

Assessment and monitoring of the CAP Spanish Strategic Plan through an interdisciplinary approach

An application for assessment SO1

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ECOLOGICAL TRANSITION OF AGRICULTURE: OPPORTUNITIES AND CHALLENGES

Córdoba, 19th June 2024

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- MAPA-CSIC AGREEMENT
- EVALUATION OF SPANISH STRATEGIC PLAN OF CAP
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- IDENTIFICATION OF IMPACT FACTORS ON FARM INCOME STABILITY
- SOME RESULTS AND NEXT RESEARCH
- CONCLUSION

MAPA-CSIC AGREEMENT

LEGAL FRAMEWORK

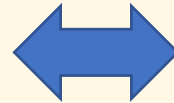
Regulation (EU) 2021/2115; Implementing regulation 2022/1475

OBJECTIVE

Scientific assistance to the Management Authority of NSP of CAP, providing support for monitoring and assesment from a triple dimesion: enviromental, social and economic

Secretaría General de Agricultura y Alimentación

To ensure an evaluation based on scientific knowledge, a **results-oriented intervention strategy**.



CSIC

It will expand and update its **data and knowledge** base of economic, environmental, and social **sustainability of agricultural activity in Spain**.



Awareness actions and dissemination of knowledge for institutions, the agricultural sector, and civil society

Partners

1

• Museo Nacional de Ciencias Naturales. **Centro Coordinador de la PTI**

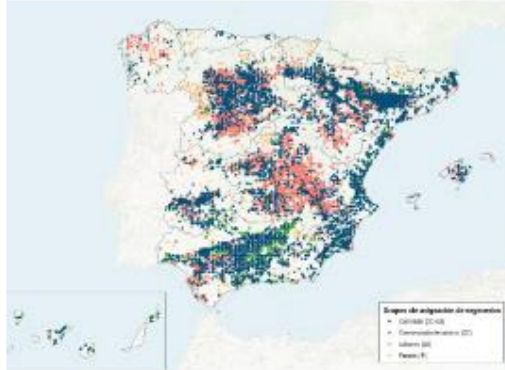
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• Instituto de Economía, Geografía y Demografía

3

• Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria

MAPA-CSIC AGREEMENT



ESYRCE – *land uses and productivity at field level (2009-present)*
FEGA - *application of Green Architecture at field and farm levels*



10 km x 10 km UTM grid
700 m x 700 m cells



Carbon content

Soil samples in two fields under Green Architecture and proper controls (8,000 cells, 16,000 sampling points, 32,000 samples)

Samples repeated every two years

Relationships between field's crop history and carbon content

MAPA-CSIC AGREEMENT



SEO/BirdLife International
SACRE program (1998-present)
ca. 7,000 samples/year



Biodiversity: birds



10 km x 10 km UTM grid
20 bird point counts
(50 m radius)



Locate bird point counts in and/or close to fields sampled for carbon contents. Complete bird sampling with proper paired treatment/controls for all elements of the Green Architecture considered as beneficial for farmland birds

Counts repeated every year

Relate local results (paired differences) with the official farmland bird index



No (yet) official monitoring scheme
EMBAL project for weeds
(3,000 sites, 250 in Spain)



Biodiversity: Pollinators and weeds Landscape structure



500 m x 500 m plots: land uses
30-m transects for weeds



Samples in the fields sampled for carbon and other elements of the Green Architecture considered as beneficial

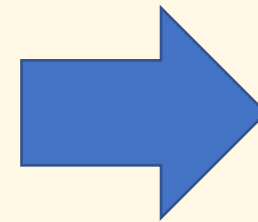
(both inside fields and in field boundaries)

Counts repeated every year

Relationships between field's crop history and pollinators and weeds

INSTITUTO DE ECONOMIA GEOGRAFIA Y DEMOGRAFIA (IEGD)

- Monitoring the achievement of socio-economic objectives through impact indicators. Social objectives: a cross-cutting aspect present in all evaluations.
- Monitoring results (comparing with PAC measures and without PAC measures). Responding to the needs of the MAPA through assistance in the design and support for the evaluation of the CAP NSP.
- Generating synergies with other investigation groups: cross-referencing socio-economic indicators at the plot-farm level with carbon sequestration data and biodiversity indicators.



Causal analysis to establish the relationship between interventions and their impact on objectives to ascertain the net impact of the CAP NSP.

PTI: AGRIAMBIO

¿What is AGRIAMBIO?

It is a PTI of the CSIC, created in June 2022, that will develop a **system of indicators for monitoring the economic, environmental, and social** objectives of the national CAP Strategic Plan (PEPAC). The indicators will measure three key objectives of PEPAC: **biodiversity and ecosystem services, fair socio-economic development of rural populations, and carbon sequestration in agricultural soils.**

Some activities linked with AGRIAMBIO

AGRIAMBIO will develop:

1. Measurement protocols for indicators in Spanish agricultural systems.
2. Training qualified professionals for their monitoring.
3. Establishing agreements to use already available indicators. Designs will focus on evaluating the effectiveness of actions implemented under the PEPAC, especially its Green Architecture, consisting of advanced conditionality, eco-schemes and agri-environmental and climate measures.

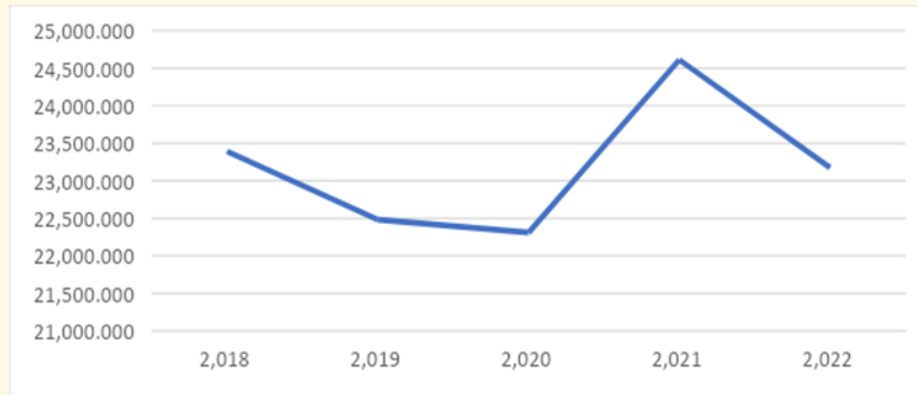
MONITORING AND ASSESMENT OF SO1: FARM INCOME STABILITY

SO	Key elements to assess		Proposed evaluation questions	Recommended factors of success (TWG)	
1	1.1	Viable farm income: Viable farm income means not only stable income but also fairly distributed income	To what extent have CAP Strategic Plan interventions ensured viable farm income?	1.1.1	<i>Agricultural income level in farms supported is increasing or, at least, stable due to CAP support.</i>
				1.1.2	<i>Income disparities between supported farms are decreasing due to CAP support.</i>
				1.1.3	<i>Disparities between the agricultural income level in farms supported and the income level in the other economic sectors are decreasing due to CAP support.</i>
	1.2	Resilience: Resilience encompasses supporting farmers facing potential risks and specific limitations which can force them to stop agricultural activity	To what extent have CAP Strategic Plan interventions supported the resilience of the agricultural sector and ensured the economic sustainability of agricultural production?	1.2.1	<i>Income support is distributed to the farmers most in need.</i>

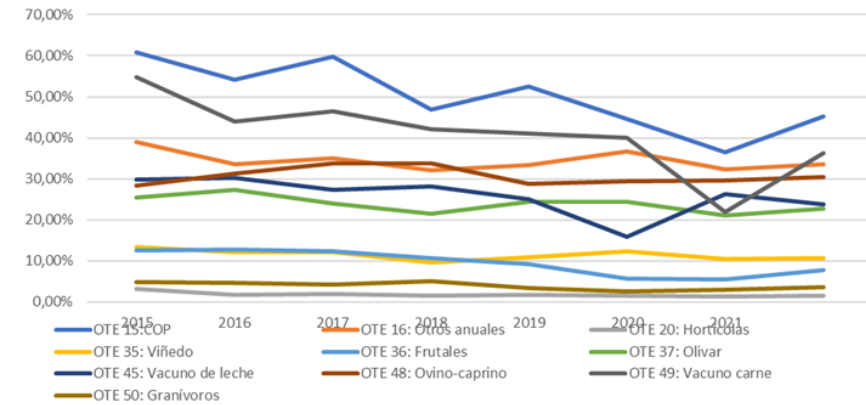
FARM INCOME CONTEXT IN SPAIN

Evolution of Agricultural Income (VAN) at basic prices

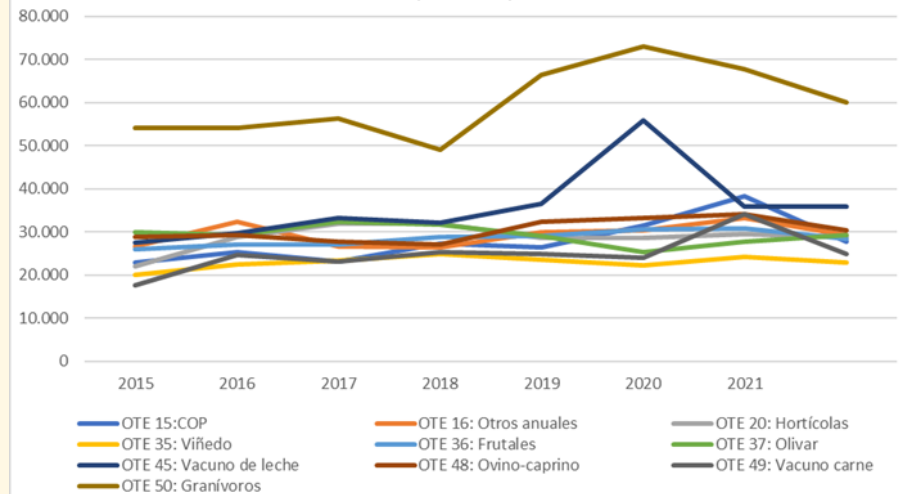
Source: MAPA-Contabilidad Agraria Nacional (2022)



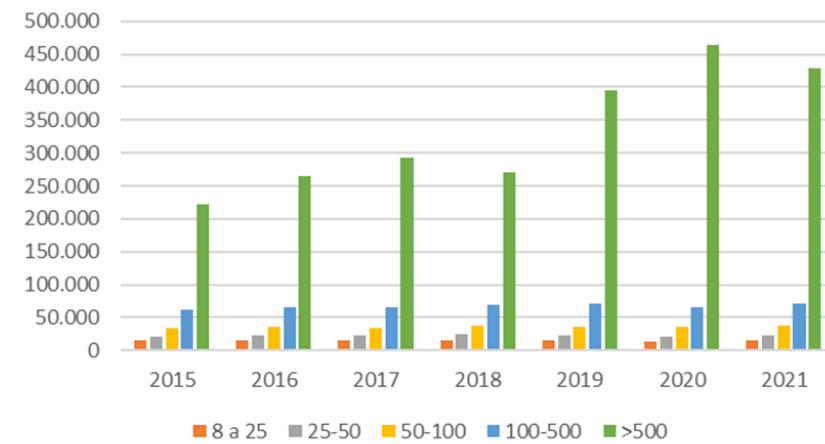
Subvenciones/VAN Explotación



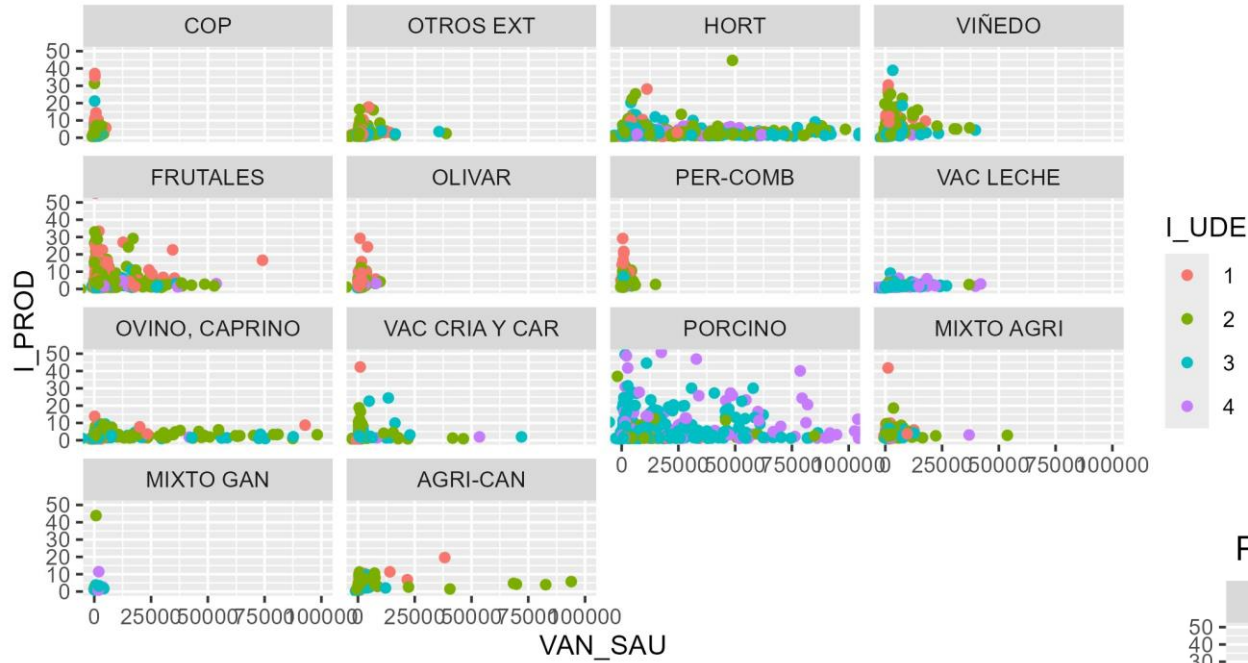
VAN/UTA (€/EXPLOT)



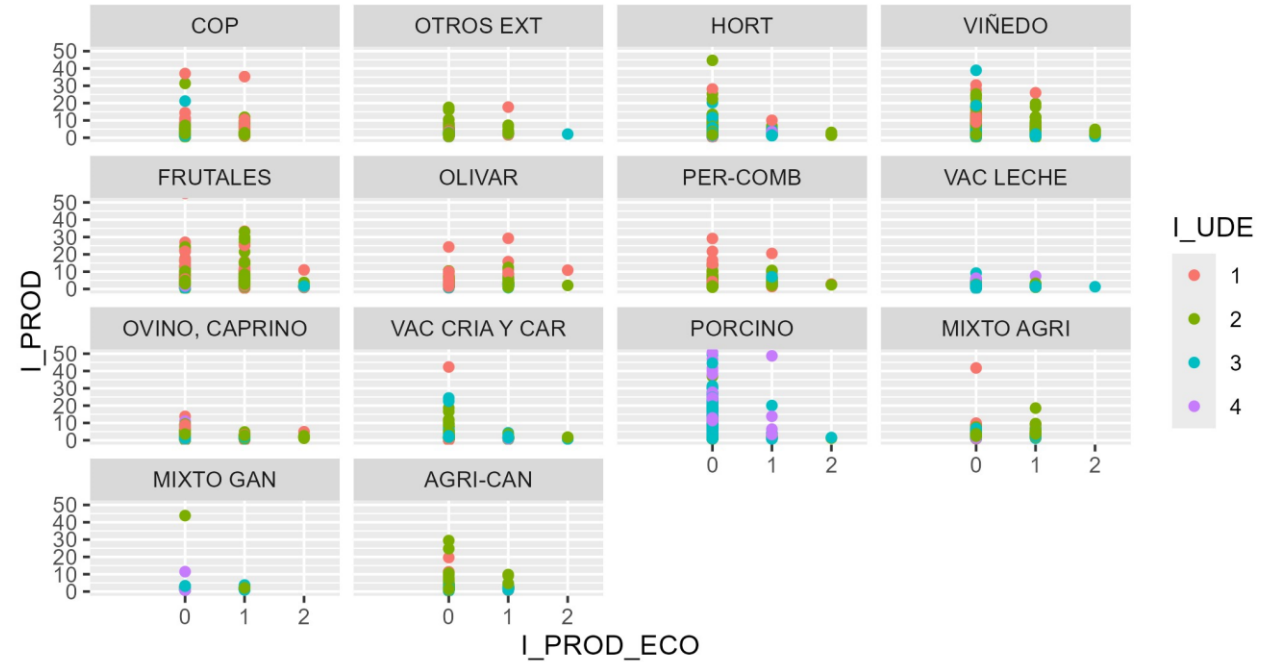
RENTA NETA POR EXPLOTACIÓN /€/explot



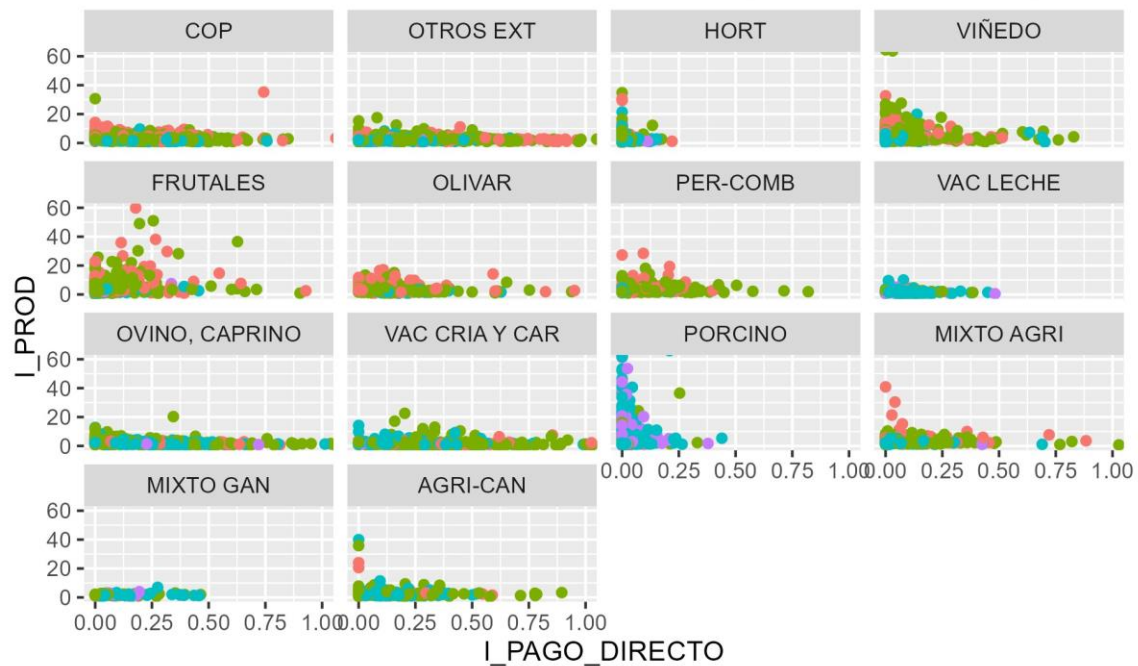
VAN/SAU versus productividad por OTEs Y UDEs (2020)



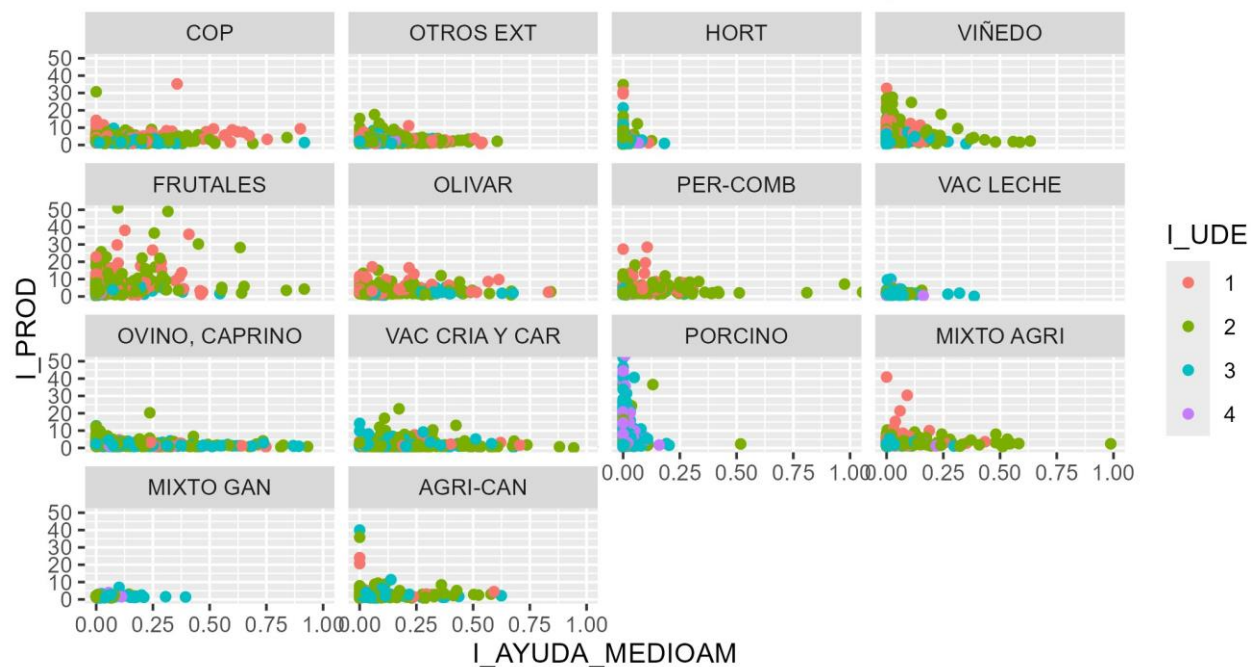
PROD.ECO versus PRODUCTIVIDAD por OTEs Y UDEs (2020)



PAGO DIRECTO versus PRODUCTIVIDAD por OTEs Y UDEs (2021)



PESO PAGO AMBIENTAL versus PRODUCTIVIDAD por OTEs Y UDEs (2021)



OBJECTIVE, DATA & METHOD

OBJECTIVE

To identify and analyze the endogenous and exogenous factors that explain farmers' income during the 2018-2021 period in order to detect the effect of CAP measures on income per productive sector.

DATA

Microdata from the Spanish FADN (2018-2022) and data from the MAPA at the provincial level.
Sample size: 30,384 farms distributed in 14 sectors. Constant sample in considered

METHODOLOGY

Data panel econometric linear model:

$$\begin{aligned} NVA_{it}^{SP} &= \beta_0 + \beta_1 ZA_i + \beta_2 ZD_i + \beta_3 ZN_i + \beta_4 UDE_i + D \beta_5 SR_{it}^* + D \beta_6 SC_{it}^* + \beta_7 Cost_{it} + \beta_8 MO_{it} + D \beta_9 Inv_{i(t-1)}^* \\ &+ \beta_{10} TFP_{it}^* + \beta_{11} Q_{it} + \beta_{12} OAL_{it} + \beta_{13} D_{it} + \beta_{14} Eco_{it} + \beta_{15} I_{it} + D \beta_{16} E_{it}^* + D \beta_{17} C_{i(t-1)}^* + D \beta_{18} PD_{it}^* \\ &+ D \beta_{19} DR_{it}^* + D \beta_{20} A_{it}^* + \beta_{21} AP_t^P + \beta_{22} PP_t^S + \beta_{23} PI_t^S + \varepsilon_{it} \end{aligned}$$

NVA_{it}^{SP} is defined as variable SE425 (Farm Net Value Added per Annual Work Unit (AWU)) per sector, year and farm for each sector and province.

i : Farm

t : Year

S : Sector or Technical-Economic Orientation (OTE)

P : Province

*: Variables with Box-Cox transformation to adjust to a normal distribution with constant variance.



INDICATORS

Group	Variable	Acron.	Type	Range	Description	Level	Source
Fixed Factors	Altimetric Location	ZA	Cat.	1 – 3	By altitude of larger part of UAA	Farm	FADN
	Disadvantaged Area	ZD	L.	T – F	If larger part of UAA is located under a disadvantaged area. Includes mountain area, areas with natural and specific limitations and progressive elimination of payments.	Farm	FADN
	Natura 2000 Area	ZN	L.	T – F	If larger part of UAA is located in Natura 2000 area	Farm	FADN
	Economic Dimension (UDE)	UDE	Cat.	1 – 4	By potential farm income	Farm	FADN
	Technical-Economic Orientation (OTE)	OTE	Cat.	1 – 14	By larger part of agricultural production output category	Farm	FADN
Economic and Productive Factors	Irrigation Surface	SR	Cont.	0 – 1	Irrigated area / UAA	Farm	FADN
	Greenhouse Surface	SC	Cont.	0 – 1	Area under greenhouse structure / UAA	Farm	FADN
	Cost Structure	Cost	Cont.	0 – 1	Intermediate costs (SE275) / Total costs (SE270)	Farm	FADN
	Labour Intensity	MO	Cont.	0 – ∞	Salaried AWU (SE020) / UAA	Farm	FADN
	Investment	Inv	Cont.	0 – 1	Investment support (previous year) (SE406) / Fixed capital (SE441)	Farm	FADN
	Total Factor Productivity	TFP	Cont.	0 – 1	Agricultural and livestock production (SE135 + SE206) / Specific and external factors costs (SE282 + SE283 + SE365)	Farm	FADN
	Quality Label Production	Q	Cat.	0 – 2	By percentage of production under quality label scheme. Includes DOP, IGP, ETG and mountain.	Farm	FADN
	Other Lucrative Activities (OAL)	OAL	Cat.	1 – 3	Categories by percentage of OAL / Total Income	Farm	FADN

INDICATORS

Group	Variable	Acron.	Type	Range	Description	Level	Source
Environmental Factors	Diversification Index	D	Cont. D.	1 – ∞	Number of different crops and livestock	Farm	FADN
	Organic Production Certification	Eco	Cat.	0 – 2	Categories depending of how much of the production is under organic certification	Farm	FADN
	Input Intensity Index	I	Cat.	1 – 3	Categories by 0.33 and 0.66 quantiles of Input Intensity (*).	Farm	FADN
	Extensivity	E	Cont.	0 – 1	UAA not cultivated (SE074) / UAA. Includes farrow and permanent pastures.	Farm	FADN
	Circularity	C	Cont.	0 – 1	Value of farm production reused as input (SE265) / Agricultural and livestock production (SE135 + SE206)	Farm	FADN
CAP Support	Direct Payments	PD	Cont.	0 – 1	Total amount of Direct Payments received (SE606) / Total Production (SE131)	Farm	FADN
	Rural Development Support	DR	Cont.	0 – 1	Total amount of Rural Developement aid received (excluding environmental aid) (SE624 - SE621) / Total Production (SE131)	Farm	FADN
	Environmental Support	A	Cont.	0 – 1	Total amount of enviroenmental aids received under the Rural Developement program (SE621) / Total Production (SE131)	Farm	FADN
Exogenous Factors	Precipitation Anomalies	AP	Cont.	-∞ – ∞	Annual precipitation - 1998-2010 precipitation mean by province	Province	AEMET
	Perceived Prices Index	PP	Cont.	0 – ∞	Mean agricultural and livestock production prices by sector (base 2015=100)	National	MAPA
	Input Prices Index	PI	Cont.	0 – ∞	Mean input prices by sector (base 2015=100)	National	MAPA
Not used in the model	Input Intensity (*)		Cont.	0 – ∞	Specific agricultural and livestock costs (SE284 + SE283) / UAA	Farm	FADN

RESULTS

OTE	R ²	Mean VIF	DW
15. Cereals, Oilseeds and Protein Crops (COP)	0.57	1.76	1.76
16. Other Extensive Annual Crops	0.63	3.65	1.77
20. Horticulture	0.96	2.07	1.74
35. Viticulture	0.55	1.91	1.82
36. Fruit Trees	0.62	1.71	1.74
37. Olive Grove	0.46	2.26	1.69
38. Other Combined Crops	0.86	3.88	1.82
45. Dairy Cattle	0.52	2.15	1.71
48. Sheep, goats and other herbivores	0.55	1.67	1.80
49. Breeding and Meat Beef	0.73	1.79	1.78
50. Granivores	0.38	2.00	1.73
60. Mixed Agriculture	0.75	1.98	1.74
70. Mixed Livestock	0.66	1.95	1.90
80. Mixed Agriculture and Livestock	0.76	1.84	1.77
Mean	0.64	2.19	1.77

Fixed Factors

OTE	β_0	$\beta_1 (ZA=2)$	$\beta_1 (ZA=3)$	$\beta_2 (ZD=T)$	$\beta_3 (ZN=T)$	$\beta_4 (UDE=2)$	$\beta_4 (UDE=3)$	$\beta_4 (UDE=4)$
15. Cereals, Oilseeds and Protein Crops (COP)	8.1498***	0.0216	0.0798	-0.1900	0.1994	0.9686***	2.2117***	3.3812***
16. Other Extensive Annual Crops	-10.2836***	-0.6729*	-0.3874	-0.2551	-2.2477***	0.3998*	2.3842***	4.0390***
20. Horticulture	4.3656***	0.0060	-0.0099	0.0072	-0.0562***	0.0377***	0.0697***	0.1325***
35. Viticulture	14.6703***	0.7375*	0.8702**	-0.5189*	0.5608	1.6105***	3.0897***	6.2140***
36. Fruit Trees	8.5328***	-0.0021	0.1642*	0.0037	0.0873	0.1250***	0.3099***	0.6000***
37. Olive Grove	17.6007***	-1.2222***	0.5320	-0.5239	-1.5028*	1.1997***	2.7247***	3.5922***
38. Other Combined Crops	8.1166***	-0.2827**	-0.2459*	0.0304	-0.4543	0.1096*	0.2175*	0.5013
45. Dairy Cattle	-203.9512***	6.1305***	3.2517	-1.4819	-0.3194	20.5769	29.4645*	31.0487*
48. Sheep, Goats and Other Herbivores	8.0961***	0.5122	1.6903***	0.4607*	-0.2049	1.0215***	2.5236***	3.6455***
49. Breeding and Meat Beef	6.5869***	0.0327	0.2343***	-0.0289	-0.0910	0.2767***	0.6213***	0.8543***
50. Granivores	9.2441***	-0.0026	0.0798	0.0885	-0.1912	0.0095	0.1268	0.7002
60. Mixed Agriculture	8.9897***	-0.3551*	-0.1669	-0.0297	-0.3726	0.8588***	1.6190***	2.7154***
70. Mixed Livestock	35.1822	10.0202*	1.2853	11.0092**	-52.8817***		2.9264	4.8535
80. Mixed Agriculture and Livestock	9.8697***	0.3141	0.6794**	0.2334	0.5012	1.2538***	2.2986***	2.3116***

Economic and Productive Factors

OTE	β_5 (<i>D*SR</i>)	β_7 (<i>Cost</i>)	β_8 (<i>MO</i>)	β_9 (<i>D*Inv</i>)	β_{10} (<i>TFP</i>)	β_{11} (<i>Q=1</i>)	β_{11} (<i>Q=2</i>)	β_{12} (<i>OAL=2</i>)	β_{12} (<i>OAL=3</i>)
15. Cereals, Oilseeds and Protein Crops (COP)	0.0804	-4.5355***	11.7660	-0.1704	16.0943***	-0.6831*		1.0179**	-0.6431
16. Other Extensive Annual Crops	0.4229*	-3.9161***	3.0363*	0.4557	49.7920***	-0.0803		1.9701***	2.5209
20. Horticulture	0.0039	-0.0964***	0.0027	0.0136	0.4042***	0.0026			0.2855***
35. Viticulture	-0.9223**	-5.7210***	10.0082***	0.0607	12.0355***	-0.1014	-2.2251***	1.4597*	2.9603**
36. Fruit Trees	0.0008	-0.4958***	0.2952**	-0.0414	1.7487***	-0.0710		0.0796	-0.0350
37. Olive Grove	1.2504	-4.4352***	-14.7571**	-0.8201	8.7257***	0.4540			
38. Other Combined Crops	-0.1001	-1.0697***	1.7044	-0.2067***	1.9173***	-0.1049		-0.0500	1.2222
45. Dairy Cattle	0.1441	-14.3419*	0.5434	0.8691	637.9332***	-0.1393		-7.3559	-14.4478***
48. Sheep, Goats and Other Herbivores	0.3021	-0.7067	0.8731**	0.3784*	22.7269***	0.2774	-0.4148	0.1460	-2.4094***
49. Breeding and Meat Beef	0.1056*	0.1005	0.3587**	-0.1691**	4.9149***	0.0062	-0.0344	0.1918	1.3580***
50. Granivores	0.1419	0.5102	0.0940***	0.1171	1.9193***	-0.2264	-0.3844	-0.0524	
60. Mixed Agriculture	-0.1262	-1.6178***	0.2601	0.0368	5.3322***	-0.0118	0.2511	0.7261	0.9913
70. Mixed Livestock	3.9265	-29.4251**	30.6635	-2.7161	163.0856***	3.7849		0.8419	8.7778
80. Mixed Agriculture and Livestock	0.2016	0.0721	0.8225	-0.3035	7.1406***	0.3410		-0.4167	-0.1787

Environmental Factors

OTE	β_{13} (D)	β_{14} (Eco=1)	β_{14} (Eco=2)	β_{15} (I=2)	β_{15} (I=3)	β_{16} (D*E)	β_{17} (C)
15. Cereals, Oilseeds and Protein Crops (COP)	0.1933***	-0.1546	-0.3405	0.9623***	1.7317***	-0.2160*	-0.3176
16. Other Extensive Annual Crops	0.2223***	-0.6278		1.3664***	1.1709***	-0.3289	-0.3013
20. Horticulture	0.0016	0.0071	-0.0482	0.0373***	0.0684***	-0.0123*	0.0017
35. Viticulture	0.3726***	0.0298	-0.0622	1.8372***	3.6098***	0.4338	-0.1113
36. Fruit Trees	-0.0042	0.0512	-0.2881*	0.2251***	0.3666***	0.0357	0.0783
37. Olive Grove	0.5033**	-0.0594	-4.3922*	1.6266***	2.4515***	0.6473	
38. Other Combined Crops	0.0392	0.2787***	-0.8863	0.2278***	0.6020***	0.0810	-11.5824
45. Dairy Cattle	-0.0268	0.4323		4.5261***	2.8031*	0.3333	-3.2940***
48. Sheep, Goats and Other Herbivores	0.3394***	-0.2718	-3.0006**	0.4999***	0.8637***	-0.3064*	-0.8019***
49. Breeding and Meat Beef	0.0370***	0.2001**	0.2276	0.1229***	0.1436***	0.0480	-0.1315***
50. Granivores	0.1694***	-0.2203	0.5171	0.5490***	1.5394***	0.0288	-0.0340
60. Mixed Agriculture	0.0163	-0.1021		0.4204***	0.7114***	-0.1336	0.0122
70. Mixed Livestock	2.0119**	-0.6186		2.9840	8.3294*	-0.7008	-3.7258
80. Mixed Agriculture and Livestock	0.1501***	-0.2733		-0.0275	0.3953	-0.3420	-0.1026

CAP Support and Exogenous Factors

OTE	$\beta_{18} (D*PG)$	$\beta_{19} (D*DR)$	$\beta_{20} (D*A)$	$\beta_{21} (AP)$	$\beta_{21} (PP)$
15. Cereals, Oilseeds and Protein Crops (COP)	0.2601***	-0.1150	0.1277	-0.0003	0.0147***
16. Other Extensive Annual Crops	0.7779***	0.0846	0.6257**	0.0014***	0.0423***
20. Horticulture	-0.0136*	-0.0008	-0.0006	0.0000	0.0004
35. Viticulture	0.5424***	-0.3304*	0.6989***	-0.0005	0.0181***
36. Fruit Trees	-0.0533**	-0.0025	0.0225	-0.0001	-0.0015
37. Olive Grove	-0.0365	-1.9121	1.1096***	0.0004	0.0043
38. Other Combined Crops	-0.0617	-0.1263*	0.0790**	-0.0002	0.0034*
45. Dairy Cattle	-3.1844**	0.8290	2.5570	-0.0062***	0.0776
48. Sheep, Goats and Other Herbivores	0.4256***	-0.3730***	0.1537**	-0.0005	0.0221***
49. Breeding and Meat Beef	0.0665***	-0.0384*	0.0915***	0.0000	-0.0017
50. Granivores	-0.2062*	-0.2649*	-0.1276	0.0000	0.0221***
60. Mixed Agriculture	0.0877	-0.0145	0.0791	0.0000	0.0126***
70. Mixed Livestock	1.3668	-2.0078	1.4554	-0.0026	-0.6754
80. Mixed Agriculture and Livestock	0.3636*	-0.2244*	0.0315	-0.0003	0.0111

DISCUSSION

- ✓ **The economic dimension**, mainly in intensive livestock farming and **the efficiency in the use of inputs**, are the factors that best explain the variability in income. **The cost structure** negatively impacts mainly olive groves, vineyards, and COP. **The intensity of labor** marks a difference in olive groves (negatively) and in vineyards (positively).
- ✓ **The production systems are definitive for income**: The **intensification processes** are positive especially in vineyards and olive groves, **the diversification of livestock** is positive, as is **crop diversification** in vineyards, extensive crops, and mixed systems. **Extensive farming** is neutral in the income of extensive crops. **Irrigation**, it is not definitive except in extensive crops in a positive way, and in vineyards, it has a negative effect.
- ✓ **Environmental aspects** such as **circularity** penalize dairy cattle farms, as well as **100% organic farms** (mainly in olive groves and sheep and goat farming).
- ✓ **Subsidies are important (but not essential)** in COP farms and other extensive farming, with negative effects on dairy cattle. **Agri-environmental subsidies** are only influential in olive groves and, to a lesser extent, in sheep and goat farming. **Rural development subsidies**, although they are not very influential, do affect sheep and goat farms.
- ✓ **Exogenous variables** such as **price variation index** have little influence on incomes, although they are significant in extensive crops, viticulture, and livestock, especially granivores. The anomaly of precipitation relative to the average of recent years has not had an influence since it has not been an especially dry period.
- ✓ **Physical aspects linked to the territory**, such as altitude, have shown positive effects in sheep, goat farming, and viticulture, while being in a **Natura 2000** area negatively influences some extensive crops.

CONCLUSION

This preliminary analysis has provided us with the following findings:

- The factors that most influence the income level of farms are **defined by the production system, the efficiency in the use of inputs**, and the **cost structure**.
- The weight of subsidies** is not definitive in the income level of farms, although it is important in some sectors, such as agri-environmental subsidies in olive groves or direct payments in COP and extensive crops.
- To assess **the impact of external factors** on income variability, it would be important to include **the year 2022**, a key year for the rise in **prices received and paid by farmers**, as well as the **widespread drought** affecting most productive areas in Spain.

Complementary lines of work initiated:

- Delve into the role of subsidies by calculating the **Income Transfer Efficiency (ITE)** using a GMM-SYS model. Dynamic models that distinguish the long-term and short-term effects of subsidies on farms.
- Analyze **the resilience, vulnerability, and competitiveness** of farms by segmenting them based on the value of NVA/AWU, characterizing of these groups of farms.

A landscape photograph featuring a row of trees in the background and a grassy field in the foreground. A bright yellow rectangular box is overlaid in the center, containing the text "THANK YOU FOR YOUR ATTENTION!".

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