Agricultural transformations within the agri-food system (Spain, 1980-2016)

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Abstract

There is growing consensus that agriculture is a key activity due to its potential to tackle many of the sustainability problems we currently face, but also because of its important economic, social and cultural role. Nevertheless, its weight in terms of value added and labour has followed a downward trend in most of the economies, while increasingly becoming a source of harmful environmental problems. The industrialization process of agriculture and its integration in the global agri-food system are considered major drivers of this path. Yet, conventional narrative of agrarian history mainly approaches agriculture as a single activity without taking into account its linkages with other economic activities, which remain poorly understood. This is also the case of Spain. This article aims at examining the evolution of Spanish agriculture within the agri-food system by adopting an input-output approach. To do that, Supply and Use Tables and Input-Output Tables from the Instituto Nacional de Estadística (INE) of Spain are analysed from 1980 to 2016. Results confirm the continuous loss of weight of agriculture's value added and labour shares within agri-food system, while at the same time food industry and particularly services related to food significantly grew. Moreover, findings show that agriculture underwent a process of decoupling to the land -relying less on its internal inputs- at expenses of enlarging its dependence on external ones. Such shift went hand in hand with a growing enrolment in the global agri-food system and the increase of the rate of salaried labour.

Key words: agri-food system, agriculture, Supply and Use Tables, input-output

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1. INTRODUCTION

There is no doubt that agriculture develops multiple vital functions. From being the most important economic sector in terms of its potential to be a net provider of renewable materials and energy carriers to the rest of the economy (Georgescu-Roegen, 1971), to its capacity in providing ecosystem services (e.g. carbon sequestration, water supply or disease control) that are essential for the sustainability of human life (Daily, 1997; MEA, 2005). Agroecosystems are the kind of human intervention on natural systems with the wider territorial scope on earth by far, taking up roughly 40% of total land area (IAASTD, 2009). This way, agriculture is considered a key dimension in tackling many of the environmental problems we currently face (Shukla et al., 2019). Furthermore, agriculture entails a major social role, since it is a source of employment and a way of cultural heritage all over the world (Koohafkan & Altieri, 2011). Despite this, the weight of agriculture in terms of value added and labour has sharply reduced in most countries (World Bank, n.d.-a, n.d.-b). This is also the case of Spain. What is behind this fact?

Agriculture has undergone unprecedented transformations since the second half of 20th century. It had historically the function to feed the world, being the core sector of food production. However, new economic processes have gradually developed between the agricultural production of food and its consumption since industrialization (i.e., transportation, packaging, processing and distribution) resulting in larger value chains of the so-called agri-food system (Malassis, 1973; Infante-Amate & González de Molina, 2013). This makes the distinction between the concept of «agricultural product» and «food product» essential. The former understood as the output derived from the production of the agriculture sector (Rodríguez-Zúñiga & Soria, 1986), whereas the latter it is defined as the final production of goods resulting from the transformation of

agricultural products and addition of diverse uses (Lancaster, 1966). Thus, ongoing debates on agriculture and food should be framed in the entire agri-food system.

In addition, the current agri-food system has become increasing globalized, turning into only a link in a wider global value chain ruled by agribusiness and wholesale traders. This new stage of agricultural transformation was coined as «internationalised agri-business model» (Clar et al., 2018) and is framed in the «third food regime» (Friedmann, 2018; Krausmann & Langthaler, 2019; McMichael, 2009). At the same time, the global agri-food system turned highly unsustainable, both from an environmental (Cardinale et al., 2012; Infante-Amate & González de Molina, 2013; Laso & Hoehn, 2018; Tscharntke et al., 2012) and social side (Camarero et al., 2006; FAO et al., 2018; Tello & González de Molina, 2017). The transition from traditional diets to new consumption patterns led by higher contents of refined sugar, fats, oil and meat is a primary source of environmental threats at a global scale, entailing also detrimental impacts on human health (Kearney, 2010; Tilman & Clark, 2014).

This article examines the economic transformations experienced by the agriculture economic sector within the agri-food system in Spain over the last four decades, putting particular focus on the inter-dependences between agri-food system related economic activities. To do that, an input-output approach is adopted that fundamentally lies in the exploration of Supply and Use Tables (SUTs) and Input-Output Tables (IOTs) published by the Instituto Nacional de Estadística (INE) of Spain from 1980 to 2016. Based on them, series on value added, labour, supply and uses were constructed for the links of the agri-food chain corresponding to «agriculture», the «food industry» and «food services». Additionally, a specific series was created for the intermediate input structure of agriculture aiming at identifying the main trends over time. Series include disaggregated

data on the activities and products involved in the agri-food system's sectors, enabling to carry out a more in-depth analysis of the changes experienced in this period.

The input-output approach was also used by Naredo (1991), who analyzed the process of modernization of Spanish agriculture in the second half of the 20th century (1950-1990). Among other contributions, Naredo examined agrarian Gross Domestic Product (GDP) and income as well as agricultural and food products' uses (using IOTs of years 1970, 1975, 1980 and 1985). By doing so, he linked for the first time the decline of agriculture to the development of the food industry. This work was next enlarged by assessing the Spanish transition from «traditional agriculture» towards the «agro-industrial system» (Abad & Naredo, 1997). Through the study of Spanish IOTs (1962, 1970, 1980 and 1990), the authors put forward how agriculture sharply rose its dependency from inputs from other industries while, at the same time, agricultural outputs were increasingly allocated in other activities (majorly in the food industry) rather than to final consumption. Along with the study of the main agrarian macro-magnitudes, they argued that such transformation explained the fall of the share of agricultural GDP and active population regarding to Spain's total.

This article contributes to this literature by providing new evidence on the dynamics followed by the agriculture sector and the food industry, also including food services for the first time. This way, it entails a step forward in broadening the study of agriculture towards the whole agri-food system and in highlighting the linkages with other economic activities. Furthermore, the period of analysis is widened from the 90's to recent times. Although from an historiographic standpoint it would be desirable to take the study back on time, the availability of published data limits this possibility for now. Despite this fact, the period studied in the article (1980-2016) is of high interest since a key historical event

took place: Spain joined the European Economic Community (EEC) in 1986. This episode had major consequences on the subsequent development of the country. Firstly, Spain started to open to international trade agreements, what boosted exports and imports. Secondly, Spanish agriculture was since then under the rule of the European Union (EU) Common Agrarian Policy (CAP).

It is also expected to contribute to other works on Spanish agrarian change that focus primarily on the agriculture sector, either on its economic side from an orthodox economics standpoint (Clar et al., 2018), or broadening the analysis by including biophysical aspects from socio-metabolic approaches (González de Molina et al., 2020; González de Molina et al., 2017). It can also add to other fields, such as «new political economy of agriculture», from which the Spanish agri-food system was also studied (Etxezarreta, 2006). Although based on data from the Spanish input-output framework, the economic transformations presented in this article should be further integrated with other dimensions beyond the marked-based one. That way, an additional goal is to contribute to the debate on the need of adopting a more holistic view to accurately address the agrarian change, which must include -at least- biophysical aspects as well the care or reproductive work from a feminist economics perspective (Carrasco, 2014). However, market dynamics exert a high pressure on the above dimensions, largely determining their trajectory. In here lies the importance of this work, as a first stage in the approach of the agri-food system transformations which must be further combined in a wider multi-dimensional and multi-criterial framework.

The article is structured as follows. After this introduction, section 2 briefly presents the database and the methodological approach. Results of the analysis are depicted in section 3, divided into the outcomes from value added and labour changes (section 3.1.), the

findings regarding supply and uses (section 3.2.), and the intermediate structure of agriculture (section 3.3.). Discussion of results are put forward in section 4 and concluding remarks in section 5.

I included a new section (3.4.) showing new results from a very recent analysis that explores in more depth the uses for the agriculture sector, the food industry and food services. These results have not been yet discussed neither properly integrated in the remaining sections of this paper due lack of time. Despite this fact, I decided to include them as they show relevant information that I would like to share and I consider they can be easily interpretated.

2. DATA AND METHODOLOGICAL REMARKS

This study relies mainly on data from SUTs and IOTs from the National System of Accounts from the INE (c). Whereas a Supply Table shows goods and services, classified by type of product, that an economy (i.e., a country) can get either because they have been produced by domestic sectors or they have been imported, an Use Table shows how those goods and services are used in the economic system (i.e., intermediate inputs, final consumption, investment and exports). This way, an Use Table enables to know the input or cost structure of national sectors (Eurostat - European Commission, 2008). It also shows the components of gross value added by sector. Additionally, an IOT[1] displays the relations between homogeneous products and components of the final demand in an economy under the assumption that each product is produced by a single sector (*product technology assumption*) (Eurostat - European Commission, 2008).

[1] Input-Output Tables published by the INE are *product by product* kind of (INE, 1999).

Both SUTs and IOTs are accounted in monetary units. However, there are some nuances. Supply Tables are compiled in basic prices[2], including a valuation matrix which allows to transform total supply by product at basic prices into purchasers' prices[3]. Use Tables are compiled in purchasers' prices unless data on value added that is accounted at basic prices. In addition, the INE published Use Tables at purchasers' prices for some years. IOTs are entirely accounted at basic prices.

The INE published SUTs from 1995 to 2016 on an annual basis, whereas IOTs were published for 1980, from 1985 to 1994 also on annual basis, from 1995 to 2015 once every five years, and for 2016. For the purpose of this article, fundamentally of descriptive character, data from SUTs is preferred due to the wider and more precise information they show. As previously noted, the compilation of IOTs rely on certain assumptions that require the application of adjustments. Under the *product technology assumption*, secondary production -that is, the production that is not characteristic of a sector- is reassigned so that symmetric IOTs can be built. While useful for analytical purposes, this adjustment entails a distancing from primary data that SUTs do show and that is more accurate for descriptive analysis.

However, as SUTs are not published from 1980 to 1994 data from IOTs is used as a proxy for this period. It can be considered a sound proxy since secondary production within the agri-food system is relatively low according to own calculations (see ANNEX I). This results are consistent with those by the Eurostat (2008), according to that secondary output of Spanish sectors lied on an average of 4,7% between 1995 and 2000.

[2] Basic prices imply that goods are valued by aggregating the production costs (i.e. intermediate consumption of goods and services at purchasers' price, primary inputs -labour and capital-, and other taxes less subsides on production) (Eurostat - European Commission, 2008).
[3] Purchasers' prices are calculated by adding trade and transport margins, plus taxes less subsides on products to basic prices (Eurostat - European Commission, 2008).

Furthermore, the lack of labour data from 1980 to 1995 from the input-output framework was completed with data from the Spanish *Encuesta de Población Activa* (EPA), and the *Anuarios* (INE, 1990, 1994, 1996, 1997).

From this data sources, I constructed series on value added, labour, supply and uses for all the categories of activities and products related to the value chain links of «agriculture», «food-industry» and «food services» . These three sectors are assumed to form the agri-food system in the framework of this study. In addition, I constructed a specific series on the main intermediate inputs of agriculture in order to study its cost structure. In this case, the scope of economic activities and related products was broadened to the whole economy.

It should be noted that different systems of accounts and accounting base years have been applied since 1980. These changes affected particularly the classification of products and activities (see Figure 1).

Figure 1. Database description

Period	System of Accounts	Products class.	Industries class.	Base	Tables	Agri-food system products Class.*	Agri-food System activities Class.**
2016	ESA 2010	CPA 2008	CNAE 2009	2010	**SUTs**	**A (5), I (8), S (2)**	**A (5), I (8), S (1)**
					IOT	**A (3), I (1), S (1)**	**A (3), I (1), S (1)**
2015-2010	ESA 2010	CPA 2008	NACE Rev. 2.	2010	**SUTs (all years)**	**A (3), I (1), S (1)**	**A (3), I (1), S (1)**
					IOT (2010, 2015)	**A (3), I (1), S (1)**	**A (3), I (1), S (1)**
2009-2008	ESA 1995	CPA 2008	NACE Rev. 2.	2008	**SUTs (all years)**	**A (5), I (8), S (2)**	**A (5), I (8), S (2)**
2007-2000	ESA 1995	CNPA 96	CNAE 93	2000	**SUTs (all years)**	**A (5), I (8), S (2)**	**A (5), I (8), S (2)**
					IOT (2000, 2005)	**A (3), I (5), S (2)**	**A (3), I (5), S (2)**
1999-1995	ESA 1995	CNPA 96	CNAE 93	1995	**SUTs (all years)**	**A (5), I (8), S (2)**	**A (5), I (8), S (2)**
					IOT (1995)	**A (3), I (8), S (1)**	**A (3), I (8), S (1)**
1994 - 1985	ESA 1979	R56	R56	1986 (from 1986 to 1994)	**IOT**	**A (1), I (5), S (1)**	**A (1), I (5), S (1)**

				1985 (year 1985)			
1980	ESA 1979	R43	R43	1980			

Notes:
European System of Accounts (ESA)
Clasificación de Productos por Actividades (CPA) 2008
Clasificación Nacional de Productos por Actividades (CNPA) 1996
Nomenclatura de Actividades Económicas de la Comunidad Europea (Nace Rev. 2)
Clasificación Nacional de Actividades Económicas (CNAE) 93
Supply and Use Tables (SUTs)
Input-Output Table (IOT)

* The letter refers to the sector (*Agriculture* sector is designed as "A", *Food Industry* is designed as "I" and *Food Services* is designed as "S"), while the number in parentheses refers to the categories of products which form the sector.
** The letter refers to the sector (*Agriculture* sector is designed as "A", *Food Industry* is designed as "I" and *Food Services* is designed as "S"), while the number in parentheses refers to the categories of activities which form the sector.

Source: own elaboration (INE-c)

Some systems of accounts promoted the use of classifications with larger disaggregation than others. SUTs from 1995 to 2009, based on the Clasificación Nacional de Actividades Económicas 1993 (CNAE-93) (INE, a) and the Clasificación Nacional de Productos por Actividades 1996 (CNPA-96) (INE, b) show the largest disaggregation[5]. Figure 2 outlines the categories of products and activities encompassed in agriculture, the food industry, and food & accommodation services, enabling the reader to get a general idea of this feature.

[5] CNAE-93 is structured in five hierarchical levels, including 17 sections, 60 divisions, 222 groups, 512 classes and 7666 subclasses of activities. CNPA-96 is structured in seven hierarchical levels, including 17 sections, 31 subsections, 60 divisions, 222 groups, 492 classes, 947 categories, 2305 subcategories and 6188 elements.

Figure 2. Products and activities classification according to CNPA-96 and CNAE-93

SECTOR	PRODUCTS	CNPA 96	BRANCHES OF ACTIVITY	CNAE 93
AGRICULTURE	**1. Products of cropping**	Groups: 011, 013	**1. Cropping, livestock and hunting**	Division 01
	2. Products of livestock and hunting	Groups: 012, 015		
	3. Services related to cropping and livestock	Group 014		
	4. Silviculture and forestry	Division 02	**2. Silviculture and forestry**	Division 02
	5. Fishing products	Division 03	**3. Fishing and aquaculture**	Division 03
FOOD INDUSRY	**16. Meat and meat products**	Group 151	**12. Meat industry**	Group 151
	17. Milk products	Group 155	**13. Milk industry**	Group 155
	18. Oil and fat products	Group 154	**14. Other food industries**	Group 152, 153, 154, 156, 157, 158
	19. Animal feeding products	Group 157	**14. Other food industries**	Group 152, 153, 154, 156, 157, 158
	20. Other food products	Groups: 152, 153, 156, 158	**14. Other food industries**	Group 152, 153, 154, 156, 157, 158
	21. Alcoholic beverages	Classes 1591-1597	**15. Beverage production industries**	Group 159
	22. Non-alcoholic beverages	Class 1598	**15. Beverage production industries**	Group 159
	23. Manufactured tobacco products	Division 16	**16. Tobacco industry**	Division 16
FOOD &ACCOMODATIONS SERVICES	**69. Accommodation services**	Groups: 551, 552	**44. Accommodation**	Groups: 551, 552
	70. Food and beverage services	Groups: 553, 554, 555	**45. Food and beverage services**	Groups: 553, 554, 555

Source: own elaboration (INE-d)

The consequence of the mentioned accounting differences was the impossibility to construct perfectly homogeneous series in terms of products and activities categories along the period of study. As Figure 1 shown, the component of food services is particularly affected, being aggregated along with food & accommodation services for 1980, from 1985 to 1994, from 2010 to 2015 and for 2016 in the case of activities. Yet, the examination of data from years in which food services and accommodation services are separately accounted proves that the former accounts for most of the aggregate -on average (1995-2009; 2016), food services accounted for 83.3%-. Figures A and B from Annex II show, respectively, the categories of products and the economic activities which make up agriculture, the food industry and food services by type of classification.

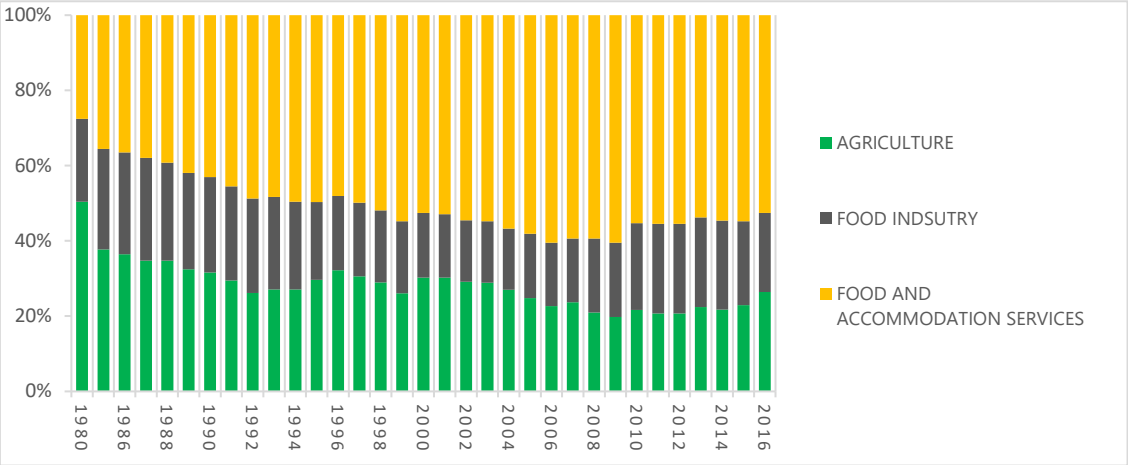
A final remark concerns the value chain links of the agri-food system related to transport and distribution. SUTs and IOTs do not directly show the share of transport services and trade services that are specifically part of the agri-food system. Disentangling their weight requires further research. Because of that, they are excluded of the boundaries of this research for now. They are only taken into account when calculating the cost structure of the agricultural sector.

3. RESULTS OF THE ANALYSIS OF THE SERIES

This section presents the results of the exploration of the series. Firstly, the evolution of value added and labour for the Spanish agriculture sector, food industry and food services is put forward in the framework of the agri-food system and the Spanish economy from 1980 to 2016. Secondly, I show the changes in the supply of agricultural products, food products and food services in terms of their origin -i.e. whether the products were domestically produced or imported-. Detailed data on the sub-categories of products which made up the main three mentioned categories of the agri-food system is included. In addition, I present the trends in their uses as intermediate inputs, household consumption, exports or investment. Finally, the transformation of the cost structure of the agriculture sector is depicted by exploring the changes within its ten main inputs.

3.1. Value added and labour in the agri-food system: agriculture's fall and food services' rise.

Figure 3. Value added by sector (% of agri-food system), Spain 1980-2016



Source: own elaboration from the input-output framework (INE-c)

The analysis of value-added figures[6][7] proves the decline of the weight of agriculture sector within Spanish agri-food system. As shown in Figure 3, the share of value added accounted by the agricultural sector reduced from 50.4% in 1980 to 26.4% in 2016. This drop was particularly pronounced from 1980 to 1992, when its weight halved. Conversely, food & accommodation services continuously increased its weight. While they accounted for 27.6% of total value added of Spanish agri-food system in 1980, they reached up to 52.5% in 2016. The share of food industry remained fairly stable along the period. This evolution results in a significant change in the composition of Spanish agri-food system, with a transfer of income from agriculture to services related to food.

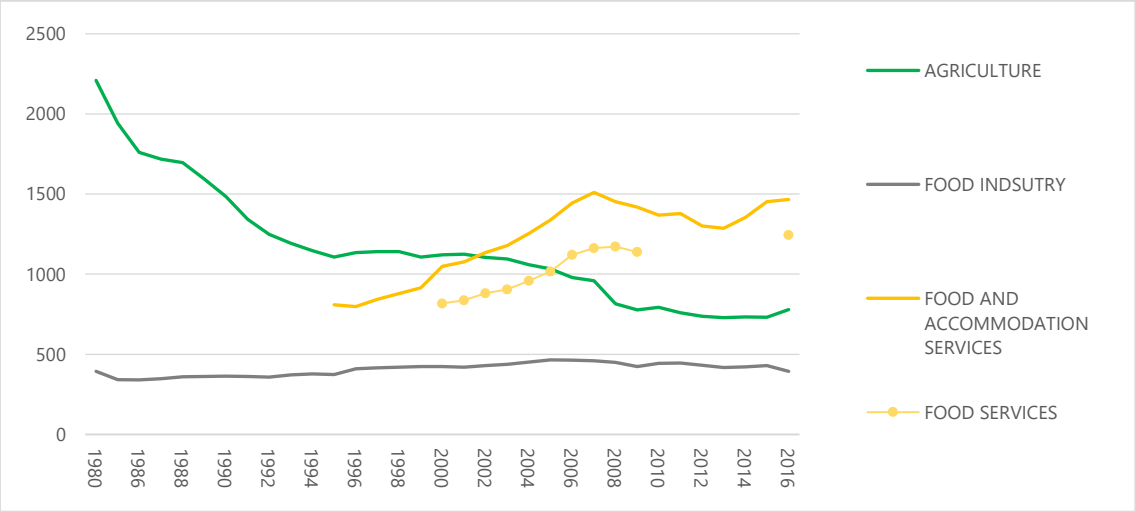
[6] Value added (i.e. gross value added, GVA) is defined as the difference between the output and the intermediate consumption of a given branch of activity, and it is identical to the sum of incomes generated: Compensation of employees; Other taxes less subsides on production; Consumption of Fixed Capital; Net operating surplus/Mixed income (Eurostat - European Commission, 2010).

[7] In 1995 an important change in the way of accounting GVA took place, with the introduction of the accounting base 1995. Before 1995, INE provided GVA data at purchasers' price (GVApp) and at factor cost (GVAfc), whereas from 1995 onwards, it is published at basic prices (GVAbp). GVAfc and GVAbp are considered as the most comparable (De la Fuente, 2015; INE, 1999). Thus, Figure 3 is based on data of GVAfc from 1980-1994 and GVAbp for 1995 to 2016.

In regard to the total value added of the Spanish economy, the shrinkage of agricultural sector is also prominent. It accounted for 7.6% of its total value added in 1980 and just for 3.1% in 2016, reducing in a rate of 59.2%. As it may be expected, food & accommodation services grew, but they did not follow the same path all over the period. Food & accommodation services' share experienced an increase in the first twenty years of the period for analysis, almost doubling its weight from 4.6% in 1980 to 8.2% in 1999 Since then, it slightly reduced at an average rate of 1.2%. As for the food industry, its weight experienced a small fall, dropping from 3.3% in 1980 to 2.5% in 2016.

The joint consequence of the above trends was the loss of importance of the agri-food system within total value added of the Spanish economy over the period. Its weight reduced from 15.1% in 1980 to 11.8% in 2016. This downward trend was only broken between 1980 and 1987, when share of value added of the agri-food system regarding the total value added of Spanish economy expanded in 1.7%. This trend does not reflect the decrease of agri-food system's output but the emergence of other economic activities, which have gained relative weight in the last decades.

Figure 4. Number of people engaged by activity (in thousands of people), Spain 1980-2016



Notes: People engaged refers to people aged 16 and older that have been working at least one hour in exchange for a remuneration in cash or in kind during the references' week. It also includes those with work but temporarily absent through illness, holidays, etc.

They are subdivided into freelance workers (employers, businesspersons without employees and independent workers) and employees (public or private) (INE).

Labour data of agriculture sector was sourced from the Spanish Encuesta de Población Activa (EPA), from the INE, for the period 1980-1995, since it was not provided by the input-output framework. It refers to "occupied people". For the rest of the period (1996-2016), data was sourced from supply tables (INE-c), showing data on "positions" from 1996 to 2007 and on "people engaged in the activity" from 2008 to 2016 (since there is no data on "people engaged in the activity" from 1996 to 2007, "positions" is used as a proxy).

Labour data of food industry was sourced from the *Anuarios* (INE, 1990, 1994, 1996, 1997) from 1980 to 1995, since it was not provided by the input-output framework. It refers to "occupied people". For the rest of the period (1996-2016), data was sourced from supply tables (INE-c), showing data on "positions" from 1996 to 2007 and on "people engaged in the activity" from 2008 to 2016 (since there is no data on "people engaged in the activity" from 1996 to 2007, "positions" is used as a proxy).

Labour data of food & accommodation services is missing from 1980 to 1995 due lack of data. For the rest of the period (1996-2016), labour data was sourced from supply tables (INE-c), showing data on "positions" from 1996 to 2007 and on "people engaged in the activity" from 2008 to 2016 (since there is no data on "people engaged in the activity" from 1996 to 2007, "positions" is used as a proxy).

Source: own elaboration from the input-output framework (INE-c), Spanish Encuesta de Población Activa (EPA) and Anuarios (INE) and the *Anuarios* (INE, 1990, 1994, 1996, 1997)

The fall of agricultural sector in terms of value added was hand in hand with a drastic drop in agricultural labour. This drop was especially pronounced from 1980 to 1995, when figures halved from 2,209,100 people engaged in 1980 to 1,106,500 in 1994 (see Figure 4). At the end of the period only 779,700 people were engaged in agriculture. Due to lack of data, it was not possible to calculate its share within the agri-food system's total labour in 1980, but it seems that it was major. The first year with available data on agricultural, food industry and food services labour is 2000. On this date, agricultural labour accounted for 47,5% of agri-food system total (excluding accommodation services). In 2016, it decreased to 32,7%. In regard to Spanish economy total labour, agricultural labour weight sharply reduced, from 18.6% in 1980 to only 4.1% in 2016.

In line with the evolution of value added, the number of people engaged in food services skyrocketed. Data is only available from 1995 onwards and it is aggregated along with accommodation services from 1995 to 2000 and for 2010 to 2015. However, food services' labour seems to have followed an upward trend since the beginning of the 80s, as it suggests Figure 4. In 2000, 771,100 people were engaged in services related to food, accounting for 34.6% of agri-food system labour (excluding accommodation services) and for 4.8% of Spain's total labour. In 2016, it reached up to 1,244,500, accounting for

half (51.1%) of agri-food system labour (excluding accommodation services) and for 6.3% regarding total Spanish economy labour.

People engaged in food industry remained stable in absolute terms along the period. It accounted for 393,850 in 1980 and for 393,400 in 2016. Though, in relative terms its weight slightly reduced. The share of food industry labour within the agri-food system was of 17,9% in 2000 and of 16,2% in 2016. Within total Spanish economy labour, it fell from 3,3% in 1980 to 2,1% in 2016.

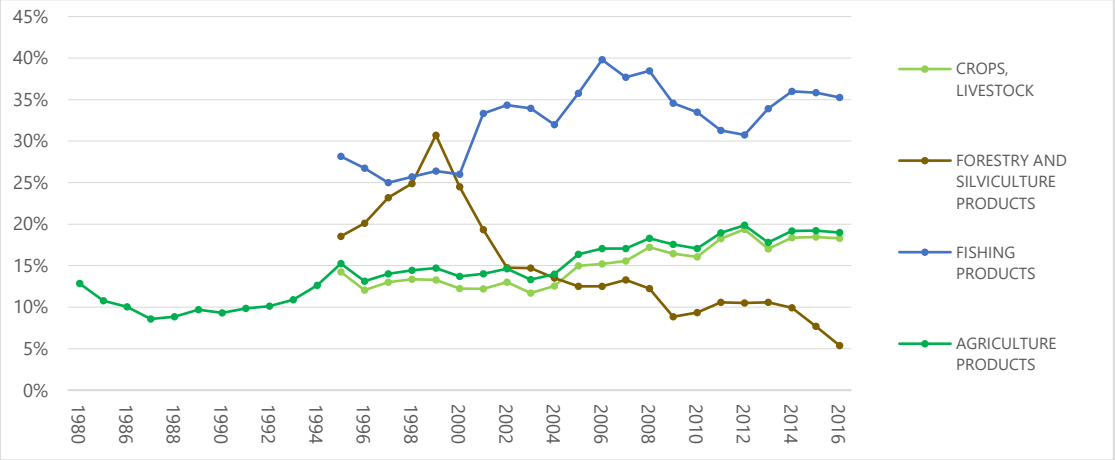
The exploration of labour data also reveals an increase of the rate of salaried labour. In the case of agriculture, salaried and non-salaried labour shares inverted from 1980 to 2016. While in 1980 agricultural non-salaried labour accounted for 71.7%, it fell to just 37.2% in 2016. These results put forward an unprecedented shift in the nature of agricultural labour. Year 1996 was a turning point in this path. When relating these findings with those pointed above, it can be concluded that agricultural labour sharply declined at the same time it became principally an employee-based economic activity at least considering total numbers (most of which hired seasonally for harvesting).

Data on the types of labour for the food industry and food services has been only published from 1995 onwards. The analysis of figures from 1995 to 2016 shows that salaried labour increased from 89.7% to 95.9% in the food industry, and from 64.3% to 75.7% in the case of food services.

3.2. Supply, uses and the globalization of the agri-food system

The first findings from the analysis of supply data are presented in Figures 5 and 6.

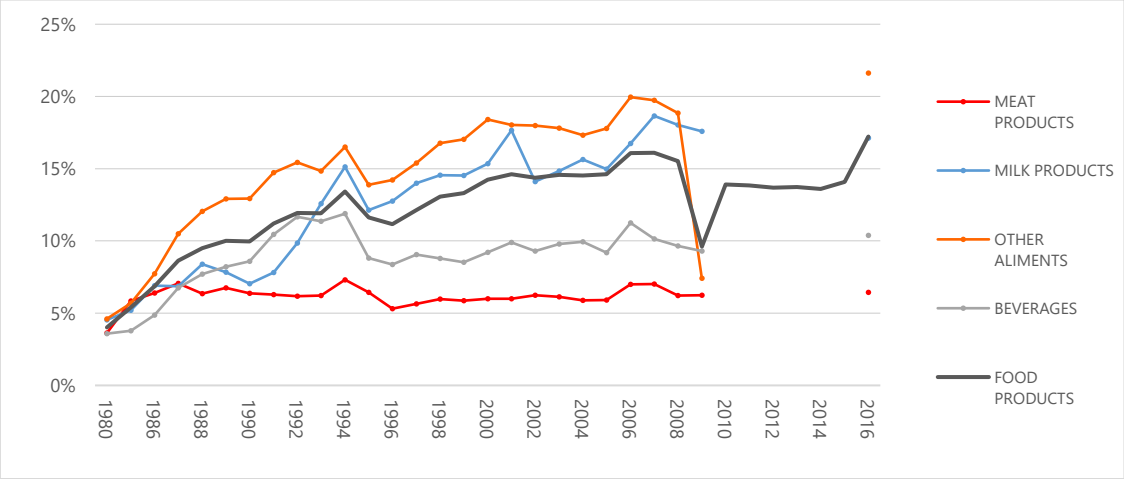
Figure 5. Imports of agricultural products by supply category (%), Spain 1980-2016



Notes: Share of imports is calculated as the number of imported products in relation to its total supply by category of product.

Source: own elaboration from the input-output framework (INE-c)

Figure 6. Imports of food products by use category (%), Spain 1980-2016



Notes: Share of imports is calculated as the number of imported products in relation to tis total supply by category of product.

Source: own elaboration from the input-output framework (INE-c)

These results show that imported products rose its relative weight in all categories -i.e., agricultural products, food products and foods services- from 1980 to 2016. In the case of agricultural products, this trend was only broken from 1980 to the moment Spain joined the EEC in 1986, reducing from 12.7% in 1980 to 8.6% in 1997. Since then, the share of imported agricultural products within its total supply more than doubled, reaching 19.9% at the end of the period. In the last decade, agricultural products have been by far the ones with the highest rate of imports, with an average of 18.3%, in contrast to food products

(14.3%) and food & accommodation services (1.6%). Surprisingly, the shares among EU and non-EU are quite similar. On the basis of available data (1995-2016), non-EU accounted for 55.2% on average while EU imports accounted for 44.8%.

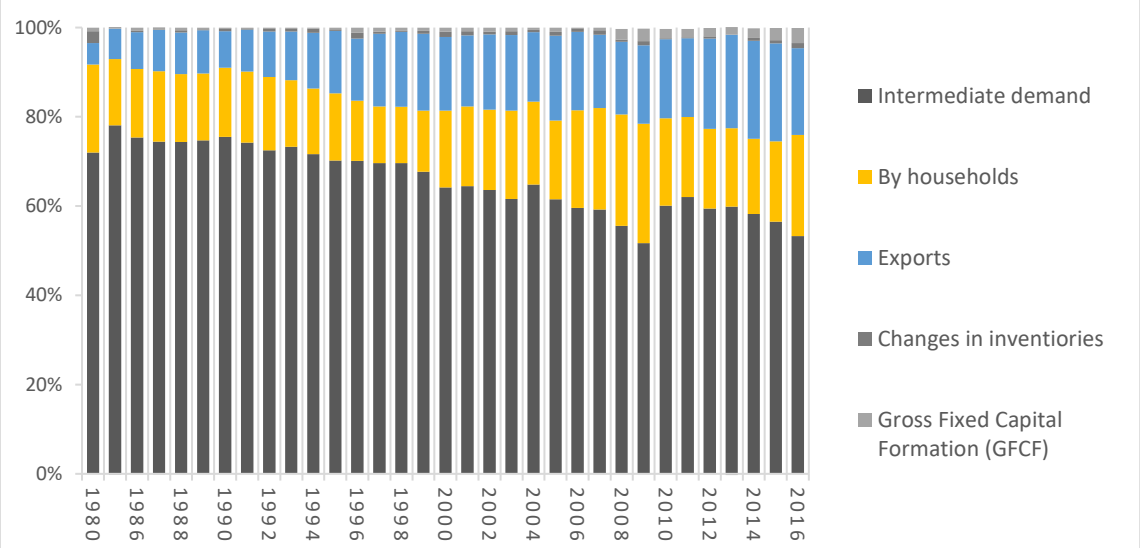
When exploring in depth the path followed by agricultural products in a greater level of disaggregation (available from 1995 onwards), it can be seen that the behaviour above described responds mostly to crop and livestock products, as they account for the majority of agricultural output. In addition, the highest rate of imported production is that of fishing products -on average 32.7%, though rates show significant volatility, as it can be seen in Figure 5-. As for forestry and silviculture products, the share or imported supply experienced a drastic change. It increased from 1995 up to 1999, accounting for 30.7%, and drastically fell since (its share was of only 5.4% in 2016).

Food products followed a similar trend, with an increase of the share of imported supply (see Figure 6). It accounted for 4.1% in 1980 and for 17.2% in 2016. Such growth was only interrupted by the crises occurred in 2008. Food products are mainly imported from the EU (65.9% in average from 1995 to 2016, while non-EU accounted for 34.2%). Within food products, the highest rate of imports corresponds to other food products -which includes oil and fat products; animal feeding and other food products-. Among them, animal feeding accounts for the most of its value. Contrary, meat products are the ones with the lowest rate of import supply. Moreover, it remained fairly stable along the period, accounting for 6.8% on average. The livestock specialization of Spanish agriculture may explain this feature. This aspect will be further addressed in the discussion (section 4).

Food & accommodation services were domestically supplied for most of the period. Only in recent years imports have surfaced. Figures for years 2015 and 2016 show an upward trend (1.4% and 2.4% respectively), though keeping in low values.

The increase of imports within products' supply went hand in hand with the rise of exports within products' uses, as shown in the following Figures 7 and 8.

Figure 7. Uses of agricultural products (%), Spain 1980-2016



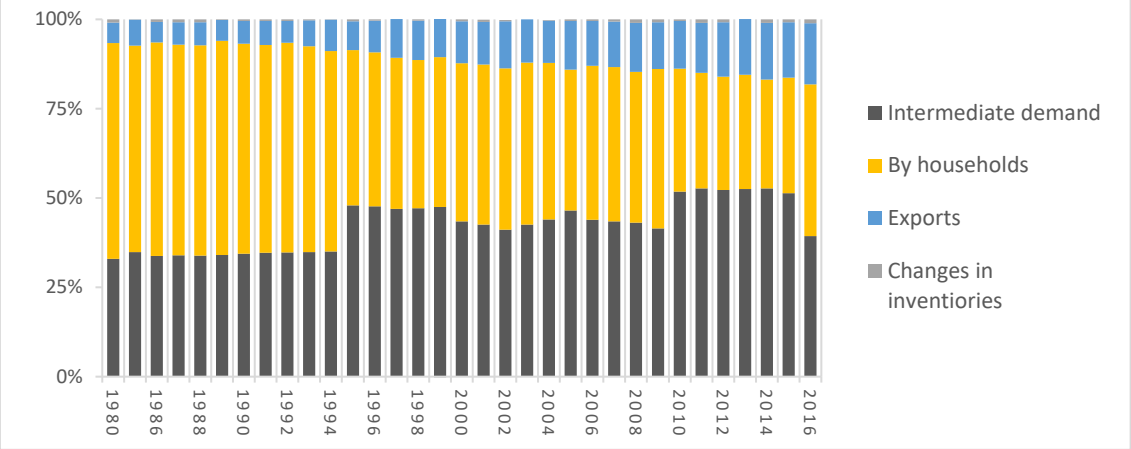
Source: own elaboration from the input-output framework (INE-c)

Agricultural products were mainly used as intermediate inputs of domestic industries in our period of analysis (see the intermediate demand item in Figure 7). However, the share of intermediate uses of agricultural products continuously fell from 1985, when it accounted for 78.1%, to 2016, with a share of 53.3%. This loss of weight seems to be a result of the rise of agricultural exports, which greatly increased from 4.8% of total uses in 1980 to 19.5% in 2016. This makes apparent an increasing integration of the Spanish final agricultural output in international markets (Ayuda & Pinilla, 2020; Ernesto Clar et al., 2018; Serrano et al., 2015). Household consumption is the third category in weight. As Figure 7 shows, it remained quite stable along the period, accounting for 17.5% on

average. The exception of this pattern was during the crisis of 2008, when it reached a peak of 26.8%.

Considering only food products, exports were the end use category that relatively increased the most, as shown in Figure 8. While its share accounted for 5.5% of the total output of food products in 1980, it reached 17.1% in 2016.

Figure 8. Uses of food products (%), Spain 1980-2016



Source: own elaboration from the input-output framework (INE-c)

Once again, we see how exports pushed the relative reduction of Spanish intermediate consumption of other sectors and final household consumption. However, contrary to agricultural products, at the beginning of the period food products were mainly allocated to satisfy household consumption, accounting for 60.4% of total uses. Though, its share described a downward trend, only reverted partially in 2016 (see Figure 8). Simultaneously, intermediate uses expanded, being from 1995 onwards the main use of food products, ranging from 48.0 to 52.7% except in some specific years (2000-2003; 2009; 2016).

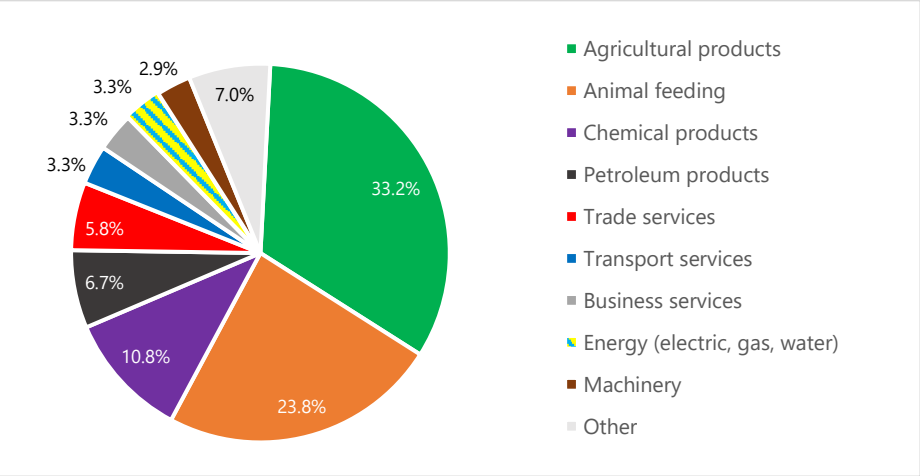
As we may expect, food & accommodation services were principally used by households, accounting for 90.1% of total uses on average. Although to a lower extent, the sector has

also experienced an increase in the share of exports among its uses. In 2016, they accounted for 6.2%.

3.3. From the inner integration to the external disintegration of agriculture

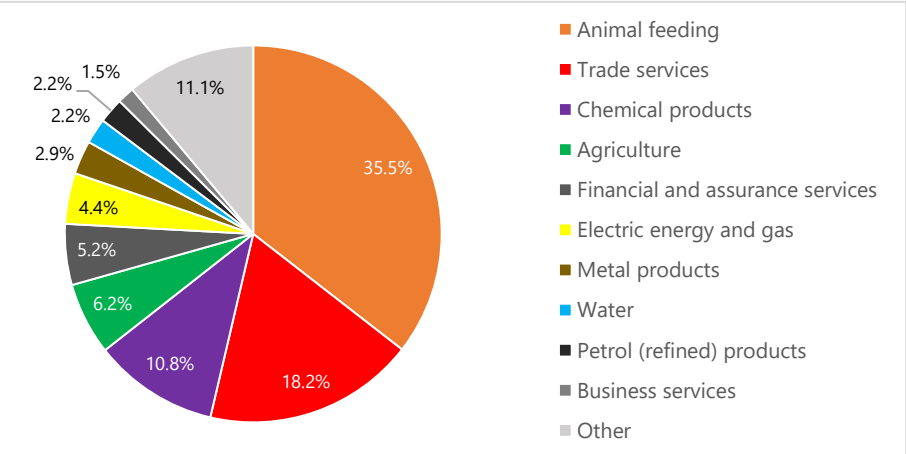
In this section I present the evolution of the cost structure of agriculture -that is, the weight of intermediate inputs (see Annex III for a detailed description) used for agricultural output- shown in Figures 9 and 10. Other inputs, such as labour or capital, are out of the boundaries of the analysis.

Figure 9. Input structure of agriculture sector in basic prices (%), Spain 1980



Source: own elaboration from input-output framework (INE-c)

Figure 10. Input structure of agriculture sector in basic prices (%), Spain 2016



Source: own elaboration from input-output framework (INE-c)

Figures 9 and 10 depict the relative weight of the major intermediate inputs (from now on just “inputs”) of agriculture in 1980 and 2016 respectively. In a first glimpse we can spot how agricultural inward inputs lost its leading position at expenses of animal feeding. In 1980, one third of the inputs agriculture needed for its production were sourced in the sector itself. This setting drastically changed in the coming years. The weight of agricultural inward inputs -or «reuse rate» (Abad & Naredo, 1997)- described a continuous downward trend up to recent days. At the beginning of the 1990s, animal feeding overpassed them, becoming the main input category so far. By 2016, animal feeding’s share had reached 35.5% of total agricultural inputs. Concurrently, agricultural inward inputs dropped to only 6.2%, moving back to the fourth position in the ranking.

Data from 1995 onwards, which presents a larger level of disaggregation, enables us to explore more deeply the dynamics between the sub-categories of agricultural activities and the evolution of their reuse rate. The linkages between cropping, livestock breeding and related services (1) with forestry (2) are of special interest since these activities historically operated in the same agroecological landscape, and their mutual disconnection has been identified as the main driver of the loss of bioeconomic circularity and energy efficiency of industrial agriculture (Cattaneo et al., 2018; González de Molina et al., 2020).

In addition, from 1995 to 2009 the INE published disaggregated data on cropping (1.1), livestock breeding (1.2.) and services related to cropping and livestock breeding (1.3), which facilitates an even more exhaustive analysis. Data reveal that flows from forestry (2) to cropping, livestock breeding and their related services (1) are notably weak. From 1996 to 2016, forestry products (2) accounted just for 0.1% within the cost structure of

cropping, livestock breeding and related services on average (1). The reuse rate within cropping, livestock breeding, and related services (1) significantly dropped from 20.7% to 6.2% during the same period.

These figures bring to light the main structural socio-metabolic change experienced by the whole agricultural sector, since cropping, livestock breeding and related services (1) account for most of agricultural output. Indeed, they equal the figures showed above when I used the share of cropping, livestock breeding and related services (1) as a proxy of the whole sector in section 2. Furthermore, when examining SUT data within cropping, livestock breeding and related services (1) from 1995 to 2009 I observe that crop products (1.1) were the intermediate input sourced internally the most. Crop products (1.1) accounted for roughly half of its (1) total internal intermediate inputs (47.9% on average). Finally, the most significant transformation is the one related to the services related to cropping and livestock breeding (1.3). While they accounted for 11.9% of total internal inputs of cropping, livestock breeding and related services (1) altogether, its share increased up to 20.5% in 2009.

As for forestry (2), the flows from cropping, livestock breeding, and related services (1) still accounted for 12.4% of its cost structure in 1995. In the following years, their weight drastically fell down, accounting for only 1.9% in 2015. At the same time, the reuse rate within forestry (2) skyrocketed, growing from 0.3% in 1995 to 48.1% in 2015. However, forestry (2) figures need to be taken with caution. The severe variations observed (Figure 5) might respond to the changes in the accounting criteria adopted by the INE. This specific issue need further research (Iriarte-Goñi & Infante-Amate, 2019).

Chemical products (which include pesticides and agro-chemicals, fertilizers and pharmaceutics) were the third most important category in terms of percentage. Their share within, the cost structure of agriculture was roughly 10% for most of the period. Chemical products were mostly imported. In that way, they contributed to intensify the above trend towards a greater dependence on industrial inputs largely coming from outside of the country.

Nevertheless, at the beginning of the 21st century the weight of trade services skyrocketed and occupied its place. Its share accounted for 18.2% in 2016, becoming the second major input of agriculture, and in 2015 its share even reached up to 23.5%. If we compare these figures with the one from 1980 (5.8%), it is noticeable how much the share of trade services expanded. Trade services are by far the new big player in the cost structure of agriculture.

The fast increase of trade costs for agricultural producers from 1980 to 2016 deserves special attention. Within the input-output framework, trade services refer to wholesale and retail services, whose output are «trade margins» (Eurostat, 2008). In turn, «trade margins» are defined as the difference between the actual or imputed sale price realized on a good purchased to resale, and the price that would have to be paid by the distributor to replace the good at the time it is sold or otherwise disposed of (Eurostat, 2010). Thus, the results above showed suggest that a significative part of the increase of the production cost of agriculture was beyond the prominent rise of trade margins. When comparing the cost structure of the year 2015 in basic prices and in purchasers' prices -which include margins charged by the industries involved in distribution (trade and transport)-, it appears that animal feeding held a substantial part of them.

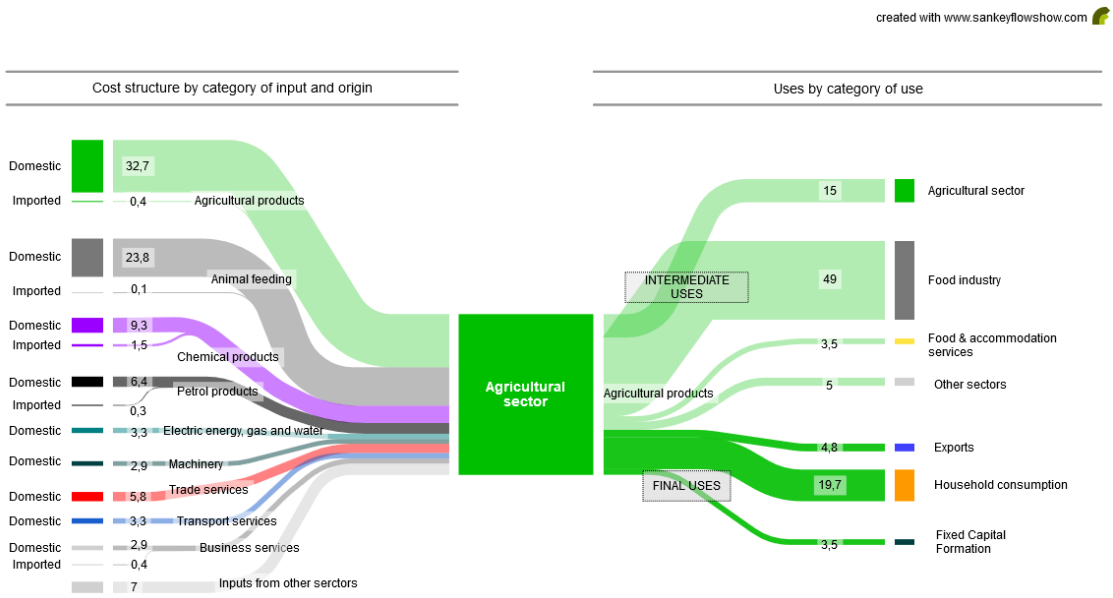
Apart from the above major transformations, data show a decline in the relative weight of fossil fuels. In 1980, the value of refined petroleum products accounted for 6.7% of agricultural intermediate inputs, while in 2016 such share fell to only 2.2%. Meanwhile, electric energy and gas, with a low proportion back in the 1980's, relatively increased their share, overpassing that of fossil fuels. These figures show an energetic transition towards electric sources that is again consistent with the shift from food to feed and livestock production in industrial feedlots with a higher consumption of electricity in heating, lighting and aeration (González de Molina et al., 2017; Infante-Amate et al, 2018; Soto et al., 2016).The abandonment of farms reported above has also reduced cropland and tillage, meaning a reduction of tractors more than proportional with those into operation being more energy efficient in Spain as everywhere in the world (Aguilera et al., 2015; Pellegrini & Fernández, 2018)

Finally, it stands out the growing weight of business services. They accounted for 5.2% of the total cost structure of agriculture in 2016, whereas their share was only of 3.3% in 1980.

3.4. NEW RESULTS

Figures 11 to 16 show the cost structure -left side of the diagram- and uses structure (including disaggregated data on the intermediate uses by type of industry) -right side of the diagram- for the agriculture sector, the food industry and services related to food for years 1980 and 2015. This way, the results put forward in sections 3.2. and 3.3. are widened and complemented, shedding further light on the linkages between economic activities.

Figure 11. Cost structure of agricultural sector (% of total intermediate inputs) and uses of agricultural products (% of total uses), Spain 1980

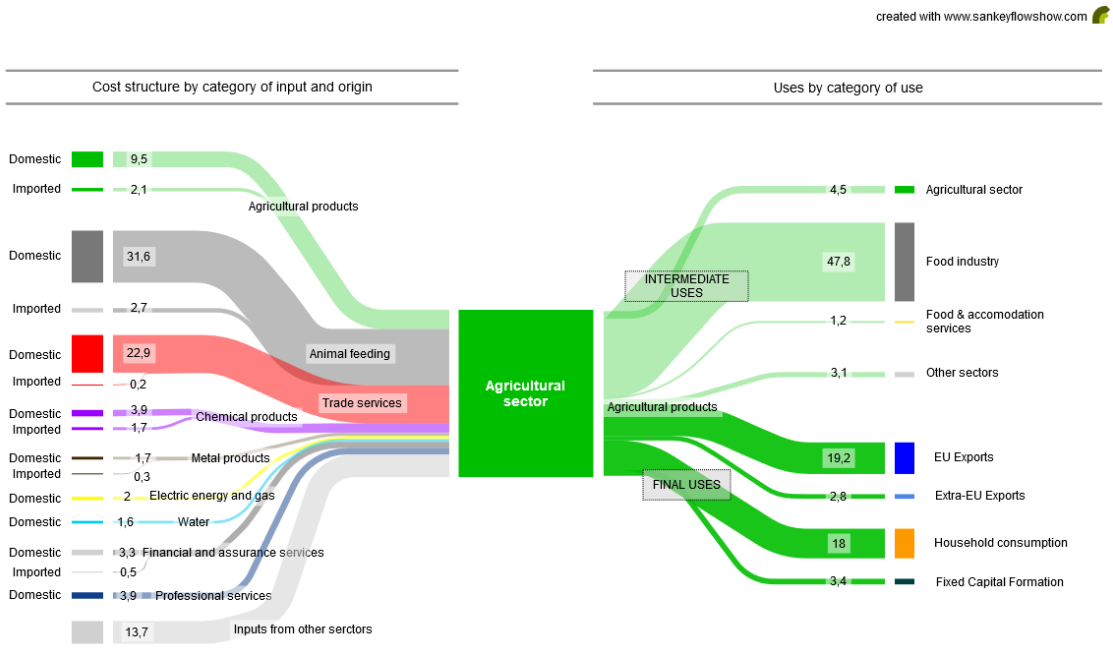


Notes:

- Data was collected from the Input-Output Table at basic prices (million ESP) 1980, INE.
- The cost structure shows the ten main categories of intermediate inputs in terms of weight.
- Agricultural sector is made up of cropping and livestock breeding (1), forestry (2) and fishing (3).
- Data on "other food products" (a) –which includes "animal and vegetal fats and oils" (a.1.), "animal feeding (a.2.)" and "other food products (a.3.)"- is used as a proxy of animal feeding. Animal feeding accounted for 98,7% of the aggregated value made up of a.1, a.2 and a.3. in 1995, first year for which the INE published disaggregated data (calculations are based on the Use Table at basic prices, 1995). Thus, it can be considered a good estimation.

Source: own elaboration from the input-output framework, INE.

Figure 12. Cost structure of agricultural sector (% of total intermediate inputs) and uses of agricultural products (% of total uses), Spain 2015

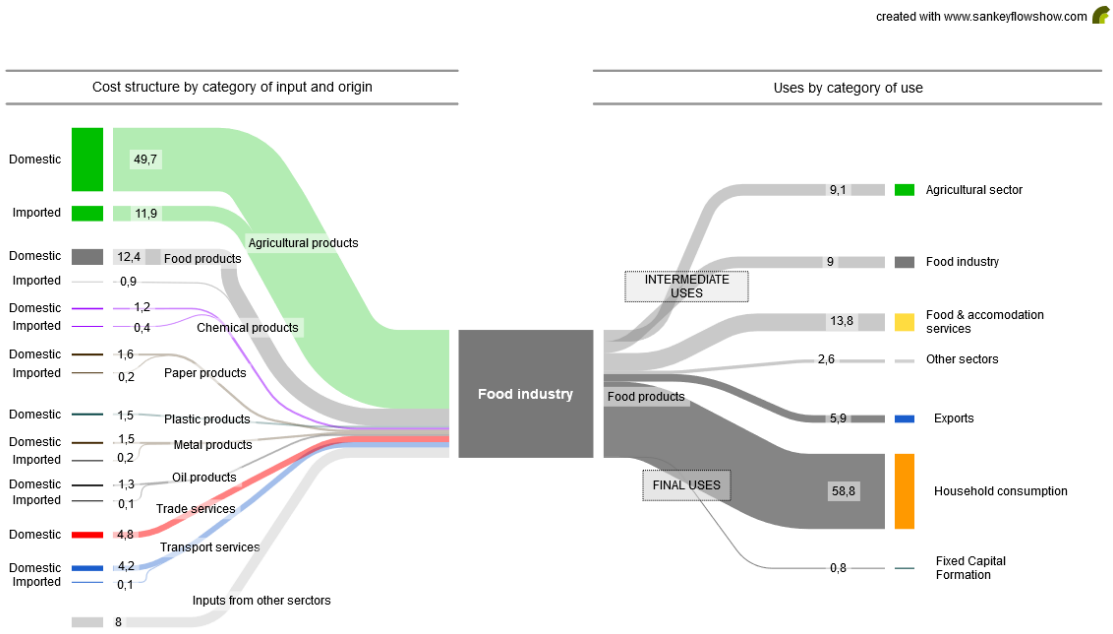


Notes:

- Data on the cost structure (left side of the diagram) was collected from the Use Table of domestic production at basic prices (million €) and the Use Table of imports at "cost, insurance and freight" (cif) (million €) of Spain, 2015, INE. Data on the uses (right side of the diagram) was collected from the Use Table at basic prices (million €) of Spain, 2015, INE.
- The cost structure shows the ten main categories of intermediate inputs in terms of weight.
- Agricultural sector is made up of cropping and livestock breeding (1), forestry (2) and fishing (3).
- Data on food products is used as a proxy of animal feeding. The Use Tables of 2015 does not show disaggregated data of the sub-categories that make up food products. However, the Supply Table at Purchaser Prices of 2016 (INE) does show it. Animal feeding accounts for 98.7% of the aggregate value. Thus, it can be considered a good estimation.
- Professional services is made up of categories "Other professional, scientific and technical services; veterinary services" and "Security and research services; building and landscaping services; administrative and office services and other business services".
- Trade services include categories "Wholesale and retail services and maintenance and repair of motor vehicles and motorcycles" and "Wholesale trade services, except of motor vehicles and motorcycles".

Source: own elaboration from the input-output framework, INE.

Figure 13. Cost structure of food industry (% of total intermediate inputs) and uses of food products (% of total uses), Spain 1980

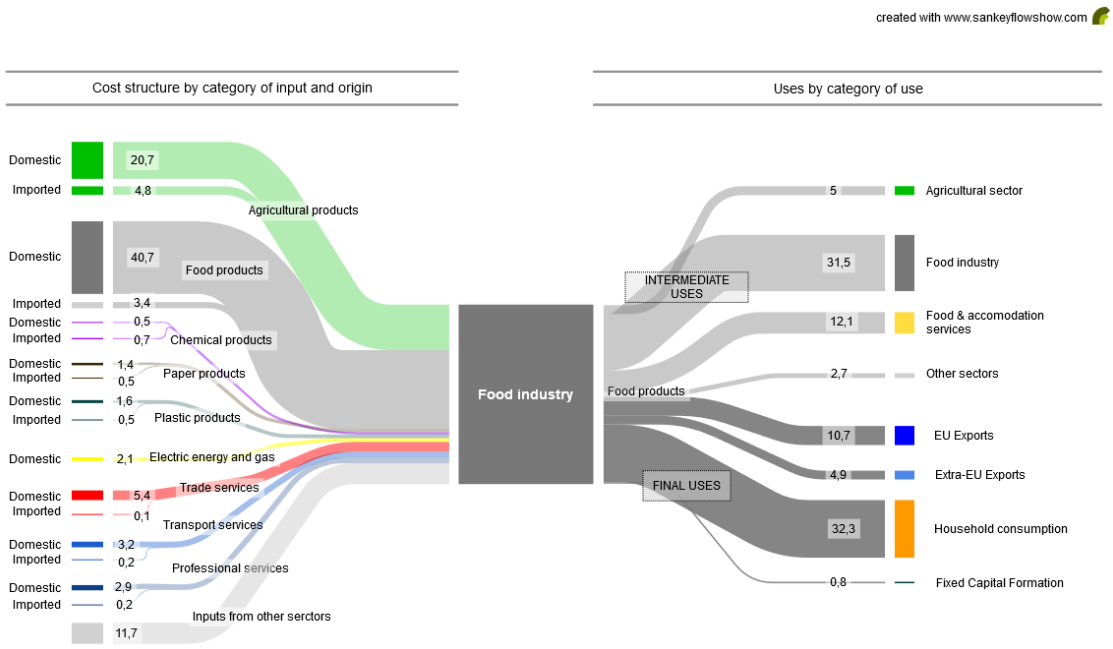


Notes:

- Data was collected from the Input-Output Table at basic prices (million ESP) 1980, INE.
- The cost structure shows the ten main categories of intermediate inputs in terms of weight.
- Agricultural sector is made up of cropping and livestock breeding (1), forestry (2) and fishing (3).

Source: own elaboration from the input-output framework, INE.

Figure 14. Cost structure of food industry (% of total intermediate inputs) and uses of food products (% of total uses), Spain 2015

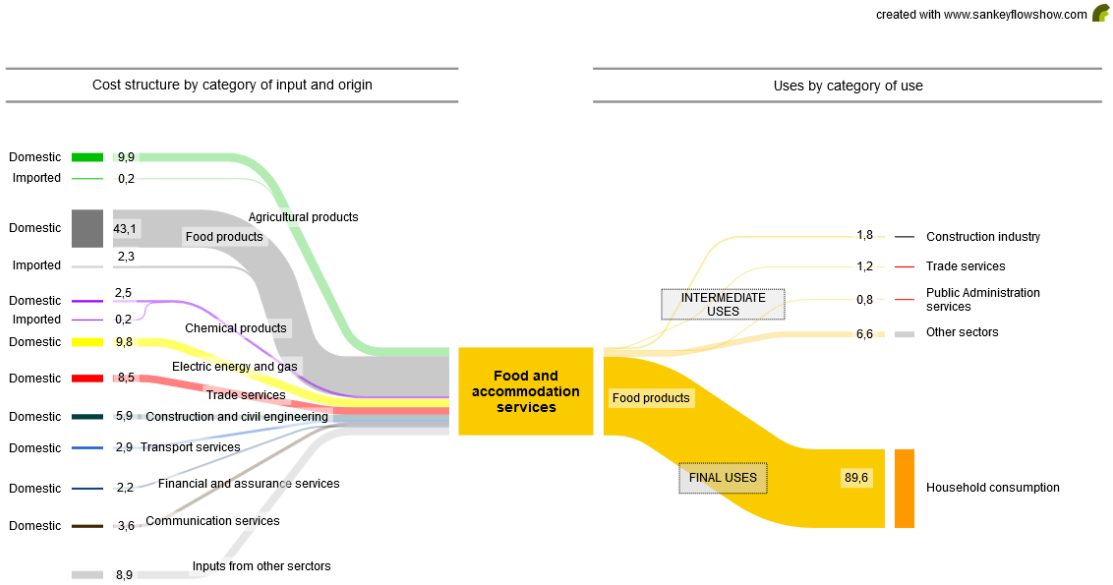


Notes:

- Data on the cost structure (left side of the diagram) was collected from the Use Table of domestic production at basic prices (million €) and the Use Table of imports at "cost, insurance and freight" (cif) (million €) of Spain, 2015, INE. Data on the uses (right side of the diagram) was collected from the Use Table at basic prices of Spain, 2015, INE.
- The cost structure shows the ten main categories of intermediate inputs in terms of weight.
- Agricultural sector is made up of cropping and livestock breeding (1), forestry (2) and fishing (3).
- Trade services include categories "Wholesale and retail services and maintenance and repair of motor vehicles and motorcycles" and "Wholesale trade services, except of motor vehicles and motorcycles".
- Professional services is made up of categories "Other professional, scientific and technical services; veterinary services" and "Security and research services; building and landscaping services; administrative and office services and other business services".

Source: own elaboration from the input-output framework, INE.

Figure 15. Cost structure of food and accommodation services (% of total intermediate inputs) and uses of food and accommodation services (% of total uses), Spain 1980

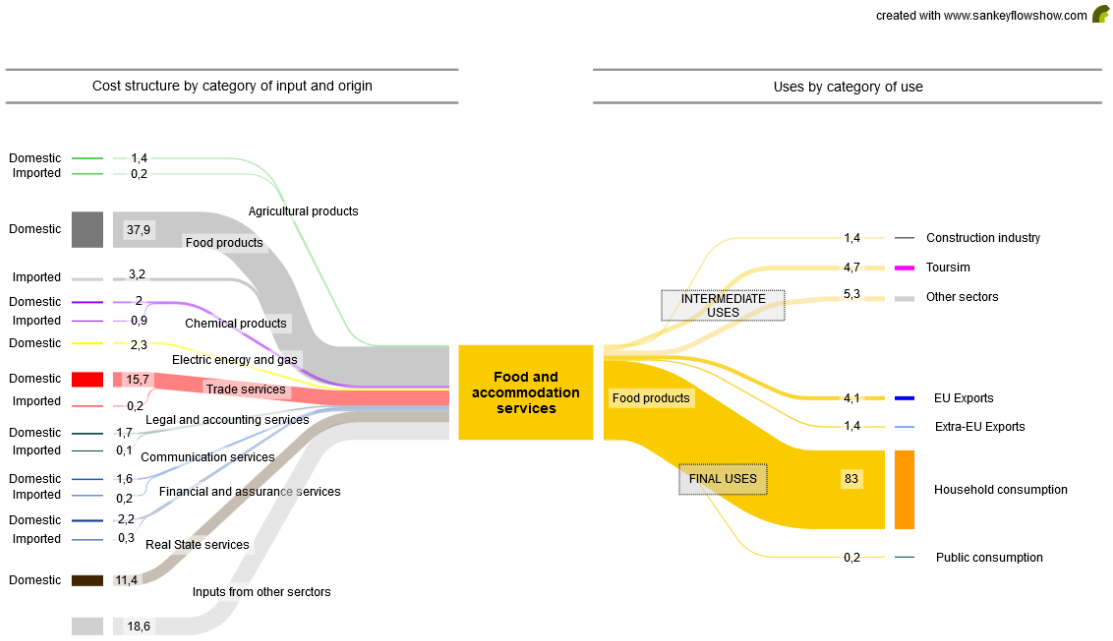


Notes:

- Data was collected from the Input-Output Table at basic prices (million ESP) 1980, INE.
- The cost structure shows the ten main categories of intermediate inputs in terms of weight.
- Agricultural sector is made up of cropping and livestock breeding (1), forestry (2) and fishing (3).

Source: own elaboration from the input-output framework, INE.

Figure 16. Cost structure of food and accommodation services (% of total intermediate inputs) and uses of food and accommodation services (% of total uses), Spain 2015



Notes:

- Data on the cost structure (left side of the diagram) was collected from the Use Table of domestic production at basic prices (million €) and the Use Table of imports at "cost, insurance and freight" (cif) (million €) of Spain, 2015, INE. Data on the uses (right side of the diagram) was collected from the Use Table at basic prices of Spain, 2015, INE.
- The cost structure shows the ten main categories of intermediate inputs in terms of weight.
- Agricultural sector is made up of cropping and livestock breeding (1), forestry (2) and fishing (3).
- Trade services include categories "Wholesale and retail services and maintenance and repair of motor vehicles and motorcycles" and "Wholesale trade services, except of motor vehicles and motorcycles".
- The Supply Tables of 2015 do not show disaggregated data on food services and accommodation services. The Supply Table of 2016 at purchasers' prices does show it. Based on it, food services (activity) output was 83,496 million € (basic prices) and accommodation services (activity) output was 28,609 million € (basic prices). Thus, food services accounted for 74% of the aggregated value of food and accommodation services. Food services (product) output was 90,161 million € (purchasers' prices) and accommodation services (product) output was 26,554 million € (purchasers' price) in 2016. Thus, food services accounted for 77% of the aggregated value of food and accommodation services. These figures can be used as an estimation of the weight of each component in year 2015.

Source: own elaboration from the input-output framework, INE.

4. DISCUSSION

Results make apparent that Spanish agriculture continued to deepen its integration in the global agri-food system from 1980 to 2016, whilst increasing its dependency on external inputs, reducing its internal reuse flows, and decoupling livestock feeding to the land (González de Molina et al., 2017). On the one hand, the exploration of agriculture's supply and uses shows a growing integration in international markets. The share of imports within agricultural products' total supply doubled from 1980 to 2016. Likewise,

exports were the category that increased the most within agricultural products' uses during this period. These figures are not surprising. Spanish agri-food trade grew at an extraordinary rate -higher than the World and European averages- during the second globalization, being even stronger after Spain joined the EEC (Clar et al., 2015). Uses data confirms that agricultural products, which had been used as intermediate inputs of other industries -fundamentally, the food industry- since the transition from «traditional agriculture» towards the «agro-industrial system» (Abad & Naredo, 1997; Clar et al., 2018), are currently mainly used by foreign industries rather than domestic ones.

On the other hand, the changes in the intermediate input structure of agriculture also reveal that the links with the global food industry tightened from the agricultural provision side. A major issue was the consolidation of animal feeding as the primary agricultural input since the 90s, reaching up to 35.5% of its total intermediate inputs in 2016. This feature highlights the shift from food to feed in the globalized agri-food system (Soto et al., 2016; González de Molina et al., 2020). The Spanish livestock specialization towards an intensive model of animal fattening in farm factories was the main driver of this shift (Clar et al., 2018) at the expense not only of animal wellbeing but of the risks they entailed for public health (Wallace, 2016).

Livestock numbers more than doubled from 1960 to 2008, being predominantly led by pigs and poultry. The fact that this type of animals are monogastric explains the high need of imported grains used as industrial compound feed that replaced to a large extent the use of pastures -as traditional livestock Spanish species such as extensively grazing sheep, goats and cattle did- (González de Molina et al., 2017)-. Thus, this transformation has entailed a change in the origin of the inputs, increasingly sourced abroad and locking Spanish producers into a strong dependence on this agro-industrial provision. The shift

away from the Mediterranean diet towards a more animal-based one explains to a large extent what happened, but also the "westernization" of diets at a global scale (Kearney, 2010), in which the Spanish meat industry had a significant role in the supply of animal products (Clar et al., 2016, 2018).

In addition, this structural change that has decoupled livestock raising in Spain form Spanish cropland, pastureland and forests is behind the drastic fall in the proportion of agricultural reuse. While in 1980 Spanish agriculture sourced internally a third of its total intermediate inputs, this share dropped to only 6.2% in 2016. Therefore, the analysis of SUTs data unveils to what extent the links between cropping, livestock breeding and forestry became progressively weaker. The disintegration of formerly complex agro-silvo-pastoral systems and their landscape mosaics, which began in the middle of 20th century (Garrabou Segura & Gonzalez de Molina, 2008; Naredo, 1991) continued and intensified up to recent days (Marull & Font, 2017; Marull et al., 2010, 2015, 2016; Parcerisas et al., 2012; Tello et al., 2020).

This structural shift is considered an important driver of the current ecological crises due to the lesser biological complexity of agroecosystems it entails (Cardinale et al., 2012; Marull et al., 2019a, 2019b) , but also due to the harmful impacts of their high dependence on fossil-fueled external inputs in terms of water use and pollution, greenhouse gas (GHG) emissions, and low energy efficiency (Aguilera et al., 2019a, 2019b; Duarte et al., 2014, 2016; Rodríguez et al., 2015). Thus, the capacity of Spanish agriculture in the provision of ecosystem services is being endangered ever more, moving in the opposite direction to the circular bioeconomy claimed by the EU (European Commission, 2018), and the agroecology territories by the Food and Agriculture Organization of the United Nations (FAO), International Panel of Experts on Sustainable Food Systems (IPES-Food)

and others (Altieri & Nicholls, 2012; FAO, 2018; IPES-Food, 2016). However, despite these prevailing trends Spanish agriculture also has an important potential not only to offset the current GHG emissions but also for carbon sequestration and climate change mitigation (Aguilera et al., 2018; Carranza-Gallego et al., 2018; García-Ruiz et al., 2019).

Apart from these major transformations, results bring to light the emergence of trade services within the agriculture cost structure. Since the entrance of the new century, the weight of trade margins –mainly linked to animal feeding as already seen— skyrocketed. In 2016, they accounted for roughly a quarter of total agricultural intermediate inputs bought outside the sector. This points out to the enormous power exerted by the agro-industrial complex of agribusiness (Davis & Goldberg, 1957; Etxezarreta, 2006). The Spanish entry to the EEC opened the path to big food-distribution international corporations that saw Spain as a main target. Their success fostered international investment in the Spanish agri-food system and its integration within the global agri-food system dynamics (Sanz Cañada, 1997).

While there is strong evidence on how the increase of agriculture's dependence on external inputs lessened its value added (Abad & Naredo, 1997; González de Molina et al., 2020), the role exerted by trade services as another driver of such decline deserves to be deeper addressed in future research. In this regard, results confirm the downward trend followed by the contribution of agriculture in terms of value added both to the total of Spanish economy as well as within the agri-food system. Under the assumption that the agri-food system is made up of agriculture, the food industry and food services, the SUTs and IOTs available evidence how agriculture's share drastically fell from accounting for half of the total value added to only one third-, while food services underwent the opposite path.. The study of trade services is essential to complete the picture of the value added

chain of the agri-food system. According to Sanz Cañada (1997), the value added accounted by food distribution had already overpassed that of food industry and agriculture by 1991.

The decline of value added retained by agriculture -which is, in turn, the income it generates- went hand in hand in with the reduction of the people engaged in the activity. The labour data confirms the persistence of this trend so far. While at the beginning of the 1980's nearly 18% of Spanish labour force was engaged in agriculture activities, only 4% did it in 2016. This deterioration was also observed in the framework of the whole agri-food system. Conversely, people engaged in food services grew considerably, following a similar trend to that described by food services in terms of value added.

Furthermore, there has been an increase of the rate of salaried workers in all agri-food system, which particularly affected agriculture. Whereas only 28% of people engaged in farming did this as employees at the beginning of the period, this share sharply rose up to 62% at the end. These figures illustrate the sharp reduction of family farms (Etxezarreta et al., 1995; González de Molina et al., 2020) and the strengthening of the "divorce between rural households economy and the agricultural production dynamics" (Abad & Naredo, 1997), increasingly integrated in the global accumulation process (Etxezarreta, 2006). This reduction was suffered in a greater extent by little farms, many of the working only part-time (Abad & Naredo, 1997; González de Molina et al., 2020). Along with the increase of Spanish average household spending, rural families underwent a process of decline in terms of living standards that trends endangered the viability of small family farms which used to be historically the main source agricultural food provision (González de Molina et al., 2020). The valuable body of knowledges that agrarian communities held and inherited generation after generation on the site-specific management of

agroecosystems, known as *agricultural heritage* (Agnoletti & Emanueli, 2016; IAASTD, 2009; Koohafkan & Altieri, 2011)is put at risk.

Further to this, the fall of income retained by agriculture rendered the sector dependent on subsides from the CAP (Etxezarreta, 2006) and on external financing (Abad & Naredo, 1997). The results of this study reveal that the weight of financial and assurance services within the cost structure of agriculture has not but increased over the period of study, from almost nothing to 5.2% (and together with business services to 6.7%).

Finally, when reflecting on the results and the discussion put forward, a final question arises: what about prices? All in all, prices -and the monetary valorization of all the processes and tasks behind them- shape the production relations that are reflected in the input-output framework. Being prices different, the whole picture of the agri-food system, and of each link of the value-added chain within it, would be different. It had been already shown that the «terms of trade» between the prices payed and received by farmers have become unstoppable worsened since the mid-20th century (Abad & Naredo, 1997; González de Molina et al., 2020; Serrano & Pinilla, 2011).

A fundamental outcome of this process has been the transfer of income from agrarian activities to other sectors of the economy, and as result, agrarian income steadily decreased. Recent events that took place in the arena of milk production in Spain, yet not applied to all the agri-food system, may be illustrative of this reality. The main corporations, most of them subsidiaries of transnational companies, were fined by the Spanish National Commission on Markets and Competition due to their agreement on fixing low prices to farmers and the resulting blocking of their negotiation capacity,

leading to detrimental outcomes on family farms whose earnings depend on milk selling (Marey, 2020).

The last unavoidable upcoming question is about the role of economic policies. With a different CAP, how things would have been? And how would they change in future? While the impacts of CAP on Spanish agrarian change had been already put forward (Clar et al., 2018; Etxezarreta et al., 1995), giving a response to this is not an easy question, and overcomes the scope of this research. Nevertheless, it seems to be a key dimension for the understanding of agricultural transformations, as well as for the debate of is future performing, which links this research with the broad literature on the historical change of Food Regimes (Friedmann, 2018; McMichael, 2009, 2013; Krausmann & Langthaler, 2019).

5. CONCLUSIONS

This article offers an overview of the transformations undergone by Spanish agriculture in the framework of the agri-food system from in the last four decades. To that aim, series on value added, labour, supply and uses have been constructed from the input-output framework of the Spanish National System of Accounts from 1980 to 2016. These series are used to identify the main trends and transformations over time. They allow to study the agricultural, livestock and forestry changes, which is addressed from a broadened scope, shedding light on how the evolution of the linkages with other economic activities might have influenced agriculture's path and fate.

Results show that the contribution of agriculture to the value added of agri-food system deteriorated in Spain from 1980 to 2016. Simultaneously, the contribution of services related to food grew significantly. The number of people engaged in agriculture

drastically fell, both in relative and absolute terms. Those remaining in the activity did it mostly as employees, showing an inverted situation if compared with the beginning of the period. The exploration of supply and uses confirms a growing integration of all activities involved in the agri-food system in international markets. However, this trend is considerably more pronounced in the case of agriculture.

Findings confirm the shift in the cost structure of agriculture, leading by the extraordinary fall of the share of reuses -mainly as a result of the decoupling of forest and livestock management from to the rest of the agricultural land- and the increasing weight of animal feeding in industrial feedlots. By the new century, trade services emerged as the second major intermediate input of agriculture. This feature points out to the need to take into consideration, together with the growing dependence on the big corporations that sell industrial inputs to agricultural producers, the role of wholesale traders within the agri-food system, as well as the impact of pricing dynamics on the value added retained by each of the stages of the agri-food chain. The sharp decline of agricultural value added and labour incomes seems to be largely determined by these globalization processes. Family farms are particularly affected, endangering many of the fundamental roles that agriculture fulfills as provider of ecosystem services beyond agri-food provisioning which are positive externalities outside the markets.

In this sense, further research needs to be conducted on the weight and role of distribution services related to the Spanish agri-food system, which is the main limitation of this study. Additionally, exploring the role of prices and how they are related to the economic policies addressed to agriculture -mainly, the CAP- is of high interest. Finally, integrating these results with the evolution of the number, structure and productive characteristics of

the units of production involved in the agri-food system would significantly contribute to a better understanding of the issue.

The portrait of agricultural transformations presented in this article is a first approach of such changes from the economic standpoint of the SUTs and IOTs databases of the Spanish National Accounts System. For a deeper analysis of the drivers behind these trends and its socioecological impact, this data needs to be further integrated with other dimensions by adopting alternative approaches that go beyond the market-based monetary view. In this regard, the inclusion of biophysical aspects as well as the role of «care work» would be crucial to gain a more realistic picture of the recent path followed by the complex and multidimensional reality of agrarian production in Spain.

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ANNEX I

Table 1. Secondary production for products related to the agriculture sector, the food industry and food & accommodation services (%), Spain (1995-2016)

Product/Year	1995	2000	2005	2010	2015	2016
Agricultural products (1)	0,35%	0,53%	0,54%			0,30%
Stockbreeding products (2)	0,00%	0,44%	0,19%			0,68%
Agriculture and stockbreeding services (3)	6,21%	6,26%	11,45%			27,98%
Agricultural and stockbreeding products (1,2,3)				**0,99%**	**0,65%**	
Silviculture and forestry products	**32,60%**	**3,78%**	**7,46%**	**12,49%**	**10,09%**	**4,63%**
Fishing products	**0,00%**	**0,00%**	**0,00%**	**0,14%**	**0,00%**	**0,00%**
Meat and meat products (4)	13,72%	18,40%	16,75%			15,88%
Milk products (5)	1,80%	3,31%	2,07%			10,00%
Oil and fat (6)	0,24%	0,29%	0,66%			18,03%
Animal feeding (7)	1,84%	0,79%	0,39%			11,02%
Other food products (8)	7,46%	6,45%	5,61%			5,36%
Alcoholic beverages (9)	1,08%	0,61%	1,02%			10,55%
Non-alcoholic beverages (10)	4,64%	6,01%	6,25%			14,98%
Tobacco (11)	0,00%	0,00%	0,00%			0,00%
Food products (4-11)				**3,44%**	**2,81%**	
Accommodation services (12)	0,85%	1,11%	0,52%			3,51%
Food services (13)	1,00%	5,60%	4,83%			7,24%
Food and accommodation services (12,13)				**1,16%**	**1,15%**	

Source: own elaboration from Supply Tables (INE-c)

ANNEX II

Figure A. Products involved in the agri-food system by type of classification and system of accounts

Years	1980	1985-1994	1995-1999	2000-2007	2008-2009	2010-2015	2016
Classification	R43	R56	CNPA-96	CNPA-96	CPA 2008	CPA 2008	CPA 2008
System of Accounts	ESA 1979	ESA 1979	ESA 1995	ESA 1995	ESA 1995	ESA 2010	ESA 2010
AGRICULTURAL PRODUCTS	*(01) Cropping, livestock breeding and fishing products*	*(010) Cropping, livestock breeding and fishing products*	*(1) Cropping products*	*(1) Cropping products*	*(1) Cropping products*	*(1) Cropping, livestock breeding and related services*	*(1) Cropping products*
			(2) Livestock breeding products	*(2) Livestock breeding products*	*(2) Livestock breeding products*		*(2) Livestock breeding products*
			(3) Services related to cropping and livestock breeding	*(3) Services related to cropping and livestock breeding*	*(3) Services related to cropping and livestock breeding*		*(3) Services related to cropping and livestock breeding*
			(4) Forestry products	*(4) Forestry products*	*(4) Forestry products*	*(2) Forestry products and related services*	*(4) Forestry products*
			(5) Fishing products	*(5) Fishing products*	*(5) Fishing products*	*(3) Fishing products and related services*	*(5) Fishing products and related services*
FOOD PRODUCTS	*(15) Meat products*	*(310) Meat products*	*(16) Meat products*	*(16) Meat products*	*(11) Meat products*	*(5) Food products, beverages and tobacco*	*(11) Meat products*
	(16) Milk products	*(330) Milk products*	*(17) Milk products and ice-cream*	*(17) Milk products and ice-cream*	*(12) Milk products*		*(12) Milk products*
	(17) Other food products	*(350) Other food products*	*(18) Fats and vegetable oils*	*(18) Fats and vegetable oils*	*(13) Fats and vegetable oils*		*(13) Fats and vegetable oils*
			(19) Animal feeding	*(19) Animal feeding*	*(14) Animal feeding*		*(14) Animal feeding*
			(20) Other food products	*(20) Other food products*	*(15) Other food products*		*(15) Other food products*
	(18) Beverages	*(370) Beverages*	*(21) Alcoholic-beverages*	*(21) Alcoholic-beverages*	*(16) Alcoholic-beverages*		*(16) Alcoholic-beverages*
			(22) Non-alcoholic-beverages	*(22) Non-alcoholic-beverages*	*(17) Non-alcoholic-beverages*		*(17) Non-alcoholic-beverages*
	(19) Tobacco products	*(390) Tobacco products*	*(23) Tobacco products*	*(23) Tobacco products*	*(18) Tobacco products*		*(18) Tobacco products*
FOOD SERVICES	*(29) Food and accommodation*	*(590) Food and accommodation*	*(68) Accommodation services*	*(68) Accommodation services*	*(73) Accommodation services*	*(36) Food and accommodation services*	*(73) Accommodation services*
			(69) Food services	*(69) Food services*	*(74) Food services*		*(74) Food services*

Notes:
Clasificación Nacional de Productos por Actividades (CNPA) 1996
Clasificación de Productos por Actividades (CPA) 2008
European System of Accounts (ESA)

Source: own elaboration from the (INE-c)

Figure B. Activities involved in the agri-food system by type of classification and system of accounts

Years	1980	1985-1994	1995-1999	2000-2007	2008-2009	2010-2015	2016
Classification	R43	R56	CNAE-93	CNAE-93	NACE Rev. 2	NACE Rev. 2	CNAE 2009
System of Accounts	ESA 1979	ESA 1979	ESA 1995	ESA 1995	ESA 1995	ESA 2010	ESA 2010
AGRICULTURE	*(01) Cropping, livestock breeding and fishing*	*(010) Cropping, livestock breeding and fishing products*	*(1) Cropping, livestock breeding and hunting*	*(1) Cropping, livestock breeding and hunting*	*(1) Cropping, livestock breeding and hunting*	*(1) Cropping, livestock breeding and hunting*	*(1) Cropping, livestock breeding and related services*
			(2) Forestry	*(2) Forestry*	*(2) Forestry*	*(2) Forestry*	*(2) Forestry*
			(3) Fishing	*(3) Fishing*	*(3) Fishing*	*(3) Fishing*	*(3) Fishing*
FOOD INDUSTRY	*(15) Meat products' industry*	*(310) Meat industry*	*(12) Meat industry*	*(12) Meat industry*	*(5) Meat industry*	*(5) Food products, beverages and tobacco industries*	*(5) Meat products' industry*
	(16) Milk industry	*(330) Milk industry*	*(13) Milk industry*	*(13) Milk industry*	*(6) Milk industry*		*(6) Milk products' industry*
	(17) Other food industries	*(350) Other food industries*	*(14) Other food industries*	*(14) Other food industries*	*(7) Other food industries*		*(6) Other food industries*
	(18) Beverage industry	*(370) Beverage industry*	*(15) Beverage industry*	*(15) Beverage industry*	*(8) Beverage industry*		*(7) Beverage industry*
	(19) Tobacco industry	*(390) Tobacco industry*	*(16) Tobacco industry*	*(16) Tobacco industry*	*(9) Tobacco industry*		*(8) Tobacco industry*
FOOD SERVICES	*(29) Food and accommodation services*	*(590) Food and accommodation services*	*(44) Food and accommodation services*	*(44) Accommodation services*	*(45) Accommodation services*	*(36) Food and accommodation services*	*(47) Accommodation services*
				(45) Food services	*(46) Food services*		*(48) Food services*

Notes:
Clasificación Nacional de Actividades Económicas (CNAE) 93-2009
Nomenclatura de Actividades Económicas de la Comunidad Europea (Nace Rev. 2)
European System of Accounts (ESA)

Source: own elaboration from the (INE-c)

ANNEX III

Figure C. Main intermediate inputs used by the agricultural sector by product classification and system of accounts

Years	1980	1985-1994	1995-1999	2000-2007	2008 - 2009	2010-2016
Classification	**R43**	**R56**	**CNPA-96**	**CNPA-96**	**CPA 2008**	**CPA 2008**
System of Accounts	ESA 1979	ESA 1979	ESA 1995	ESA 1995	ESA 1995	ESA 2010
AGRICULTURAL PRODUCTS	*(01) Products from agriculture, silviculture and fishing*	*(010) Products from agriculture, silviculture and fishing*	*(1) Cropping products; (2) Livestock breeding products; (3) Cropping and livestock breeding related services*	*(1) Cropping products; (2) Livestock breeding products; (3) Cropping and livestock breeding related services*	*(1) Cropping products; (2) Livestock breeding products; (3) Cropping and livestock breeding related services*	*(1) Products from cropping, livestock breeding and hunting, and related services*
PETROL PRODUCTS	*(04) Crude oil, natural gas and oil products*	*(073) Refined oil products*	*(12) Oil and fuel*	*(12) Coke, oil refining and nuclear fuel*	*(26) Coke and refined petroleum products*	*(26) Coke and refined petroleum products*
ELECTRIC ENERGY	*(05) Electric energy, gas, steam and water*	*(097) Electric energy*	*(13) Electricity distribution*	*(13) Electricity production and distribution*	*(54) Electric energy production, transport and distribution services*	*(24) Electric energy, gas, steam and air conditioning*
WATER		*(096) Water (collection, purification, distribution), steam, warm water, etc.*	*(15) Water collection, purification and distribution*	*(15) Water collection, purification and distribution*	*(56) Natural water; water treatment and distribution services*	*(25) Natural water; water treatment and distribution services*
CHEMICAL PRODUCTS	*(08) Chemical products*	*(170) Chemical products*	*(32) Basic chemical products; (33) Pesticides and other agrochemical products; (34) Pharmaceutical products; (35) Other chemical products*	*(32) Basic chemical products; (33) Pesticides and other agrochemical products; (34) Pharmaceutical products; (35) Other chemical products*	*(27) Basic chemical products, nitrogenated compounds, fertilizers, raw plastic and rubber ; pesticides and other agrochemical products; (28) Other chemical products; (30) Pharmaceutical products*	*(11) Chemical products; (12) Pharmaceutical products*
METAL PRODUCTS	*(09) Metal products, except from machinery and transport materials*	*(190) Metal products*	*(43) Metal products*	*(43) Metal products*	*(38) Manufactured metal products, except from machinery and equipment*	*(16) Manufactured metal products, except from machinery and equipment*
MACHINARY	*(10) Farm and industrial machinery*	*(210) Farm and industrial machinery*	*(44) Farm machinery*	*(44) Farm machinery*	*(44) Other machinery and equipment*	*(19) Machinery and other equipment*

ANIMAL FEEDING	*(17) Other food products*	*(350) Other aliments*	*(19) Animal feeding*	*(19) Animal feeding*	*(14) Animal feeding*	*(5) Food products; beverage; manufactured tobacco*
PLASTIC	*(24) Rubber and plastic products*	*(490) Rubber and plastic products*	*(37) Plastic products*	*(37) Plastic products*	*(32) Plastic products*	*(13) Plastic and rubber products*
TRADE SERVICES	*(28) Trade*	*(570) Trade*	*(65) Retail trade of fuel; (66) Wholesale and intermediary services; (67) Retail trade; repair of personal and household goods*	*(66) Retail trade of fuel; (67) Wholesale and intermediary services;(68) Retail trade; repair of personal and household goods*	*(64) Wholesale and intermediary trade services; (65) Retail trade services*	*(29) Wholesale and intermediary trade services; (30) Retail trade services, except from motor vehicles*
TRANSPORT SERVICES	*(30) Inland transport; (31) Sea and air transport; (32) Transport supporting activities*	*(613) Road and pipeline transport; (631) Sea and coasting transport; inland navigation; (633) Air transport; (650) Transport supporting activities*	*(70) Railway transport services; (71) Other types of inland transport; (72) Sea transport services; (73) Air and spatial transport services; (75) Transport supporting activities*	*(71) Market railway transport services; (73) Other market types of inland transport; (75) Sea transport services; (76) Air and spatial transport services; (77) Transport supporting activities*	*(66) Railway transport services (67) Other types of inland transport; (68) Sea and navigation routes transport services; (69) Air transport services; (71) Transport supporting activities*	*(31) Inland transport services, including pipelines; (32) Sea and inland navigation routes transport services; (33) Air transport services; (34) Storage and transport supporting services*
FINANCE AND ASSURANCE SERVICES	*(34) Credit and financial institutions*	*(690) Credit and financial services*	*(78) Financial intermediation services; (79) Insurance and pension schemes services; (80) Financial intermediation supporting services*	*(83) Financial intermediation services; (84) Insurance and pension schemes services; (85) Financial intermediation supporting services*	*(80) Financial intermediation services; (81) Insurance and pension schemes services; (82) Financial intermediation supporting services*	*(41) Financial services, expect from insurance pension schemes; (42) Insurance, re-insurance and pension schemes services, except from compulsory social security; (43) Financial and assurance supporting services*
BUSINESS SERVICES	*(35) Business services*	*(710) Business services*	*(84) Computer services; (85) Researching and market developing services; (87) Legal and accounting services; (88) Architectural and engineering technical consulting services; (89) Advertising services; (90) Investigation and security services; (91) Industrial*	*(90) Computer services; (91) Researching and market developing services;; (83) Legal and accounting services; (95) Architectural and engineering technical consulting services; (96) Advertising services; (97) Investigation and security services; (98) Industrial*	*(85) Legal, accounting, head offices, consulting and business management services; (86) Architectural and engineering technical services; Technical trials and tests; (87) Researching and scientific services; (88) Advertising and market development*	*(45) Legal, accounting, head offices, consulting and business management services; (46) Architectural and engineering technical services; Technical trials and tests; (47) Advertising and market development services; (48) Advertising and market*

			cleaning services; (92) Other business services	*cleaning services; (99) Other business services*****	*services; (89) Other professional services*	*development services*
VETERINARY			*(97) Veterinary services*	*(105) Veterinary services*	*(90) Veterinary services*	*(49) Other professional, scientific and technical services; veterinary services*

Source: own elaboration from the (INE-c)