	115.633	5,034
2001	793	213.250	5.805	2.211	111.992	5,196
2002	896	217.799	6.584	1.944	106.560	5,436
2003	1,001	221.185	7.686	1.642	104.693	5,668
2004	1,093	224.900	8.635	1.395	99.196	5,978
2005	1,155	228.600	9.523	1.205	93.193	6,652
2006	1,298	235.078	11.677	1.054	88.277	6,813
Panel B: Hospitals						
2000	399	208.518	2.503	2.629	802.778	10,864
2001	455	213.250	2.875	2.311	754.154	11,243
2002	508	217.799	3.186	1.958	712.957	11,755
2003	534	221.185	3.508	1.681	668.922	11,834
2004	560	224.900	3.655	1.421	628.238	12,230
2005	571	228.600	3.823	1.302	586.594	12,190
2006	567	235.078	3.952	1.426	588.229	11,712
Panel C: Outpatient clinics						
2000	523	208.518	3.424	2.631	35.515	12,359
2001	571	213.250	3.756	2.389	33.823	12,052
2002	617	217.799	4.027	2.110	29.461	12,514
2003	670	221.185	4.435	1.921	30.278	12,356
2004	709	224.900	4.802	1.794	28.639	12,932
2005	721	228.600	5.101	1.479	28.783	12,992
2006	796	235.078	5.645	1.213	27.961	12,602
Panel D: Skilled nursing home facilities						
2000	569	208.518	3.218	3.252	105.212	4,921
2001	695	213.250	3.911	2.432	99.688	5,138
2002	844	217.799	4.894	1.665	90.908	5,328
2003	918	221.185	5.724	1.526	88.208	5,672
2004	943	224.900	5.803	1.458	87.546	5,815
2005	946	228.600	5.814	1.434	87.548	6,122
2006	973	235.078	6.189	1.413	85.448	6,425
Panel E: Physician facilities						
2000	2,058	208.518	56.868	1.359	10.454	24,843
2001	2,170	213.250	61.571	1.191	11.013	25,094
2002	2,261	217.799	67.034	1.078	11.761	25,113
2003	2,355	221.185	71.714	0.990	11.307	24,545
2004	2,424	224.900	75.482	0.967	11.172	24,878
2005	2,442	228.600	76.474	0.953	11.203	25,281
2006	2,503	235.078	81.135	0.934	11.397	25,900

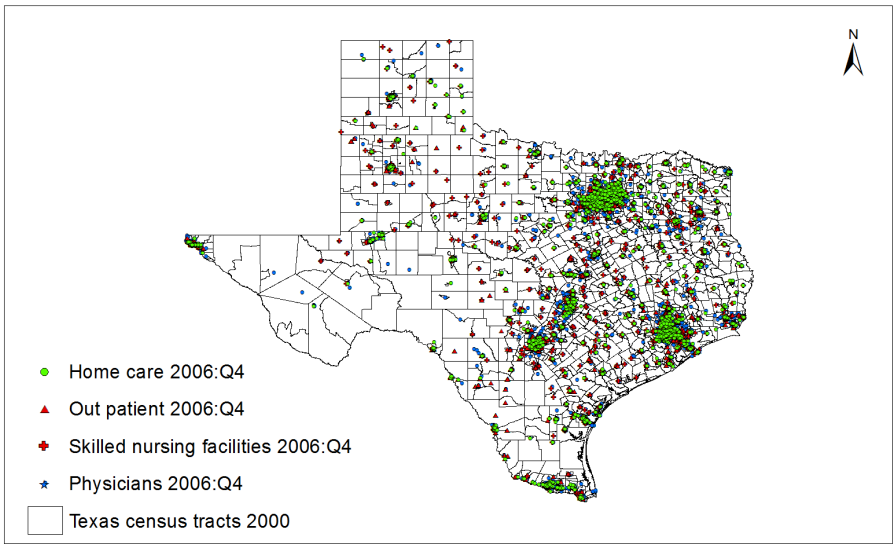
We distinguish five healthcare services based on NAICS codes to compare different growth patterns across healthcare services, such as home healthcare, hospitals, outpatient clinics, skilled nursing facilities, and physicians. Table 1 presents the summary statistics for the healthcare services in our sample. At first glance, the number of tracts with at least one establishment in each industry increased. Thus, we can infer that geographical access to healthcare services has improved. For example, only less than 23% of the areas had at least one home healthcare provider in 2000, but reached approximately 43% in 2006. Rural and remote areas are likely to have better access to healthcare in Texas. In addition, we see considerable variation in the number of establishments per 100,000 population during the sample period. With home healthcare services, the number of establishments more than doubled, from 5.227 in 2000 to 11.677 in 2006. In terms of changes in population and establishments, the number of healthcare providers is growing faster than the population in Texas.

The geographical proximity of services to people's homes decreased significantly. In 2006, any individual could access home healthcare within a 1.1 mile radius. This table also shows a notable change in the average number of employees. For instance, the five services may have a greater dependence on the supply of skilled labour which is limited by local labour supply. The number of establishments increases while the average number of employees declined, except for physician services, which means that the labour supply is inelastic in the local healthcare market. We can also infer that the size of establishments decreased, on average, as measured by the total number of employees. Lastly, the last column shows that average wage growth appears to be maintained at a similar level during this period. Poor wage growth in outpatient clinics was followed by that in physician services. Note that the poor wage growth in physicians' services is uniquely accompanied by employment growth.

Figure 1 displays the substantial changes in the distribution of home care establishments between Q1:2000 and Q4:2006. Home care firms are located close to other firms in certain areas. They are not uniformly distributed across Texas, and their concentrations remain stable over our sample period. Another important feature is the large turnover of establish-

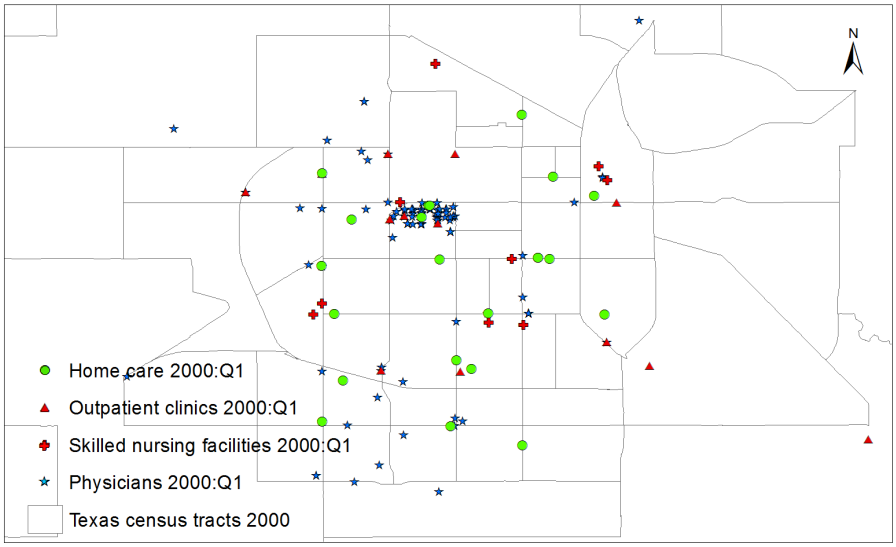


(a) Panel A: Texas in 2000: Q1

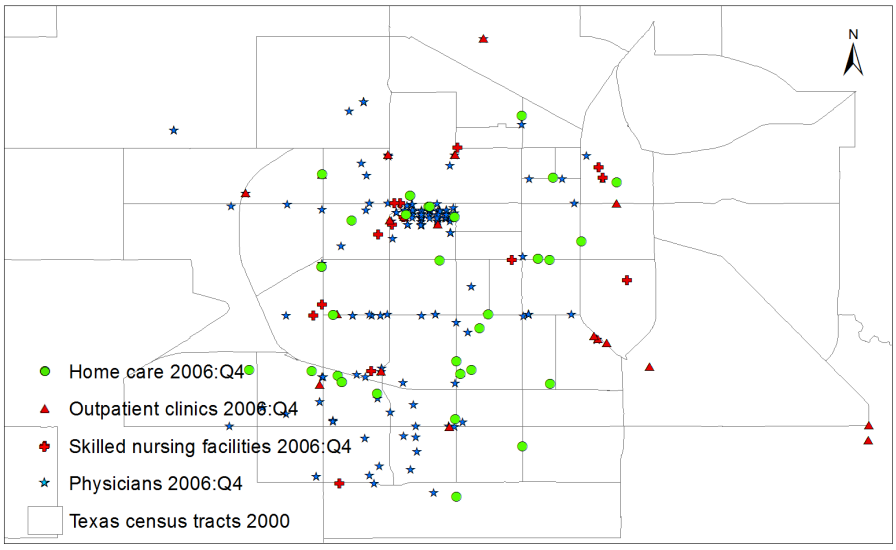


(b) Panel B: Texas in 2006: Q4

Figure 1: Distribution of Healthcare-Related Facilities in Texas



(a) Panel A: Lubbock County, 2000: Q1



(b) Panel B: Lubbock County, 2006: Q4

Figure 2: Distribution of Healthcare-Related Facilities in Lubbock County

ments in the home care industry. Figure 2 illustrates the concentration of these home care establishments in Lubbock, a suburban area of Texas, between Q1:2000 and Q4:2006. We note the low concentration, relative to the state's MSAs. Less urbanized areas are less likely to attract a cluster of home care establishments.

Table 2: Tract-level summary statistics

Variable	Mean	Standard deviation
Number of Tracts	4,388	
Average number of home care providers$_{l,t}$	0.378	1.099
Average number of hospitals$_{l,t}$	0.164	0.616
Average number of outpatient clinics$_{l,t}$	0.182	0.580
Average number skilled nursing home facilities$_{l,t}$	0.203	0.516
Average number of physician facilities$_{l,t}$	3.431	12.365
Average number of employees in home care providers$_{l,t}$	36.948	197.608
Average number of employees in hospitals$_{l,t}$	107.508	1,005.871
Average number of employees in outpatient clinics$_{l,t}$	6.153	64.491
Average number of employees in skilled nursing home facilities$_{l,t}$	19.662	73.471
Average number of physicians$_{l,t}$	37.348	173.981
Average median income (in \$10,000)$_{l,t}$	4.377	2.270
Average number of amenity establishments $_{l,t}$	5.470	12.753
Average number of roads$_{l}$	13.006	11.974
Average unemployment rate$_{l,t}$	4.512	3.402
Average population (in 1,000)$_{l,t}$	5.056	2.885
Average land area (in 100 in square miles)$_{l}$	0.634	2.351
Tract is located in a boarder county$_{l}$	0.162	0.368

Further, Table 2 provides summary statistics for the tract-level characteristics. We obtain the census-based covariates in a given year by linearly interpolating the Census data from 2000 to 2010. The average number of home care providers was even greater than twice the average number of hospitals per tract. However, the average number of employees at

hospitals is three times higher than that of home care providers. The average income per tract during the sample period in Texas is $43,770. Note that in our empirical analysis, we categorize median income into four groups: (less than $30,000; $30,000-$60,000; $60,000-$100,000; more than $100,000).

2.2 Economic Model

We empirically model the location decision of healthcare establishments as a conditional logit framework. Suppose the existence of L location choices with $l = 1, \ldots, L$. If firm i locates in area l at time t, its profit function is

$$\pi_{ilt} = \mathbf{X}'_{lt}\boldsymbol{\beta} + \mathbf{W}'_{l}\boldsymbol{\gamma} + \mathbf{Z}'_{ilt}\boldsymbol{\delta} + \varepsilon_{ilt}.$$

$\mathbf{X}_{lt}$ is a vector of time-variant explanatory variables specific to each tract, such as median income, number of amenity establishments, unemployment rate, and population. The vector $\mathbf{W}_l$ also includes tract-specific time-invariant characteristics such as number of roads and the land area of a tract. $\mathbf{Z}_{ilt}$ captures agglomeration and local competition effects, measured by counting the number of firms in a given tract. Finally, we assume ε_{ilt} is independently and identically distributed (IID) according to a type value I distribution. Then, firm i chooses tract l if and only if the area yields the highest expected profit. We can show that

$$\pi_{ilt} > \pi_{ikt} \quad \text{for all} \quad l \neq k.$$

Following the method in McFadden (1974), we can write the probability of any firm i locating in tract l at time t among all the tracts as

$$\Pr(d_{ilt} = 1) = \frac{\exp(\mathbf{X}'_{lt}\boldsymbol{\beta} + \mathbf{W}'_{l}\boldsymbol{\gamma} + \mathbf{Z}'_{ilt}\boldsymbol{\delta})}{\sum_{l=1}^{L} \exp(\mathbf{X}'_{lt}\boldsymbol{\beta} + \mathbf{W}'_{l}\boldsymbol{\gamma} + \mathbf{Z}'_{ilt}\boldsymbol{\delta})},$$

where $d_{1lt} = 1$ when firm i chooses location l at time t and $d_{1lt} = 0$ otherwise.

As in entry exercise, we also consider home care firm's decision to exit the industry using

a conditional logit model. The dependent variable is a binary variable equal to one when a firm exits a given year and zero otherwise. A positive (negative) coefficient estimate indicates that firms are more (less) likely to exit the market. To estimate a firm's growth, we employ a censored regression. Specifically, we regress the log of the end-of-period employment on initial employment and initial market structure at a given location, including the other initial values for the covariates. This approach is similar to that taken by Deltas et al. (2019).

3 Empirical Results

In Table 3, we first present home care firms' entry and exit years over the sample period. For example, 210 new establishments entered the home care market in 2000. Of these new entrants, 4, 3, 12, 15, 7, and 7 firms exited the industry from 2000 to 2006, respectively. Only a few observations lie on the diagonal matrix, indicating that few new entrants immediately exited the market in the initial year and most entrants survived longer in subsequent years. During the sample period, 2,069 new establishments entered and only 400 of them failed by the end of the period. Next, we report the results from the empirical estimations.

Table 3: Entry and exit of home healthcare providers by year

Entry	Total	Exit year						Total
year	entry	2001	2002	2003	2004	2005	2006	exit
2000	210	4	3	12	15	7	7	48
2001	142		6	17	17	7	8	55
2002	197		4	33	23	15	7	82
2003	282				37	23	9	69
2004	349				28	33	19	80
2005	417					26	29	54
2006	472						12	12
Total	2,069	4	13	62	120	110	91	400

We use a conditional logit model and report our entry decision results in Table 4. The dependent variable is the tract chosen by each establishment during a certain period. The set of covariates in this study includes local competition and agglomeration, socioeconomic and demographic characteristics, the availability of amenities, and convenient transport connections in a tract. For local agglomeration factors, we find evidence that a location with more complementary firms is more likely to attract new firms, while entrants tend to avoid locations with more competitors, such as hospitals. This finding is consistent with the view that entrants could benefit from the presence of other firms in the same industry that provide complementary medical services. When considering the relationship between entry and income distribution, we find that entrants are unlikely to be present throughout the income distribution. Instead, we see a higher probability of an entrant choosing an area with income levels at the mean of the income distribution.

Table 4: Conditional logit regression results: Entries

Variable	(1)	(2)
Number of incumbent home care establishments$_{l,t}$	0.166***	0.164***
	(0.003)	(0.003)
Number of incumbent hospitals$_{l,t}$	-0.155***	-0.156***
	(0.035)	(0.035)
Number of incumbent outpatient clinics$_{l,t}$	0.016	0.027
	(0.027)	(0.027)
Number of incumbent skilled nursing home facilities$_{l,t}$	0.334***	0.291***
	(0.029)	(0.031)
Number of incumbent physician establishments$_{l,t}$	0.012***	0.012***
	(0.001)	(0.001)
Median income$_{l,t}$: <\$30,000	-0.071	-0.101
	(0.080)	(0.080)
Median income$_{l,t}$: \$30,000 - <\$60,000	0.131***	0.136***
	(0.028)	(0.028)
Median income$_{l,t}$: \$60,000 - <\$100,000	-0.041	-0.033
	(0.034)	(0.034)
Median income$_{l,t}$: $\geq$\$100,000	-0.082	-0.083
	(0.054)	(0.054)
Number of incumbent amenity establishments$_{l,t}$	0.005***	0.005***
	(0.001)	(0.001)
Number of roads$_{l}$	-0.000	-0.000
	(0.002)	(0.002)
Unemployment rate$_{l,t}$	0.013*	0.017**
	(0.007)	(0.007)
Population (in 1,000)$_{l,t}$	0.058***	
	(0.006)	
Population $<$ 65 (in 1,000)$_{l,t}$		0.058***
		(0.006)
Population $\geq$ 65 (in 1,000)$_{l,t}$		0.073***
		(0.007)
Land area (in square miles)$_{l}$	-0.142***	-0.152***
	(0.028)	(0.029)
Border county$_{l}$	Yes	Yes
Log likelihood	-16,059.944	-16,048.139
χ^2	2,231.740	2,255.350
Number of tracts	4,388	4,388
Number of entrants	2,069	2,069

Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 5: Conditional logit regression results: Entries in MSAs

Variable	(1)	(2)
Number of incumbent home care establishments$_{l,t}$	0.165***	0.163***
	(0.003)	(0.004)
Number of incumbent hospitals$_{l,t}$	-0.196***	-0.192***
	(0.039)	(0.039)
Number of incumbent outpatient clinics$_{l,t}$	0.031	0.036
	(0.029)	(0.029)
Number of incumbent skilled nursing home facilities$_{l,t}$	0.314***	0.285***
	(0.033)	(0.034)
Number of incumbent physician establishments$_{l,t}$	0.013***	0.012***
	(0.001)	(0.001)
Median income$_{l,t}$: <\$30,000	-0.058	-0.074
	(0.087)	(0.087)
Median income$_{l,t}$: \$30,000 - <\$60,000	0.141***	0.143***
	(0.030)	(0.030)
Median income$_{l,t}$: \$60,000 - <\$100,000	-0.050	-0.046
	(0.035)	(0.035)
Median income$_{l,t}$: $\geq$\$100,000	-0.083	-0.082
	(0.054)	(0.053)
Number of incumbent amenity establishments$_{l,t}$	0.005***	0.005***
	(0.001)	(0.001)
Number of roads$_{l}$	0.001	0.001
	(0.002)	(0.002)
Unemployment rate$_{l,t}$	0.013*	0.015**
	(0.008)	(0.007)
Population (in 1,000)$_{l,t}$	0.058***	
	(0.007)	
Population $<$ 65 (in 1,000)$_{l,t}$		0.058***
		(0.007)
Population $\geq$ 65 (in 1,000)$_{l,t}$		0.071***
		(0.008)
Land area (in square miles)$_{l}$	-0.299***	-0.317***
	(0.071)	(0.072)
Border county$_{l}$	Yes	Yes
Log likelihood		
χ^2		
Number of tracts		
Number of entrants		

Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 5: Conditional logit regression results: Entries in non-MSAs

Variable	(1)	(2)
Number of incumbent home care establishments$_{l,t}$	0.721***	0.715***
	(0.039)	(0.039)
Number of incumbent hospitals$_{l,t}$	0.212**	0.169*
	(0.097)	(0.098)
Number of incumbent outpatient clinics$_{l,t}$	-0.125	-0.126
	(0.104)	(0.105)
Number of incumbent skilled nursing home facilities$_{l,t}$	0.301***	0.282***
	(0.081)	(0.080)
Number of incumbent physician establishments$_{l,t}$	-0.005	-0.007
	(0.007)	(0.007)
Median income$_{l,t}$: <\$30,000	0.102	0.015
	(0.223)	(0.225)
Median income$_{l,t}$: \$30,000 - <\$60,000	0.024	-0.003
	(0.126)	(0.124)
Median income$_{l,t}$: \$60,000 - <\$100,000	-0.322	-0.380
	(1.144)	(1.277)
Median income$_{l,t}$: $\geq$\$100,000		
Number of incumbent amenity establishments$_{l,t}$	0.019	0.012
	(0.012)	(0.012)
Number of roads$_{l}$	0.000	0.001
	(0.006)	(0.006)
Unemployment rate$_{l,t}$	0.049*	0.057**
	(0.027)	(0.025)
Population (in 1,000)$_{l,t}$	0.045	
	(0.032)	
Population $<$ 65 (in 1,000)$_{l,t}$		0.023
		(0.033)
Population $\geq$ 65 (in 1,000)$_{l,t}$		0.043
		(0.032)
Land area (in square miles)$_{l}$	-0.034	-0.032
	(0.027)	(0.027)
Border county$_{l}$	Yes	Yes
Log likelihood		
χ^2		
Number of tracts		
Number of entrants		

Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 5: Logit regression results: Exits

Variable	(1)	(2)
Number of incumbent home care establishments$_{l,t}$	-0.005	-0.005
	(0.012)	(0.012)
Number of incumbent hospitals$_{l,t}$	-0.032	-0.033
	(0.066)	(0.066)
Number of incumbent outpatient clinics$_{l,t}$	-0.032	-0.027
	(0.057)	(0.057)
Number of incumbent skilled nursing home facilities$_{l,t}$	0.134*	0.116
	(0.071)	(0.072)
Number of incumbent physician establishments$_{l,t}$	0.002	0.002
	(0.003)	(0.003)
Median income$_{l,t}$: <$30,000	-0.183	-0.200
	(0.196)	(0.196)
Median income$_{l,t}$: $30,000 - <$60,000	0.151**	0.152**
	(0.063)	(0.063)
Median income$_{l,t}$: $60,000 - <$100,000	0.015	0.023
	(0.069)	(0.070)
Median income$_{l,t}$: $\geq$$100,000	-0.043	-0.045
	(0.117)	(0.117)
Size$_{i,t}$	-0.002**	-0.002**
	(0.001)	(0.001)
Wage (in $ 10,000)$_{i,t}$	-0.021**	-0.021**
	(0.010)	(0.010)
Number of incumbent amenity establishments$_{l,t}$	0.001	0.001
	(0.001)	(0.001)
Number of roads$_{l}$	0.005	0.005
	(0.003)	(0.003)
Unemployment rate$_{l,t}$	-0.015	-0.010
	(0.018)	(0.018)
Population (in 1,000)$_{l,t}$	-0.023	
	(0.016)	
Population $<$ 65 (in 1,000)$_{l,t}$		-0.023
		(0.016)
Population $\geq$ 65 (in 1,000)$_{l,t}$		-0.017
		(0.018)
Land area (in square miles)$_{l}$	-0.086*	-0.088*
	(0.048)	(0.049)
Border county$_{l}$	Yes	Yes
Log likelihood	-1,465.000	-1,464.000
χ^2	41.230	42.000
Observations	6,223	6,223

Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 5: Logit regression results: Exits in MSAs

Variable	(1)	(2)
Number of incumbent home care establishments$_{l,t}$	-0.006	-0.007
	(0.012)	(0.012)
Number of incumbent hospitals$_{l,t}$	-0.016	-0.015
	(0.066)	(0.066)
Number of incumbent outpatient clinics$_{l,t}$	-0.019	-0.016
	(0.061)	(0.060)
Number of incumbent skilled nursing home facilities$_{l,t}$	0.158**	0.146*
	(0.078)	(0.078)
Number of incumbent physician establishments$_{l,t}$	0.001	0.001
	(0.003)	(0.003)
Median income$_{l,t}$: <$30,000	-0.363*	-0.378*
	(0.205)	(0.205)
Median income$_{l,t}$: $30,000 - <$60,000	0.178***	0.178***
	(0.068)	(0.068)
Median income$_{l,t}$: $60,000 - <$100,000	0.002	0.007
	(0.071)	(0.072)
Median income$_{l,t}$: $\geq$$100,000	-0.035	-0.036
	(0.117)	(0.116)
Size$_{i,t}$	-0.002**	-0.002**
	(0.001)	(0.001)
Wage (in $ 10,000)$_{i,t}$	-0.027**	-0.027**
	(0.012)	(0.012)
Number of incumbent amenity establishments$_{l,t}$	0.001	0.001
	(0.001)	(0.001)
Number of roads$_{l}$	0.003	0.003
	(0.004)	(0.004)
Unemployment rate$_{l,t}$	-0.015	-0.013
	(0.018)	(0.018)
Population (in 1,000)$_{l,t}$	-0.020	
	(0.017)	
Population $<$ 65 (in 1,000)$_{l,t}$		-0.019
		(0.017)
Population $\geq$ 65 (in 1,000)$_{l,t}$		-0.014
		(0.019)
Land area (in square miles)$_{l}$	-0.503**	-0.513**
	(0.249)	(0.251)
Border county$_{l}$	Yes	Yes
Log likelihood	-1,465.000	-1,464.000
χ^2	41.230	42.000
Observations	6,223	6,223

Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 5: Logit regression results: Exits in non-MSAs

Variable	(1)	(2)
Number of incumbent home care establishments$_{l,t}$	-0.131	-0.127
	(0.118)	(0.118)
Number of incumbent hospitals$_{l,t}$	-0.187	-0.195
	(0.284)	(0.286)
Number of incumbent outpatient clinics$_{l,t}$	-0.217	-0.211
	(0.262)	(0.262)
Number of incumbent skilled nursing home facilities$_{l,t}$	0.021	0.007
	(0.211)	(0.214)
Number of incumbent physician establishments$_{l,t}$	-0.017	-0.018
	(0.044)	(0.044)
Median income$_{l,t}$: <\$30,000	1.444**	1.441**
	(0.680)	(0.677)
Median income$_{l,t}$: \$30,000 - <\$60,000	-0.051	-0.085
	(0.260)	(0.303)
Median income$_{l,t}$: \$60,000 - <\$100,000	4.233*	3.981*
	(2.344)	(2.227)
Median income$_{l,t}$: $\geq$\$100,000		
Size$_{i,t}$	-0.000	-0.000
	(0.002)	(0.002)
Wage (in \$ 10,000)$_{i,t}$	0.008	0.008
	(0.025)	(0.025)
Number of incumbent amenity establishments$_{l,t}$	-0.001	-0.003
	(0.032)	(0.032)
Number of roads$_{l}$	0.028**	0.028**
	(0.013)	(0.013)
Unemployment rate$_{l,t}$	0.008	0.013
	(0.090)	(0.090)
Population (in 1,000)$_{l,t}$	0.064	
	(0.082)	
Population $<$ 65 (in 1,000)$_{l,t}$		0.057
		(0.081)
Population $\geq$ 65 (in 1,000)$_{l,t}$		0.063
		(0.082)
Land area (in square miles)$_{l}$	-0.152*	-0.147*
	(0.083)	(0.085)
Border county$_{l}$	Yes	Yes
Log likelihood	-176.900	-176.800
χ^2	29.060	29.520
Observations	823	823

Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

A positive estimate for number of amenity establishments indicates the availability of more amenities, holding other variables constant. This makes the tract more attractive for new firms. Transportation networks appear to have no statistically significant impact on home care entry. The coefficient for the population in a tract is statistically significant and positive, as expected. In particular, the number of people aged over 65 has a more positive impact than the number of people under age 65 on a firm's propensity to locate in the given tract. Additionally, we find a negative relationship between land area and the likelihood of entry in the given tract.

The results in Table 5 indicate that the number of incumbent home care establishments does not affect or has no statistically significant effect on a firm's survival. We have evidence that higher average employment (size covariate in the regression) in existing firms is associated with a lower rate of market exit. The coefficient on wages suggests a negative impact on exits (lower probability of exit). A higher wage level for a firm may indicate the firm's greater ability to produce and we can expect a firm to be more likely to survive longer in the market. We find no evidence that the availability of amenities, transportation networks, and other socioeconomic and demographic factors have significant impacts on a firm's exit decision.

Table 6: Censored regression results for employment growth

Variable	Number of employees in the final period$_{i,l,t}$			
	(1)	(2)	(3)	(4)
Log initial number of employees$_{i,t}$	0.706***	0.732***	0.651***	0.649***
	(0.016)	(0.015)	(0.019)	(0.019)
Log initial wage$_{i,t}$	-0.113***	-0.114***	-0.105***	-0.095***
	(0.027)	(0.027)	(0.027)	(0.027)
Log initial number of employees at rival home healthcare establishments$_{l,t}$	0.064***		0.211***	0.211***
	(0.014)		(0.024)	(0.024)
Log initial number of employees in hospital$_{l,t}$	-0.003		0.004	0.002
	(0.010)		(0.022)	(0.022)
Log initial number of employees at outpatient clinics$_{l,t}$	0.012		0.009	0.020
	(0.017)		(0.032)	(0.032)
Log initial number of employees at skilled nursing home facilities$_{l,t}$	-0.016		-0.001	0.006
	(0.012)		(0.023)	(0.023)
Log initial number of employees at physician establishments$_{l,t}$	0.013		0.016	0.017
	(0.015)		(0.028)	(0.028)
Log initial number of rival home healthcare establishments$_{l,t}$		-0.051	-0.527***	-0.531***
		(0.038)	(0.065)	(0.063)
Log initial number of hospitals$_{l,t}$		-0.059	-0.066	-0.065
		(0.062)	(0.125)	(0.123)
Log initial number of outpatient clinics$_{l,t}$		0.068	0.012	-0.038
		(0.060)	(0.107)	(0.108)
Log initial number of skilled nursing home facilities$_{l,t}$		-0.064	-0.020	0.008
		(0.063)	(0.121)	(0.119)
Log initial number of physician establishments$_{l,t}$		0.054*	0.015	0.024
		(0.028)	(0.052)	(0.052)
Log initial median income$_{l,t}$: <\$30,000	-0.202**	-0.205**	-0.176*	-0.143
	(0.097)	(0.100)	(0.095)	(0.092)
Log initial median income$_{l,t}$: \$30,000 - <\$60,000	-0.032	-0.058*	-0.061**	-0.060*
	(0.031)	(0.032)	(0.031)	(0.031)
Log initial median income$_{l,t}$: \$60,000 - <\$100,000	-0.035	-0.049	-0.027	-0.046
	(0.032)	(0.032)	(0.032)	(0.032)
Log initial median income$_{l,t}$: ≥\$100,000	-0.038	-0.036	-0.057	-0.049
	(0.034)	(0.031)	(0.038)	(0.037)
Log initial number of amenity establishments$_{l,t}$	-0.040	-0.012	-0.037	-0.031
	(0.028)	(0.028)	(0.028)	(0.028)
Log number of roads$_{l}$	-0.024	-0.028	-0.003	-0.007
	(0.041)	(0.041)	(0.041)	(0.041)
Initial unemployment rate$_{l,t}$	-0.025**	-0.021**	-0.022**	-0.025**
	(0.010)	(0.010)	(0.010)	(0.010)
Log initial population (in 1,000)$_{l,t}$	-0.117**	-0.071	-0.031	
	(0.047)	(0.048)	(0.047)	
Log initial population < 65 (in 1,000)$_{l,t}$				0.006
				(0.029)
Log initial population ≥ 65 (in 1,000)$_{l,t}$				-0.111***
				(0.038)
Log of land area (in square miles)$_{l}$	0.014	-0.002	-0.001	-0.000
	(0.024)	(0.024)	(0.023)	(0.022)
MSA county$_{l}$	Yes	Yes	Yes	Yes
Border county$_{l}$	Yes	Yes	Yes	Yes
Log likelihood	-3,037.000	-3,048.000	-3,000.000	-2,992.000
Observations	2,069	2,069	2,069	2,069

Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Table reports the weighted marginal effects.

Table 6 presents the estimation results for employment growth at an establishment. We can decompose these results into growth attributable to the initial number of employees at a home healthcare establishment and growth arising from the initial employment levels in the given location. The results indicate that initial number of employees and establishment in the home healthcare industry increase the number of employees at an establishment, supporting strong agglomeration effects. These results are consistent across all our specifications. Neither initial hospital employment nor the initial number of facilities (outpatient clinics, skilled nursing home facilities) are statistically significant determinants. Interestingly, while a firm's initial number of employees increases the growth of its employment, the initial number of rival home healthcare establishments is a hinderance. The more competitors in terms of employment among home healthcare establishments in the area, the more limited the employment growth of an establishment. Considering the other variables, the initial income in general seems to have a negative effect on growth while the initial number of amenities and transportation networks have no effects on employment growth statistically.

4 Conclusion

This study investigates the entry, growth, and exit patterns of the home healthcare industry. We use detailed data to identify all establishments and their exact locations. In addition, by working at the Census tract level, we analyse firm's behaviours at a relatively small geographic scale. Our empirical results provide reliable evidence that home healthcare providers benefit from localized economies. Potential entrants are likely to choose locations where more firms exist. The other factors, such as income levels, number of amenity establishments, unemployment rates, and population, play a significant role in home care firm entry or exit decisions. However, we find no evidence that transportation networks influence the probability of entry and exit. Instead, firm size and average wage positively affect survival in the industry. In addition, our empirical results support the spatial persistence of employment in the home healthcare industry.

Our empirical results suggest the policy implication that fostering industry clusters can

promote further growth in the home healthcare sector, as providers benefit from localized economies. While competition is vital for market efficiency, an excessive concentration of firms may constrain individual firm expansion, signalling the need for a balanced approach. Moreover, policies that target aging populations and support competitive wages are essential for the long-term sustainability of the home healthcare industry.

Disclosure Statement

No potential conflict of interest was reported by the authors.

Data availability statement

The authors obtained these data under an agreement of confidentiality, and the disclosure of the actual data is subject to certain restrictions.

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