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Revising linked hunting and private amenity incomes

**Application to 13 red deer silvopastoral farms case studies
in Andalusia, Spain**

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CONTENS

✓ **BAKGROUND**

✓ **CONCEPTS AND METHODS**

✓ **RESULTS**

✓ **CONCLUDING REMARKS**

SILVOPASTORAL FARMS PRIVATE LANDOWNERS' ECONOMIC BEHAVIOR

The academic literature shows that private non-industrial landowners invest manufactured capital in silvopastoral farms activities, although they could involve market operating losses, for the reason of producing private non-commercial intermediate services that they are re-employed in improving the production of private environmental amenities.

BAKGROUND (1)

Private **dehesas** and Californian **ranches** scientific researches show:

- ✓ That their owners gain long term real total profitability rates over 3% (**Oviedo *et al.*, 2013;** **Ovando *et al.*, 2015**).
- ✓ That their **traded products** often offer **negative profitability rates** on manufactured investments.
- ✓ The positive returns of private environmental services enjoyed by the private owners of the **dehesas** and Californian **ranches** have resulted in their competitive long term total profitability rates.

ANDALUSIA HUNTING BACKGROUND (2)

1. We estimated for Andalusia silvopastoral systems that livestock and game grazing intermediate products (livestock fodder consumption and game captures leases), respectively, in 2010 accounted for 67 and 27 millions euros (Caparrós *et al.*, 2016: p. 531).
2. The hunting commercial net operating margin estimated in 2010 in Andalusia hunting reserves (Herruzo *et al.*, 2015: p. 369) was three times lower that it could be if landowners lease theirs game reserves.
3. Andalusia red deer reserves cover 1.2 million hectares.

CONCEPTS (1)

Non-commercial intermediate services

Public ($ISSnc_{PUP}$)

Government net payment to the land (including wild biota) and livestock owners that is due to the production of non-commercial intermediate services that are re-used as inputs in other activities that contribute to improving the offer of ecosystem public final products. A negative net payment reflects taxes on production paid by the owner outweigh the subsidies ("compensations") received from the government.

Private ($ISSnc_{PR}$)

The economic rationality of a non-industrial private landowner could potentially include the production of non-commercial intermediate services re-used as inputs in the final production of private amenities (environmental services without market prices) enjoyed by the landowner.

CONCEPTS (2)

Hunting products, services and disservices

1. We measure **hunting ecosystem private products and incomes**: Intermediate hunting captures (substitute value of hunting grazing lease), non-commercial intermediate services, final captures and game inventory change.

2. We do not measure **hunting public ecosystem services and disservices**: scenic recreation, landscape, game biodiversity, increasing global warming, wild biodiversity loss, spreading diseases and land (soil and biota) depletion and degradation.

CONCEPTS (2)

Private incomes

Total income. Maximum total product consumption that maintains the same real value of closing and opening ecosystem total capital .

Capital income. Net operating margin and capital gains earned by owners from their investments in land and manufactured goods (livestock, infrastructure and machinery) silvopastoral farming .

Environmental income. Nature economic rent embedded in ecosystem total income.

Ecosystem services: Nature economic contribution embedded in total products consumption.

METHODS (3)

AAS incomes identities

$$\checkmark \mathbf{TI = NC + CNW}$$

Total income – Net consumption + Change of net worth

$$\checkmark \mathbf{TPc = = IRM + ISS + S + A + O}$$

Total product consumption = Intermediate raw materials + Intermediate services + Sales + Autoconsumption + Other consumption

$$\checkmark \mathbf{NC = TPc - IC}$$

Net consumption = Total product consumption – Intermediate consumption

$$\checkmark \mathbf{IC = RM + SS + WPU}$$

Intermediate consumption = Raw materials + Services + Work in progress used

$$\checkmark \mathbf{CNW = GCF - CFC + Cr - Cd + Cad}$$

Change of net worth = Gross capital formation – Consumption of fixed capital + Capital revaluation – Capital destruction + Capital adjustment

$$\checkmark \mathbf{R = TPc + GNW}$$

Revenues = Total product consumption + Gain of net worth

$$\checkmark \mathbf{E = IC + LNW}$$

Expenditures = Intermediate consumption + Loss of net worth

METHODS (4)

AAS profitability rates

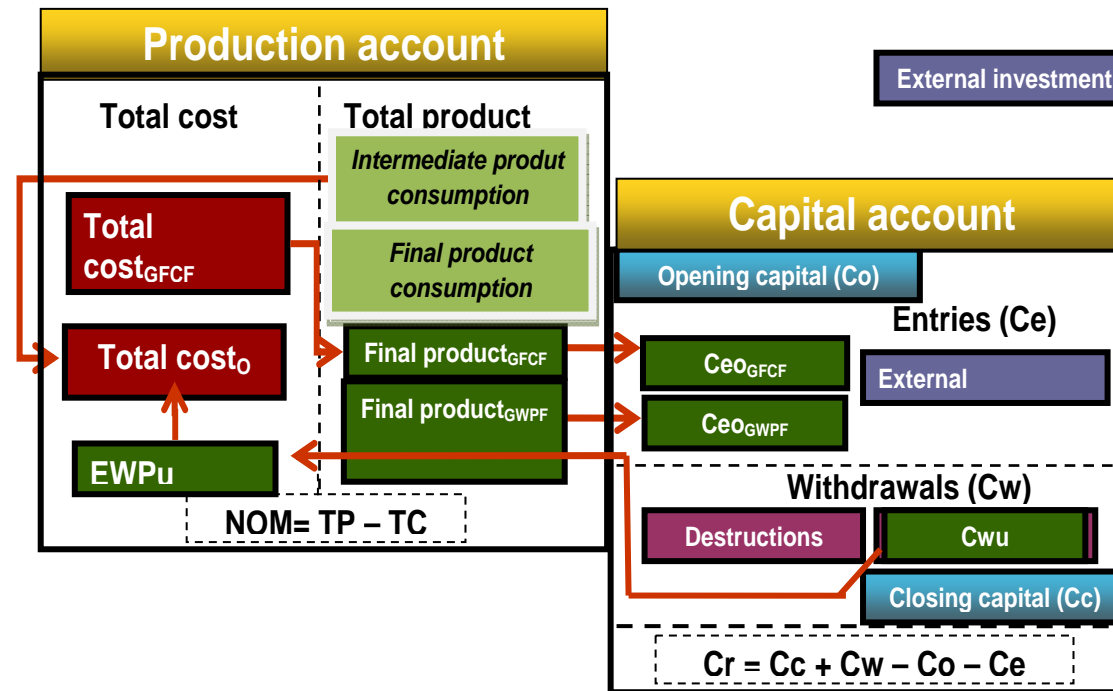
Operating profitability rate: Quotient between net margin and total immobilized capital: $r_o = \text{NOM/IMC}$.

Gain rate: Quotient between capital gain and total immobilized capital: $g = \text{CG/IMC}$.

Total profitability rate: Quotient between capital income and total immobilized capital: $r = \text{CI/IMC}$.

Agroforestry Accounting System (AAS)

Source: Campos et al. (2016a)



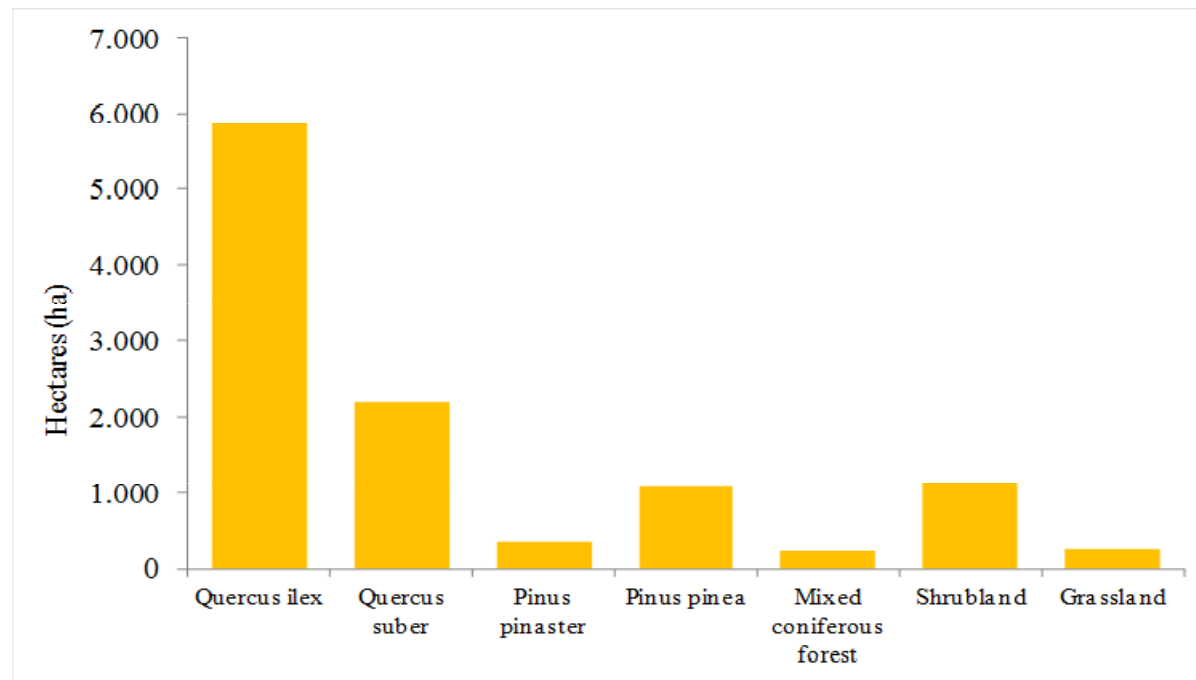
Abbreviations. GFCF: gross fixed capital formation (own account durable investment on constructions, equipments, trees plantations, etc.); GWPF: gross work in progress formation (woody natural growth, etc.); C_{wu} : inventory withdrawals of woody vegetation harvested and game captured; EWP_u : Opening environmental work in progress used as intermediate consumption; NOM: the net operating margin is the operating capital income measured as balancing item of production account. C_r : The capital revaluation is the balancing item of the capital account.

Farms' surface by vegetation types

Andalusia 13 red deer silvopastoral farms case studies

Mean farm surface: 950 ha

Source: Campos *et al.* (2016b)



Farms grazed fodder consumption (2010: FU/ha)

Andalusia 13 red deer silvopastoral farms case studies

Mean farm surface: 950 ha

Source: Campos *et al.* (2016b)

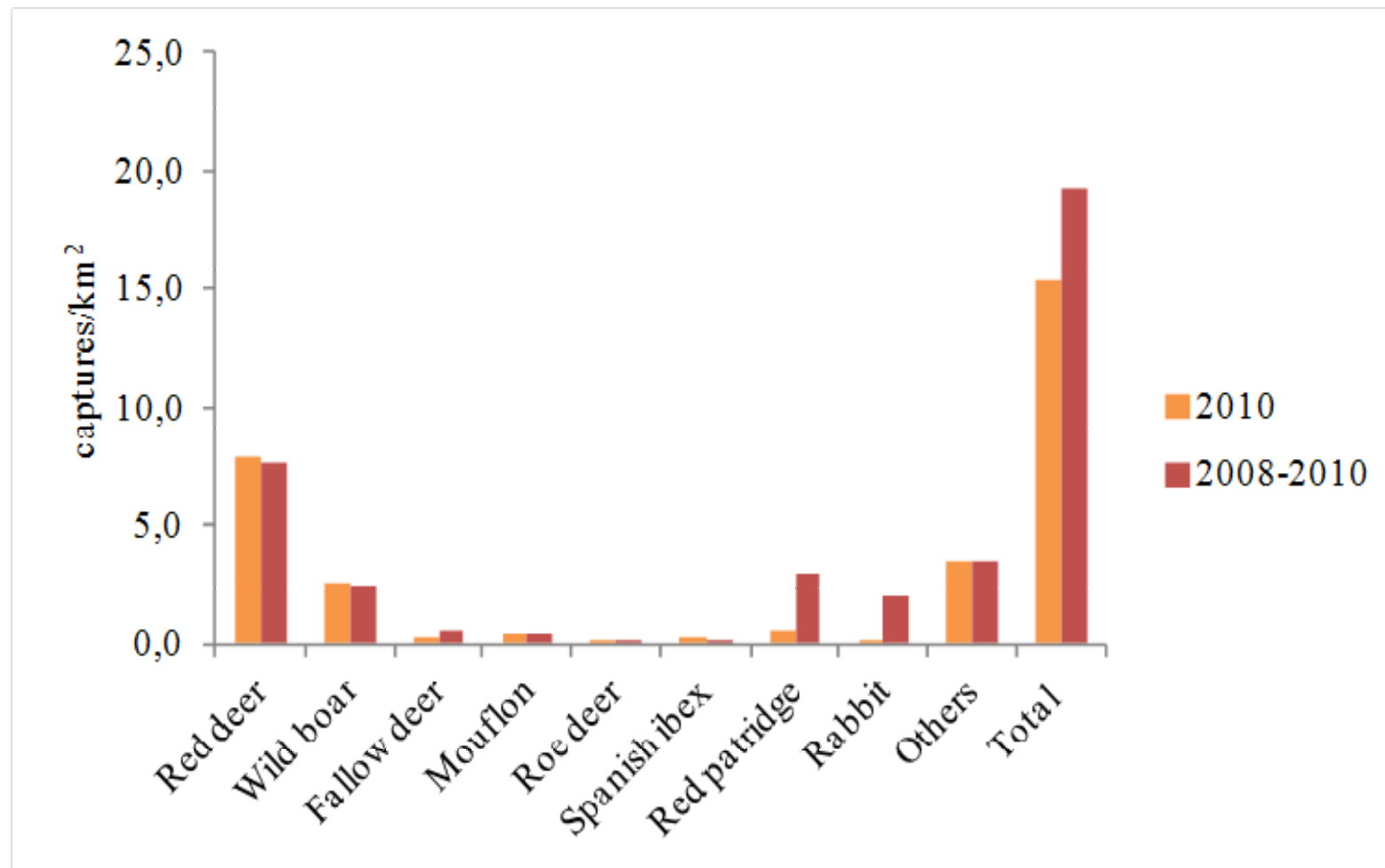
Class	Coniferous forest		Dehesa		Grazing (FU/ha) (N=13)	Grazing contribution to total fodder (%)
	Fenced (N=2)	Open (N=4)	Fenced (N=7)	Total (N=11)		
1. Game	207.2	612.9	277.6	370.6	352.5	83.9
1.1. Economic	140.0		113.6	82.1	88.5	70.7
1.2. Unpriced	67.1	612.9	164.0	288.4	264.0	100.0
2. Livestock	11.6	375.7	284.7	309.9	277.1	47.6
2.1. Economic	11.6	318.1	284.7	294.0	262.8	46.3
2.2. Unpriced		57.6		16.0	14.2	100.0
Total	218.8	988.6	562.3	680.5	629.6	62.8

Captures by game species

Andalusia 13 red deer silvopastoral farms case studies

Mean farm surface: 950 ha

Source: Campos *et al.* (2016b)



Hunting private extended current commercial total income Andalusia 13 red deer silvopastoral farms case studies.

Mean farm surface: 950 ha (2010: €/ha)

Source: Campos *et al.* (2016b)

S 21	HA 4	OH 5			
RM 16	SS 13	WPU 13	LNW 7		
				TI -19	
		LC 18		CI -36	
		EI 13		MCI -49	

Acronyms. **S:** Hunting sales; **HA:** Hunting auto-consumption; **OH:** Other final consumption of hunting; **RM:** Raw materials consumption; **SS:** Consumed services; **WPU:** Work in progress used; **LNW:** Loss of net worth; **TI:** Hunting private extended current commercial total income; **LC:** Labor cost; **CI:** Hunting capital income; **EI:** Environmental income; **MCI:** Manufactured capital income.

Private extended current incomes (2010: €/ha)

Andalusia 13 red deer silvopastoral farms case studies. Campos *et al* (2016b)

Class	Hunting	Amenity	Livestock	Forestry	Other	Total
<i>Extended Agroforestry Accounting System</i>						
1. Total product (TP)	108.5	259.4	365.1	170.0	26.0	929.0
1.1 Intermediate product (IP)	64.8		85.6	66.9	11.2	228.4
1.1.1 Raw materials (IRM)	22.2		0.1	65.4	0.2	87.9
1.1.2 Services (ISS)	42.6		85.5	1.5	11.0	140.6
Commercial (ISSc)					9.7	
Public non-commercial (ISSnc _{PUP})	0.0		26.4	1.5	1.3	29.2
Private non-commercial (ISSnp _{PR})	42.6		59.1			101.7
1.2 Final product (FP)	43.7	259.4	279.5	103.1	14.8	700.5
1.2.1 Consumption (FPc)	29.9	259.4	119.5	58.4	12.6	479.8
1.2.2 Gross capital formation (GCF)	13.8		160.0	44.7	2.2	220.8
2. Total cost (TC)	90.1	111.4	348.2	175.1	35.9	760.6
2.1 Intermediate consumption (IC)	63.5	111.4	300.5	133.5	8.9	617.8
2.2 Labor compensation (LC)	17.6		37.5	37.1	14.2	106.5
2.3 Consumption of fixed capital (CFC)	9.0		10.2	4.5	12.7	36.4
3. Net operating margin (NOM)	18.4	148.0	16.9	-5.1	-9.9	168.3
3.1 Environmental (ENOM)	13.8	148.0		31.9		193.7
3.2 Manufactured (MNOM)	4.6		16.9	-37.0	-9.9	-25.4
4. Net value added (NVA)	36.1	148.0	54.4	32.0	4.3	274.8
5. Capital gain (CG)	-12.2	-172.5	-20.1	116.4	-21.7	-110.2
5.1 Environmental (ECG)	-1.0	-172.5		120.9		-52.7
5.2 Manufactured (MCG)	-11.2		-20.1	-4.5	-21.7	-57.5
6. Capital income (CI)	6.2	-24.5	-3.2	111.3	-31.6	58.2
6.1 Environmental (EI)	12.8	-24.5		152.7		141.0
6.2 Manufactured (MCI)	-6.6		-3.2	-41.5	-31.6	-82.9
7. Total income (TI)	23.8	-24.5	34.3	148.4	-17.3	164.6
8. Ecosystems services consumption (ESc)	13.0	148.0	0.0	41.0	0.0	202.0
<i>Standard Economic Accounts for Agriculture and Forestry</i>						
9. Final product (FP)	29.9		98.4	94.9	24.7	247.9
10. Intermediate consumption (IC)	23.0	9.7	106.3	52.1	8.9	200.1
11. Net value added (NVA)	-2.1	-9.7	-18.1	38.3	3.1	11.5

Hunting private extended current total income

Andalusia 13 red deer silvopastoral farms case studies

Mean farm surface: 950 ha (2010: €/ha) .Campos *et al.* (2016b)

S 21	HA 4	OH 5	ISS 43		
RM 16	SS 13	WPU 13	LNW 7	TI 24	
			LC 18		CI 6
				EI 13	MCI -7

Acronyms. **S:** Hunting sales; **HA:** Hunting autoconsumption; **OH:** Other final consumption of hunting; **ISS:** Hunting residual non market intermediate services; **RM:** Raw materials consumption; **SS:** Consumed services; **WPU:** Work in progress used; **LNW:** Loss of net worth; **TI:** Hunting private extended current total income revised; **LC:** Labor cost; **CI:** Hunting capital income; **EI:** Environmental income; **MCI:** Manufactured capital income.

RESULTS (8)

Farms private extended real total income Andalusia 13 red deer silvopastoral farms case studies

Mean farm surface: 950 ha (2010: €/ha)

Source: Campos *et al.* (2016b) (in preparation)

Class	Public non-commercial intermediate services (ISSnc _{PUP}) 1.1	Private non-commercial intermediate services (ISSnc _{PR}) 1.2	Manufactured commercial capital income (MCCI) 1.3	Manufactured extended real capital income (MCIr) 1=1.1+1.2+1.3	Real environmental income revised (EIr) 2	Extended real capital income (CIr) 3=1+2	Labour cost (LC) 4	Extended real total income (TIr) 5=3+4
Hunting	0.0	42.6	-49.2	-6.6	12.8	6.2	17.6	23.8
Amenity					321.1	321.1		321.1
Livestock	26.4	59.1	-88.7	-3.2		-3.2	37.5	34.3
Forestry	1.5		-43.0	-41.5	152.7	111.3	37.1	148.4
Other	1.3		-32.8	-31.6		-31.6	14.2	-17.3
Total	29.2	101.7	-213.8	-82.9	486.6	403.7	106.5	510.2

RESULTS (7)

Farms extended current total income

Andalusia 13 red deer silvopastoral farms case studies

Mean farm surface: 950 ha (2010: €/ha)

Source: Campos *et al.* (2016b) (in preparation)

IRM 88	ISS 141	S 205	A 265	O 10	GNW 74
RM 197		SS 192	WPU 229	TI 165	
				LC 106	CI 58
				EI 141	MCI -83

Acronyms. **IRM:** Intermediate raw materials; **ISS:** non-commercial intermediate services; **S:** Sales; **A:** Autoconsumption; **O:** Other final consumption; **GNW:** Gain of net worth; **RM:** Raw materials consumption; **SS:** Consumed services; **WPU:** Work in progress used **TI:** Extended current total income revised; **LC:** Labor cost; **CI:** Capital income; **EI:** Environmental income; **MCI:** Manufactured capital income.

Farms private extended real total income

Andalusia 13 red deer silvopastoral farms case studies

Mean farm surface: 950 ha (2010: €/ha)

Source: Campos *et al.* (2016b) (in preparation)

IRM 88	ISS 141	S 205	A 265	O 10	GNW 420
RM 197	SS 192	WPU 229	TI 510		
			LC 106	CI 404	
			EI 487		MCI -83

Acronyms. **IRM:** Intermediate raw materials; **ISS:** non-commercial intermediate services; **S:** Sales; **A:** Autoconsumption; **O:** Other final consumption; **GNW:** Gain of net worth; **RM:** Raw materials consumption; **SS:** Consumed services; **WPU:** Work in progress used **TI:** Extended real total income revised; **LC:** Labor cost; **CI:** Capital income; **EI:** Environmental income; **MCI:** Manufactured capital income.

Farms private immobilized capital

Andalusia 13 red deer silvopastoral farms case studies

Mean farm surface: 950 ha (2010: €/ha)

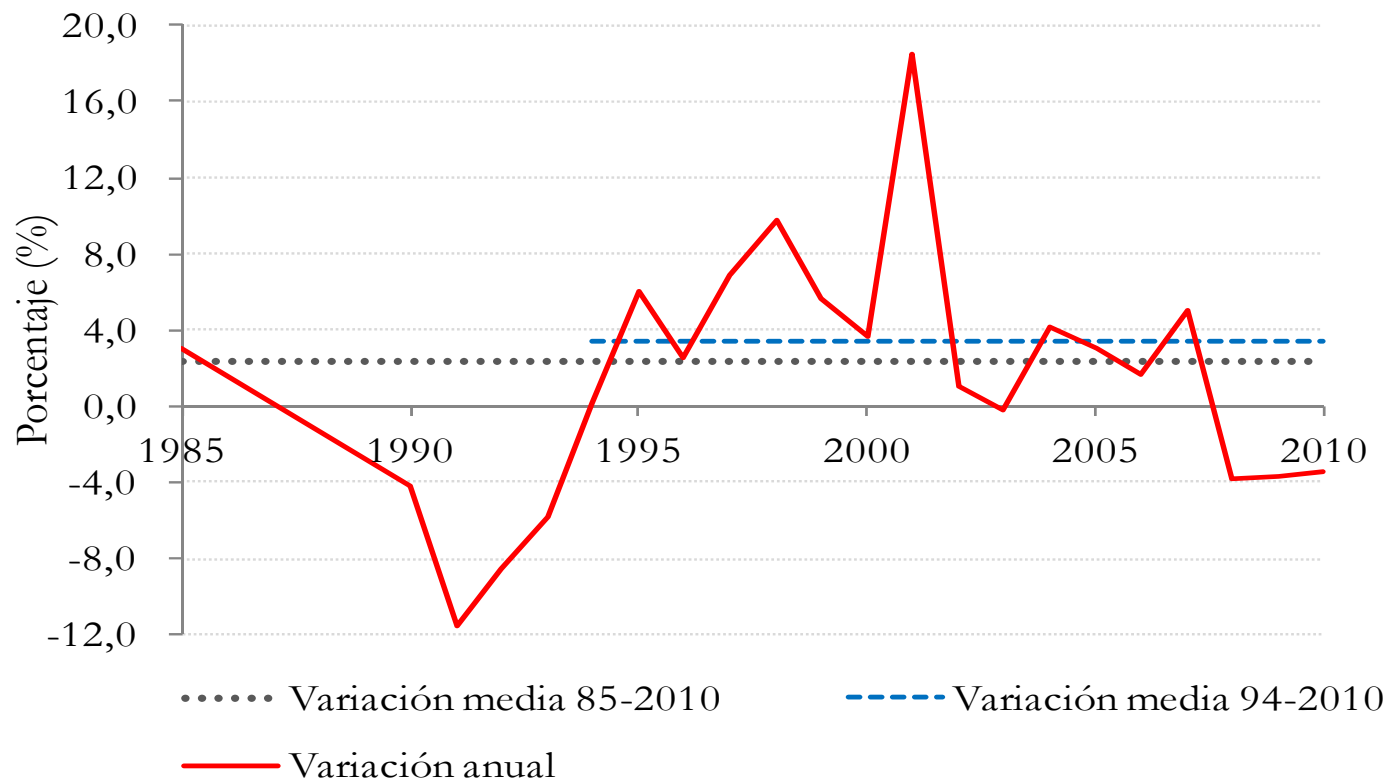
Source: Campos *et al.* (2016b)

Class	Opening environmental asset	Opening manufactured capital	Opening capital	Working capital	Immobilized capital
Hunting	540.1	139.9	680.0	13.0	693.0
Amenity	2,040.1		2,040.1		2,040.1
Livestock		540.1	540.1	24.1	564.2
Forestry	2,468.9	42.8	2,511.7	18.5	2,530.3
Other	25.6	478.8	504.4	8.0	512.4
Total	5,074.7	1,201.5	6,276.3	63.6	6,339.9

RESULTS (8)

Spanish shrubland price real cumulative annual variation

Source: Ovando *et al.*(2015: Figure 11, p. 339)



Spanish shrubland price real cumulative annual variation in the period 1994-2010: 3.4%.

Farms private extended profitability rates

Andalusia 13 red deer silvopastoral farms case studies

Mean farm surface: 950 ha (2010: %)

Source: Campos *et al.* (2016b)

Class	Current profitability rates (N =13)			Real profitability rates (N =13)		
	Operating	Gain	Total	Operating	Gain	Total
Hunting	0.3	-0.2	0.1	0.3	-0.2	0.1
Amenity	2.3	-2.7	-0.4	2.3	2.7	5.1
Livestock	0.3	-0.3	-0.1	0.3	-0.3	-0.1
Forestry	-0.1	1.8	1.8	-0.1	1.8	1.8
Other	-0.2	-0.3	-0.5	-0.2	-0.3	-0.5
Total	2.7	-1.7	0.9	2.7	3.7	6.4

CONCLUDING REMARKS

- ✓The captures of **big game** are present in 29% of private Andalusia silvopastoral farms (Oviedo *et al.*, 2015: Table A.4.8, p. 125).
- ✓Hunting contributes to **economic value of grazing** that livestock does not consume/pay.
- ✓Hunting often leads to **manufactured capital income losses** that are usually offset by its intermediate production of **non-commercial services** that are used up to increase the landowner **private amenities** (Oviedo *et al.*, 2015: Table 8, p. 45).
- ✓The **government does not compensate** the landowner for the intermediate production of non-commercial services that hunting contributes as inputs of the final production of **public woodland landscape services**. Instead, livestock receives compensation.
- ✓Livestock keepers are compensated by government from **hunting disease damage** to livestock.
- ✓The **challenges of hunting management**, such as livestock, is to avoid the **depletion of natural resources** consumed in a context of promotion of **native species** and local **cultural practices** globally inclusive.

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