

An Empirical Analysis of Hunting Lease Pricing and Value of Game in Sweden

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29th Jan, 2016

*Presented at 2016 Workshop on Evaluation of Ecosystem Services
Geneva-Switzerland*





Background & Motivation

- Hunting is an important activity undertaken by millions of people around the world
- Economic, Social and Cultural values are associated with hunting.
- Recreational hunting is big and growing, particularly in developed economies
 - Total value of recreational hunting in Sweden is 3 billion SEK (Mattson et al. 2008)
 - In the UK hunting tourism generates 12,000 jobs and revenues in excess of £5 million p.a (Murray and Simcos, 2003)
- There are associated costs as well
 - Wildlife damages to agriculture, forestry and motor accidents.

Hunting Lease Market in Sweden

- Hunting rights are vested in the hands of landowners
- Hunting teams purchase the right to hunt via lease from the landowners
- Leases can be long and short term.
- Hunting seasons for most valuable wildlife are regulated
- Main hunted species include moose, fallow deer, roe deer, wild boar.



Research Questions and Objective

- The importance of the hunting industry requires efficient regulation of the sector as well as mgt of wildlife populations to ensure sustainability.
- Key Question
 - What are the associated economic values of game species in Sweden?
 - How are hunting lease prices determined?
- Aim of the study
 - 1 To estimate the economic value of main hunted game species to inform policy on wildlife mgt and regulation of hunting industry.
- Approach: Hedonic pricing method

Empirical Strategy

- 1 Estimate the determinants of hunting lease prices via Hedonic price model $P = f(z, H, s)$
 - Estimate via OLS
 - Estimate using spatial models (SAC/SARAR)
- 2 Estimate Implicit values i.e. marginal WTP

Spatial spillovers can occur via 2 channels

- 1 Prices of an amenity in neighboring localities can exert upward or downward pressure on the price of the same amenity in a particular location.
- 2 Unobserved factors or omitted variables that affect amenity prices can be correlated over space

The Spatial-Autoregressive with Auto-correlated Errors Model (SAC/SARAR) accounts for these effects.

Data: Two year panel data from 54 Swedish municipalities.

Non-spatial model: pooled OLS

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	
Size of plot (log)	0.0896* (0.0474)	0.0877* (0.0460)	0.0859* (0.0454)	0.0654 (0.0527)	0.0393 (0.0465)	0.0747 (0.0467)	0.0608 (0.0497)	0.0857* (0.0460)	0.0434 (0.0528)		
Commercial/public own.	0.0534 (0.0424)	0.0811* (0.0440)	0.0920** (0.0433)	0.0641 (0.0428)	0.0833** (0.0404)	0.148*** (0.0424)	0.154*** (0.0430)	0.0922** (0.0441)	0.151*** (0.0436)	0.212*** (0.0593)	
Distance to city	-0.342*** (0.0600)	-0.347*** (0.0600)	-0.351*** (0.0597)	-0.333*** (0.0594)	-0.299*** (0.0550)	-0.304*** (0.0529)	-0.295*** (0.0551)	-0.350*** (0.0618)	-0.279*** (0.0585)	-0.230*** (0.0474)	
Income (log)	-1.418*** (0.444)	-1.521*** (0.454)	-1.532*** (0.448)	-1.386*** (0.437)	-1.174*** (0.404)	-1.446*** (0.397)	-1.390*** (0.416)	-1.529*** (0.465)	-1.271*** (0.444)	-1.092*** (0.414)	
Size of hunting group (log)	-0.141*** (0.0417)	-0.138*** (0.0407)	-0.138*** (0.0399)	-0.130*** (0.0437)	-0.0995** (0.0413)	-0.104** (0.0444)	-0.100** (0.0448)	-0.138*** (0.0404)	-0.0902* (0.0459)	-0.0527* (0.0302)	
Forest share (log)	-3.106*** (0.655)	-3.377*** (0.683)	-3.386*** (0.661)	-3.263*** (0.666)	-3.208*** (0.668)	-2.963*** (0.685)	-3.064*** (0.671)	-3.388*** (0.660)	-2.932*** (0.688)	-0.206 (0.205)	
Forest share sq. (log)	3.945*** (0.745)	4.255*** (0.768)	4.244*** (0.742)	4.136*** (0.753)	4.009*** (0.725)	3.628*** (0.718)	3.757*** (0.701)	4.247*** (0.741)	3.595*** (0.719)		
Roe deer harvest (log)				0.0314 (0.0271)			0.0135 (0.0247)		0.0323 (0.0289)	-0.00166 (0.0282)	
Fallow deer harvest (log)					0.0836*** (0.0178)	0.108*** (0.0189)	0.108*** (0.0176)		0.124*** (0.0230)	0.121*** (0.0241)	
Moose harvest (log)						0.102*** (0.0256)	0.0985*** (0.0261)		0.110*** (0.0277)	0.117*** (0.0308)	
Wild boar harvest (log)							-0.00707 (0.0103)	-0.000742 (0.0107)	-0.00879 (0.0103)	-0.00326 (0.0124)	
Game diversity index (all animals)		0.140* (0.0843)							-0.114 (0.104)		
Game diversity index without boar			0.255** (0.111)					0.255** (0.112)			
Constant	14.42*** (2.590)	15.02*** (2.654)	15.09*** (2.619)	14.30*** (2.559)	13.05*** (2.344)	14.35*** (2.287)	14.09*** (2.405)	15.08*** (2.709)	13.42*** (2.568)	12.02*** (2.488)	
Observations	108	108	108	108	108	108	108	108	108	108	
Adjusted R ²	0.385	0.399	0.412	0.386	0.457	0.507	0.500	0.45	0.502	0.343	

Robust Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; Dept. variable is log of lease price

Spatial model:SAC/SARAR

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Size of plot (log)	0.091** (0.041)	0.094** (0.042)	0.098** (0.042)	0.087** (0.044)	0.033 (0.040)	0.057 (0.040)	0.050 (0.043)	0.095 (0.042)	0.031 (0.044)	
Commercial/public own.	0.039 (0.053)	0.062 (0.056)	0.0710 (0.056)	0.042 (0.054)	0.043 (0.050)	0.098* (0.052)	0.106** (0.052)	0.076 (0.058)	0.093* (0.052)	0.131*** (0.060)
Distance to city	-0.255*** (0.041)	-0.272*** (0.043)	-0.283*** (0.044)	-0.257*** (0.043)	-0.238*** (0.040)	-0.239*** (0.038)	-0.229*** (0.040)	-0.277*** (0.044)	-0.212*** (0.041)	-0.160*** (0.042)
Income (log)	-0.969*** (0.368)	-1.118*** (0.386)	-1.177*** (0.388)	-0.991*** (0.374)	-0.759** (0.354)	-0.921*** (0.341)	-0.818** (0.354)	-1.133*** (0.395)	-0.671*** (0.361)	-0.597*** (0.371)
Size of hunting group (log)	-0.133*** (0.039)	-0.135*** (0.040)	-0.139*** (0.039)	-0.132*** (0.040)	-0.092** (0.038)	-0.090** (0.036)	-0.087** (0.037)	-0.138*** (0.039)	-0.077** (0.037)	-0.058* (0.03)
Forest share	-2.584*** (0.448)	-2.885*** (0.479)	-2.96*** (0.479)	-2.656*** (0.467)	-2.878*** (0.426)	-2.852*** (0.408)	-2.855*** (0.422)	-2.953 (0.481)	-2.713*** (0.427)	-0.1046 (0.137)
Forest share sq.	3.352*** (0.582)	3.703*** (0.617)	3.782*** (0.616)	3.438*** (0.605)	3.699*** (0.553)	3.605*** (0.531)	3.621*** (0.549)	3.778 ** (0.619)	3.459*** (0.552)	
Roe deer harvest (log)				0.008 (0.019)			-0.003 (0.021)		0.014 (0.024)	-0.019 (0.023)
Fallow deer harvest (log)					0.082*** (0.019)	0.108*** (0.019)	0.111*** (0.02)		0.126*** (0.022)	0.111*** (0.023)
Moose harvest (log)						0.089*** (0.026)	0.085** (0.026)		0.094*** (0.027)	0.092** (0.030)
Wild boar harvest (log)							-0.008 (0.009)	-0.004 (0.010)	-0.009 (0.009)	-0.004 (0.011)
Game diversity index (all animals)		0.093* (0.068)							-0.109 (0.078)	
Game diversity index without boar			0.192** (0.098)					0.189 * (0.098)		
Spatial lag dept var (λ)	0.373*** (0.123)	0.316** (0.140)	0.295** (0.143)	0.357*** (0.138)	0.264** (0.115)	0.225** (0.106)	0.239*** (0.107)	0.305*** (0.142)	0.244*** (0.105)	0.327*** (0.151)
Spatial lag residual (ρ)	-0.427*** (0.149)	-0.373** (0.168)	-0.345** (0.174)	-0.409 ** (0.167)	-0.425 *** (0.131)	-0.431*** (0.127)	-0.446*** (0.129)	-0.355** (0.173)	-0.462 *** (0.126)	-0.366* (0.197)
Observations	108	108	108	108	108	108	108	108	108	108
Time fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust Standard errors in parentheses: * p < 0.1, ** p < 0.05, *** p < 0.01. Data available in [RePEc data archive](#)

Summary of Regression results

- 1 Negative Income effect
- 2 Congestion effect
- 3 Distance decay effect
- 4 Game diversity is important, esp. deer species
- 5 Moose and fallow deer are the most important game in terms of lease pricing
- 6 Spatial spillovers in hunting lease pricing

Marginal Implicit Values

- Marginal implicit values calculated from the regression models expressed in SEK (US dollar equivalent in parenthesis)

	Spatial Model	pooled OLS
Fallow deer	2,689 (331)	2,548 (314)
Moose	12,145 (1,496)	14,145 (1,743)

Conclusion and Policy Implications

- 1 Significant spatial spillovers in lease prices is indicative of information effect in the market. Hence possibility of natural monopolies is minimal.
 - However reducing constraints in access to hunting leases will be worthwhile.
- 2 Moose and fallow deer attract higher economic values. Sustainable mgt of these wildlife species will inure greater benefits to society.
 - Encouraging the spread of fallow deer vis-a-vis the current system of restricting them to game estates.
 - Policies that seek to reduce predator populations should be encouraged.
 - Land use activities/policies must carefully consider the effects on wildlife populations.

THANK YOU



"Congratulations on surviving
another hunting season."