# Who benefits from foreign trade?

Production and publication of Trade in Value Added (TiVA) - indicators as experimental statistics

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**Abstract**

*Foreign trade and its significance for different economies have long been measured by monitoring the development of trade in goods. Statistics on exports and imports of services have complemented the overall picture and the concept of economic ownership has clarified the principles of statistics. However, these developments alone are not enough to measure the importance of foreign trade, as traded products may consist of inputs produced in several countries. What is Finland's share in these global value chains in reality? To illustrate that, it was required to produce information on trade in value added regularly. The resulting indicators, such as the domestic value added of exports, now enhance our understanding of international trade and its significance.*

*Building on the previous efforts and collaboration of Nordic NSIs, and on the work done by OECD and WTO, Statistics Finland, together with OECD, developed national statistics on trade in value added. By combining existing data in novel ways, without any additional data collection or increased response burden for enterprises, we created statistics that give a more accurate picture of the integration of different types of Finnish companies into global value chains. With these new statistics, it is possible to shed light on focal questions, such as, how foreign trade actually benefits the Finnish economy, who are the main trading partners and to what degree the country's labour force is dependent on global value chains.*

*Trade in Value Added statistics are published annually as part of the Statistics Finland's experimental statistics. The paper describes the development work carried out in cooperation with the OECD, depicts the current production process in Statistics Finland and presents selected indicators enterprise characteristics. We will highlight key results, discuss limitations and potential areas for further development.*

**Keywords:** trade in value added, global value chains, experimental statistics, new statistics – no response burden

## 1. Introduction

As has often been stated, Finland is a relatively small open economy with significant exposure to foreign trade. Better knowledge of Finnish enterprises' integration on global trade is pivotal to secure good policymaking, economic stability, and growth. Especially during economic turbulence and events with far-ranging impacts on everyday lives of people, it is important to have an easy access to facts-based information. Yet, when the project on Trade in Value Added (TiVA) with the OECD and Statistics Finland initially began, it was hardly possible to expect the circumstances in which the project's output would be utilised. The global pandemic and Russia's attack on Ukraine have highlighted information needs related to foreign trade and the position of Finnish enterprises in global value chains to a greater degree than could have been imagined.

According to UNECE Guide to Measuring Global production (UNECE, 2015) value chain refers to the value added activities required to bring a good or service from its conception, design, production, marketing, distribution and support to final customers. It is the value added to the good or service at each stage of the network. A value chain can be between enterprises in a local economy or span enterprises across a group of countries which is the case of global value chains. Between the various stages of global value chain, the complexity of the value chain and the enterprise relationships can vary by industry and enterprise.

During 2019 and 2020, Statistics Finland worked together with the OECD to develop trade in value added (TiVA) statistics based on the OECD-WTO framework. OECD Factbook (OECD, OECD Factbook 2015-2016: Economic, Environmental and Social Statistics, 2016) defines that "Trade in value added data are statistical estimates of the source(s) of the value (by country and industry) that is added in producing goods and services for export (and import)." It measures the value each country adds to the final exported product and thus provides a perspective on how dependent countries are on each other. With the help of TiVA -indicators, we can explore the importance of trade partner countries for example by comparing gross export values and domestic value added export values. Some countries might seem to be important trade partners in the

terms of gross export but the exported value might consist mainly of inputs that were imported in order to produce the exported goods i.e. even though exported value is high there might be low share of domestic value added.

The primary goal of the project was to develop a replicable process for producing TiVA indicators in a national setting. Other goals were first to extend the view of TiVA by adding more granular industries, (NACE breakdowns) and breakdowns by enterprise characteristics compared to the indicators provided in OECD TiVA database (OECD, Trade in Value Added, 2022). Secondly, the project strived to expand the dimensions of TiVA by adding workforce and wage indicators. As all statisticians certainly know, our data users appreciate up-to-date data, so thirdly, one aim of the TiVA-project was to reduce the publication lag of TiVA indicators.

The development project was launched to fulfil needs of several stakeholders, including policymakers, ministries and analysts. The project was co-funded by the Ministry for Foreign Affairs, the Ministry of Economic Affairs and Employment, the Finnish Prime Minister´s Office and the Teollisuuden ja Työnantajain Keskusliiton säätiö -foundation.

## 2. Development phase with the OECD and Statistics Finland

The workflow in this joint research project of the OECD and Statistics Finland, begun with extracting and linking the microdata from existing data bases by Statistics Finland. Then the data was pooled in a manner agreed with the OECD and aggregated. These aggregated, microdata-based, tables were submitted to the OECD together with the supply and use tables.  Supply and use tables are matrices that record how supplies of different kinds of goods and services originate from domestic industries and imports and how those supplies are allocated between various intermediate or final uses, including exports (OECD, Glossary of Statistical Terms, 2001).

Also preliminary, unbalanced supply and use tables were transmitted to OECD. As a result, Statistics Finland and the OECD developed a standardized process for disaggregating domestic supply- and use tables using firm level microdata, generated extended input-output tables, balanced the extended tables, and calculated trade in value-added indicators. At the end of 2020 Statistics Finland had set up a regular publication process of granular trade in value-added indicators, including employment

indicators, at t+17 months after the end of the reference period. During the development process no microdata was exchanged with the OECD, only SAS programming code and aggregate data.

### 3. Organization of production process in Finland and short description of the method

The main responsibility of producing TiVA indicators lies with the analysis team in the Enterprise, Globalisation and Innovation group of Statistics Finland. Each statistical area that is utilised in TiVA production (see Graph 1) is attended by its own statisticians, but the analysis team compiles the data in the MDL -database.

Graph 1. Data infrastructure – Micro Data Linking
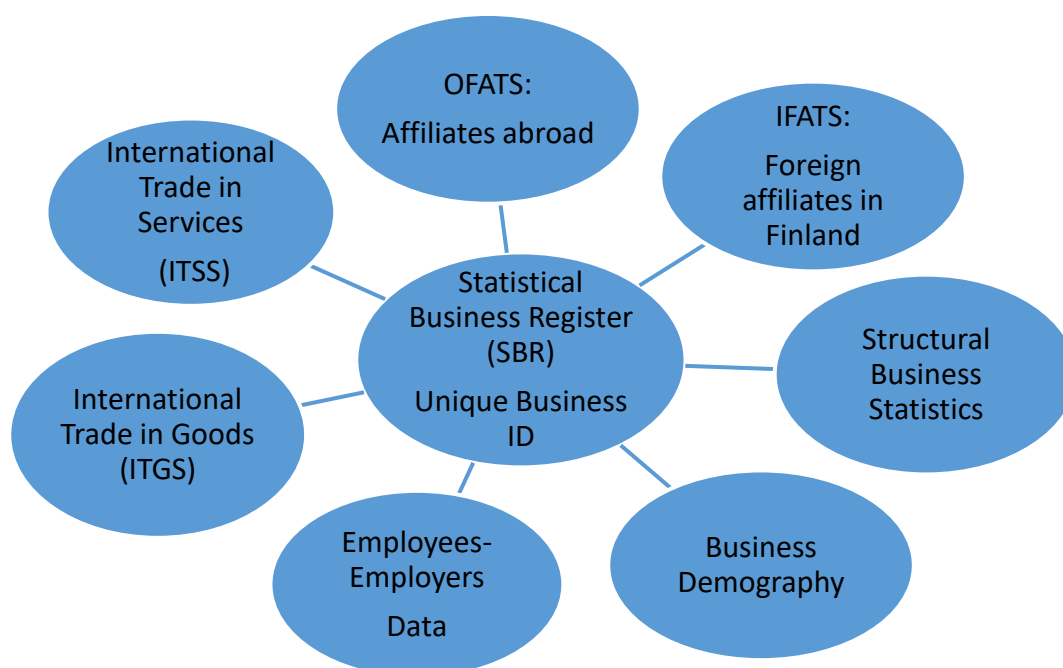


Supply and Use (SUT) tables team in National Accounts is obviously responsible for producing the supply and use tables and input-output tables which form the essential basis for Trade in Value Added -indicators. Based on programming work done in the OECD, the analysis team is almost automatically able to disaggregate conventional SUTs by firm characteristics with the help of aggregated enterprise data. The main steps of the processing of supply and use tables are described below and in the Methodology section (Annex 1.) of the report "Globalisation in Finland: Granular

insights into the impact on businesses and employment" (OECD and Statistics Finland, 2020).

In the Supply table:

Step 1: Break down gross output by firm characteristics using business data

Step 2: Split columns of supply matrix using proportionality assumption

Step 3: Estimate domestic supply of products by firm characteristics using business data

Step 4: Breakdown total imports by firm characteristics using business data

Step 5: Calculate total purchases by firm characteristics from domestic purchases and total imports

In the Use table:

Step 6: Split value added by firm characteristics using business data

Step 7: Split intermediate import use matrix proportionally by firm characteristics using business data

Step 8: Domestic intermediate use is calculated, by firm type, as the remainder of gross output less value added and imports in intermediates

Step 9: Break down total exports by firm characteristics using business data

Step 10: Split the rows by firm characteristics. This allocates the remainder of purchases to intermediate use and final consumption by firm type. This is perhaps the most important of the assumptions used in creating extended SUTs, as by design, it generates relationships between categories of firms.

The approach used here takes a neutral position by assuming that for a given category of firms (for example domestically owned firms) the share of residual purchases (purchases minus exports) that is allocated to final demand (excluding exports) and intermediate use follows the shares that are seen in the industry.

In practice, this potentially generates a bias if, for example, domestically owned firms in many industries provide relatively more intermediate parts for foreign-owned affiliates.

The extended SUTs are balanced using a RAS method which is a well-known method for data reconciliation. From extended SUTs, IO tables by firm categories can be estimated using a fixed product sales structure assumption. Finally, trade in value added indicators are generated based on extended input output tables.

Graph 2. Methodology in short
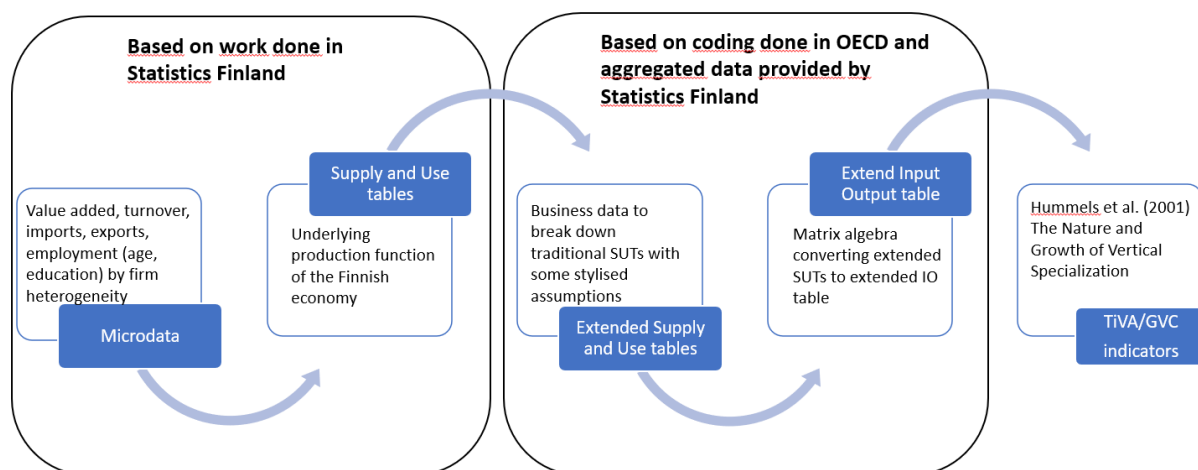


### 4. Publication

From the beginning of the project, the objective was to publish the results, the trade in value added indicators data, in the web pages of Statistics Finland in the section of experimental statistics. National trade in value added indicators that were developed together with OECD are a textbook case of experimental statistics in Statistics Finland. Typically, experimental statistics describe some new phenomena, utilise new types of data or are based on novel calculation methods. Trade in value added indicators, as experimental statistics in general, are still in the development phase and are being developed together with data users.

Experimental statistics database about Trade in Value Added consist of three sets of indicators and includes seven data tables (PxWeb) (Statistics Finland , 2022).

Graph 3: Structure of Trade in Value Added publication

| Principal indicators | • Table: Value added trade principal indicators by industry and firm trading status<br>• Table: Value added trade principal indicators by industry,  firm size and group relation<br>• Table: Value added trade principal indicators by firm ownership |
|---|---|
| Employment indicators | • Table: Value added trade employment indicators by indusrty and firm trading status<br>• Table: Value added trade employment indicators by industry,firm size and group relation<br>• Table: Value added trade employment indicators by firm ownership |
| Partner country indicators | • Table: Trade in value added by industry and region |

The so-called principal indicators are a set of indicators we have considered to be the most relevant ones when analysing global value chains. We have included the basic indicators of the national economy (gross exports and import, gross output and value added) in the set of figures, in order to make it easier for users to proportion the figures and analyse the results.

Principal indicators consist of:

- Direct domestic value added content of gross exports

- Domestic value added content of gross exports, by exporting industry

- Domestic value added content of gross exports, by source industry

- Foreign value added content of gross exports

- Indirect domestic value content of gross exports

- Indirect domestic value content of gross exports, from manufacturing industries

- Indirect domestic value content of gross exports, from service industries

- Indirect domestic value added content of gross exports, by source industry

Gross exports can be split into three components: direct domestic value added content of gross exports, indirect domestic value added content of gross exports and foreign value added content of gross exports.

Domestic value added content of gross exports is the sum of direct domestic value added content of gross exports and indirect domestic value-added of gross exports.

Graph 4: Gross export divided into sub-items according to the source of the value added.
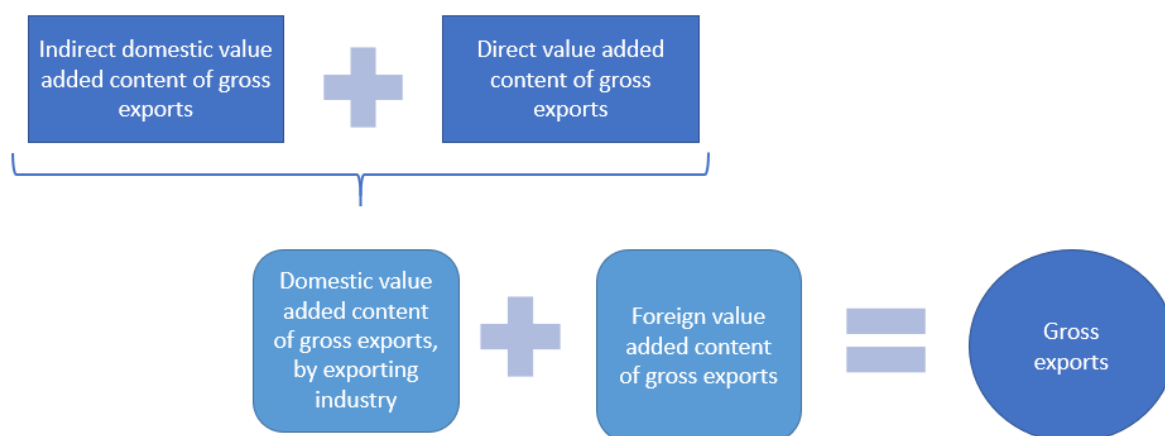
In order to determine the source of the indirect value added in the exports by industry, the indirect domestic value added in gross exports has been broken down into the value added from the industrial sector and value added from service sectors.

In addition to NACE, principal and employment indicators are categorized 1) by firm trading status, 2) by group relation and size and 3) by ownership:

Firm trading status

- Exporters: Export value > 5000 € and export share of turnover > 5%
- Importers: Import value > 5000 € and import share of purchases > 5%
- Two-way trader: Fill the criteria for both
- Non-traders
- Not categorized

Group relation and size

- Independent with 0-<10 employees
- Independent with 10-<50 employees
- Independent with 50-<250 employees
- Dependent with 0-<10 employees
- Dependent with 10-<50 employees
- Dependent with 50-<250 employees
- Large enterprises with 250+ employees
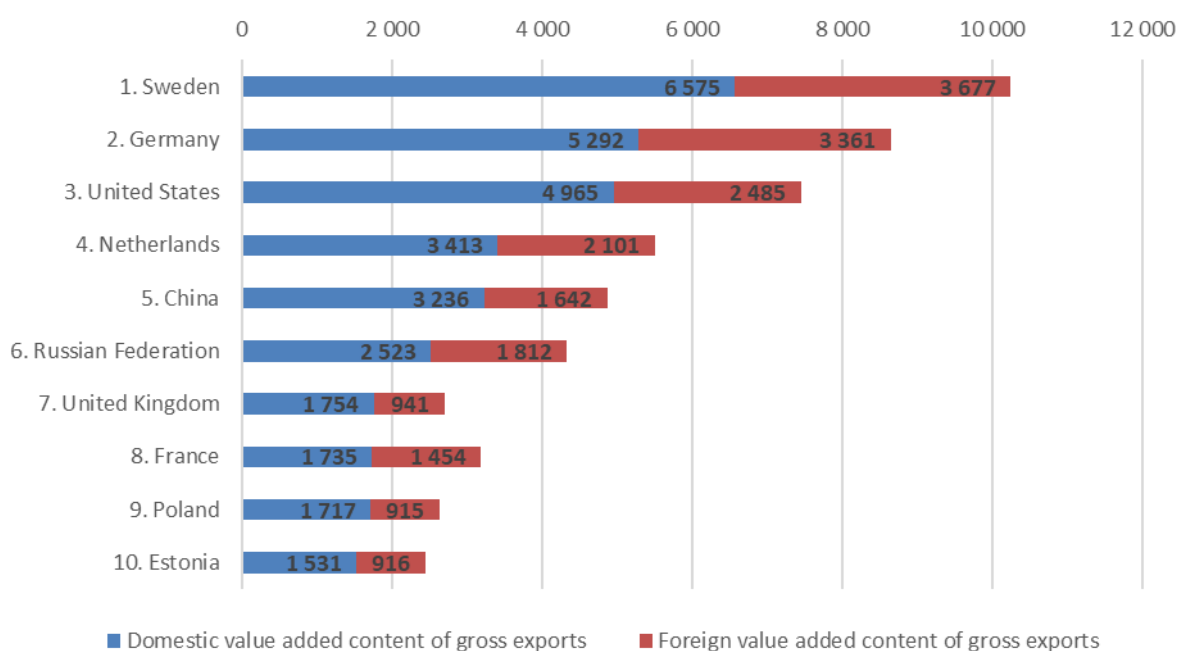- Not categorized

Firm ownership

- Domestic enterprise
- Domestic multinational enterprise
- Foreign multinational enterprise

- Other

Employment indicators are also classified according to gender and education (low-skilled, medium-skilled, high-skilled) distributions. Not categorized are typically units which are not included in the MDL database because these units are not part of business register for example public sector actors.

## 5. Finnish perspective: enterprises as a part of global value chains

Partner country indicators provide an easy way to analyse the importance and relationships of trading partners. Below Graph 5 presents Finland's 10 most significant trading partners in terms of domestic value added content of gross exports in 2020. For example United Kingdom is the seventh important trading partner in terms of domestic value added even though in terms of gross export (domestic value added + foreign value added) it would be the eight important trading partner. Dispite the fact that gross export to France is higher than gross export to United Kingdom or to Poland, these countries are in almost equal positions when we look at the domestic value added content of exports. French gross exports has a higher share of foreign value added content which means that the production process of these goods uses relatively more imported intermediate products.



| Country | Domestic value added content of gross exports | Foreign value added content of gross exports |
|---|---|---|
| 1. Sweden | 6 575 | 3 677 |
| 2. Germany | 5 292 | 3 361 |
| 3. United States | 4 965 | 2 485 |
| 4. Netherlands | 3 413 | 2 101 |
| 5. China | 3 236 | 1 642 |
| 6. Russian Federation | 2 523 | 1 812 |
| 7. United Kingdom | 1 754 | 941 |
| 8. France | 1 735 | 1 454 |
| 9. Poland | 1 717 | 915 |
| 10. Estonia | 1 531 | 916 |

■ Domestic value added content of gross exports    ■ Foreign value added content of gross exports

Graph 5. Finnish exports to the top 10 target countries in 2020 measured by the value of the domestic value added for exports and the distribution of gross exports to the domestic value added and the foreign value added, EUR million. Source: Trade in Value Added, Statistics Finland

Based on trade in value added indicators we were able to estimate the effects of diminishing Russian exports on Finnish economy. As seen in Graph 5 domestic value added content of Russian gross export was 2523 million euros in 2020. When we compare this value to Finnish gross value added we get 1,2 % which is an estimate of the potential direct impact (assuming other factors constant) on Finnish economy as exports to Russia presumably decreases.

With the help of partner indicators and NACE breakdowns it's possible to evaluate value chain dependencies between different trading partner countries and economic activities. In graph 7 we have a look on total gross exports by economic activities. Gross exports are broken down by domestic value added and by foreign value added content of gross exports. We also show the value added content that originates from Russia which is included in foreign value added content of gross exports.
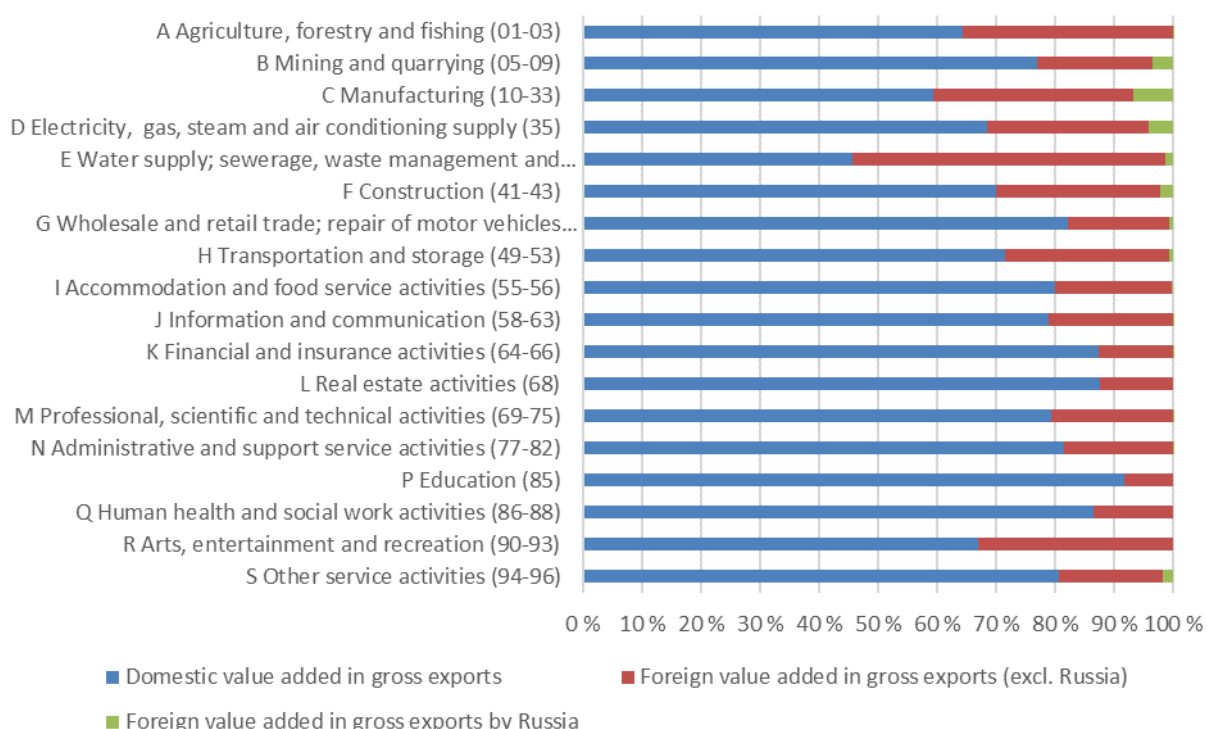


Graph 6. Role of Russia in Finnish exports: breakdown of industry exports into domestic and the foreign value added in 2020. Source: Trade in Value Added, Statistics Finland

In addition to industry "E Water supply; sewerage, waste management and remediation activities" foreign value added content of gross exports is high also in industry "C Manufacturing". In industry "C Manufacturing" the share of foreign value added content originating from Russia (imports from Russia) is the highest. This is also the case in volume terms. When we took a look on previous years, it was interesting to see that the importance of Russia to Finland as export destination country has declined over the years while the importance of Russia to Finland as an import partner had almost remained the same. This is mainly due to oil imports from Russia.

## 6. User needs and future plans

In future, our objective is to integrate TiVA -statistics into Official Statistics of Finland. To meet the criteria of Official Statistics of Finland the production process must be continuous, of high quality and the producer of the statistics must also commit to quality criteria which are compatible with the ones of the European Statistical System (ESS).

The users of the TiVA -indicators have expressed a wish that Statistics Finland will publish the extended supply and use tables and preliminary supply and use tables that form the basis for the indicators. Currently the final input-output tables are published in Finland in T+24 months. Preliminary tables are used in the production process of indicators but are not published at present. In the final input-output tables there are 181 industries in the drafting phase, and around 800 products. Compared to the final supply and use tables, preliminary supply and use tables are not balanced manually in any phase, and only automated RAS method is performed at a crude level. We are considering publishing the information that our users require, but it is also necessary to first examine revisions more closely in the future and secondly to ascertain the best way to provide multi-dimensional tables while also securing the confidentiality of enterprise data.

A recurring wish from users is to add more trading partners (countries) in the publication. Currently the trading partner categories are based on those of used also in the publication of international trade in services publication. We will strive to expand the availability of country-specific information in future releases.

Users have also expressed their need for more specific product-level information. One option to respond this data need is to consider what kind of tables we produce about supply and use. Supply and use tables are product by industry matrices. Input-output tables can be product-by-product or industry-by-industry matrices combining both supply and use tables into a single matrix. In Finland, we use the industry-by-industry approach for input-output tables. In order to response to user needs, we have been discussing about the possibility to produce also product-by-product input-output -matrice albeit in Finland industries are relatively „clean" in product sense, meaning that high share of produced product by certain industry corresponds to it's main activity / product.

Green transition is a hot topic in the world of statistics. Users are interested in whether these indicators could be applied to describe this phenomenon. Main challenge is the definition of "green enterprise". This is a big question and related to many other statistics as well. With the correct and easily applicable definition, enterprises could theoretically be classified as green enterprises and their foreign trade structure examined. However, this is easier said than done but our aim is to follow how the statistics and definitions evolve in this area.

In 2023 our aim is to release the final figures for 2020 and preliminary figures for 2021 in March i.e. the new release schedule would be T+15 months instead of current T + 17 months.

## 7. Summary

Trade in Value Added indicators help to deepen the perspective offered by traditional foreign trade statistics on the links of Finnish companies to global value chains. The indicators can be used to assess the significance of various dependencies and to highlight previously hidden aspects of production chains. The indicators will also help illustrate the labour dependency of export companies from the perspective of education and gender.

The TiVA publication is openly available in the web-pages of Statistics Finland, so we do not know exactly who uses these TiVA-indicators. We assume that the publication still needs to be marketed so that it can find potential users more easily. User's contacts increased when Russia attacked Ukraine and it became necessary to

assess also the effects on foreign trade. Content of the publication (for example firm categories) can be further developed from the user's point of view.

Production of TiVA indicators is based on comprehensive, reliable and easily combinable micro-data that are as consistent as possible with national accounts. Producing these indicators does not increase the respondents' burden but requires a number of high-quality statistical data, internal and external cooperation, learning from each other and listening to users' needs. Fortunately, this is something we are already used to doing in the Nordic countries!

## 8. References

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