Price and Income Elasticities of Demand for Canine Wellness Visits:
An Exploratory Analysis

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Background

Since 1997:

- fees for veterinary services *doubled* (vet price index rose to 216)
- dog owners who did not visit a veterinarian in prior year rose to 19%
- number of visits/year by dog owners who did visit declined by 18%
- alternative sellers of pet health services or products proliferated and
- veterinarians' incomes have stagnated compared to similarly educated professionals'
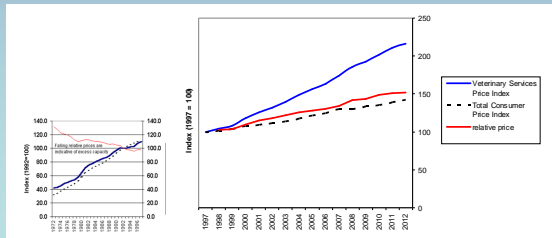
Sources: KMPG (1999); BLS (various years)

Question

Is an aggressive pricing strategy rational, or is the demand for veterinary services more price elastic than veterinarians implicitly believe?

Data

The 2012 Pet Demographic Survey (AVMA, 2012)

Nationwide scope; every five years (2002, 2007, 2012,...)
50,000 respondent households
Socioeconomic characteristics:
    age, family size, education, employment status, race, ethnicity, income, housing type, location
Pets and pet characteristics:
    numbers of dogs, cats, birds, ...
    each pet's age, sex, weight, breed, source, ...
Attitudes about pets and about veterinarians
by pet category (Dogs, cats, birds, horses, ...)
    Expenditure on the last/most recent visit to a veterinarian with dog(s)
        veterinary procedures at that last visit to a veterinarian (0/1)
    Total expenditure on veterinary care for the previous year on dog(s)
        veterinary procedures during the previous year (0/1)
    Total number of visits in previous year to the veterinarian with dog(s)
Pet health insurance (0/1)

The 2012 Veterinary Fee Reference (AAHA, 2012))

Nationwide scope; annual
~700 responding veterinary practices or hospitals
by location, size and type of practice,
    for each type of pet (dog, cat, horse, ...),
        for each age, sex, weight class (as appropriate):
            fee charged for each veterinary procedure or service,
            and percent change in fee charged since prior year

Data Issues

- Expenditure data on visit bundles confounds prices paid, quantities, and procedures purchased.

- PDS "amount spent" responses displayed far more variation than AAHA "fee charged" data.

Last visit:Exam only
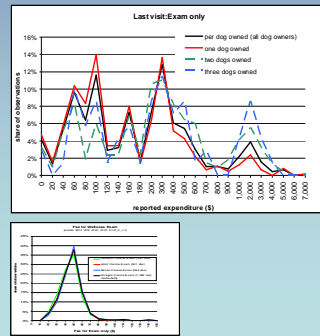
- How to measure the latent price faced by pet owners who did not visit a veterinarian in the year?

Solutions

- Focus on observations reporting "wellness visits" only (exam and/or vaccination) in the prior year, excluding outliers ($30 ≤ spent ≤ $250).

- Measure Q by the answer "times visited."

- Measure P by "spent"/ "times visited."

- Measure latent *P* using hedonic regression.

Hedonic Model of Expenditure on Last Visit consisting of Exam and/or Vaccination

variable	label	Coefficient	Std. Error	t-value
fee for exam	Constant	88.124	1.807	48.757
fee for vaccination	Vac	7.152	1.974	3.623
Atlantic	reg2	-3.930	4.081	-0.965
East North Central	reg3	-8.266	4.012	-2.060
West North Central	reg4	-16.573	4.522	-3.665
South Atlantic	reg5	2.361	4.210	0.561
East South Central	reg6	-10.520	5.078	-2.072
West South Central	reg7	-17.261	4.630	-3.728
Mountain	reg8	-24.273	4.491	-5.405
Pacific Region	reg9	-26.074	4.505	-5.788
commute zone, ln	lnCZpop	4.527	1.145	3.955
county	CoPop	-0.086	0.066	-1.304
pop. density (100s)	pd	0.047	0.021	2.228
250K-1 million	bc2	4.867	2.271	2.143
50-250K	bc3	10.796	3.211	3.363
20-50K adjacent	bc4	8.945	3.947	2.267
20-50K non-adjacent	bc5	10.739	6.941	1.547
2.5-20K adjacent	bc6	7.009	4.305	1.628
2.5-20K nonadjacent	bc7	15.955	5.779	2.761
< 2.5K adjacent	bc8	-5.209	9.754	-0.534
< 2.5K non-adjacent	bc9	23.421	9.929	2.359
% non-white	nw	0.139	0.059	2.359
labor force participtn rate	labor	0.423	0.190	2.231
county mean:median hhi	hhir	10.571	10.774	0.981
median income ($1,000)	hhi	0.521	0.088	5.915
# dogs < 1 yr	dogs1	-2.870	2.365	-1.214
# dogs 1-5 yrs old	dogs2	0.867	1.712	0.506
# dogs 6-10 yrs old	dogs3	5.112	1.692	3.021
# dogs 11 yrs or older	dogs4	4.613	1.992	2.316

Spending on canine "wellness visit" (exam and/or vaccinations)

	Mean	Minimum	Maximum
Observed (PDS subsample who spent $30-$250)	$94.14	$30.00	$250.00
Estimated using the hedonic model	$94.14	$41.58	$155.84
Simulated for non-consumers using hedonic model	$93.63	$45.61	$157.96

Demand Function Estimation

'Wellness Visits' per dog owner/ year	count	0	1	2	3	4	5	6	7	8	9	12	20	mean	var
	Freq	3330	1589	747	160	105	13	21	1	5	4	2	1	0.72	1.18

(1) Poisson Count Data Model

$$\lambda_i = \exp(X_i \beta) = e^{X_i \beta}$$

$$Q = e^{\alpha + \varepsilon \ln(P) + \eta(\ln Y) + \beta(\ln Y)Z + \gamma X}$$

where $ln(P)$ is the natural log of the price paid (estimated latent price for non-consumers), Y is household income, Z is the "(not) important" attitude variable interacted with $ln(Y)$, and X is a vector of socioeconomic characteristics, attitudes, and other variables.

Table 7. Base Poisson Model of the Demand for Canine Wellness Visits
Number of observations: 5,978; LogLikelihood: -6214.1

variable	Coefficient	Estimate	Robust SE	z-Value
constant	α	2.2975	0.2606	8.817
$ln(P)$	ε	-1.0358	0.0478	-21.691
$ln(Y)$	η	0.3099	0.0265	11.694
important*$ln(Y)$	β	0.6341	0.1255	5.052
age (HH head)	γ_{age}	0.002	0.0016	1.245
black	γ_{blk}	-0.1544	0.1567	-0.985
Hispanic	γ_{hisp}	-0.12	0.0853	-1.406
HH size	γ_{size}	-0.0576	0.0155	-3.729
insured	γ_{insrd}	0.3036	0.0891	3.409
#dogs <1yr	γ_{dogs1}	0.0737	0.0412	1.786
# dogs 2-5 yrs	γ_{dogs2}	0.2707	0.0262	10.327
# dogs 6-10 yrs	γ_{dogs3}	0.2451	0.0306	8.01
# dogs 11 older	γ_{dogs4}	0.1824	0.0374	4.881
important	γ_{impt}	-3.6445	0.5226	-6.974
pet is property	γ_{prpty}	-0.9245	0.2471	-3.741
1 if house	γ_{house}	0.0054	0.0519	0.105
1 if mobile home	γ_{mobile}	-0.4502	0.0925	-4.865
$ln(popdensity)$	γ_{lnpd}	0.0929	0.0112	8.317

Note:

Attitude variable "Important" = 1 if respondent did not agree that 'routine checkups are important for their pet.'

'Pet is property' =1 if respondent rated their dog as 'property' rather than 'a member of the family' or 'a companion.'

Oaxaca dummy =1 if household income < $35,000), D=0 otherwise, interacted with $ln(P)$ in "Oaxaca" models.

Weighting essentially reduced the number of zero patronage observations from 3330 to 2171, ~ 45% of the observations used to estimate the model.

Findings*

The binary choice to make a wellness visit to a veterinarian appears* to be **price elastic**.
   And the demand for canine wellness visits may* be:
1) price inelastic among current consumers
2) more price elastic among non-consumers who are nonetheless "in the market"
3) price elastic among poorer households
4) income inelastic among all potential consumers
5) ~unitary income elastic among those who do not think routine checkups are important.

Summary: Nine Models of Demand for Canine Wellness Visits

Model Specification	# Parameters	Log Likelihood	Estimated Elasticity Price	Estimated Elasticity Income
(6) Truncated Poisson (2,648 obs)	18	-2599.5	**0.52**	0.173
(1) Full Sample Poisson (6,505 obs)	18	-7316.0	0.622	0.2845
(9) Double Hurdle: in the market / out of the market	36	-6030.4	0.744 / 0.958	0.188 / 0.319
(4) Wtd Oaxaca Poisson: non-poor / poor	19	-5540.0	0.805 / 0.852	**0.170**
(5) Negative Binomial	19	-6193.8	1.01	0.413
(3) Oaxaca Poisson: non-poor / poor	19	-6205.9	1.021 / 1.072	0.206
(2) Poisson w/o outliers (5,978 obs)	18	-6214.1	1.04	0.406
(8) Single Hurdle	36	-5885.0	1.18	0.312
(7) Binary Choice	18	-3285.5	**1.76**	**0.428**

* All findings are tentative and preliminary given the ambiguity in PDS questions/responses, recall error, and other issues with the existing data.

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