INSTITUTO NACIONAL DE ESTADISTICA

International Trade in Value-Added Indicators Panel

Technical Project

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1 INTRODUCTION

Globalisation has transformed the production and distribution of goods and services, creating complex networks of economic interconnection and fragmenting production chains beyond national borders. Measuring global value chains is essential for understanding the economic and social interdependence between countries. Hence the importance of having data that allows for the evaluation of these phenomena and, with it, the identification of both the benefits and challenges faced by countries and companies, and understanding key dynamics of international trade.

The analysis of global value chains allows for the forecasting of risks in the face of geopolitical changes with the potential impact on supply chains, such as those recently experienced during the pandemic or conflicts in Ukraine and the Middle East. The identification of the links in these chains is also crucial for addressing issues such as economic inequality and environmental sustainability.

One of the inspiring strategic lines of the 2025-2028 National Statistics Plan[1], (10) 'Statistics on globalisation', aims to respond, in general, to this demand for information.

In fact, some very recent projects, or those very close to being finalised, coming from business statistics and foreign trade statistics, are completing the catalogue of official Spanish statistics in this area, shaping this strategy:

On one hand, it is worth mentioning the *Business Statistics by Group Status*, published annually by the INE since the reference year 2021, as a by-product of the *Structural Business Statistics*, which introduces the detail of affiliation to a domestic or multinational group (Spanish or foreign control), and which, in particular, allows for meeting the requirement on statistics of foreign subsidiaries in Spain imposed by *Regulation (EU) 2019/2152 on European Business Statistics*.

Also, the *Global Value Chains Statistics*, also required by Regulation (EU) 2019/2152 on *European Business Statistics* and also regulated by *Implementing Regulation (EU) 2022/918, which establishes the Technical Specifications for Data Requirements for the Global Value Chains Topic*, and which the INE will publish in Spain every three years, starting in 2025. The new operation will allow for describing the companies involved in international outsourcing operations and global value chains.

On the other hand, the *International Trade in Service Statistics by Supply Modes* and by *Business Characteristics*, also originating from the same legislative base.

In addition, the creation of the Large Cases Unit (LCU) at the INE has been a milestone in adopting new approaches for measuring globalisation and the statistical description of large multinational groups, both in business statistics and in macroeconomic synthesis statistics.

Order ETD 378/2022 for the creation of the LCU assigns a wide range of transversal functions to the new Division, that address the challenge of measuring globalisation from different approaches and areas. In particular, it entrusts the analysis of all available information related to the key aspects of globalisation.

A good example of this type of information is the multiregional input-output models being developed by various international organisations globally, based on the national

[1]National Statistics Plan 2025-2028. Annex 1

accounts of each country, and which are positioning themselves as a key analytical tool in the field. These models allow for analysing, within the framework of national accounts, how the production and exchange of goods and services flow between countries and how these interactions affect their key economic variables, such as employment, GDP growth, and carbon emissions. They are also the basis for compiling **Trade in Value-Added Indicators (TiVA)**, which allow simulating the impact on the value added generated by a national economy from a change in demand patterns in its exports or from a supply shock affecting its imports, or quantifying what portion of the value of our exports corresponds to domestic or foreign value added or employment.

The specialisation and expert knowledge acquired by the LCU in the use of these sources and, in general, in measuring globalisation, enables the INE to begin addressing some of the initiative outlines in the strategic line (10) of the upcoming NSP 2025-2028, such as *'the national publication of a globalisation dashboard, the Extended Origin-Destination Tables, and the Trade in Value-Added Indicators (TiVA)'*.

Specifically, this project proposes the compilation and dissemination of an ***International Trade in Value-Added Indicators Panel (TiVA)*** for the Spanish economy. Its calculation is based on the application of the Leontief model to the multiregional input-output framework provided by the FIGARO tables published by EUROSTAT, which are themselves prepared from the results of the national accounts of each country. It is, therefore, an excellent example of institutional cooperation and the reuse of information generated within the European statistical system.

2 INTERNATIONAL AND EUROPEAN CONTEXT

The development of multiregional input-output (MRIO) models and trade in value-added indicators (TiVA) has been driven by the growing economic globalisation and the complexity of international value chains. Organisations such as the OECD and the European Commission have led the development of these models, aiming to provide a more accurate picture of the economic interdependencies between countries and regions.

These tools allow mapping these interconnections, tracking not only the total value of trade exchanges but also the value added at each stage of production. This information is crucial for formulating more effective economic policies, as it allows identifying how countries actually contribute to the creation of global value, and not just measuring gross trade, which often hides the role of countries in international supply chains.

In fact, the spirit of several of the Sustainable Development Goals[2] is closely aligned with the need for a better understanding of global trade dynamics, the distribution of value along production chains, and the impact of globalisation on sustainable development. Some goals can be highlighted. For example: Goal 8.2, *achieve higher levels of economic productivity through diversification, technological modernisation, and innovation,* from SDG 8, *Decent work and economic growth*, which involves the efficient use of resources in global value chains; Goal 9.3, *increase access of small industries*

[2]The Sustainable Development Goals (SDGs) are a universal call to action to end poverty, protect the planet, and improve the lives and prospects of people worldwide. In 2015, the 193 Member States of the United Nations adopted 17 Goals and 169 specific targets as part of the 2030 Agenda for Sustainable Development. This Agenda outlines a plan to achieve the goals over 15 years through the action of all societal actors.

and other businesses, particularly in developing countries, to financial services, including affordable credit, and their integration into value chains and markets, from SDG 9, *Industry, innovation, and infrastructure*; Goal 10, *apply the principle of special and differential treatment for developing countries, particularly least developed countries, in accordance with the agreements of the World Trade Organisation,* from SDG 10, *Reduced inequalities*, as fair and equitable participation in global trade is essential to reduce inequalities between countries; or Goal 17.10, *promote a universal, rules-based, open, non-discriminatory, and equitable multilateral trading system under the World Trade Organisation framework,* from SDG 17, *Partnerships for the goals*, which focuses on fair and equitable trade. In general, the use of trade in value-added indicators can contribute to a better understanding of the actual contributions of countries to global trade.

Thus, in the mid-2000s, the OECD began developing databases and methodologies to calculate trade in terms of value-added, using international input-output matrices. The ICIO (Inter-Country Input-Output) tables 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. It is this latter format that serves as the basis for calculating and publishing TiVA indicators, which the OECD has incorporated into its regular product catalogue since 2013. This provides economic policy makers with a more refined tool to analyse global economic interdependencies and design more effective trade and development policies.

In fact, the OECD is the driving force behind the methodology for TiVA indicators, which can be developed from MRIO models. This methodology has also been employed by EUROSTAT and other national statistical offices for the development and publication of these indicators.

In the European context, the FIGARO project (Full International and Global Accounts for Research in Input-Output Analysis) by Eurostat develops MRIO tables that integrate economic data from EU Member States and the rest of the world. It is the result of cooperation between Eurostat and the Joint Research Centre (JRC), becoming official European statistics in 2022 and providing annual results for each year t, referring to year t-2. Currently, the result series is available from 2010. EUROSTAT also accompanies the dissemination of FIGARO with a TiVA indicator panel since the reference year 2022.

It is also worth mentioning other similar initiative developed by other international bodies, 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 computational models by various international entities also requires a new effort for harmonisation and convergence on a global data framework needed to feed the various MRIO-TiVA initiatives. This is what is being pursued under the GIANT acronym (Global Input-Output AccouNTs), an initiative promoted by the United Nations, IMF, OECD, Eurostat, the Economic Commission for Latin America and the Caribbean (ECLAC), ADB, and the World Trade Organisation (WTO).

3 RESEARCH AREAS

3.1 POPULATION SCOPE

The indicators to be included in this experimental statistics refer to the entire national economy, in terms of the European System of National and Regional Accounts 2010 (ESA 2010)[3]. They also refer to the impact of Spain's foreign trade flows on the rest of the world.

3.2 GEOGRAPHIC SCOPE

The indicators refer to the national economic territory, defined in terms of ESA 2010.

Some of them will refer to the impact of the national economy's foreign trade on the rest of the world (also in terms of ESA 2010).

3.3 TEMPORAL SCOPE

These are annual reference indicators, starting from 2010.

3.4 STUDY AND CLASSIFICATION VARIABLES

The statistics would include a list of indicators to assess the impact on national (or global) economic activity of Spain's participation in global value chains from different perspectives, such as the value added generated, the related employment, or the emission of pollutants. All of this within the framework of the national accounts system and in consistency with the macroeconomic aggregates of Spain's National Accounting.

The panel will initially consist of the indicators listed below, although new indicators will be gradually incorporated once their compilation is tested and the interpretability is facilitated, through a more refined dissemination strategy:

1. Domestic value added, by industry, generated by the national economy's exports.
2. Domestic value added generated by exports from each industry.
3. Domestic value added generated by exports, by destination country.
4. Value added of each industry generated by its exports.
5. Value added from other industry generated by the exports of each sector, by industry.
6. Foreign value added (produced outside of Spain) generated by the national economy's exports, by importing industry and country.

[3] *Regulation (EU) 549/2013, regarding the European System of National and Regional Accounts of the EU of 2010.*
https://www.boe.es/buscar/doc.php?id=DOUE-L-2013-81250

7. Foreign value added, by country of origin, generated by the national economy's imports.
8. Domestic value added generated by the exports of the rest of the world, by country.
9. Percentage of domestic value added generated by the exports of other countries compared to the value added generated by the national economy's exports.
10. Percentage of domestic value added generated by the exports of the rest of the world over the total exports of the rest of the world.
11. Percentage of domestic value added generated by Spain's exports of intermediate goods over the total exports of these goods, by industry and destination country.
12. Percentage of domestic value added generated by Spain's exports of final products over the total exports of these products, by industry and destination country.
13. Percentage of domestic value added generated by Spain's exports of services (sections G to U).
14. Percentage of domestic value added generated by Spain's exports of goods (sections A to F).
15. Domestic employment linked to Spain's exports, in thousands of people, by industry and destination country.
16. Domestic CO2 emissions generated by exports, in thousands of tonnes.
17. Foreign CO2 emissions generated by imports, in thousands of tonnes.

4 CALCULATION METHODOLOGY

The compilation of the indicators to be included in the panel is carried out within the conceptual framework of the current national accounts systems (System of National Accounts, SNA 2008 and ESA 2010).

The basic information source is FIGARO, produced by EUROSTAT from the national accounts of each country. Additionally, the results of employment, production, and value added by industry from Spain's National Accounts are used, as well as the gas emissions from the *Environmental Accounts*. *Air Emission*, prepared by the INE.

Its methodological basis is the application of the Leontief model to the multiregional input-output framework provided by the FIGARO tables. This approach allows estimating the production required to meet a given demand in a multiregional system of 46 economies and 64 interconnected industries. And with that, the value added, employment, or emissions of pollutants generated by this demand in the national economy or other economies, considering the techno-economic relationships that define the production structure measured in the multiregional input-output tables. In particular:

– *Export* is considered 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 from a resident to a non-resident. *Expenditures by non-residents in the national economic territory* are excluded, as in the multiregional model they are aggregated into household final consumption expenditure (which is considered domestic final consumption); *re-exports* are also excluded from the model to avoid double counting of their value.

– *Value added* is understood as the value generated in the *production* of goods and services by each industry within the production boundary of national accounts. It is equivalent, on one hand, to the value of *production at basic prices* minus the *intermediate consumption* at *acquisition prices* used in the production process; on the other hand, to the *remuneration of employees*, plus *gross operating surplus*, plus other *taxes minus subsidies on production*.

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

In particular, the results show the value added, employment, or emission of pollutants incorporated into the external demand for a particular product.

Therefore, the following elements are computed from FIGARO for each reference year:

– *Technical coefficient matrix* for the production of the homogenous industry, defined as:

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

Where the *intermediate consumptions* are c_{ij}

– Leontief inverse matrix:

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

– Export vector, Y.

– Vector of the *Value-Added* to *production* by industry: v.

– Vector of the employment to *production* ratio by industry: t.

– Vector of CO2 emissions to *production* by industry[4]: g.

With all this, the following is obtained:

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

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

– Employment (in terms of *employed individuals*) generated by exports (i.e., the employment generated by exports. The brackets indicate the diagonalized vector):

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

– CO2 emissions generated by *exports* (i.e., the emissions linked to the generation of value incorporated into exports. The brackets indicate the diagonalized vector):

$$\langle g \rangle B \langle Y \rangle$$

From the previous formulas, all indicators can be calculated by modifying the demand vector. From a given demand vector (such as exports from one country to another, for example), the production generated in an economy (in particular, the Spanish economy)

[4]Value of emissions according to the *Environmental Accounts. Air Emission*, prepared by the INE.

can be calculated, and from production, the value added, employment, or emissions can be calculated.

5 DISSEMINATION OF INFORMATION

The results will be disseminated in graphic format, as part of an indicator panel, following the model already developed for successful recent initiatives, such as the *Environmental Indicators Panel*.

In the first stage, the collection of the aforementioned indicators will be published. The dissemination of the information will be accompanied by its corresponding methodology and metadata, as well as a press release to facilitate its interpretation.

Gradually, more indicators will be added to the panel in order to complete the statistical description of the Spanish economy's connection with global value chains and the economic interdependence between countries, as well as its impact on economic growth, employment, and environmental sustainability. This progressive incorporation of more indicators will entail redesigning the panel, and organising the information into potential fields and sections to facilitate access and interpretability.

The future addition of other structural indicators related to foreign trade, multinational groups, and foreign investment would also enable addressing the goal of providing users with a comprehensive *globalisation dashboard*, facilitating access to an integral view of a phenomenon for which, until now, only partial and fragmented information exists within the statistical system. Similar initiatives have already been implemented by some international organisations, such as EUROSTAT [5], and some national statistics offices[6].

Special emphasis will be placed on metadata and methodological documentation accompanying the results to facilitate the interpretability of the indicators and clarify the potential limitations of these indicators in the analysis.

5.1 DISSEMINATION SCHEDULE

The first publication of the statistics could take place between the 2nd and 3rd quarters of 2025.

The indicators will be updated annually in the last quarter of the year, always following the publication of FIGARO results by EUROSTAT and incorporating the updated annual results of national accounts.

The results published in each year t will cover up to reference period t-2. They will also involve the update of the results series in line with the revision policy of national accounts. Thus, each year t, the results of t-3 will be updated; additionally, a complete revision of the result series will be carried out during each ordinary (every 5 years) or extraordinary statistical revision of the national accounts.

[5] https://ec.europa.eu/eurostat/cache/dashboard/globalisation/

[6] https://www.destatis.de/EN/Themes/Economy/Globalisation-Indicators/intro-overview.html

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