AmAgri Antimicrobials in Agriculture

Time required by veterinarian to perform veterinary acts in routine: a regression analysis

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https://veteconomics.envt.fr/

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INRAE la science pour la vie, l'humain, la terre

Context

Veterinary activity

Public health

Private market: client-paid services

Veterinary practice: firm

Rational behavior: maximization of profit

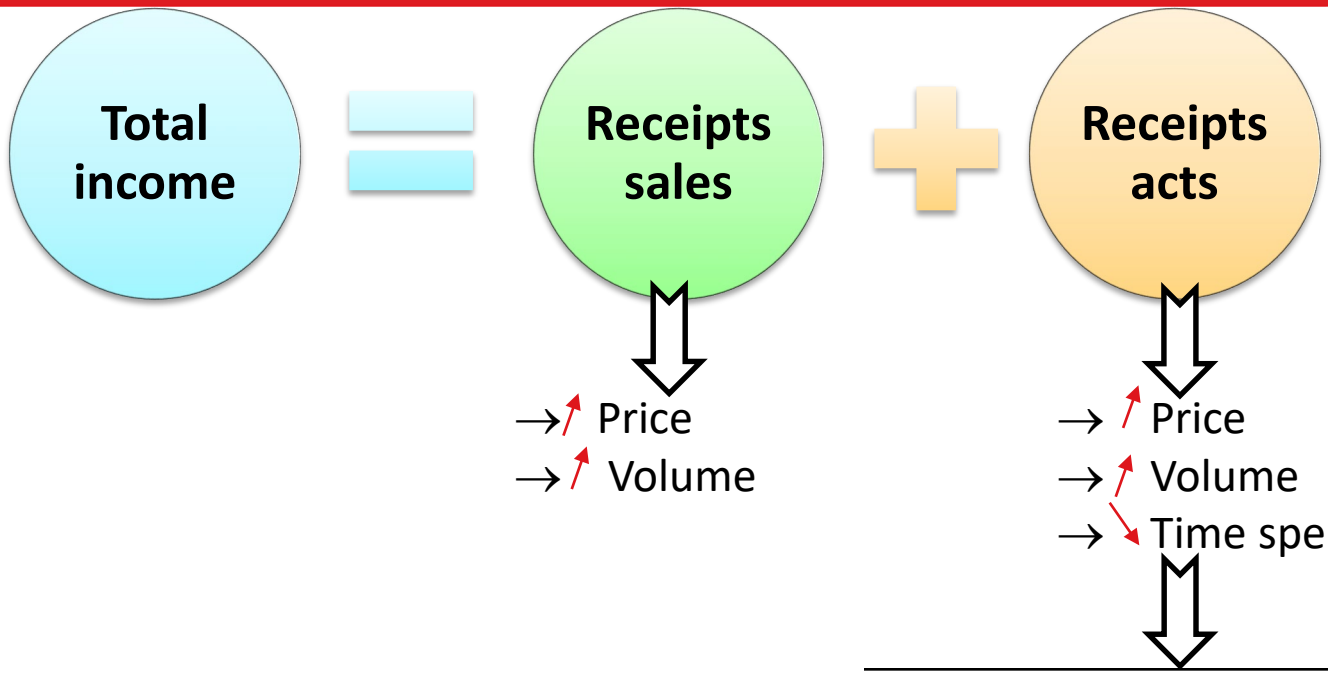
Context

Diversity of veterinary activity

Heterogeneity of veterinary activity (companion animal/farm animal/mix)

Supply of veterinary practices: health production + sales

Context



Invoiced value +	Time spent +
Invoiced value +	Time spent -
Invoiced value -	Time spent -
Invoiced value -	Time spent +

→ Objective : estimate the working time required to perform veterinary acts and identify the origin of the variation

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Material and Method : Data collection and mining

Sample of veterinary practices

Four veterinary general mixed practices (companion animals & farm producing animals)	5 to 12 associate/employed/assistants

Revenue

Average annual revenue for acts :1,200,000€	Average share for CA : 40% Average share for FPA : 56% Average share for equine : 4%

Material and Method : Data collection and mining

Dataset

- **215,398** observations
- Period **2015-2017**
- **22** sub-categories

Category	FPA consultation	CA consultation	Herd monitoring	CA surgery

- Similar sub-categories into FPA and equine activities have been grouped : the share of revenue for equine was low (4%) and the same act was expected to be equally time-consuming in these two sectors

- All categories considered similarly time-consuming according to author's experience, were grouped

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Material and method : Multivariable linear regression model

$$Y = \beta 0 + \beta 1X1 + \beta 2X2 + \ldots + \beta nXn + \varepsilon$$

Y : number of days worked (calculated) per month
X : number of activities per month, for each activity
β : time required to perform each activity

How to caculate the number of days worked per month?

Material and method: calculation of days worked per month

Hypothesis : day with an invoice made = day worked

The number of days worked during each of the 36 months by each veterinarian was calculated from ***the invoices dates***

How to validate the hypothesis?

Material and method: calculation of days worked per month

Comparison of declared average days worked per year and calculated average days worked per year for 3 veterinary practices

	Year	Average days worked per year declared (days/year)	Average days worked per year calculated (days/year)
Veterinary practice #1	2015	213	188
	2016	186	182
	2017	216	175
Veterinary practice #2	2015	209	197
	2016	216	187
	2017	215	187
Veterinary practice #3	2015	200	142
	2016	197	140
	2017	239	195

Results

	Estimate	Std.Error	P-value
FPA consultation	0.0859	0,006	<2e-16 ***
CA consultation	0.0546	0,005	<2e-16 ***
CA surgery	0.1793	0,018	<2e-16 ***
Herd monitoring	0.3286	0,054	<2e-16 ***

R2 = 69%

Interactions between activities are significant and showed an estimate of -0.002 for CA consultation * CA surgery, and -0.004 for FPA consultation * herd monitoring without any change in the order of magnitude for the other coefficients

Results

Assuming that veterinarians worked 9 hours per day in average

Veterinary act	Working time (minutes)	Confidence interval
FPA consultation	46	(95%CI=39-55)
CA consultation	29	(95%CI=19-36)
CA surgery	97	(95%CI=77-116)
Herd monitoring	177	(95%CI=159-190)

Discussion

→ Comparison of the results of two approaches (survey/data)

Veterinary act	Working time calculated based on a data approach	Working time declared based on a survey approach
CA consultation	29min	18min
CA surgery	97min	182min
FPA consultation	46min	41min
Herd monitoring	177min	48min

→ The results are slightly different between the two approaches,
→ The travelling time to the farms is not included in the herd monitoring time (survey approach),
→ The external validity of our results needs to be improved, but the method appears to be robust,

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Discussion

FPA consultation: 46min
Herd monitoring : 177min

CA consultation: 29min

Resources required for each activity are different

- Travel expenses
- Vehicles
- Depreciation of equipment

- Building cost
- Nurses
- Assistant salaries

Conclusion

- The use of the billing information for the calculation of working time , is an original approach and valorization of existing data,
- Interest in knowing the working time to qualify the economic model,
- Opening on work around other important parameters : billed rate of acts, environment …
- These results can therefore be used to calibrate a mathematical model whose objective is to optimize profit under time constraints,

Acknowledgements

- **Didier Raboisson**
- **Guillaume Lhermie**
- **Youba Ndiaye**
- **Ahmed Ferchiou**

Work supported by

VetFamily

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