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**Value Added and Employment in Spanish
Exports: An analysis Based on FIGARO
Data**

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Exports play a crucial role in the Spanish economy, contributing significantly to the gross domestic product and employment. This study analyzes the value added and employment generated by Spanish exports during the years 2010 to 2022, using data provided by FIGARO (Full International and Global Accounts for Research in Input-Output Analysis), a database developed by Eurostat that offers detailed information on the input-output relationships between countries and economic sectors.

The research focuses on evaluating how Spanish exports contribute to the creation of domestic value added and the generation of employment, both directly and indirectly, through global value chains. It examines the evolution of these indicators during the period from 2010 to 2022, with the final years marked by the COVID-19 pandemic and the subsequent economic recovery.

The study examines the distribution of value added and employment generated by Spanish exports across different branches of activity and identifies the main destination markets and their evolution during the analyzed period.

The work concludes by highlighting the strategic importance of exports for the Spanish economy, not only as a source of economic growth but also as a driver of quality job creation and the improvement of international competitiveness. It emphasizes the need to develop such statistics that harmonize information from different countries for the development of public policies that promote business internationalization, innovation, and adaptation to new global trends, such as digitalization and the green transition.

This analysis provides valuable information for policymakers, entrepreneurs, and academics interested in understanding the dynamics of Spanish exports and their impact on the national economy. The results obtained can serve as a basis for designing strategies that enhance the value added and employment associated with export activities, thus contributing to the sustainable economic development of Spain in an increasingly competitive and changing global context.

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Exports play a crucial role in the Spanish economy, contributing significantly to the gross domestic product and employment. This study analyzes the value added and employment generated by Spanish exports during the years 2010 to 2022, using data provided by FIGARO (Full International and Global Accounts for Research in Input-Output Analysis), a database developed by Eurostat that offers detailed information on the input-output relationships between countries and economic sectors.

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1. Introduction

The Statistical Challenge of Globalization

Measuring globalization and global value chains is crucial for understanding the economic and social interdependence between countries. Globalization has transformed how goods and services are produced and distributed, creating complex networks that connect multiple economies. Evaluating this process allows us to identify the benefits and challenges that nations and businesses face.

Economic globalization has increased interdependence among national economies, necessitating continuous improvement in statistical measurement to provide more accurate and comprehensive data on international trade, investment, and global value chains (OECD, "Understanding Global Trade and Value Chains," 2013). However, the fragmentation of production chains across national and continental borders greatly complicates the measurement of economic activity. Accurate measurement of globalization facilitates the analysis of economic impacts, such as GDP growth, job creation, and technological development. Moreover, it allows for an understanding of international trade dynamics, such as knowledge transfer and foreign direct investment, which are essential for competitiveness and innovation.

The importance of measuring globalization lies in several key aspects. First, it enables countries and businesses to understand how global production and trade networks affect their economies. The impact on economic growth, job creation, and technological innovation can be assessed. For example, statistics on international trade and foreign direct investment are essential for analyzing how companies are expanding their operations beyond their borders and how this contributes to the economic development of recipient countries.

Additionally, measuring globalization provides a foundation for comparative analysis between countries. It allows for the identification of winners and losers in the globalization process and, consequently, facilitates the formulation of policies that promote more equitable growth. For example, the data reveal how certain countries, regions, or

activities benefit more from global economic integration, while others may be falling behind.

Specifically, the analysis of global value chains is vital for optimizing the efficiency and sustainability of production. Identifying the weakest or most vulnerable links in these chains and being able to simulate the economic effects of unforeseen events on any of these links enables companies and governments to implement strategies to minimize risks caused by supply disruptions or changes in demand patterns. The recent experiences with the COVID-19 pandemic or the wars in Ukraine and the Middle East highlight the vulnerability of global supply chains, demonstrating the importance of having accurate and up-to-date data on how these chains are structured and function, as well as the ability to foresee their potential impacts. By identifying the weakest links, businesses and governments can develop strategies to mitigate risks, such as diversifying suppliers or relocating certain stages of production.

Finally, measuring globalization and global value chains provides essential data for addressing issues such as economic inequality and environmental impact.

Multiregional Input-Output Models: The FIGARO Project

In this context, multiregional input-output (MRIO) models stand out as an essential analytical tool. These models allow for the analysis of how the production and exchange of goods and services flow between countries and how these interactions affect key economic variables such as employment, GDP growth, and carbon emissions.

MRIO models extend the traditional input-output framework of national accounts to a multilateral framework, integrating the origin-destination matrices of various countries (or all countries) into a single analytical structure. These models enable the detailed tracking of economic transactions between sectors of activity within each geographic area and the economic interactions between activities and countries.

In particular, MRIO models allow for the decomposition of the value of a final good or service into the contribution of each region to the generation of that value, providing a clear view of how economies are interconnected through global value chains. They are also the basis for generating indicators that can simulate the impact on the value added

generated by a national economy from a change in the demand pattern for its exports or from a supply shock affecting its imports (Trade in Value Added indicators, TiVA).

In the European context, the FIGARO project (*Full International and Global Accounts for Research in Input-Output Analysis*) by Eurostat is a key initiative to improve the understanding of economic and environmental interdependencies in Europe and the world. FIGARO develops MRIO tables that integrate detailed economic data from EU Member States and the rest of the world. It is the result of cooperation between Eurostat and the Joint Research Center (JRC) of the European Commission, becoming official European statistics since 2022 and providing annual results each year t referring to year $t-2$, with the series currently available from 2010.

In the analysis of FIGARO, and any multiregional model, it is necessary to be aware of the possible differences that their results may show compared to macroeconomic aggregates and national origin-destination tables. These differences arise from the need to resolve, within a multiregional framework, all the asymmetries present in national international trade data and to add granularity to the geographic and sectoral disaggregation available in the foreign trade flows of national accounts. In particular, in the FIGARO tables, exports and imports are valued in Free on Board (FOB) terms and are transformed into basic prices, while in the national origin-destination table, import data are valued in Cost, Insurance, and Freight (CIF) terms.

A similar exercise to FIGARO is conducted by the OECD in its Inter-Country Input-Output Tables (ICIO). The ICIO are available in two versions: one with 76 countries and the rest of the world (*Regular ICIO*), and another extended version (*Extended ICIO*) with 76 countries, China, and Mexico, and sectoral disaggregation by activity. This latter format is used as the basis for the calculation and publication of TiVA indicators, which the OECD has incorporated into its regular product catalog.

It is also worth mentioning other similar initiatives developed by other international organizations, such as the IMF's MARIO project (*Multi-Analytical Regional Input-Output Models*) or the MRIO tables (*ADB MRIO*) compiled by the Asian Development Bank.

The widespread development of multiregional models across various international organizations necessitates further efforts towards harmonization and convergence within a global data framework required to support the various MRIO-TiVA initiatives. This is the

goal pursued under the acronym GIANT (*Global Input-output AccouNTs*), an initiative driven by the United Nations, IMF, OECD, Eurostat, the Economic Commission for Latin America and the Caribbean (ECLAC), ADB, and the World Trade Organization (WTO).

In summary, multiregional input-output models are powerful tools for analyzing global economic interdependence and value chains. The models developed by various international organizations have proven valuable in understanding the dynamics of international trade and sustainability. As globalization and concern for sustainability continue to grow, the importance of these new statistical products will continue to rise, providing crucial information for informed decision-making in an interconnected world.

An analytical application of these tools is presented below for the Spanish economy, using the results provided by FIGARO for Spain. The analysis describes the intensity with which the value added and employment in the Spanish economy would react to an increase in exports from different branches of economic activity and the changes observed in this structural pattern of interrelation between the Spanish economy and the rest of the world

2. Methodology and sources

The calculations and analyses conducted are based on the conceptual framework of the current national accounts systems (System of National Accounts, SNA 2008, and European System of National and Regional Accounts, ESA 2010). Specifically:

- *Exports* are defined as the change of ownership of a good between a resident and a non-resident in the national economy, or the provision of a service by a resident to a non-resident. The *expenditure of non-residents within the national economic territory* is excluded, as it is aggregated into *final household consumption expenditure* in the multiregional model (this is considered domestic final consumption); *re-exports* are also excluded from the model to avoid double-counting their value.
- *Value added* refers to the value generated in the production of goods and services by each industry within the production boundary of the national accounts. It is equivalent, on the one hand, to the *value of production at basic prices minus intermediate consumption at purchase prices* used in the production

process; and on the other hand, to the *compensation of employees* plus the gross *operating surplus*, plus *other taxes less subsidies on production*.

- *Employment* refers to the number of *employees or self-employed individuals* involved in productive activities within the production boundary of the national accounts.

The methodological basis of the results generated in this analysis lies in the application of the Leontief model to the multiregional input-output framework provided by FIGARO. This approach allows for the estimation of the production required to meet a given demand within a multiregional system consisting of 46 economies and 64 interconnected branches of activity. Consequently, it also estimates the value added and employment generated by this demand within the national economy, considering the technical-economic relationships that define the productive structure of the Spanish economy as measured in the input-output tables of the National Accounts. Specifically, the results show the value added and employment that are incorporated into the external demand for a particular product.

The analysis, therefore, works with the following elements computed from FIGARO for each reference year:

- The matrix of *technical coefficients* for the production of the homogeneous activity branch, defined as:

$$A = a_{ij} = \frac{c_{ij}}{x_j}$$

Where c_{ij} represents intermediate consumption.

- The inverse of the Leontief matrix:

$$B = (I - A)^{-1}$$

- Vector of Spain's exports by branch, Y .
- Vector of the *Value Added to Production* ratio by branch of activity in the national economy.: v .

- Vector of the *Employment to Production* ratio by branch of activity in the national economy: t .

With all of these elements, the following is obtained:

- The *Value Added* in Spain contained in our exports (i.e., the value added in the Spanish economy generated by Spanish exports. The brackets indicate the diagonalized vector):

$$\langle v \rangle B \langle Y \rangle$$

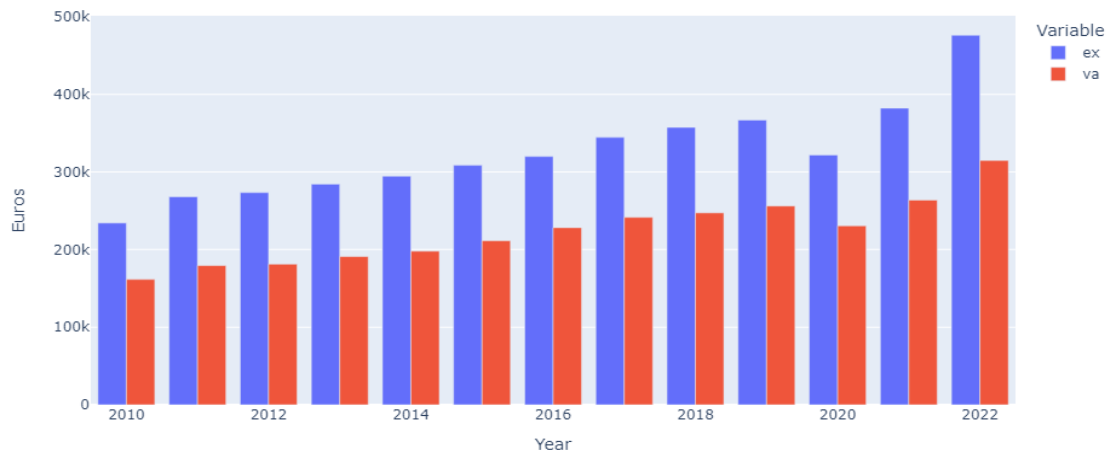
- The employment (in terms of employed persons) generated by exports (i.e., the employment created in Spain by our exports. The brackets indicate the diagonalized vector):

$$\langle t \rangle B \langle Y \rangle$$

3. Results

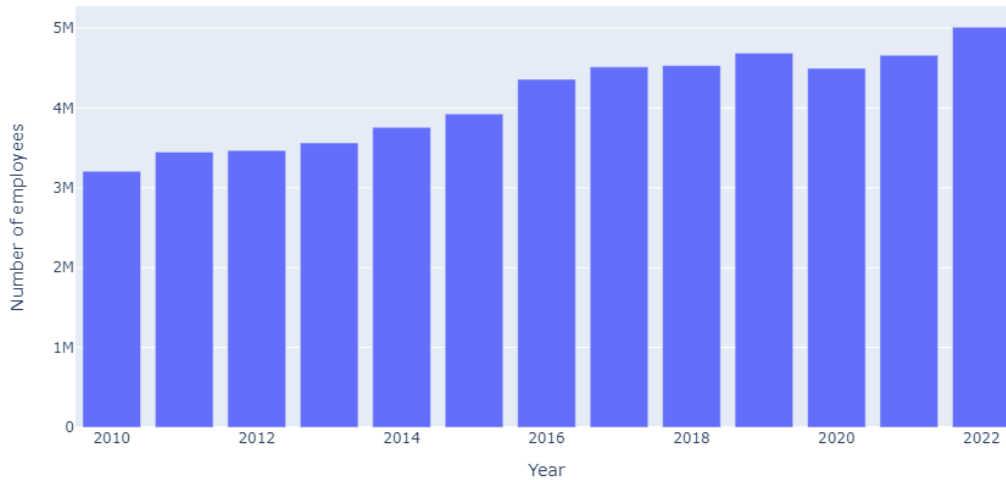
With the obtained data, it is possible to visualize the evolution of exports in Spain over recent years alongside the evolution of the value added contained in them (nominal data in millions of euros). The export figures do not match those from the National Accounts due to necessary adjustments in FIGARO.

Evolution of exports and their value added content



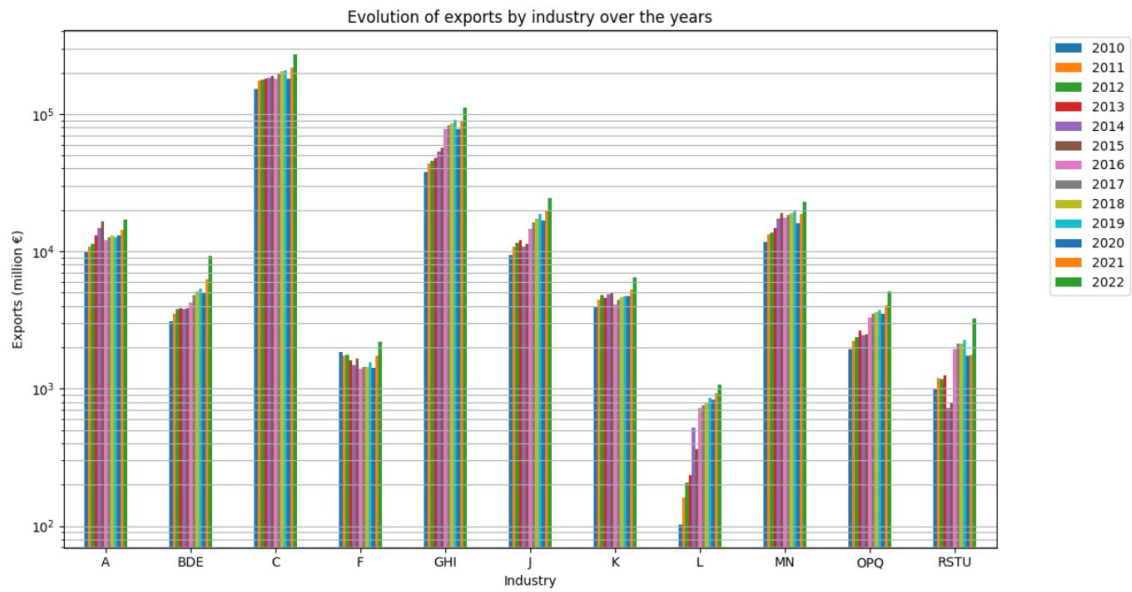
Similarly, the evolution of employment (in terms of *employed persons*) generated by these exports can be visualized (data in units)¹.

Evolution of the number of employees in exports

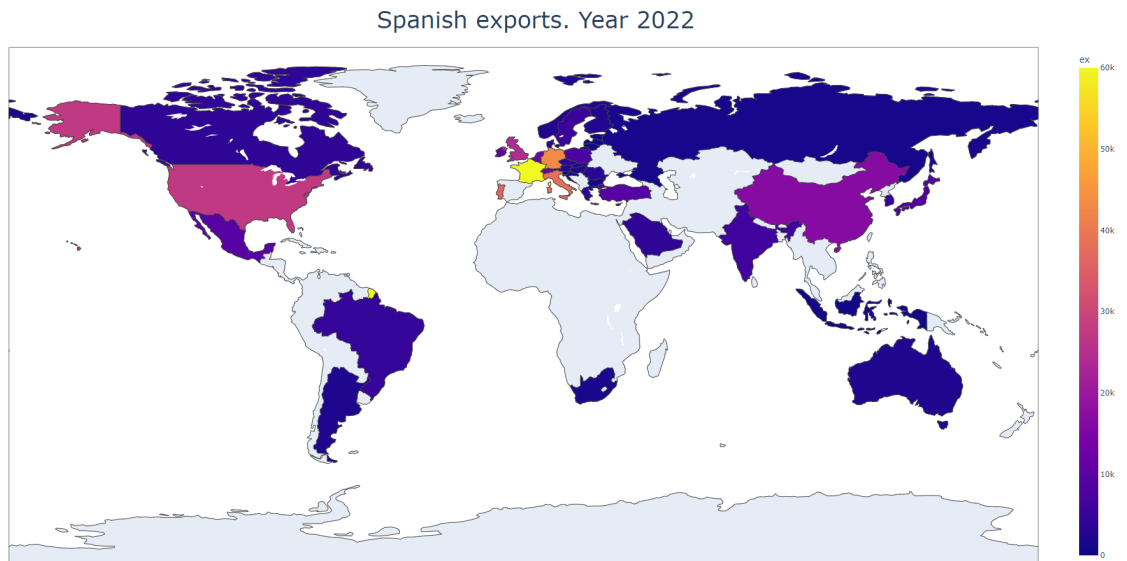


The following chart, in logarithmic scale, shows the value of Spain's exports according to FIGARO data by branch of activity (disaggregation A*10, according to the *National Classification of Economic Activities*, NACE 2009).

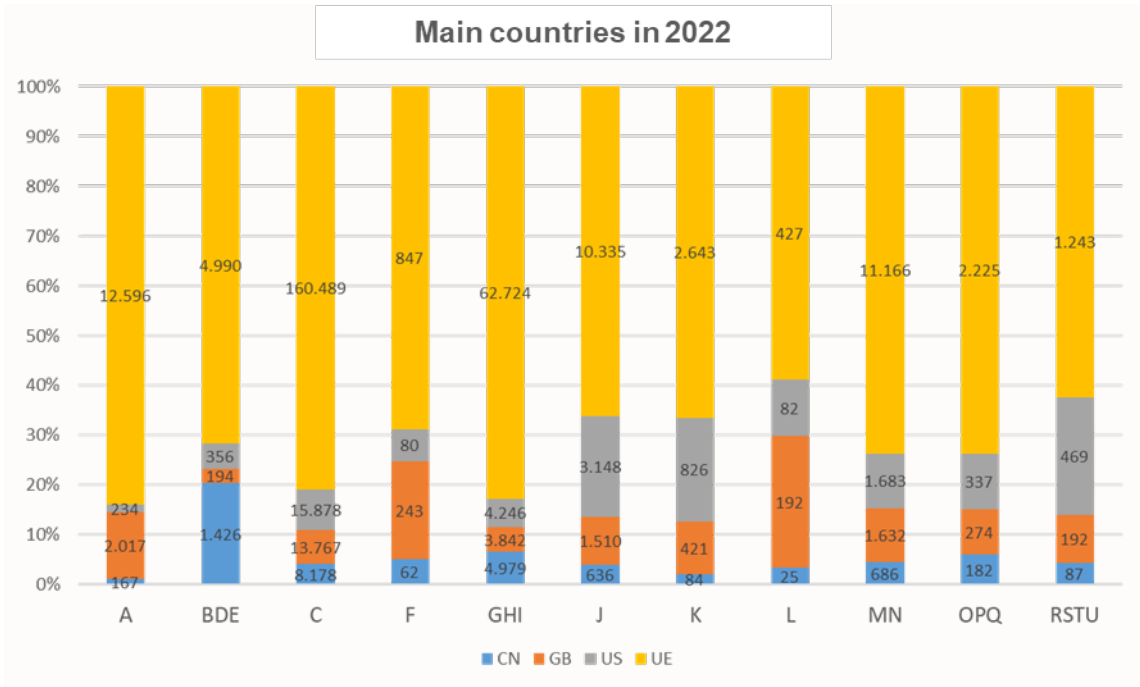
¹ Employment figures for the year 2022 are not available at the required level of disaggregation at the time of publication of this article. For illustrative purposes, the employment data from 2021 has been attributed to 2022.



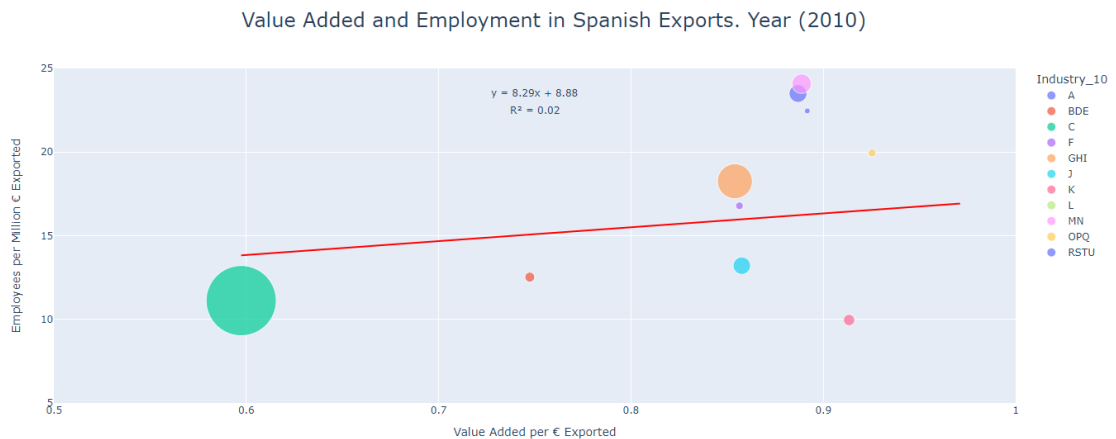
FIGARO also allows for visualization of the geographic destination of these exports.



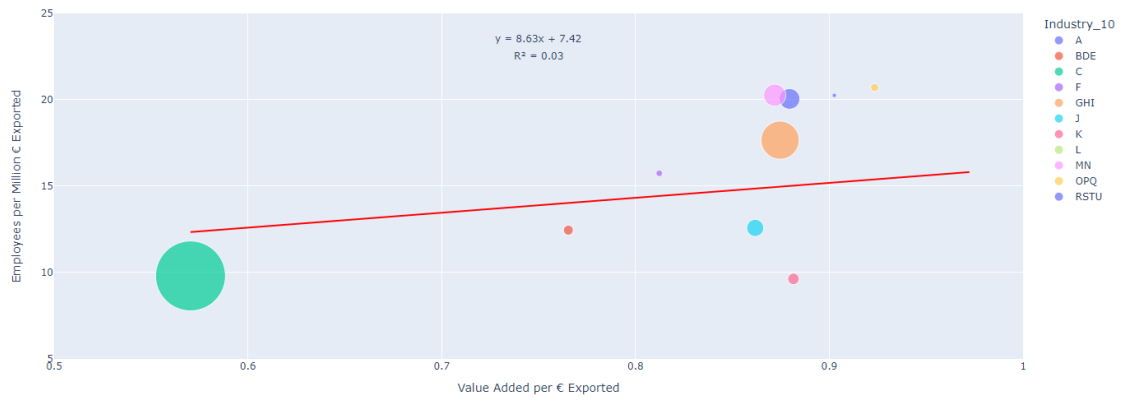
It is also possible to observe the structure of exports by branch and geographic destination, with a focus on the four most important geographic destinations:



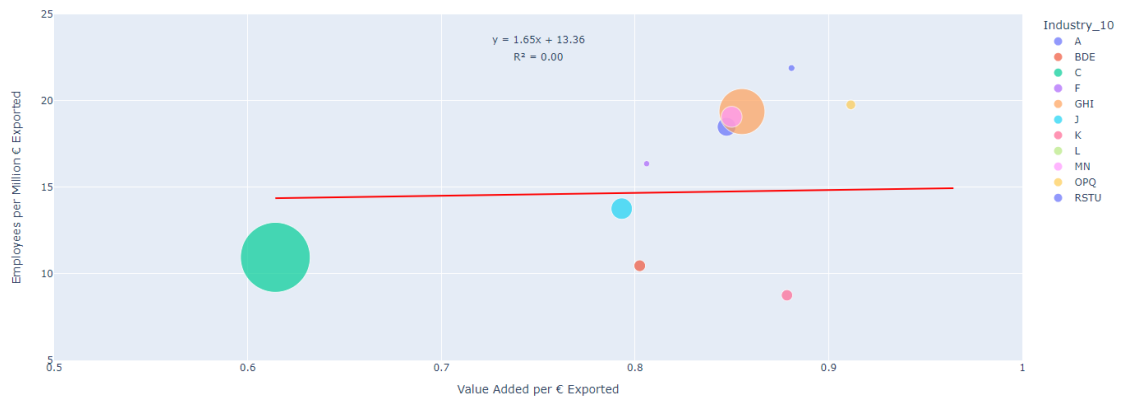
The calculations described using the multiregional model data allow for the calculation of the *Value Added* and employment (in terms of *employed persons*) generated in the national economy that is contained in the value of the exported product, for each type of product (homogeneous branch of activity, according to NACE). The area of the circles is directly proportional to the value of the exports of each type of product:



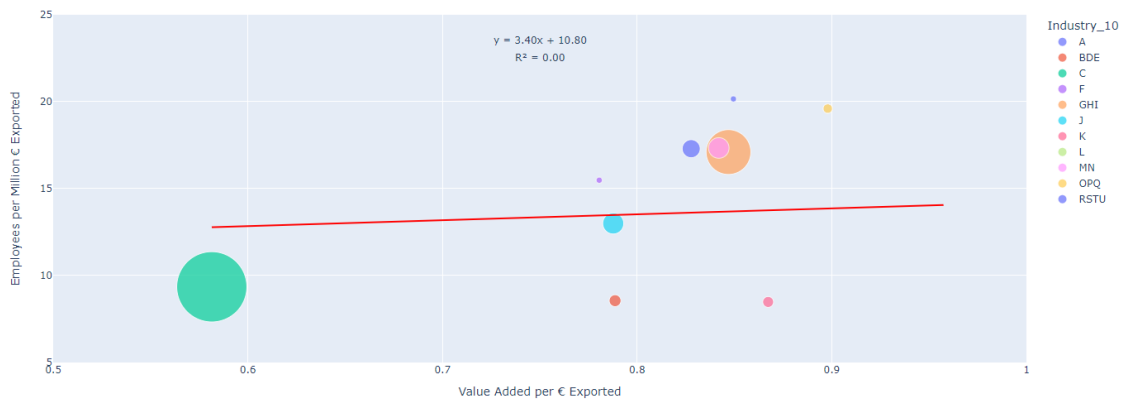
Value Added and Employment in Spanish Exports. Year (2015)

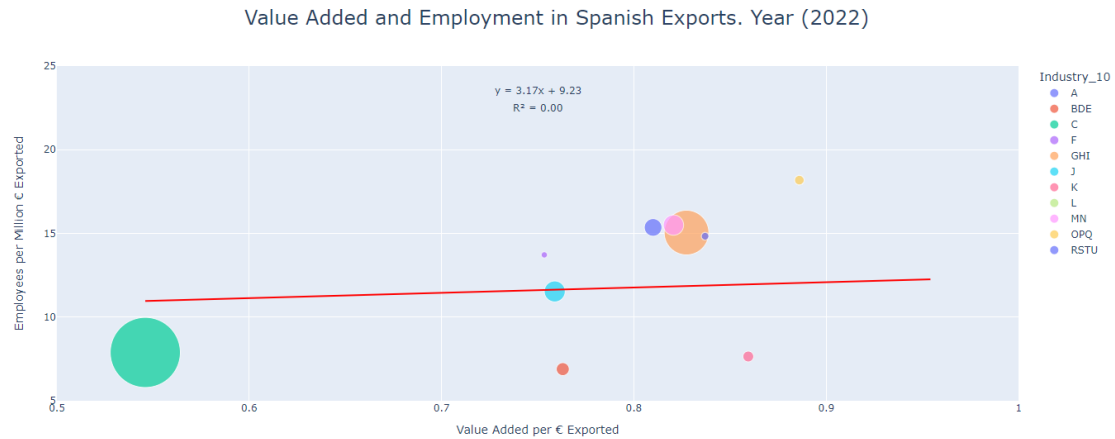


Value Added and Employment in Spanish Exports. Year (2020)



Value Added and Employment in Spanish Exports. Year (2021)

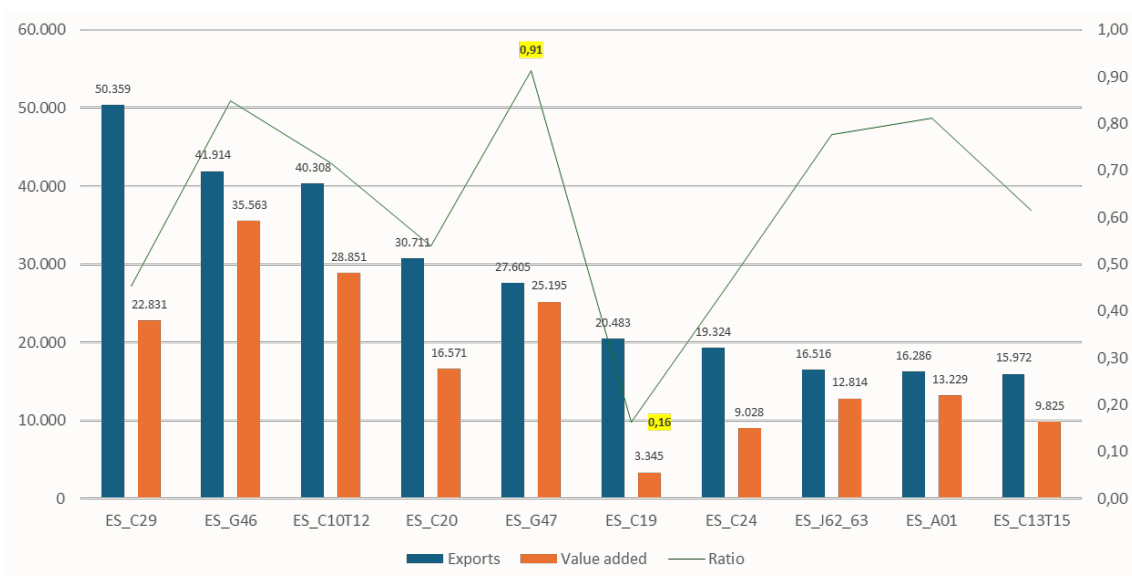




This type of analysis allows for visualizing the varying contributions to national economic activity (in terms of value added and employment) from external demand for each type of product, revealing significant structural disparities:

- The *manufacturing industry* (C) accounts for the majority of Spain's export value. However, these exports contain the least amount of value added produced in Spain. They also have the lowest linkage with domestic employment volume.
- The activities of *trade, transportation, and hospitality* (GHI) are the second most significant in terms of export value, with a higher content of value added and domestic employment compared to the manufacturing industry.
- Exports from *activities related to education, healthcare, and public administration* (OPQ) contain the highest value added and domestic employment.
- Services such as *professional, scientific, and technical activities*, as well as *administrative and support services*, contain over 90% of domestic value added in their exports. However, these services have a lower linkage with domestic employment compared to other products.
- Other services, such as those related to *recreational and entertainment activities, associations, and other personal services* (RSTU), have exports with a greater linkage to domestic employment than to the generation of value added in our economy.

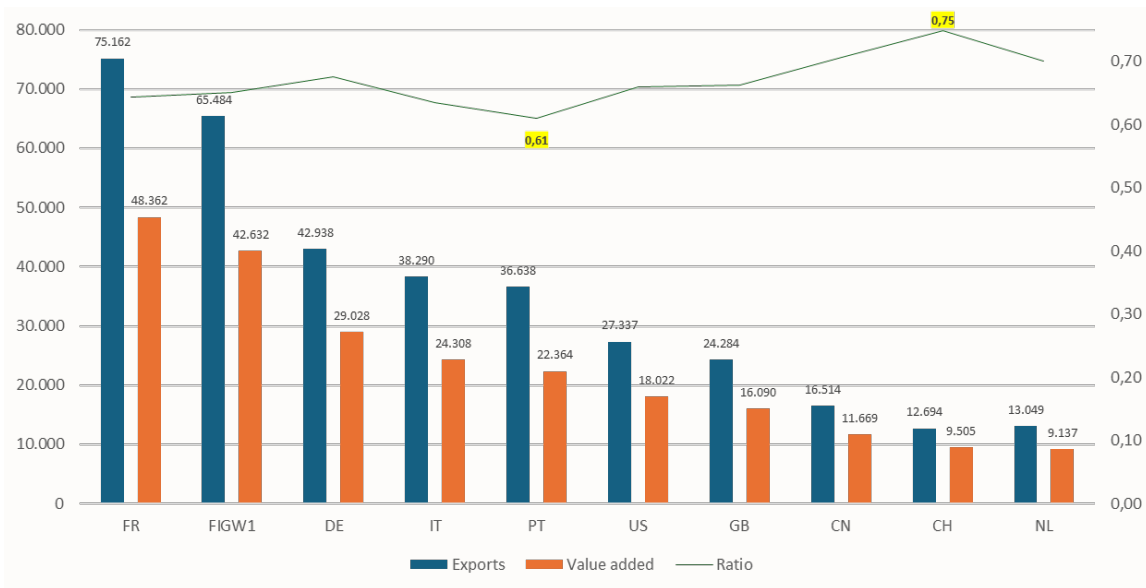
Expanding the analysis to the 64 branches and considering the 10 most important based on the value of their exports, the following is obtained:



In line with the general observations, branch C29 (*Manufacture of motor vehicles, trailers, and semi-trailers*) is the branch with the highest export value; however, it is not the one that generates the most value added in the economy. Conversely, branch G46 (*Wholesale trade and intermediaries in trade*) has a lower export value but generates the most value added.

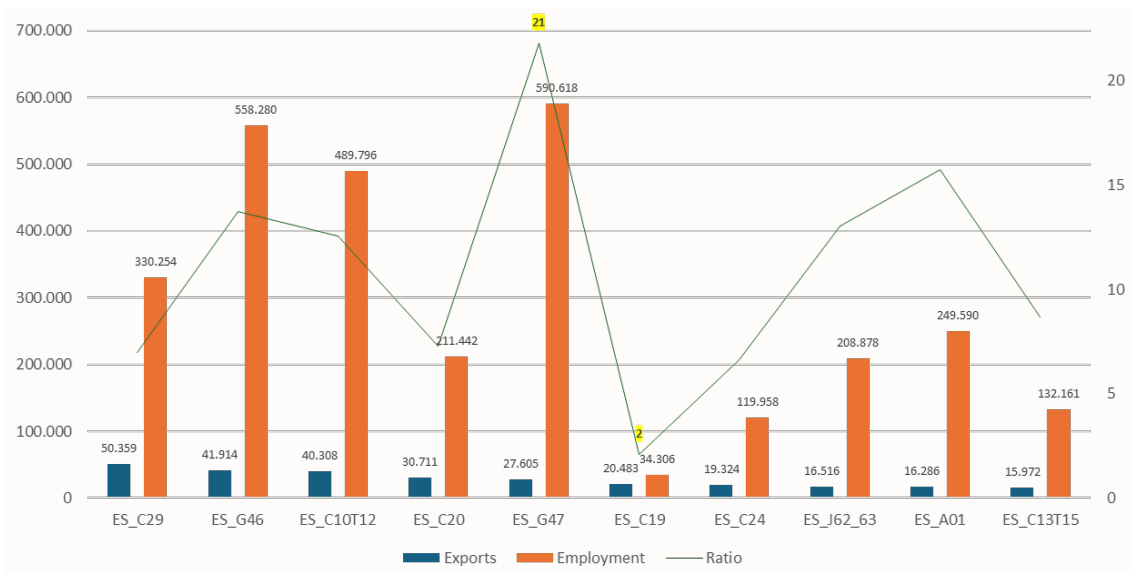
Relatively, branch G47 (*Retail trade*) generates the highest value added in the economy, €0.91 per euro exported, while among the top 10 exporting branches, branch C19 (*Coking and petroleum refining*) generates the least value added, €0.16 per euro exported.

Regarding geographic destination, the top 10 economies to which Spain exports the most concentrate 75% of Spain's total exports.



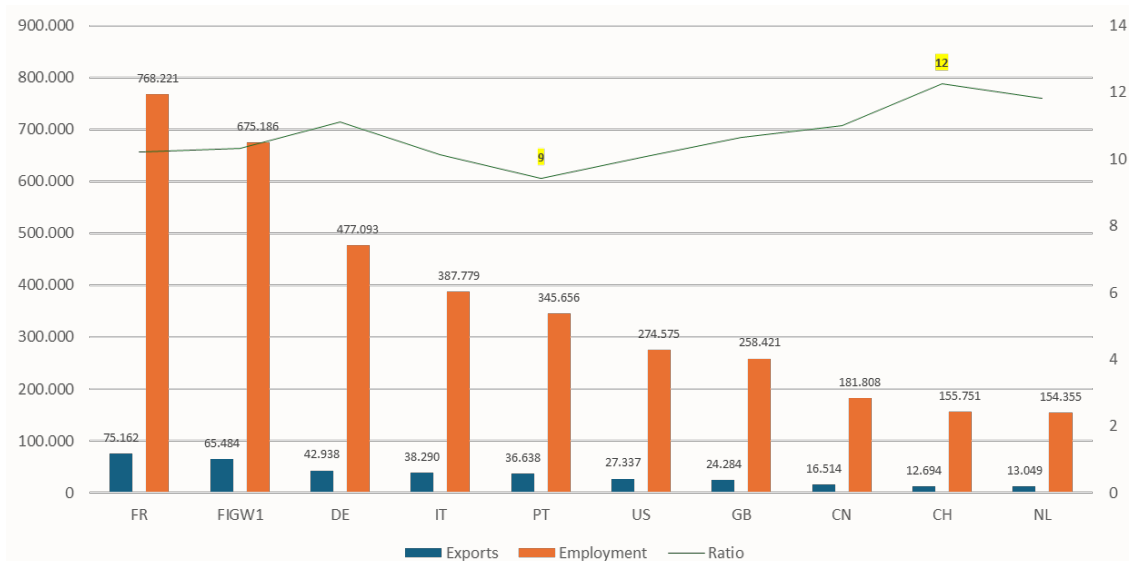
Switzerland (CH) stands out as one of the lower positions in the top 10 in terms of export volume and value added generated. However, it is the leading country regarding the weight of value added relative to export volume, at €0.75 per euro exported. Additionally, in Switzerland, the value added generated by exports from the *pharmaceutical manufacturing industry* (C21) accounts for 15% of the total exports to this country, a significant figure considering that in other counterpart economies it averages around 3%.

The same analysis by branches and geographic destination is conducted for employment generated by exports, yielding the following results:



It is observed that branches G47 (*Retail trade*) and G46 (*Wholesale trade and intermediaries in trade*) are the ones generating the most employment in the Spanish economy due to their exports. Relatively, branch G47 generates the highest employment, with 21 employees per million euros exported. Conversely, within this top 10, branch C19 (*Coking and petroleum refining*) is one of the least employment-generating sectors, with 2 employees per million euros exported.

The following information is provided for the top 10 countries:



Just as in terms of value added, Switzerland (CH) is the country that generates the highest number of employed persons relative to the volume of exports, with 12 employees per million euros exported. On the opposite end, Portugal (PT) generates 9 employed persons per million euros exported.

4. Conclusions

Multiregional input-output models are powerful tools for analyzing economic interdependence and value chains in the context of a globalized economy. Models developed by various international organizations, based on national accounts data and macroeconomic aggregates from each country, are proving valuable for understanding international trade as a reflection of the global production of goods and services and the generation of value worldwide, and its relationship with the activity and employment of

each national economy. As globalization, interest in its positive effects, and concern about its potential risks and adverse impacts continue to grow, the importance of these new statistical products will keep increasing, providing crucial information for informed decision-making in an interconnected world.

However, despite their potential, it is necessary to be aware of some inherent limitations of all multiregional input-output models and the value-added trade statistics generated from them, such as those shown:

- The construction of MRIO models, such as FIGARO, relies on national account tables and results from each country, requiring detailed disaggregation. Therefore, the accuracy of the results is dependent on the quality of all national data, not just the data from the model itself, and is directly related to the development of statistical systems in each country.
- Similar to national accounts, the multiregional input-output table is a theoretical mathematical model constructed from origin-destination estimates by product and branch of activity derived from the National Accounts of each country and other sources used by the model. Essentially, the model is based on assumptions of product technology (products of the same type have the same input structure) or branch technology (products from the same branch have the same input structure) which reflect, as accurately as possible, the productive relationships. However, all results are subject to the validity and stability of these assumptions.
- The value-added trade indicators generated are also subject to assumptions of linearity and proportionality (e.g., between value added or employment and production). This prevents capturing more complex dynamics of the productive structure, such as economies of scale or technological changes.
- Such statistics require very detailed and accurate data, which imposes some delay in their availability. Although the results are usually structurally marked, as productive structures and trade relationships do not change significantly over time, these relationships are increasingly influenced by factors such as technological innovation, geopolitical changes, and market fluctuations, which are closely tied to the globalization process itself. This new context may

significantly compromise the validity of conclusions drawn from data referring to past years.

These limitations do not negate the usefulness of these models and statistics, although they should not be overlooked when interpreting the results for decision-making.

An example of the analytical use of these tools for the Spanish economy, utilizing results from the European FÍGARO project, has been presented here. It describes how the value added and employment in the Spanish economy would respond to a boost in external demand for different types of goods and services, as well as the changes observed over time in this structural pattern of interaction between the Spanish economy and the rest of the world.

This is an initial analytical exercise for the Spanish economy that highlights the potential of these statistical tools to assess the vulnerability of our economy to specific external demand shocks or potential disruptions in global supply chains, always conditioned by various regional geopolitical scenarios.

With this same methodological foundation, it is possible to address measurements of the environmental footprint associated with the linkage of our products with foreign demand, as well as the impact on the activity and employment of the countries we trade with and on global sustainability, related to the external supply needs of the Spanish economy, all with extensive and detailed geographic and economic sector disaggregation. This analytical capability also allows for a more focused examination of the vulnerability of the Spanish economy and other global economies to geopolitical instability caused by events and crises of various kinds.

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