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Business Statistics Framework for Global Value Chains

Michael Polder, José Vila, Robbin te Velde, Oscar Lemmers and Bart Loog

2024 edition

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Glossary

ADIMA. *Analytical Database on Individual Multinationals and Affiliates*. An OECD database that uses open 'big data' sources that can provide new insights into individual multinational enterprises (MNEs) and their global profiles.

AMNE. *Activity of Multinational Enterprises*. A database that presents detailed data on the activities of foreign affiliates in OECD countries (inward and outward activity of multinationals). The data indicate the increasing importance of foreign affiliates in the economies of host countries (particularly in production, employment, value added, research and development, labour compensation and exports). AMNE consists of 17 variables broken down by country of origin (inward investment) or location (outward investment) and by industrial sector for many OECD countries. AMNE is based on data reported to the OECD and Eurostat within the framework of annual surveys on the activities of foreign-controlled enterprises and foreign affiliates abroad that are controlled by residents of the compiling country.

BEC. *Classification by broad economic categories*. High-level aggregation of existing product classifications. It provides an overview of international trade based on the detailed commodity classifications in the Standard International Trade Classification (SITC), the Harmonized Commodity and Coding System (HS) and the Central Product Classification (CPC).

BoP. *Balance of payments*. A statistical summary of the transactions of a given economy with the rest of the world. It consists of three elements: (i) a current account; (ii) a financial account; and (iii) a capital account.

BPM6. *Balance of Payments and International Investment Position Manual* (sixth edition). Guidelines for the compilation of consistent, sound and timely BoP statistics. BPM6 updates the fifth edition (BPM5), which was released in 1993. The update was undertaken in close collaboration with the IMF's Committee on Balance of Payments Statistics and involved extensive consultations with national compilers, and regional and international agencies over many years.

CBF. *Classification of business functions*. Business functions are the activities carried out by an enterprise. They can be divided into core functions and support functions. Core business functions are activities of an enterprise yielding income and usually make up the primary activity of the enterprise, but they may also include other (secondary) activities. Support business functions are ancillary (supporting) activities carried out by an enterprise in order to permit or to facilitate the core business functions.

CBS. *Central Bureau of Statistics* (Statistics Netherlands). The national statistical office of the Kingdom of the Netherlands, whose mission is to compile statistics on a wide range of social topics and to make the results publicly available.

COVID-19. *Coronavirus disease 2019* (SARS-CoV-2). A highly contagious respiratory illness and the cause of the COVID-19 pandemic.

CPA. *Statistical classification of products by activity*. A system for categorising and organising products based on their economic activities.

CPC. *Central Product Classification*. A standardised system used for classifying products based on their attributes, functions and purposes. The CPC provides a hierarchical structure that allows the consistent categorisation and comparison of products across different industries and countries.

DMD. *Distributed microdata*. Distribution of individual-level data records across multiple sources while maintaining privacy and security.

EBOPS. *Extended balance of payments services classification*. A classification system that categorises international trade transactions related to services according to detailed economic activities and types of services provided.

EBS. *European business statistics*. Statistical data and information related to business activities, economic indicators and trends within the European context. EBS provide insights into and analysis on various aspects of the European business landscape, including employment, turnover, investment and other relevant business areas.

ECB. *European Central Bank*. The central bank for the EU's single currency, the euro. Its main task is to maintain the euro's purchasing power and thus price stability in the EU Member States that have introduced the euro since 1999 and now form the euro area.

EFTA. *European Free Trade Association*. An intergovernmental organisation established in 1960 by seven European countries to promote free trade and economic integration for the benefit of its Member States. Its current members are Norway and Switzerland (two of the original signatories), as well as Iceland and Liechtenstein.

EGR. *EuroGroups register.* A European statistical register on multinational enterprise groups. The ESSnet EGR is responsible for developing the methodology and the technical specifications for the EGR system, which is administered by Eurostat.

ESA2010. *European System of National and Regional Accounts*. The latest internationally-compatible EU accounting framework for a systematic and detailed description of an economy. It has been implemented since September 2014 and data transmission from the EU Member States to Eurostat has followed ESA 2010 rules since that date.

EU. *European Union*. The economic and political union of 27 European countries. The EU was established on 1 November 1993 by the Treaty on European Union (the Maastricht Treaty).

FATS. *Foreign affiliates statistics*. These statistics describe the activities of foreign affiliates: enterprises resident in a country or area (such as the EU) that are controlled or owned by (multinational) enterprises which are resident outside that country or area.

FDI. *Foreign direct investment.* International investment within the balance of payment accounts. Essentially, a resident entity in one economy seeks to obtain a lasting interest in an enterprise resident in another economy. A lasting interest implies (i) the existence of a long-term relationship between the direct investor and the enterprise, and (ii) an investor's significant influence on the management of the enterprise.

FGP. *Factoryless goods producer.* A company that produces goods without owning or operating a physical manufacturing facility. It instead outsources the production process to external suppliers or contractors.

FIGARO. *Full International and Global Accounts for Research in input-Output analysis.* A comprehensive framework used for conducting research and analysis in the field of input-output analysis. It involves the creation of extensive international and global accounts to study the interrelationships and flows of goods, services and resources between different sectors and economies.

GDP. *Gross domestic product*. A basic measure of the overall size of a country's economy. As an aggregate measure of production, GDP is equal to the sum of the gross value added of all resident institutional units engaged in production, plus any taxes on products and minus any subsidies on products.

GGR. *Global Groups Register.* A register or database that contains information about global groups or multinational corporations. The GGR typically includes details such as the names of the global groups, their subsidiaries, ownership structures and other relevant information. It serves as a resource for researchers, policymakers and analysts interested in studying or monitoring the activities of global groups and their impact on the global economy.

GNI. *Gross national income*. The sum of incomes of residents of an economy in a given period. It is equal to GDP minus primary income payable by resident units to non-resident units, but plus primary income receivable from the rest of the world (from non-resident units to resident units).

GVC. *Global value chain*. An international network of activities, processes and resources involved in the production, distribution and consumption of goods and services. A GVC includes various stages, including sourcing of raw materials, manufacturing, assembly, logistics, marketing and final consumption. It often involves multiple countries and companies collaborating and specialising in specific tasks to create a final product or service. The concept of GVCs highlights the interconnectedness and interdependence of economies in the global marketplace.

HRM. *Human resource management*. The strategic approach and practices involved in managing an organisation's workforce. It includes activities such as recruitment, selection, training, performance evaluation, compensation and employee development. HRM focuses on maximising the effectiveness and productivity of employees while ensuring their well-being and adherence to organisational goals and policies.

ICIO. *OECD Inter-Country Input-Output Tables*. The tables describe the sale and purchase relationships between producers and consumers within an economy. The tables are provided for 76 countries (and Rest of the World) from as of 1995[1].

ICP. *Intra-community VAT trade data (ICP declaration)*. Information and statistics related to value added tax (VAT) trade within a specific community or economic region. It provides data on the movement of goods and services between entities or countries within the community, along with associated VAT transactions. Intra-community VAT trade data are used to analyse trade flows, monitor economic integration and assess the impact of VAT policies within the community.

ICT. *Information and communication technology*. All technical means used to handle information and aid communication. This includes both computer and network hardware, as well as their software.

IFATS. *Inward foreign affiliates statistics*. The overall activity of foreign affiliates resident in the compiling economy. A foreign affiliate within the terms of IFATS is an enterprise resident in the compiling country over which an institutional unit not resident in the compiling country has control. An institutional unit is in the context of national accounts an economic entity that is capable, in its own right, of owning assets, incurring in liabilities and engaging in economic activities and in transactions with other entities.

IMF. *International Monetary Fund*. An international organisation that currently has 189 member countries. Its mission is to foster global monetary cooperation, secure financial stability, facilitate international trade, promote high employment and sustainable economic growth, and reduce poverty around the world.

IOT. *Input-output table*. This table describes the sale and purchase relationships between producers and consumers within an economy. They can show flows of final and intermediate goods and services that are defined either according to industry outputs or according to product outputs.

ISCO. *International Standard Classification of Occupations*. An international classification under the responsibility of the International Labour Organization (ILO) for organising jobs into a clearly defined set of groups according to the tasks and duties undertaken in the job.

ISIC. *International Standard Industrial Classification of all economic activities*. The standard United Nations Statistics Division (UNSD) classification of economic activities. It allows entities to be classified according to the activity they carry out.

ITGS. *International trade in goods statistics*. The collection and analysis of data related to the movement and trade of tangible goods between countries. ITGS capture information about the value, volume and characteristics of imported and exported goods, including their classification, origin, destination and trade partners.

ITSS. *International trade in services statistics*. The monetary indicators for trade in services broken down by service categories (e.g. computer services and legal services) and by partner countries. These statistics come from the transactions recorded under the country's balance of payment (i.e. the transactions that take place between an economy's residents and non-residents).

kWh. *Kilowatt hours*. A unit of energy representing 1 000 watt hours. Kilowatt hours are often used as a measure of domestic energy consumption. 1 kWh is equivalent to a steady power of 1 kilowatt running for 1 hour and is also equivalent to 3.6 million joules.

LCU. *Large cases unit*. A specialised division or department within a statistical organisation or tax authority that focuses on handling complex or significant cases. An LCU typically deals with high-value transactions, large-scale enterprises or cases involving unique circumstances that require specialised expertise and attention. Its purpose is to ensure effective management, accurate analysis and appropriate decision-making for such items.

MDE. *Microdata exchange*. A system or platform that facilitates the sharing and exchange of microdata between different entities, such as statistical agencies, researchers and policymakers. An MDE ensures secure and standardised access to individual-level data collected from surveys or other sources while also protecting privacy and confidentiality.

MDL. *Microdata linking*. The process of combining or linking microdata from different sources to create a unified dataset for analysis or research purposes. MDL involves matching and integrating individual-level data based on common identifiers or variables, such as demographic information or unique codes.

MNE. *Multinational enterprise*. Also known as a multinational corporation (MNC), a multinational or an international

1 https://www.oecd.org/sti/ind/inter-country-input-output-tables.htm

corporation. This is an enterprise that produces goods or delivers services in more than one country.

MRIO. *FIGARO Multi-Regional Input-Output Tables*. These tables show a number of things, including relations between an industry A in country B with industry C in country D, or the amount that industry E in country F supplies for final consumption in country G. MRIO tables can be used to map out GVCs using input-output analysis. For example, it is possible to derive how much value added is generated in industry A in country B due to final demand in country C.

NA. *National accounts*. Statistics that focus on the structure and evolution of economies. They describe and analyse, in an accessible and reliable way, the economic interactions (transactions) within an economy. There is an almost unimaginably large number of these transactions.

NACE. Statistical classification of economic activities in the European Community (*Nomenclature statistique des Activités économiques dans la Communauté européenne)*. A four-digit classification that provides the framework for collecting and presenting statistical data according to economic activity in a wide variety of EU statistics in the economic, social, environmental and agricultural domains. NACE Rev 2 update 1 (NACE Rev 2.1) was established in 2023 and will be progressively rolled out in all relevant statistical domains from 2025 onwards. This report uses NACE Rev. 2, as this version was current during the time of its drafting.

NSO. *National statistical office.* A central government agency or organisation responsible for collecting, compiling, analysing and making publicly available official statistics at the national level.

OECD. *Organisation for Economic Co-operation and Development.* An international organisation of 38 countries committed to democracy and the market economy. The OECD was established in 1961.

OFATS. *Outward foreign affiliates statistics*. The overall activity of foreign affiliates resident abroad but controlled by an enterprise resident in the compiling country. A foreign affiliate within the terms of outward FATS is an enterprise not resident in the compiling country over which an institutional unit resident in the compiling country has control.

R&D. *Research and development*. Creative and systematic work undertaken in order to increase the stock of knowledge (including knowledge of humankind, culture and society) and to devise new applications of available knowledge.

RIAD. *Register of Institutions and Affiliates Database*. A comprehensive database or register that contains information about various institutions, organisations and their affiliates.

SBR. *Statistical business registers*. Centralised databases that maintain updated information on businesses. This includes details like legal status, industry classification, size and ownership.

SBS. *Structural Business Statistics*. Statistics that describe the detailed structure, economic activity, and performance of businesses over time. They are part of the European business statistics (EBS). The SBS data collection has a very good coverage in terms of size classes of enterprises and their economic activity. Thus, this source provides the most comprehensive picture of the European economy, both at country and EU level.

SME. *Small and medium-sized enterprises*. Enterprises can be classified in different categories according to their size. In the European Statistical System (ESS), SMEs are defined as those which employ fewer than 250 persons. They should also have an annual turnover of no more than EUR 50 million or a balance sheet total of no more than EUR 43 million.

SNA. *System of National Accounts*. An internationally agreed standard set of recommendations on how to compile measures of economic activity in accordance with established accounting conventions based on economic principles. The recommendations are expressed in terms of a set of concepts, definitions, classifications and accounting rules that comprise the internationally agreed standard for measuring such items as gross domestic product (GDP).

SPE. *Special-purpose entity.* A formally registered and/or incorporated legal entity which is recognised as an institutional unit, with no or little employment, no or little physical presence and no or little physical production in the host economy, and which is directly or indirectly controlled by a non-residential entity. SPEs usually are the legal owner of intellectual property products (IPPs) on behalf of the parent, and receive (on behalf of the parent) income from royalties or licences to use the IPP as well as the revenues from IPP copies or licences to use or reproduce (UNECE, 2015).

STEC. *Services trade by enterprise characteristics*. This links trade in services statistics to the characteristics of the enterprises that trade in services. It does so by creating new information about classes of enterprises, including not only the enterprise's size and industry, but also its ownership (domestic or foreign).

SUIOT. *Supply, use and input-output table*. A comprehensive statistical framework that integrates information on the production, supply and use of goods and services within an economy.

SUT. *Supply and use table*. A statistical framework that presents a detailed and balanced account of the supply and use of goods and services within an economy.

TEC. *Trade by enterprise characteristics*. Data and analysis that focus on the characteristics and behaviour of enterprises involved in international trade.

TiVA. *Trade in value added*. An approach to measuring international trade that considers the value added by each country or industry in the production process. TiVA statistics provide a more comprehensive and detailed picture of global trade by tracing the value added at each stage of production along the supply chain.

UCI. *Ultimate controlling institutional unit*. An institutional unit, moving up a foreign affiliate's chain of control, which is not controlled by another institutional unit (i.e. not owned more than 50% by another entity). The UCI has a key role in the statistics on globalisation. It determines how a unit should be treated in inward or outward FATS and FDI statistics.

UNCTAD. *United Nations Conference on Trade and Development*. The main organ of the United Nations General Assembly dealing with trade, investment and development. Its mission is to integrate developing countries into the world economy, with a particular focus on ensuring that domestic policies and international action are mutually supportive in bringing about sustainable development.

UNDP. *United Nations Development Programme*. A United Nations organisation formed in 1965 to help countries eliminate poverty and achieve sustainable human development. It is an approach to economic growth that emphasises improving the quality of life of all citizens while conserving the environment and natural resources for future generations.

UNSD. *United Nations Statistics Division*. A division of the United Nations committed to the advancement of the global statistical system. The UNSD is responsible for compiling and disseminating global statistical information, developing standards and norms for statistical activities, and supporting countries' efforts to strengthen their statistical systems. It also facilitates the coordination of international statistical activities and supports the functioning of the United Nations Statistical Commission.

VAT. *Value added tax*. A general consumption tax that is assessed on the value added to goods and services. It applies broadly to goods and services bought and sold for use or consumption in the EU. It does not normally apply to goods and services bought and sold for use or consumption outside the EU. VAT is charged as a percentage of the price charged, so the actual incremental tax burden is visible at each stage in the production and distribution chain.

WIOT. *World input-output table*. The sale and purchase relationships between producers and consumers within an economy. The table can show flows of final and intermediate goods and services defined either according to industry output (industry × industry tables) or according to product output (product × product tables).

WTO. *World Trade Organization*. An international organisation of 164 countries (since July 2016). The WTO was established in 1 January 1995 and it is the only global international organisation dealing with the rules of trade between nations.

Abstract

This paper examines the complexities of global value chains, which involve multiple enterprises and geographic locations in the production and distribution of goods and services. The paper highlights the need for comprehensive statistics, in particular in the domain of business statistics, to capture the intricate relationships between trade, investment, and production within GVCs. It discusses the challenges national statistical offices face in tracking these globally dispersed activities and underscores the importance of understanding GVCs for effective policymaking, especially in light of crises like the COVID-19 pandemic and geopolitical conflicts. The paper proposes a new framework for measuring GVCs from a business statistics perspective, offering indicators to describe the distribution of labour and the economic positioning of enterprises in different countries.

The paper begins by highlighting the importance of measuring cross-national business activities and identifying gaps in current frameworks, then defines core concepts related to enterprises and their roles within GVCs. It further details the dimensions and current practices of GVC measurement, identifies existing gaps, and concludes with suggestions for improving GVC measurement methodologies and recommended indicators.

Keywords: global value chains, GVC, business statistics, statistical framework.

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The studies were implemented by Dialogic as a contractor of Eurostat for a service contract (Ref. 2019.0085) in collaboration with Statistics Netherlands and DevStat.

1

Global value chains: building a new measurement framework

1.1. Introduction

1.1.1. Background of the project

Global value chains (GVCs) can be defined as complex networks of enterprises, countries and institutions involved in the creation, production and distribution of a product or service, where each stage of the production process is located in different geographic locations and where the product or service is traded across borders (European Commission, 2023). GVCs are composed of interlinked core production activities and supporting services activities in order to produce a final product under the coordination and leadership of a lead firm. In other words, a GVC can also be defined as the full range of activities (design, production, marketing, distribution and support to the final consumer, etc.) that are carried out by multiple firms and workers across geographic spaces in order to bring a product from its conception to its end use and beyond. In our globalised world, producing final goods and services often involves a long chain of activities carried out in different countries. In this context, the production process can become very fragmented, with different players responsible for intermediate steps and intermediate components across different borders and even across the same border several times.

To adequately cover the interrelationships between trade, investment, innovation and production, there is a growing need for statistics as well as new research (Matic & Sunjka, 2022). The extent of intra-firm trade and of multinational enterprises (MNEs) and their affiliates creates both opportunities and challenges for governments, particularly in relation to trade and tax issues. However, a proper understanding of the nature of such GVCs and global dependencies requires a truly global view of production and consumption. A GVC can be broadly defined as (1) a **production process** that (2) embodies **value added** (3) from **at least two countries** (definitions are provided in the next chapter). This also includes regular market transactions (e.g. a 'spot trade' between two independent enterprises). A narrower view of GVC would focus on inter-firm and intra-firm transactions that involve customised inputs and relational contracting (Antràs, 2020) [2].

The challenge for national statistical authorities (NSAs) is to keep track of the increasingly specialised and complex business linkages in widely dispersed value chains. National statistical systems have historically focused on the national economy. Except for trade statistics, business activities outside one's own country were classified in the 'rest of the world' repository. A lot of effort has recently been made within the statistical community to better cover the globalisation of business and trade activities. However, these strands usually only cover a particular aspect or part of GVCs. For example, they still usually have a macroeconomic perspective.

The main purpose of this new framework model is to measure a GVC from a **business statistics** perspective (i.e. the point of view of enterprises) and to suggest indicators that can describe the new economic reality of globalisation. For example, in order to (better) describe the global division of labour within a GVC, the actual activities of individual enterprises within a GVC will be measured in terms of business functions. Such indicators

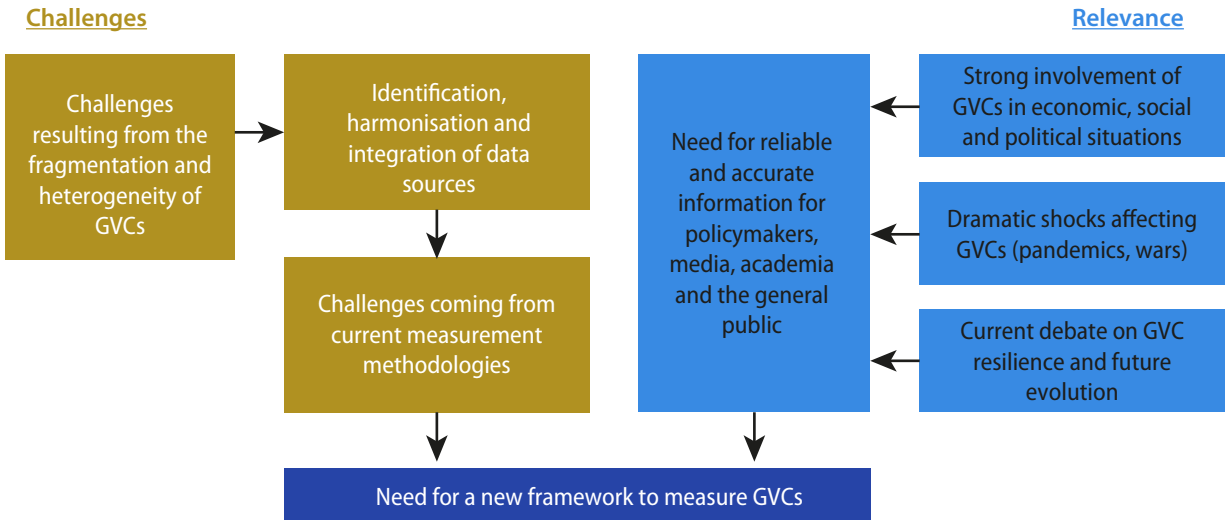
2 See Section 3.5 on governance.

might also shed new light on the particular position of a country within the regional (e.g. EU) or global economy (i.e. how its domestic enterprises are generally positioned within GVCs (e.g. in terms of functions performed and/or value added)) (Gerrefi & Fernandez-Stark, 2018). It should be noted that, although this document focuses on the EU (i.e. the real-world data that is used is from the EU), the presented concepts and indicators have a general business perspective and have a global scope. They could therefore be applied anywhere in the world.

As will be discussed in the following points (subsections) and as summarised in Figure 1, the relevance of the analysis of GVCs (particularly from an EU perspective) and the technical challenges after the measurement of such a complex phenomenon as a GVC is prompting research to define new methodological frameworks to improve current measurement methodologies. This project contributes to this research by providing three experimental case studies to help Eurostat in the definitions of this new GVC measurement framework.

FIGURE 1

Reasons why a new framework is needed for measuring GVCs



Source: Own elaboration.

1.2. Relevance of measurement and analysis of global value chains

Analysing GVCs is critical for a broad range of stakeholders. On the one hand, policymakers need to know how GVCs are evolving and are expected to evolve in coming years, in a context of potential deglobalisation and dramatic crises such as the COVID-19 pandemic and Russia's full-scale invasion of Ukraine. Moreover, effective policymaking requires quantification of the impact of GVCs on the core variables of national economies, such as growth, employment, income, trade and productivity.

On the other hand, reliable measurement of GVCs is required by researchers in order to understand and model the world economy, as well as by official statisticians to complete and improve estimates in different domains. In the private sector, reliable information on the evolution of GVCs is also critical for setting appropriate innovation, production and commercial strategies in a changing world where globalisation is subject to significant challenges (the shortage of components of Volkswagen Group described in Box 2 is a clear example of GVC implications in the private sector).

Finally, the general public needs to know what is actually happening with their national economy, production and commerce of certain commodities, and labour markets that are heavily impacted by GVC developments – and how this has dramatic (positive or negative) impacts on their quality of life. In summary, GVC measurement can help all these stakeholders to gain insights into two critical dimensions (as presented in Table 1).

TABLE 1

Major insights from improved GVC measurement

Measured dimension	Major measures and insights
Origins and destinations of inputs and outputs to and from economic production	measure cross-border movement of raw materials and supplies (for instance, to describe geographic dependencies and calculate ecological footprints);
	measure cross-border movement of jobs (for instance, to identify groups of workers that may be impacted);
Composition and sourcing of production chains and business functions	insight into the nature of work that is being sourced internationally (for instance, to analyse the flows of high-value-added business functions, such as R&D);
	impact of GVC participation on SMEs vs large enterprises (for instance, to design policy actions to promote the international role of SMEs);
	measure performance of enterprises participating in GVCs (for instance, to describe potential flows of technical and business knowledge capable of enhancing the productivity of certain types of companies participating in GVCs).

Source: Own elaboration.

The relevance of GVC measurement and analysis is even more evident in the light of crises affecting the EU economy and the well-being of EU citizens, such as Russia's ongoing war of aggression against Ukraine and the COVID-19 pandemic. These crises highlight the risks associated with the interconnected nature of global trade as well as the need to understand the mechanisms underlying GVCs and use empirical information when making policies to mitigate their impact. Reliance on foreign input-producers can lead to disruption in production when source countries experience a negative shock, such as a natural disaster, a pandemic or a war. Many observers argue that (i) firms will respond to these shocks by reevaluating the balance between efficiency ('just in time') and resilience ('just in case') in production; and (ii) this will lead to long-term changes in the structure of GVCs in the form of reshoring, nearshoring, diversification and even the end of globalisation (Brenton et al., 2022).

Effect of COVID-19 on GVC: implications for the EU

The COVID-19 pandemic has been one of the most significant disruptive events in modern times. This crisis amplified fault lines in the functioning of GVCs and exposed the fragility of a model characterised by major interdependencies between leading firms and suppliers located across several continents (Fortunato, 2020). Political pressures in some leading economies have suggested that internationalised production may be seen as less desirable from the perspective of the domestic economy and society than was the case in the recent past, especially given the difficulties observed in some supply chains in the early days of the COVID-19 pandemic (Shepherd, 2021). The rapid shutdown of national economies led to domestic demand shocks that generated startling disruptions in the availability of medical supplies, everyday commodities and goods in most activity sectors. These disruptions were attributed to an alleged lack of responsiveness on the part of hyper-efficient but rigid modern supply chains (O'Leary, 2020). At the macro level, the COVID-19 pandemic also prompted a rise of protectionism and economic nationalism, thus reversing decades of expanding cross-border trade and investment (Gereffi, 2020).

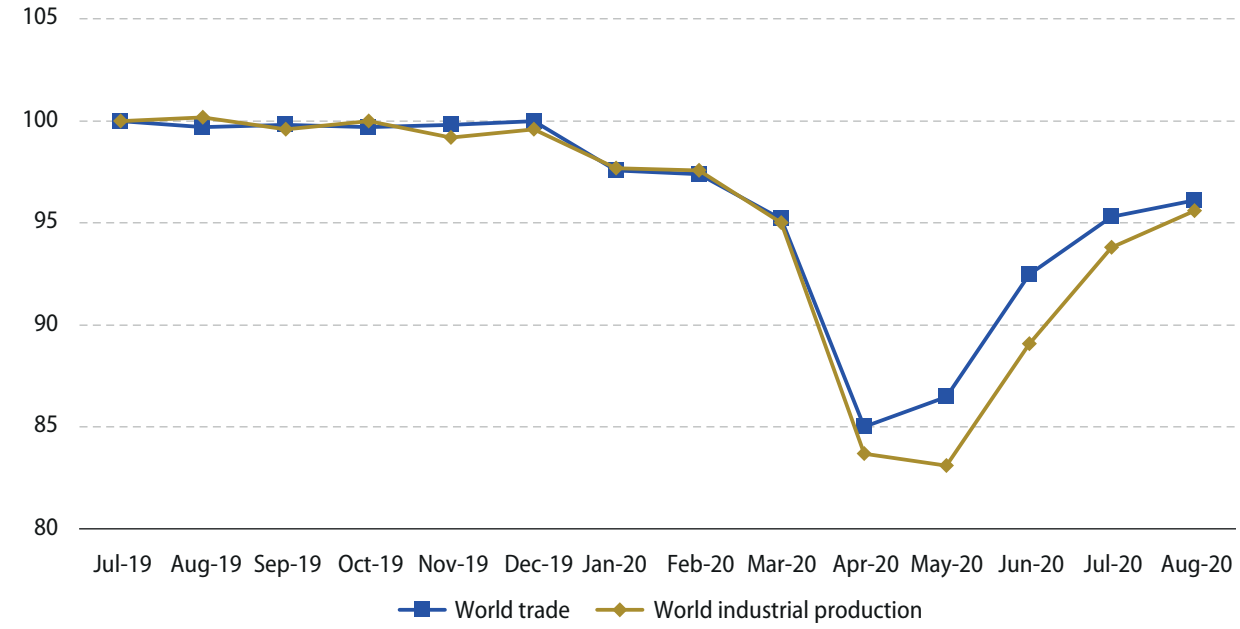
Global supply chains play a key role in many of these scenarios, but the drivers and policy implications of supply-chain disruptions during the pandemic are often unclear (Gereffi, 2020). This is largely because supply-chain dynamics vary considerably between different industries and companies, as well as between different distribution channels (Staritz et al., 2011). For instance, the question for international business and public policy is whether shortages in COVID-19 medical products were due to structural flaws or rigidities in their supply chains, as well as a lack of ability to scale up domestic production (Farrell & Newman, 2020).

Figures 2 and 3 illustrate the dramatic decline in world and EU trade due to COVID-19. Relative to its level in August 2019, world and EU trade fell to a new low in the second quarter of 2020.

After initial uncertainty regarding prospects for their recovery, trade flows have grown rapidly since the second quarter of 2020, thus exhibiting a strong resilience.

FIGURE 2

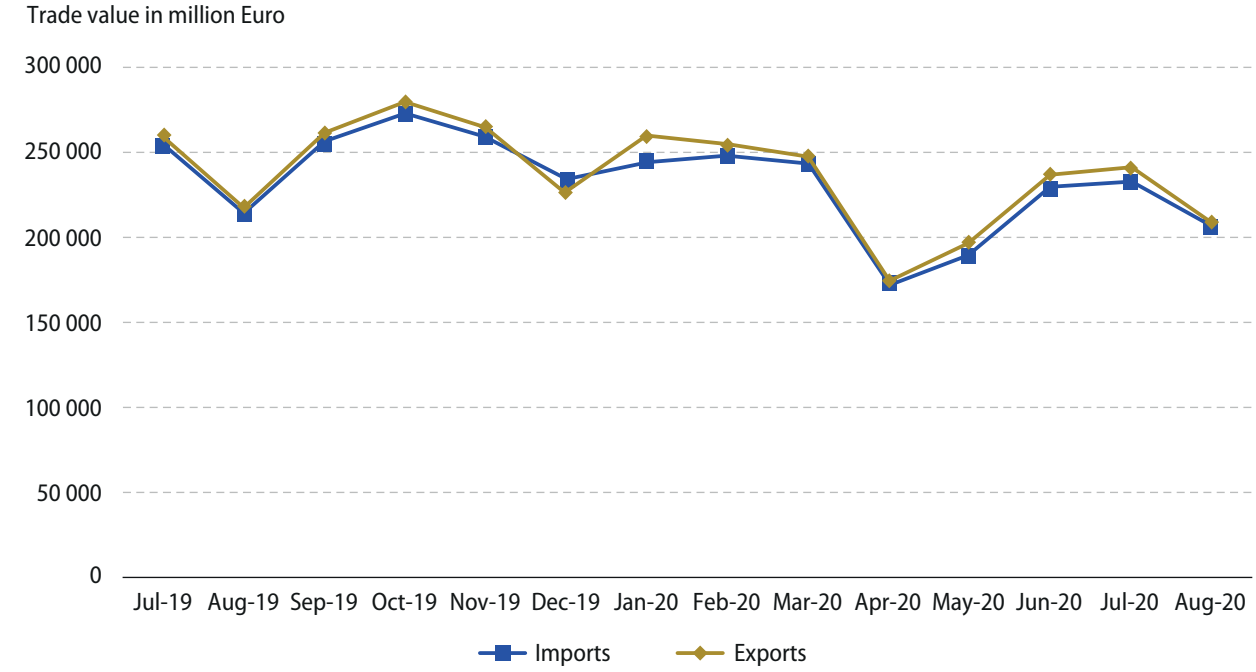
Impact of COVID-19 on world trade



Source: Adapted from Antràs (2020).

FIGURE 3

EU international trade in goods



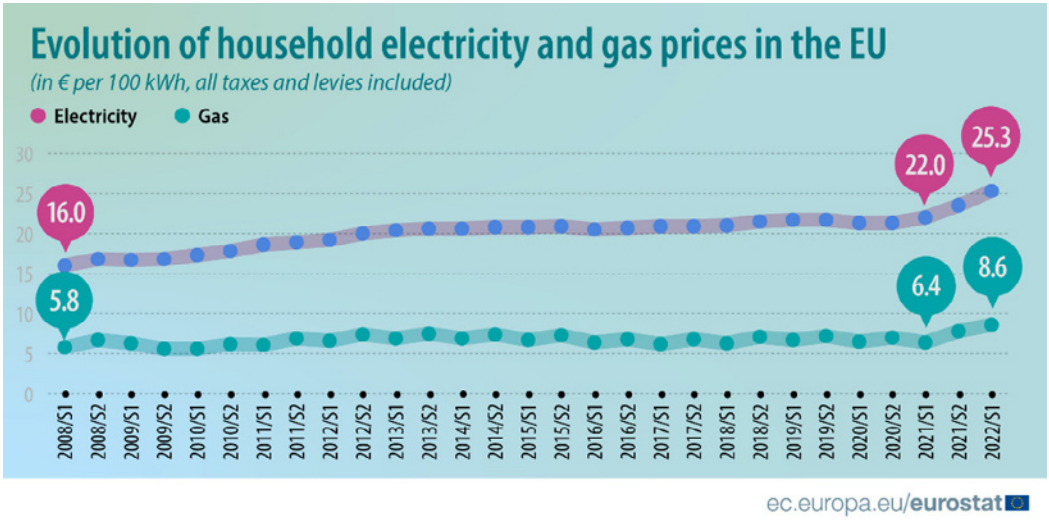
Source: Statistics Explained article 'EU international trade in goods - latest developments' (online data code: ext_st_eu27_2020sitc, Eurostat 3)

Effect of Russia's war of aggression against Ukraine on GVCs: implications for the EU

The negative impact of the COVID-19 crisis was compounded when Russia's full-scale invasion of Ukraine in 2022 triggered a new crisis affecting GVCs[4]. Russia's military aggression has destabilised exchange rates and increased commodity prices (especially for food and energy) (Figure 4).

FIGURE 4

Evolution of household electricity and gas prices in the EU in EUR per 100kWh



Source: Eurostat (2022).

The economic effects of the war and the economic sanctions imposed on the Russian Federation, as well as the high national debt levels generated by the pandemic, will probably slow the pace of economic recovery and increase differences between countries in terms of dependence on food and fuel imports. The situation is affecting supply and demand, and disrupting GVCs (including by creating supply shortages and bottlenecks). For instance, Volkswagen Group's supply of components sourced from Ukraine was disrupted by Russia's full-scale invasion in 2022 and the company was forced to halt production at two electric vehicle plants in Germany (AMonline, 2022).

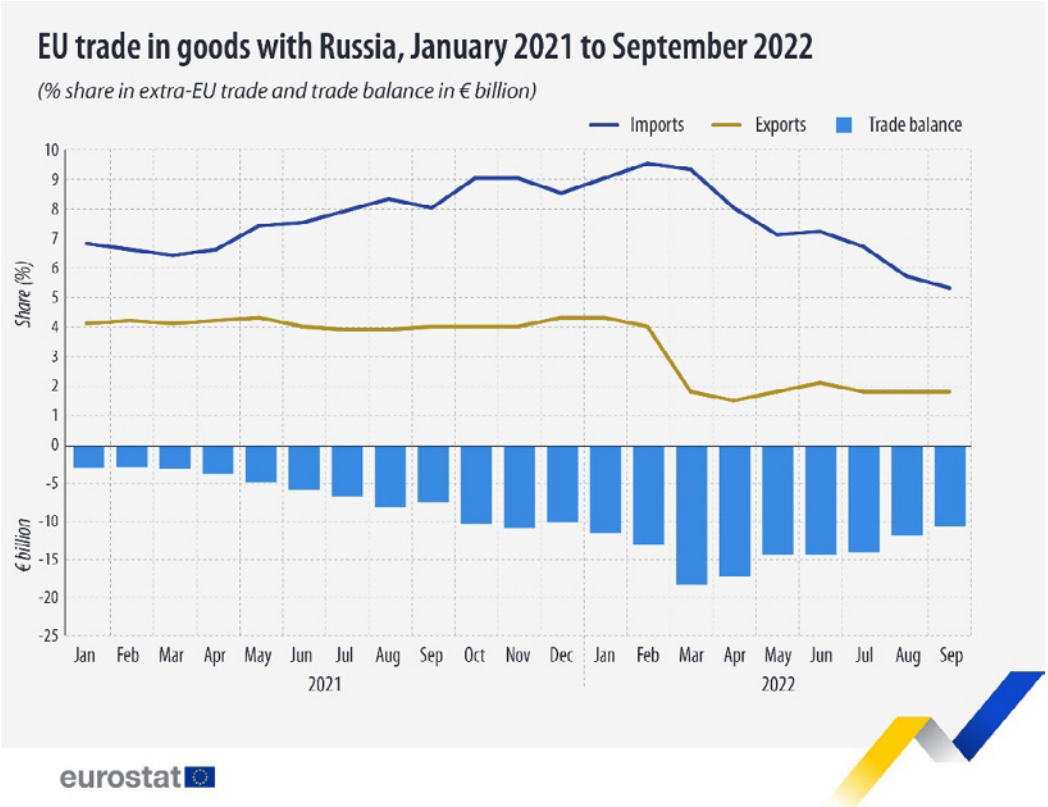
Russia is an important exporter of primary and intermediate goods and services that other countries use at an early stage of production before exporting onward in turn. Indeed, Russia's position in global GVCs is marked by high forward GVC participation. However, Russia's military aggression and the resulting sanctions are reshaping EU-Russian commercial relations, leading to a significant fall in the EU's imports from and exports to Russia (Figure 5).

3 https://ec.europa.eu/eurostat/statistics-explained/index.php?title=EU_international_trade_in_goods_-_latest_developments

4 UNCTAD (2022) *Train and Development Report Update. Tapering in a Time of conflict*. Retrieved from https://unctad.org/webflyer/tapering-time-conflict-trade-and-development-report-update-march-2022 on 29 September 2022.

FIGURE 5

EU trade in goods with Russia



Source: Eurostat (2023).

Finally, analysis and measurement of the evolution of GVC helps inform the debate on the potential deglobalisation of the world economy. According to the European Commission, globalisation may have been losing momentum in recent years, as trade and investment flows have become more subdued and protectionist measures have become more prevalent (European Commission, 2021). The rise of anti-globalisation sentiment in some countries is a challenge both for globalisation and for GVCs and their economic and social impacts. Moreover, companies are becoming more aware of the risks resulting from dependency on sources located abroad and may be considering reshoring strategies. However, the resilience of international trade (as presented in Figure 3) suggests that this deglobalisation scenario is unlikely to occur anytime soon. The European Parliament has contributed to this debate by adopting a resolution[5] that acknowledges that globalisation is facing many challenges (including the rise of protectionist measures and geopolitical tensions) but that also emphasises the continuing importance of global trade and investment. In this context, a relevant and reliable measurement of GVCs would help reduce future uncertainties related to globalisation and their expected impacts, and would guide EU policymakers, companies and citizens.

1.3. Challenges for current measurement frameworks of global value chains

A detailed assessment of current models to produce GVC statistics will be presented in Chapter 4. This present section in the meantime highlights two challenges that arise from this assessment and that help explain the need for a new measurement model framework (Figure 1).

5 European Parliament (2020). Impact of international trade and the EU's trade policy on global value chains. Retrieved from https://www.europarl.europa.eu/doceo/document/TA-8-2017-0330_EN.html.

Challenge 1: gaps in current models.

Production and trade arise from interaction between individual economic agents, especially enterprises. However, current models of GVC measurement depart from aggregates at country or industry level and do not consider direct relations between enterprises, which may be identified in already existing or improved business statistics. This approach means that, although it is possible to identify the country in which income is earned (the GDP approach), it is not possible to analyse this income according to the country in which each activity actually ends. Moreover, globalisation and the rise of GVCs are causing GNI (the income a country can spend) and GDP (and especially its underlying numbers) to diverge. For example, we cannot determine which part of the value added by an enterprise, of an industry or of total exports actually remains in a particular country. In summary, GVC measurement needs to include new inputs (such as the use of microdata from business surveys) that supplement macroeconomic accounting tools, which are organised around products, industries and sectors. These new inputs would include inputs on business processes and activities to describe the actual operations of GVCs.

Challenge 2: new statistical developments are required to improve GVC measurement.

The economic cycle, as well as external shocks such as the COVID-19 pandemic and Russia's full-scale invasion of Ukraine (see 1.1.1), has an important impact on the structure (size and complexity) and functioning (dynamics) of GVCs that is not always considered in current models. For instance, the volume of intra-firm international trade in goods and services is increasing significantly, but intra-firm activities may not be taken into account when using current measurement methodologies. Similarly, the value added by intangible assets is becoming increasingly relevant in GVCs, but current models are more oriented towards production of and trade in physical goods. When analysing intangible assets, there is greater scope for more flexible rules for the allocation of added value to the different units of a MNE, but this may distort conventional measurement methods.

1.4. Outline of the report

The report is structured as follows.

- Chapter 1 explains the importance of measuring cross-national business activities and broadly describe gaps in current measurement frameworks.
- Chapter 2 defines the core concepts in this report (enterprises and their various roles and manifestations).
- Chapter 3 describes the three core dimensions of GVC measurement: business activities, geography and business size, and governance. It starts with a schematic overview of all relevant actors and flows in relation to GVC trade and sourcing. The indicators used throughout this report are defined by reference to one of these flows, usually according to the type of actor. Annex 1 contains an overview of all the indicators (the numbering of the indicators in the main text corresponds to the numbering in Annex 1).
- Chapter 4 describes current practices in measuring GVCs. This includes a set of indicators that are already being used to capture specific dimensions of GVCs.
- Chapter 5 provides further detail on the gaps in current measurement frameworks (respectively business statistics (GVC survey), foreign affiliate statistics, trade statistics, national accounts, and financial statistics).
- Chapter 6 sets out the overall conclusions of the report and contains various suggestions to improve current GVC measurements (e.g. an extended GVC survey, microdata linking, improved trade statistics, reuse of VAT information and disaggregation of national accounts). Chapter 6 also contains a set of recommended indicators.

2 Elements of global value chains

2.1. Overview

Before we can define the core concept GVC, we need to define its fundamental elements (i.e. all the concepts needed to describe the operation of a GVC):

- the enterprise itself (which can be regarded as both an economic and an institutional entity);
- the business functions of which the enterprise is composed (which can be either insourced or outsourced);
- the value the enterprise adds by producing goods or services, based on performing one or more business functions (or usually a combination thereof);
- the characteristics of trade in goods or services;
- the investments made by an enterprise in another (newly established or existing) enterprise abroad (i.e. foreign direct investments).

2.2. Economic entity

Under Generally Accepted Accounting Principles (GAAP), the economic entity principle states that the recorded activities of a business entity should be kept separate from the recorded activities of its owner(s) (i.e. the institutional entity and any other business entities).

We define six different types of economic entities within a GVC.

Global enterprise group

An enterprise group operating within a specific GVC in several countries. A global enterprise group could have a number of different and important business functions within one or more GVCs.

If a GVC coincides entirely with one enterprise group, there is a 'hierarchy' governance model (see Figure 12). The GVC is then an integrated firm.

Lead firm

The enterprise that drives the value chain in terms of value addition and distribution (i.e. realises a fair amount of control over the GVC). In Figure 12 this refers to the lead firm in one of the three 'network' models of governance: 'modular', 'relational' and 'captive'.

Affiliated supplier

Any enterprise that is controlled (as per FDI control measures – see Section 2.8) by the lead firm as the ultimate controlling parent (UCI – see Section 2.3). This refers to a business unit within an integrated firm as depicted in the 'hierarchy' governance model from Figure 12.

Foreign affiliate (foreign-controlled enterprise)

An enterprise resident in one country which is under the control of an ultimate institutional unit (UCI, see hereafter, Section 2.3) resident in another country.

Non-affiliated supplier

Any enterprise that supplies goods or services to the GVC over which the lead firm has influence but in which it does not hold a controlling interest. A non-affiliated supplying enterprise is any enterprise from which the lead firm obtains inputs but over which it does not have any direct

influence. If there is no influence whatsoever, the 'market' governance model in Figure 12 applies. If the lead firm has indirect influence, any of the three 'network' governance models of Figure 12 applies.

Partner

An affiliate that is not a supplier (e.g. a lead firm supplying IP services, or affiliates performing assembly or shipping).

2.3. Institutional entity

An institutional unit is an economic entity that is capable, in its own right, of owning assets, incurring liabilities and engaging in economic activities and in transactions with other entities. The essential difference with economic entities at large is therefore in the type of business functions that the entity performs (i.e. productive or not).

Each institutional unit is a resident of only one economic territory. In the case of a multi-territory enterprise, it is preferable for separate institutional units to be identified for each economy.

Ultimate controlling institutional unit (UCI) [6]

An institutional unit, moving up a foreign affiliate's chain of control, which is not controlled by another institutional unit (i.e. not owned more than 50% by another entity) [7].

Special-purpose entities (SPEs)

A formally registered and/or incorporated legal entity which is recognised as an institutional unit, with no or little employment, no or little physical presence and no or little physical production in the host economy, and which is directly or indirectly controlled by a non-residential entity. SPEs usually are the legal owner of intellectual property products (IPPs) on behalf of the parent, and receive (on behalf of the parent) income from royalties or licences to use the IPP as well as the revenues from IPP copies or licences to use or reproduce (UNECE, 2015).

'near-SPE'

An enterprise that conducts both SPE-like (financial intermediation) and non-SPE-like (production) activities (IMF, 2018).

2.4. Business functions

Business functions are a grouping of common tasks that enterprises must carry out regularly, either internally or externally, to bring goods or services to the market (Technical Subgroup on the Classification of Business Functions, 2022). Business functions are typically distinguished from business processes, which refer to work organised temporarily to achieve a specific goal. Business functions are therefore relatively stable in an organisation, while business processes last only until the goal is met.

Classification according to business functions is, in a way, at odds with the conventional way of classifying companies' activities (i.e. in terms of the (specific) products and services produced (e.g. in trade statistics)). Business functions are generic recurring business processes that are more or less the same across all companies (e.g. production or logistics). They are described in detail in Section 3.2.

Business functions can either be core functions (i.e. they define the very essence of the business) or supportive functions (i.e. they support such core functions). Respondents sometimes find it difficult to determine in practice and in advance whether a specific business function is (considered) 'core' or 'supportive' (the importance of business functions also sometimes shifts over time, according to the company's strategic direction). However, in the *ex post* analysis of the survey data, the statistician can often make the distinction on the basis of some simple rules of thumb (Technical Subgroup on the Classification of Business Functions, 2022).

Core business functions

Activities of an enterprise yielding income: the production of final goods or services intended for the market or for third parties. The core function may span several activities and include related vertical activities (e.g. production of inputs). Enterprises do incur costs when carrying out core business functions, but the outputs of these functions can also be directly associated with turnover.

An enterprise may have one or more core business functions.

Support business functions

Activities carried out by the enterprise in order to permit or facilitate the core business functions (e.g. ICT services,

6 There can be a chain of UCIs. Usually the last UCI in the chain (the 'ultimate beneficial owner' – UBO) derives most of the benefits associated with ownership or control when an enterprise initiates a transaction. Current financial regulation therefore requires financial institutions to register a UBO (Directive (EU) 2018/843 of the European Parliament and of the Council of 30 May 2018 amending Directive (EU) 2015/849 on the prevention of the use of the financial system for the purposes of money laundering or terrorist financing, and amending Directives 2009/138/EC and 2013/36/EU).

7 This is the 'Winner Takes All' (WTA) approach (Eurostat, 2012), as opposed to the 'proportional approach' (OECD, 2009).

logistic and transportation services and administrative functions). The outputs (results) of support business functions are not themselves intended directly for the market or for third parties (i.e. they do not directly generate income – only costs). The notion of support business functions is related to the concept of ancillary activities as defined in SNA 2008.

2.5. Sourcing of business functions

Business functions can either be performed in-house ('internal sourcing') or by a third party ('external sourcing'). They can also be located either at home ('domestic sourcing') or abroad ('external sourcing'). Sourcing refers to a given situation ('state'). The widely used notions of 'insourcing' and 'outsourcing' refer exclusively to a change in the situation (i.e. a movement from external to internal sourcing (or vice versa)).

In addition to the institutional locus of the business function (inside or outside the enterprise), there is also a geographic dimension. Sourcing can occur either within the same country ('domestic') or in another country.

Both dimensions are key to the measurement of GVCs. A GVC obviously always involves international sourcing, which could be either inside (MNE) or outside the enterprise group. In the latter case, of particular importance to the measurement of GVCs are arrangements that go beyond mere market transactions (e.g. the buying or selling of commodities), such as the acquisition of specific processed intermediate goods and services (see point 4.2.1 and the corresponding Annex 2).

The combination of the institutional and geographic dimensions gives four sourcing options (Technical Subgroup on the Classification of Business Functions, 2022).

Domestic outsourcing

The movement of a business function to another legal entity outside the enterprise or enterprise group within the compiling country. This refers to domestic external suppliers.

Domestic insourcing

The movement of a business function to another legal entity within the enterprise or enterprise group within the compiling country (i.e. to domestic or intra-group sources).

International outsourcing

The movement of a business function to another legal entity outside the enterprise or enterprise group outside the compiling country. This refers to all the GVC governance models except the 'hierarchy' model (see Section 2.9).

International insourcing

The movement of a business function to another legal entity within the enterprise or enterprise group outside the compiling country (i.e. to international intra-group affiliates). This refers to the 'hierarchy' model of GVC governance (see Section 2.9).

These options are available for any business function. An enterprise might therefore choose different options for its various business functions. In a tabular format, it looks like Table 2.

TABLE 2

Generic survey question on business function sourcing by organisation and location

Location	Domestic		International	
Organisation	**Insourcing**	**Outsourcing**	**Insourcing**	**Outsourcing**
Business function A				
Business function B				
Business function C				
Business function ...				

Source: Adapted from CBF (2022).

2.6. Value added (enterprise view)

Domestic value added

Domestic value added in gross exports is the difference between gross output at basic prices and intermediate consumption at purchasers' prices.

Using enterprise statistics, it is straightforward to estimate value added that is embodied in exports at enterprise level (Mion, 2018). This allows very detailed analysis, but it is important to stress that this information is not directly observed (and cannot be derived from microdata-linking). An estimate can be derived under rather strict assumptions (e.g. that the share of firm-level value added due to exports is similar to export share in sales on the domestic markets). Moreover, even if one is willing to make these assumptions, the picture remains incomplete because an enterprise will also have value added due to indirect exports. These go through a wholesaler or are intermediate goods and services integrated into the exports of another enterprise. By combining rich enterprise-level data with information from national accounts, one can estimate the domestic value due to indirect exports as well. This is not at enterprise level but at 'industry by type of firm' level.

Foreign value added

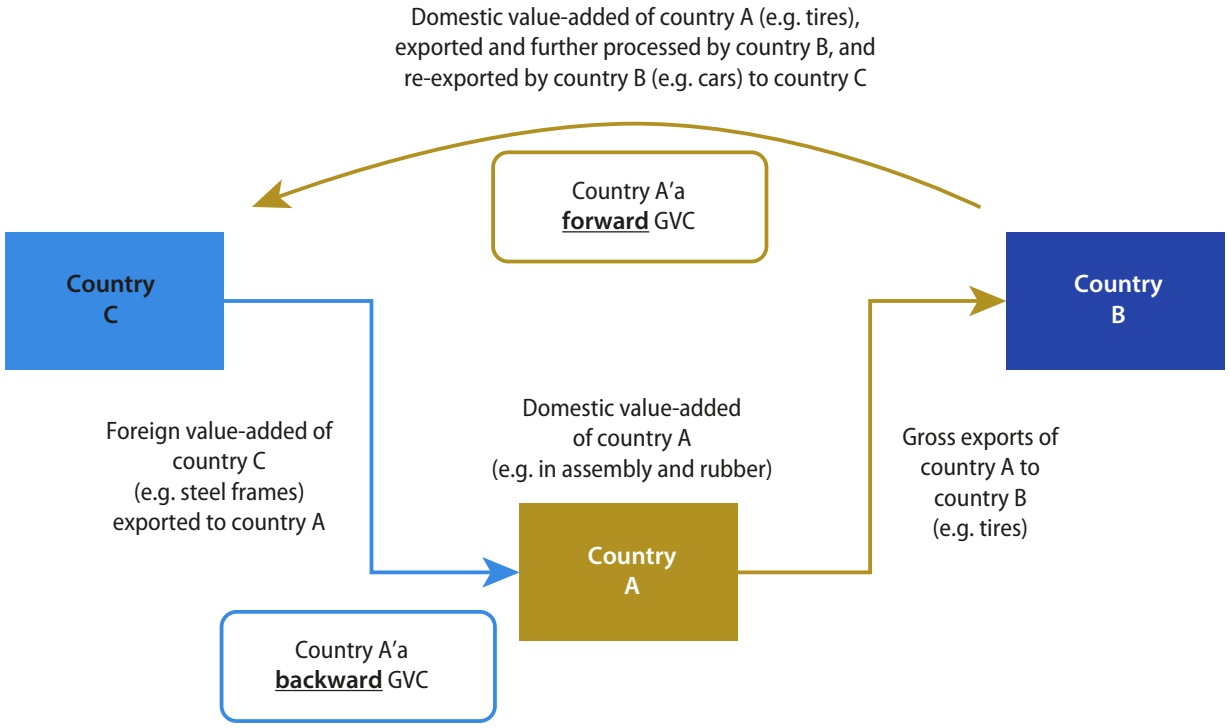
The value added of inputs that were imported in order to produce intermediate or final goods or services to be exported.

Similar to domestic value added, using linked enterprise statistics and additional assumptions, one can estimate how many direct imports (imports by the enterprise itself) are embodied in its production and in its exports. In this case, one might assume that the import content of products is the same, regardless of whether they are intended for either the export or domestic market. An enterprise can have indirect imports as well – through a wholesaler or imports that are used by other firms to produce intermediate goods and services for this particular firm. It is not possible to properly estimate indirect imports at firm level. However, the combination of enterprise-level data with information from national accounts makes it possible to make estimates at a more aggregate level (i.e. indirect foreign value added (imports) for a specific industry by type of firm level).

It is particularly relevant to the measurement of GVCs that the perspective of the enterprise on value added varies according to its position in the value chain. **Forward GVC participation** is the ratio of domestic value added sent abroad to the economy's total gross exports. This is the perspective of the selling enterprise. **Backward GVC participation** is the ratio of foreign value added to the economy's total gross exports. This is the perspective of the buying enterprise. The underlying structure of these two types of GVC participation is depicted in Figure 6, which is based on an example from (Cigna, Gunnella, & Quaglietti, 2022).

FIGURE 6

Decomposition of country A's exports to country B. Origin and destination of value added



Source: Adapted based on Cigna et al. (2022).

2.7. Trade in goods and services

Trade is the exchange of domestic goods. It is considered as domestic trade when the trade is wholly carried out at home (i.e. within the geographic boundaries of one country). If it involves movement in or out of the country, it is considered as international trade. International trade can be defined as the quantities and values of goods or services that add to or subtract from a nation's stock of goods as a result of movement into or out of a country.

When an asset changes ownership is important and depends on the definition of 'ownership'. A buyer of a good or service may already be the legal owner but not yet the economic owner. The latter requires the actual transfer of the asset (i.e. the risks and rewards related to the holding or use of the asset over a period of time have also been transferred). The economic owner is therefore the entity that is entitled to claim the benefits associated with the use of the asset ('beneficial owner') by virtue of accepting the associated risks (Eurostat, 2013)[8]. The economic owner actually controls the asset by performing the functions related to the asset and may prevent (restrict) others from using the asset.

According to ESA2010/BPM6, the purchase of material inputs by the principal has to be recorded as importation of goods in the country where the principal resides, because the economic ownership of the goods is transferred from a non-resident to a resident. The sale of finished products by the principal has to be recorded as export of goods in the country where the principal resides, because ownership is transferred from a resident to a non-resident (Chong, 2015, p. 10).

The exact value of the goods or services depends on the valuation principle that is being used: **'free on board' (FOB)** or **'cost, insurance and freight' (CIF)**. FOB includes

8 'Beneficial ownership' is a term that originally stems from English trust law. It was introduced in the OECD model tax treaty so that the sole holder of 100% legal ownership (not economic ownership) would not benefit from certain treaty benefits. Beneficial ownership requires both 100% legal ownership and a certain degree of economic risk (van Bladel, 2012, p. 3).

the transaction value of the goods and the value of services (freight and insurance) performed to deliver goods to the border of the exporting country. CIF includes the transaction value of the goods, the value of services (freight and insurance) performed to deliver goods to the border of the exporting country and the value of the services performed to deliver the goods from the border of the exporting country to the border of the importing country.

International trade can be either direct or indirect (see Section 3.1 for a schematic overview).

Direct trade refers to the direct sales of purchase of goods or services abroad. The local agents or distributors are owned by the company that sells or buys the goods or services. This refers to the integrated firm as depicted in the 'hierarchy' governance model (see Section 2.9). Indirect trade is the use of third parties (i.e. affiliate networks or re-sellers) to market and retail goods or services to end-use consumers abroad (see point 6.2.3 for the measurement of indirect trade).

2.8. Foreign direct investment

Foreign direct investment (FDI) is of particular importance when describing the operation of GVCs. FDI refers to the creation of productive assets or the purchase of existing assets (through mergers, acquisitions and takeovers) by foreigners. FDI flows include (i) the net purchase by the investor of the investment company's equity capital, (ii) the direct investor's share in the company's reinvested earnings and (iii) other capital (i.e. the net increase in trade and other credit, including the net purchase of debt and other financial instruments). FDI flows can be either outward (from the reporting country to the partner country) or inward (from the partner country to the reporting country).

FDI flows are measured at the level of countries not at the level of enterprises. FDI flows can thus be used to provide an overall picture of the intensity of foreign firms' activity in a country, which can provide a plausible approximation of the extent to which domestic firms are part of GVCs and possibly of the position of domestic firms in the governance of GVCs. However, they are not suitable for describing individual GVCs.

2.9. Global value chains (GVC)

A value chain is the full range of value-adding activities required to bring a product or service from conception through the different phases of production and delivery to final consumers. A global value chain refers to the sequence of all functional activities required in the process of value creation involving more than one country (Technical Subgroup on the Classification of Business Functions, 2022) – in other words, the full range of cross-border value-adding activities required to bring a product or service from conception through the different phases of production and delivery to final consumers (Gerrefi & Fernandez-Stark, 2018). What distinguishes a 'global value chain' from a 'global supply chain' is the inclusion of both goods and services – a global supply chain focuses mainly on the physical movement of goods and materials [9].

GVCs integrate the know-how of lead firms and suppliers of key components at different stages of production and in multiple international sourcing locations. This international inter-firm flow of know-how is the key distinguishing feature of GVCs (World Bank, 2020). It is the basis for global coordination across production and distribution hubs (see point 3.5) [10].

Value added (see Section 2.6) essentially reflects two main components: (i) operating surplus or compensation for capital and (ii) compensation for employment. The latter component largely reflects the direct benefits that accrue and 'stick' within the economy through production, but the case is not so clear for the former component, where foreign affiliates are concerned. In perfect markets, the operating surplus generated by foreign affiliates is equivalent to the return on produced 'tangible' and 'intangible' capital and also non-produced assets used in production.

Countries' national accounts attribute the ownership of this capital to the affiliated enterprise, but the ultimate beneficiary of the operating surplus (the UBO) is not necessarily the affiliate but its parent (see Section 2.3). This has prompted questions about the actual benefits of foreign MNEs for the host economy; and more recently, indeed, about the usefulness of GDP itself as a tool for macroeconomic policymaking.

9 The concept of 'global value chain' is closely related to the notion of 'global production network' (GPN), but GPN has a more developmental aspect and focuses on the interdependencies between developed and developing nations (see, for instance, (Coe, Dicken, & Hess, 2008)). GVC literature seems to take a rather more neutral approach. The notion of governance within the value chain / production network is nevertheless a key aspect of GVC measurement ('who is in charge?' and 'who benefits most?') – see Section 3.4.

10 These definitions specify neither the form taken by the foreign value added in production nor the structure (configuration) of the 'chain'. For the latter, see (Baldwin & Venables, 2013).

The complexity of the value chain and the business relationship between the various stages can vary according to industry and enterprise. A value chain can be between enterprises in a local economy or can span enterprises across a group of countries (Gerrefi & Fernandez-Stark, 2018). GVCs are particularly the object of analysis in the context of global production. The proper identification of value added at each step of the chain is fundamental to national accounting, particularly when the chain involves several countries.

3

Dimensions of cross-national business activities

3.1. Overview

Before proceeding to the discussion of current practices in measuring GVCs or to the identification of challenges and recommendations, this chapter first discusses relevant dimensions of GVC measurement. Figure 7 gives a schematic overview of actors and flows in relation to GVC trade and sourcing. Whenever possible, the discussion of the suggested framework indicators in other parts of the document will be related to Figure 7. The set of indicators includes not only those that are already being used to capture specific dimensions of GVCs (as discussed in Chapter 4), but also recommendations for new indicators based on either existing data or potential future data collection and research efforts (Chapter 6).

The 'Trader' is central to Figure 7. For graphical purposes, we assume that the Trader is both a supplier and a user. The Trader is a resident in the **domestic market**. It can trade directly with other actors located either in the same domestic market or abroad (**rest of the world**). These trade partners can be **affiliates** or **non-affiliates** (i.e. part of the same business group or not). In addition, **indirect trade** is possible (i.e. the Trader does not trade directly with another firm but there is an indirect supply or use relation with this firm through the value chain). Such relations are important to consider as regards, for instance, supply-chain dependencies and vulnerabilities. Taking into account whether the partner is a supplying or using party, this gives rise to the 10 different types of trading partners depicted in Figure 7.

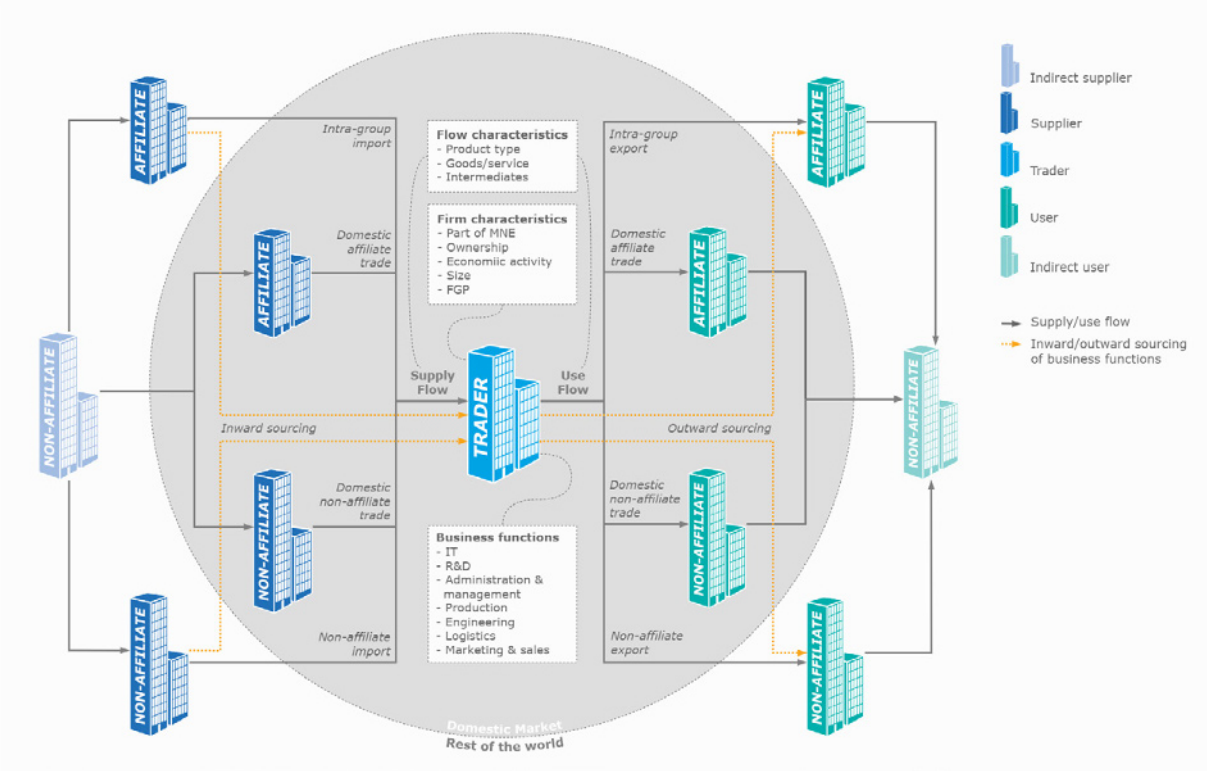
The Trader can be classified according to its **firm characteristics** (indicated in the box). Some of these characteristics are not related to trade or GVC (e.g. size and economic activity). Other features are more directly related to trade or a GVC (e.g. whether the Trader is part of a multinational, is foreign-owned, operates as a factoryless goods producer (FGP), etc.). These examples of characteristics are of course non-exhaustive. A basic type of indicator would be breakdowns of the population by GVC-related characteristic (e.g. counts or shares of MNEs, FGPs, etc.). GVC-related characteristics can also be a useful way to break down more general economic indicators (e.g. value added or employment by MNE-status or type of ownership). Both the more general and the GVC-related characteristics can be a useful way to break down a population total of a GVC indicator (e.g. trade by type of firm).

The interactions of the trader with the other actors result in **supply and use flows**. Such flows can be categorised by the type of partner (e.g. **affiliate or non-affiliate trade** which can be domestic or export/import depending on the location of the partner). In addition, the trade flows can be detailed further by **flow characteristics** (e.g. by product type or destination). Such characteristics may increase the usefulness of GVC measurement – trade in intermediate products, for instance, is generally considered to be closely related to GVC trade.

Trade flows may also be the consequence of **inward and outward sourcing** (see Section 2.5). In this case, it can be useful to distinguish **business functions** (see Section 2.4). The Trader may outsource certain business functions (such as ICT or production activities) or be on the receiving end and carry out certain activities for other firms.

FIGURE 7

Schematic overview of all entities and relationships between entities that are relevant to the measurement of GVCs



Source: Own elaboration.

Needless to say, the graphical representation is very stylised and sacrifices detail and completeness for the sake of clarity. As a result, it does not directly represent each and every single element of GVC trade. For instance, the graph is implicitly focused on business-to-business trade. In principle, the role of other institutional sectors (government, households and non-profit institutions) as user and/or supplier can be accommodated by considering these types of partners as 'non-affiliates'. In addition, the supplier and user can in theory be the same actor. In the case of inward and outward processing trade (See points 4.2.2 and 6.4.5.), a firm may outsource production activities to another firm, thus leading to outward and inward flow between two traders. More generally, the structure of production networks will be much more complex than what can be depicted in a single graph, due to feedback loops and multiple direct and indirect links between entities. For instance, we have assumed for simplicity that indirect trade takes place with a non-affiliate only, but in practice intermediate steps may also exist for trade between two affiliates of the same group. It is nevertheless useful to have a simplified picture of such a network in order to be able to visualise the general idea of different indicators and their mutual relation in a framework.

3.2. Business activities

3.2.1. Supply-chain segments

The activities within a supply chain can be grouped in sequential segments based on the traditional broad stages of production from upstream research and development (R&D), through acquiring of inputs, production of components and final products, until the later activities of distribution and sales. Figure 8 provides a simple illustration of a GVC divided into its supply-chain segments.

Supply-chain management may cover the whole chain (as reflected in the figure) or specific parts of it. Similarly, some stages of the chain may be controlled by a parent company whose affiliates are responsible for other stages in the supply chain. GVCs typically cover the entire chain.

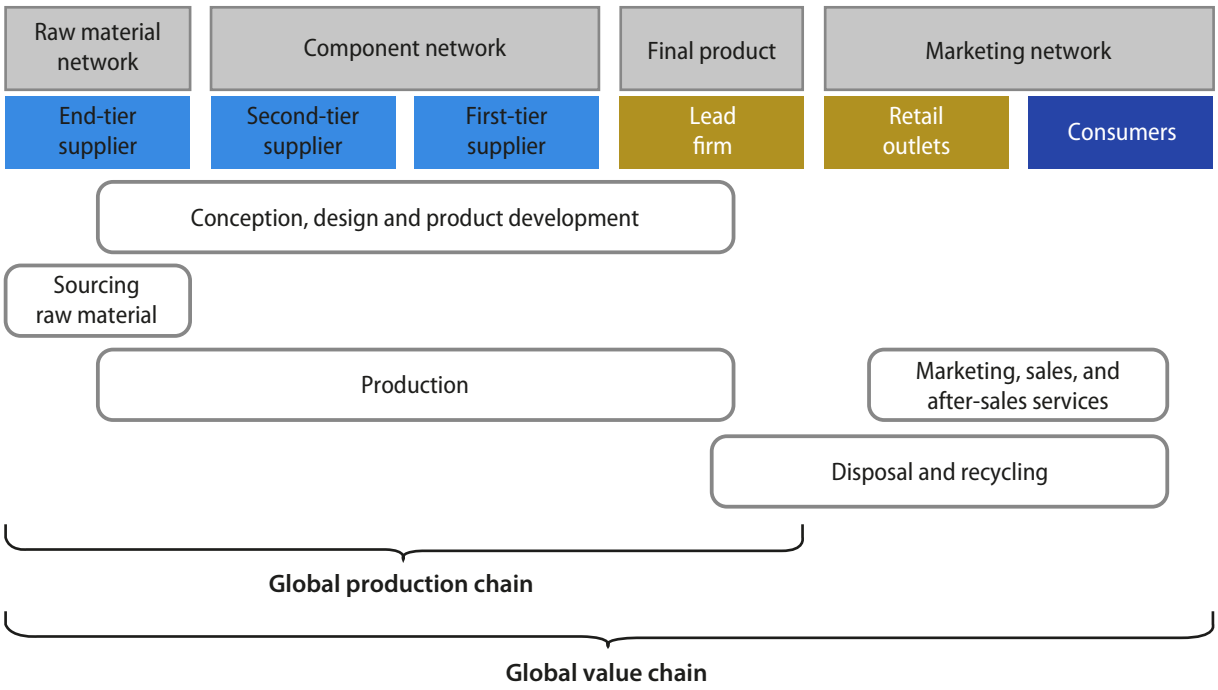
FIGURE 8

Illustration of fragmented production

Source: Adapted based on UNECE (2015).

FIGURE 9

Global production and value chains



Source: Adapted based on APEC Policy Support Unit (2012).

3.2.2. Business functions

GVCs are characterised by a business line that represents a sequence of business production processes or business functions. This sequence of production arrangement brings a product to its final consumers from its conception. Business functions are the activities controlled by the lead firm. They can be divided into core functions (i.e. production activities that generate income for an enterprise) and support functions carried out by the enterprise in order to permit or facilitate the core business functions of the GVC. They are undertaken by the lead, affiliate and non-affiliate firms in the GVC (see Section 2.2).

Depending on the role of the enterprise in a GVC, a business function can be either core or supporting (see Section 2.4) [11]. Core functions may produce either goods or services, but support functions consist entirely of services.

In order to construct satellite accounts for GVCs, business functions are mapped to the reference classifications of economic activities (NACE and ISIC Rev. 4) [12].

In the latest Commission Implementing Regulation (EU 2022/919) [13], the technical specifications of data requirements for the topic global value chains have defined core business functions in two aggregated groups of NACE-sections:

1. B+C+D+E+F (industry and construction);
2. G+H+I+J+K+L+M+N (business services).

Seven distinctive support business functions have been defined:

1. transportation, logistics and storage;
2. marketing, sales and after-sales services [14];
3. information technology;
4. management and administration [15];
5. engineering and related technical services;
6. research and development;
7. other business functions not included elsewhere (e.g. design).

Business functions generally differ significantly in terms of structure and functioning. GVCs are therefore best described at the level of a business function and not at the aggregate level of a lead firm.

3.3. Business size

The prevalence of sourcing (the outward movement of business functions currently performed in-house) is linked to business size. The larger the enterprise, the higher the prevalence of sourcing. In turn, within that sourcing the share of international sourcing (see also Section 3.4) is substantially bigger for larger enterprises (i.e. those that employ 250 persons or more) than for smaller enterprises (Sunjka & Papadopoulos, 2022). In general, however, EU enterprises do relatively little international sourcing (see Table 3).

TABLE 3

Enterprises sourcing abroad and domestically by size class, percentage of all enterprises in the same size class, selection of EU-27 Member States, 2018

Number of employees	Total sourcing (%)	Of which domestic (%)	Of which international (%)	International as share of total sourcing (%)
50-99	15.8	11.9	3.9	24.9
100-249	18.6	13.6	4.9	26.6
250+	25.7	16.5	9.1	35.5
Total (50+)	18.3	13.2	5.1	27.9

Source: Eurostat (2022).

11 For a heuristic to distinguish supporting business functions from core business functions, see (Technical Subgroup on the Classification of Business Functions, 2022, pp. 19-23).

12 ISCO, CPA and CPC mapping will also be available soon (it is currently under development).

13 Commission implementing regulation (EU) 2022/918 of 13 June 2022 laying down technical specifications of data requirements for the topic Global Value Chains pursuant to Regulation (EU) 2019/2152 of the European Parliament and of the Council (https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32022R0918&from=EN)

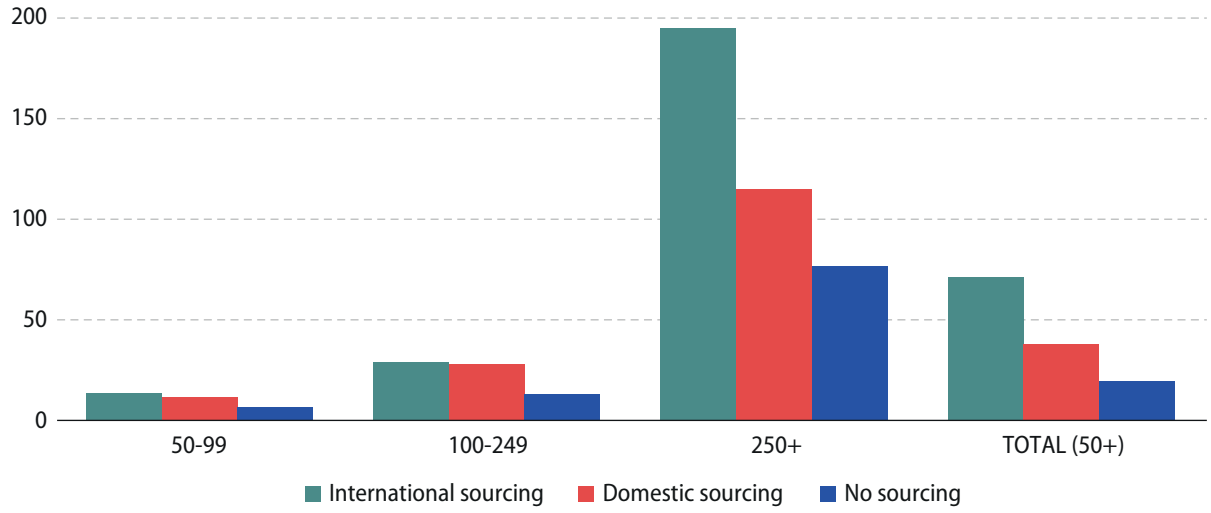
14 This includes help desks and call centres.

15 This includes human resource management (HRM), legal and accounting.

However, in terms of turnover and value added (at factor cost), the difference between domestic and international sourcing enterprises is much more pronounced. This is a pattern that occurs across business sizes. Overall, the turnover of enterprises that source internationally is 1.9 times higher than the turnover of enterprises that only source domestically (2.2 times higher value added) and 3.7 times higher than the turnover (5.0 times higher value added) of enterprises that do not source at all.

FIGURE 10

Average enterprise turnover by size class and sourcing status, 2018 (in EUR millions), totals for Bulgaria, Denmark, Portugal, and Romania



Source: Linking statistics on international sourcing with other business statistics. Sunjka & Papadopoulos, Statistics Explained articles, Eurostat (2022)

There is a definite geographical dimension to the international sourcing patterns. Most enterprises that source abroad are foreign-controlled [16]. The underlying reason for this is that multinational enterprises (MNEs) play a key role in the cross-border organisation of production and GVCs (Cigna et al., 2022). When compared with domestically-owned companies, foreign multinationals have a substantially large involvement in GVCs, especially in emerging markets and in the euro area. Foreign affiliates of MNEs rely more than domestic firms on backward linkages (see Figure 6). This reflects the facts that offshoring activity of MNEs relies on foreign intermediate inputs and that multinational activity is often related to reprocessing activity in the host country (see Section 3.4). The presence of foreign MNEs is positively associated with foreign value added being sourced from the country where these foreign MNEs are headquartered. This emphasises the strong GVC ties of foreign affiliates with parent companies abroad (see Section 3.5) (Cigna et al., 2022).

3.4. Geography

GVC statistics need to cover the geographic dimension, providing a breakdown by domestic and foreign value added. It is recommended that foreign value should, if possible, be split in terms of individual countries, which can then be aggregated for the different world regions.

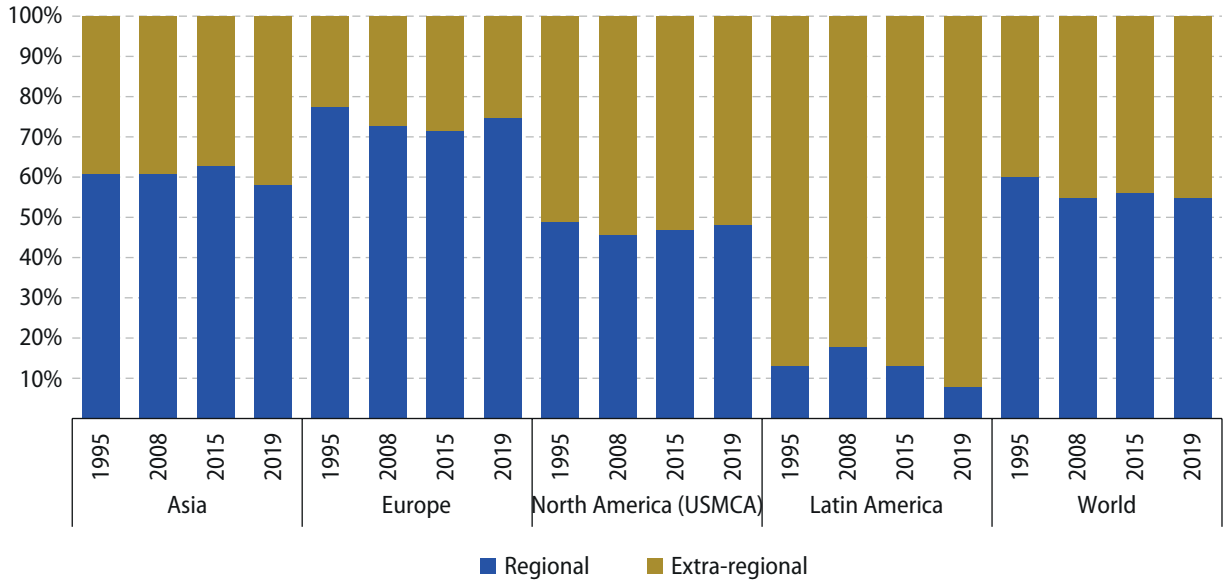
The geographical distribution of value added can be described in terms of concentration (the distribution of value added between countries) and spread of contribution (the number of countries for which the GVC is an important part of the economy). Typically depending on the characteristics of a sector, GVCs can be globally dispersed (i.e. a large spread of concentration) and more (e.g. electronics) or less (e.g. food and beverages) concentrated. Other GVCs are less geographically dispersed (so more local/regional bound) and also more (e.g. business services) or less (e.g. transport and logistics) concentrated.

16 There are marked differences, however, between the five countries that were involved in the Eurostat study. In Bulgaria and the Netherlands, the percentage of foreign-controlled enterprises is around 70% but around 50% in Denmark, Portugal and Romania (Sunjka & Papadopoulos, 2022).

The prevalence of GVCs in world economy has been increasing for decades (i.e. the intensity of GVC participation has steadily increased for an increasing number of countries). In geographic terms, this does not necessarily mean that GVCs have become more global in nature (in this respect the label 'global' is a misnomer). In fact, in countries in Europe and Asia (and to a lesser extent in North America), GVC participation has risen largely on the back of stronger supply linkages **within the region itself,** while countries in Latin America have become integrated into GVCs by strengthening linkages with partners from other regions (Cigna, Gunnella, & Quaglietti, 2022). In 2019, 75% of GVC participation by Europe was regional (i.e. within Europe). In terms of international sourcing, Sunjka and Papadopoulos (2022b) arrived at similar figures for 2018: 80% of the enterprises sourcing anywhere abroad, source to the EU. This percentage is quite similar for core business functions (79%) and support business functions (92%).

FIGURE 11

Relative contributions to GVC participation, per world region



Source: Cigna et al. (2022).

Underlying the diversity in geographical distributions is the network structure ('length') of a GVC in terms of the number of steps. Changes in the structure of a GVC largely depend on the strategic decisions made by the lead enterprise to either unbundle or rebundle tasks for specific business functions. If a task is unbundled it can later be produced either at home or abroad, and either inside or outside the own enterprise group (see Section 3.5). The international location of new production facilities is ultimately up to GVC lead firms (Taglioni & Winkled, 2016, p. 13). Where to geographically (re)locate the production is another decision that is shaped partly by the inherent sectoral characteristics of a business function (e.g. in terms of economies of scale, transportation costs, need for customisation, etc.) and partly by strategic decisions (e.g. transaction costs, risks involved, tax and regulation, etc.)

The 'inherent' sectoral characteristics of a business function are not static but can be influenced in the longer term by technological developments. Digitalisation in the supply chain, for instance, will probably favour trends towards unbundling (vis-à-vis rebundling), offshoring (vis-à-vis re/nearshoring) and outsourcing (vis-à-vis insourcing), but automation in the supply chain probably has precisely the opposite effect (UNCTAD, 2020). The net effect differs between sectors and (depending on its position in the GVC) countries. Current technological trends will probably lead to more reshoring and more regionalisation, especially in high tech industries (such as electronics, automotive, machinery and equipment), in which GVCs generally play a central role (UNCTAD, 2020, p. 166).

These longer-term trends might, at least in the shorter run, be amplified by various trends in the policy environment.

In the post-pandemic era, in which geopolitical tensions are rising, there is generally a push for more regional economic cooperation, stronger regional self-reliance and the building-up and protection of strategic industrial capacity. On top of this is the ever-increasing need for more sustainable production and consumption, which also leads to unbundling, reshoring and insourcing.

3.5. Governance

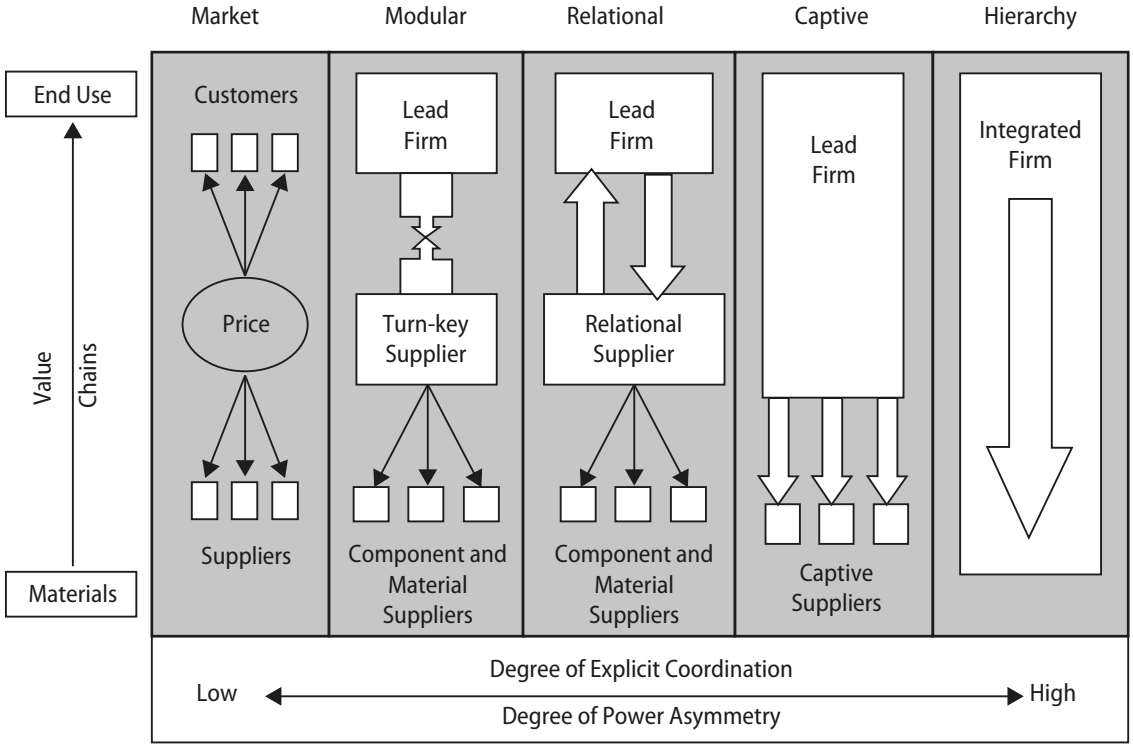
GVCs are globally dispersed and organisationally fragmented production and distribution networks. They span multiple countries and consist of multiple production and distribution hubs (see Section 3.4).

What binds these dispersed hubs together is some degree of **coordination** between them. Gereffi et al. (2005) distinguish five analytical types of coordination within such dispersed global networks (Gereffi, Humphrey, & Sturgeon, The governance of global value chains, 2005). These align with five models of governance of a GVC (see Figure 12).

The governance model with the least degree of coordination is a network that is entirely built on marked-based relationships between independent businesses ('market'). The governance model with the highest degree of coordination is a fully vertically integrated business ('hierarchy'). These two extremes coincide with the classical models from Transaction Cost Economics (Williamson). Between them lie three models of governance that relate to Powell's specific notion of a form of economic organisation, 'network' (Powell, 1990). What sets these three 'network' models apart from the other two models is that the businesses within the coordination are neither independent ('market') nor dependent ('hierarchy') but interdependent: they are either more ('modular') or less ('captive') free to leave the network or somewhere in between ('relational'), but they also need each other to a greater or lesser extent.

FIGURE 12

Five GVC governance types



Source: Gereffi et al. (2005).

- **Markets.** Governance can be organised through market linkages and coordinated through market prices. Market relations do not have to be completely transitory and persist over time, with repeat transactions. The essential

point is that the costs of switching to new partners is low for both parties.

- **Modular value chains**. Suppliers in modular value chains make products according to a customer's specifications, which may be more or less detailed. However, when providing 'turn-key services', suppliers take full responsibility for competencies related to process technology, use generic machinery that limits transaction-specific investments, and make capital outlays for components and materials on behalf of customers.
- **Relational value chains**. In this model of governance, buyers and sellers establish complex interactions. This often creates mutual dependence and high levels of asset specificity.
- **Captive value chains**. Small suppliers are transactionally dependent on much larger buyers. Suppliers face significant switching costs and are therefore 'captive'. Such networks are frequently characterised by a high degree of monitoring and control by lead firms.
- **Hierarchy.** This governance form is characterised by vertical integration. The dominant form of governance is managerial control, which flows from managers to subordinates, or from headquarters to subsidiaries and affiliates.

In the broad definition of Gereffi et al. (2005), a pure market and a pure hierarchy (multinational enterprise (MNE)) are also covered by the concept of GVC. In a narrower definition in the context of global strategic alliances and partnerships (Heenan & Perlmutter, 1986), the term GVC refers to (rival) transnational groupings of collaborators, and only the three 'network' governance models are included. We also tend to exclude the pure market governance type because it does not involve any degree of coordination (except the 'invisible hand' of the market).

The pure hierarchy governance type certainly qualifies as a GVC - it has a maximum degree of coordination, i.e. the lead firm is the GVC. Most production processes do not happen in a sequence ('chain') of dependent activities. They instead take place in more complex networks of production, in which participating firms are specialists in one activity and external international sourcing arrangements involve inter-firm trade with characteristics similar to intra-group trade (Taglioni & Winkled, 2016, p. 12). In present-day GVCs, lead firms rely on a complex web of suppliers, vendors and services providers of all kinds and in multiple locations.

Interestingly, with the shift from hierarchies (and markets) to global production networks, competition has also shifted from horizontal (MNEs competing in the same sector for the same customer base) to vertical (firms in the same value chain competing to perform specific and specialised tasks). The latter especially concerns 'relational value chains', in which lead firms compete with their own first-tier or second-tier suppliers.

4

Current practices in measuring global value chains

4.1. Overview

Eurostat is a useful source of statistics and indicators on the generic topic globalisation of businesses [17]. Eurostat is involved in several projects to develop new statistics on globalisation in business statistics, in cooperation with national statistical institutes and international organisations.

Eurostat has business statistics on multinational enterprise (MNE) groups, GVCs and foreign affiliates (including R&D expenditure) [18]. These are further described in Section 4.2. It also has statistics on foreign trade (Section 4.3), value added (described under national accounts in Section 4.4) and foreign direct investment (Section 4.5), and some general statistics on employment. We cover employment in Chapter 6 (see points 6.2.4 and 6.3.1).

4.2. Business statistics

4.2.1. The EuroGroups Register (EGR)

The EuroGroups Register (EGR) is the central statistical register of Eurostat and of the statistical authorities of the EU and EFTA Member States, covering MNE groups active in Europe [19]. In order to maintain the EGR, Eurostat collects data on group members, their relationships and enterprise group information from the national statistical registers. This is complemented with additional information from commercial databases. Based on these data, the EGR recreates the global structures of the MNE groups.

The group structures and characteristics are distributed to national statistics compilers in all EU and EFTA countries (countries can access the group information if it contains at least one enterprise from their country). The EGR is intended to serve as the European population-frame, from which the member countries can draw consistent samples. These coordinated populations can be used as the framework for compiling statistics related to and involving MNE groups at national level. The EGR ensures that the national statistics compilers have a harmonised picture of the structures and characteristics of the enterprise groups when compiling statistics related to globalisation as well as other enterprise statistics, involving a consistent delineation of cross-border phenomena. EGR access is in practice restricted to official statistical business register (SBR) statisticians in EU NSOs [20].

Countries provide value added tax (VAT) registration numbers or, failing that, other administrative identity numbers to Eurostat. In practice, the identification numbers that are used are a mix of VAT numbers and various alternatives, which limits the opportunities to combine the EGR information on group structure with other VAT based-information (in order, for instance, to measure intra-group trade; see also points 5.4.1 and 6.4.4).

17 https://ec.europa.eu/eurostat/web/globalisation-businesses/overview

18 In this document, we do distinguish R&D as a separate theme. R&D expenditure is covered under FATS (see point 4.2.3, indicator #9) and indirectly under employment (see point 6.3.1, indicator 17c).

19 https://ec.europa.eu/eurostat/web/statistical-business-registers/overview

20 Some experimental EGR statistics are publicly available. Examples include statistics on MNE groups in EU-EFTA countries by controlling country; and persons employed in MNE groups by size class. See https://ec.europa.eu/eurostat/web/globalisation-businesses/database.

4.2.2. Eurostat's global value chains (GVC) survey

The GVC survey (previously known as the international sourcing survey) is a triennial survey that is currently required for the GVC data production under the European Business Statistics (EBS) Regulation that collects data on the GVC-related behaviour of enterprises with 50 or more employees in the business economy. The questionnaire is intended to provide a clearer picture on the international and domestic sourcing of business function by enterprises, and its impact on job destruction and creation. Over the last two decades, it has evolved into a questionnaire to capture GVC-behaviour in general. In addition to the original core information of sourcing of business functions, the current questionnaire also collects information on (1) domestic employment-per-business function, (2) information on GVC arrangements, (3) motivations for and barriers to sourcing and (4) the impact of the COVID-19 pandemic on sourcing decisions.

National statistics offices publish a standardised set of GVC statistics from the GVC survey, (e.g. the share of enterprises sourcing each of the business functions abroad; job destruction by sourcing business functions abroad; and factors and barriers to consider when making sourcing decisions). Such results are typically broken down by several enterprise characteristics (e.g. size class and NACE). These results are gathered by Eurostat and consistently published in an EU-context (Sunjka & Papadopoulos, 2022b). In addition, national statistical offices publish specific and more granular findings for their countries in isolation (e.g. CBS, 2022 [21] and Statistics Denmark [22]).

When linked to industrial performance measures and information about enterprise characteristics in business registers (which is not yet current practice), a wide range of questions can be answered, such as (Technical Subgroup on the Classification of Business Functions, 2022, p. 14):

- how do enterprises that internationally source various business functions perform relative to enterprises that do not?
- does the type of function or source country make a difference?
- what is the impact of different business function sourcing choices on the employment and wages of specific workers?

Indicating whether an enterprise has (partly) moved a business function abroad does not immediately shed light on the **intensity** or magnitude of this sourcing decision. It might, for example, be relevant to know (i) how many (types of) business functions an enterprise has outsourced; (ii) to how many (different) locations it has outsourced them; (iii) how many workplaces were moved in the process; and (iv) what the (monetary) value of the outsourced activities was (e.g. compared with the enterprise's capital).

A first attempt to cover the first three intensity measures was made in an earlier pilot study (under Eurostat/EU-funding). This pilot covered 15 EU Member States plus Norway [23]. The main results of this pilot were as follows (Cremers & Loog, 2019).

i. Number of business functions: the number of sourced business functions can easily be calculated from the GVC survey. However, the number might not be that informative in isolation. The intensity measure should ideally be combined with information on the employment effects of the sourcing activity (per business function). Moreover, very few enterprises have reported that they have moved more than two business abroad.
ii. Number of locations: the number of locations sourced can provide an idea of the global magnitude of the sourcing operation. Moving a business function from the Netherlands to Belgium involves different challenges from those involved in moving a business function to several Asian countries. Unfortunately, the current set-up of the GVC survey does not allow us to count the number of countries sourced from. Most countries cannot be individually identified but are rather grouped into, for example, 'EU-27' or 'Central and South America'. It is therefore impossible to properly count the number of locations a business function is moved to.
iii. Sourcing intensity in terms of employment (loss): after some assumptions have been made, the GVC survey makes it possible to calculate sourcing-intensity measures in terms of employment. Enterprises are first asked about the employment-per-business function. The GVC survey also contains data on job destruction and creation following the movement of business functions. Combining these two pieces of information makes it possible to calculate, under some assumptions, the intensity of the sourcing in terms of employment

21 https://www.cbs.nl/nl-nl/nieuws/2022/14/minder-bedrijven-verplaatsten-bedrijfsonderdelen-naar-het-buitenland

22 https://www.dst.dk/en/Statistik/emner/erhvervsliv/internationale-virksomheder/outsourcing

23 For more background information on the (third) pilot, see https://ec.europa.eu/eurostat/cache/metadata/en/iss_esms.htm.

and per business function: 'What percentage of a business function – in terms of persons employed – is outsourced?'.

The fourth intensity measure – intensity in terms of (iv) the valuation – was not covered under the previously discussed grant. However, we take a first step in this direction in Chapter 6 by making a rough estimation of the **outsourced wage bill** [24].

4.2.3. Foreign affiliates statistics (FATS)

International trade flows can take place not only through transactions between residents and non-residents but also by establishing a commercial presence abroad (i.e. a foreign affiliate). For services, this method of serving foreign markets is particularly important because it could often be the only method that allows close continuing contact between service providers and their customers. However, traditional presentations do not combine the presentation of statistics on international trade in services (discussed in point 4.2.2) with statistics on foreign affiliates' services, although the EBS has recently begun to include international supply of services by modes (see also point 4.2.2). Global sourcing is often channelled through international MNE affiliates (i.e. trade in services, Mode 3; see point 4.2.2), but the ability to link FATS (or more generally FDI statistics) to the enterprise groups involved has become an important requirement for understanding the processes of economic globalisation (Sturgeon, 2013) [25].

Foreign affiliates statistics (FATS) describe the activities of enterprises resident in a country or area that are controlled or owned by MNEs which are resident outside that country or area (Eurostat, 2012). The ultimate controlling institutional unit (UCI) of a foreign affiliate is at the top of the hierarchy, and not controlled by another institutional unit. A distinction can be made between outward FATS (OFATS) (on the activities of affiliates abroad) and inward FATS (IFATS) (on the activities of foreign enterprises within the own country or area).

FATS may, for instance, be used to monitor the effectiveness of the internal market and the gradual integration of economies within the context of globalisation. This includes both IFATS and OFATS data. OFATS include the number of extra-EU foreign affiliates by destination, as well as basic economic information, such as turnover and employment [26]. Data on foreign-controlled enterprises in the EU, known as IFATS, is much richer, with 11 main variables (including production and value added, intermediate inputs and goods and services purchased for resale, investment, personnel costs and information on R&D). Ownership in the context of the FATS is defined as at least 50% of voting rights [27].

There are different ways to collect data, but business registers, statistical surveys or already existing data from administrative sources are usually the main data sources for the FATS. Information on foreign control and the country of the UCI may be obtained from other available data sources (e.g. annual reports and the internet) or by surveying enterprises. Eurostat's EuroGroup Register (EGR) is another important source in the national compilation process [28].

Indicators that could be built on FATS data (respectively for inward FATS, #9 and outward FATS, #10) are [29]:

<Foreign-controlled companies> <#9>

a) **number of foreign affiliates (part of foreign multinationals), by region and origin country**
b) **production and value added**
c) **intermediate inputs and goods and services purchased for resale**
d) **investment**
e) **personnel costs**
f) **R&D expenditure**

24 See point 6.3.1.

25 FATS concern owners that have at least 50% of the voting rights. FDI statistics concern owners that have at least 10% of the voting rights.

26 'Value added at factor costs', 'gross investments in tangible goods' and 'personnel costs' are also published For a limited number of countries. In total, 13 countries in the European statistical system provide OFATS data on a voluntary basis. A broader coverage of variables is envisaged under the European business regulation.

27 The BoP items for FDI concern 10% of voting rights. The FATS population can therefore be seen as a subgroup of the population of FDI investments. In other words, affiliates are a special case of FDI where the UCI has either a direct or an indirect controlling interest. FDI statistics therefore cover equity investment while FATS statistics provide business statistics on affiliates.

28 See point 4.1.1.

29 https://ec.europa.eu/eurostat/web/globalisation-businesses/information-data#Key%20concepts

The existing information in the IFATS provides insights into foreign presence in the host economy. They measure several relevant aspects. The enterprises involved are part of a global (control) chain because they are under foreign control (i.e. they are belong to foreign multinationals, which are important players in a GVC [30]).

<Economic significance of foreign affiliates abroad> <#10>

a) **number of enterprises with foreign affiliates (domestic multinationals)**
b) **total number of foreign affiliates of domestic enterprises**
c) **turnover**
d) **number of persons employed**
e) **value added at factor costs**
f) **gross investments in tangible goods**
g) **personnel costs**

The existing information in the OFATS provides insights into domestic presence in foreign economies. They measure several relevant aspects. Again, this is a sign that there might be GVC involvement.

If indicators 9 and 10 are combined and broken down by firm population by multinational status (i.e. are they part of a domestic or foreign multinational group) rather than foreign ownership, an additional indicator 11 can be constructed.

<Economic significance of multinationals> <#11>

A limitation of historic OFATS information is that one may only be able to see part of the structure of the foreign part of the group (depending on how OFATS are produced in a country, only the part outside the EU might be captured).

4.3. Trade statistics

4.3.1. International trade in goods statistics (ITGS)

International trade in goods statistics (ITGS) published by Eurostat measure the value and quantity of traded goods, both intra-EU and extra-EU (see Text Box 1). EU ITGS are the main official harmonised [31] source of information about the EU's exports, imports and trade balances, its Member States and the euro area [32]. The basic data on both exports and imports concern (besides the reference period) the countries involved, and the value and quantity of the trade flow by product type. Classification by the mode of transport is also available for extra-EU trade.

TEXT BOX 1

Intra-EU versus extra-EU trade statistics [33]

Intra-EU statistics concern transactions that occur within the EU (i.e. exports of goods leaving one EU Member State that are destined to arrive in another). The arrival of the single market on 1 January 1993 and the removal of customs formalities between EU Member States resulted in a loss of information and required the establishment of a new data collection system. For intra-EU flows, the data collection system is the survey on intra-EU trade in goods (formerly Intrastat) and is closely linked to VAT systems that are based on collecting data directly from taxable persons (traders). Traders were previously only required to report an intra-EU transaction whose annual trade value exceeded a certain threshold, but such thresholds are no longer officially in use. Reporting units can receive a reporting obligation from their

30 It is theoretically possible that those foreign-owned firms do not participate in a global value chain (i.e. if their foreign owner only uses them for activities and transactions in the country of residence).

31 Despite this harmonisation, discrepancies between Eurostat data and national data may exist due to the application of different concepts and definitions.

32 See https://ec.europa.eu/eurostat/web/international-trade-in-goods. The distinction between intra-EU and extra-EU is relevant because trade policy is largely determined at the EU level and, in addition, with a view to monitoring the EU's internal market.

33 https://ec.europa.eu/eurostat/statistics-explained/index.php?title=International_trade_in_goods_for_the_EU_-_an_overview.

national statistical office to report intra-EU imports and/or exports of goods. There is a coverage ratio of 95% for intra-EU exports and microdata about intra-EU exports are shared between national statistical offices through the compulsory monthly 'microdata exchange' (MDE).

Extra-EU statistics record flows of goods exported and imported between the EU-27 and non-EU countries. Goods 'in transit' through an EU Member State are excluded. Extra-EU trade statistics are collected through a different system – Extrastat – which uses records of trade transactions for customs declarations that are gathered by customs authorities.

The general concept of international merchandise trade in trade statistics is independent of the ownership of the goods and concerns only their physical movement [34]. This has important known consequences for the use of ITGS information for national accounts and balance of payments statistics where (since the introduction of the ESA2010 and the BPM6) international transactions are defined in terms of change of economic ownership and regardless of any physical movement across borders. In particular, in the case of production arrangements such as processing of goods abroad, merchanting, and factoryless goods production (see the end of point 6.3.1), a discrepancy arises between the treatment of resulting trade flows. BoP (balance of payments) and national accounts (NA) compilers need to make further adjustments in order to incorporate ITGS data into their accounts, for instance regarding the valuation of flows (CIF versus FOB, see Section 2.7).

ITGS could be used to construct GVC-related indicator #3, which indicates whether the goods and services that are exported are for final use (the GVC then ends there) or for intermediate use (the GVC might then continue, although in theory all foreign inputs can be used to produce goods for domestic consumption). Using the BEC classification (see Annex 2) the identification of these intermediate goods should be relatively straightforward (albeit less so for services):

<Export and import of goods and services by end-use category of product><#3>

Moreover, based on ITGS (and ITSS), information about the distribution of trade could also be given, in particular on the concentration of trade in a couple of firms. Relevant indicators on this topic are:

<Concentration of exports by enterprise by top-X sellers/buyers><#30a>

< Concentration of imports by enterprise by top-X sellers/buyers ><#30b>

< Trade by number of partner countries and activity><#30c>

International trade is typically dominated by a small number of businesses, so this indicator shows the share of the total trade accounted for by the top 5, 10, 20, etc. companies. Trade by number of partner countries shows how geographically diversified the export and import markets are. The intention is to capture the diversification of dependencies (e.g. does a firm rely on relatively few partner countries for a major part of its trade?). These indicators already exist for goods (in TEC) [35]. For service trade, 2022 is the first reference year for STEC in the EBS Regulation. The indicators have not yet been computed, but this could already be done in principle. We discuss further possible ways to improve the measurement of cross-border trade in services in Section 6.4.

4.3.2. International trade in services statistics (ITSS)

International trade in services statistics (ITSS) [36] record transactions between residents and non-residents. They are part of the BoP statistics and are also used within NA. The value of services is recorded when the service is provided (on an accrual basis). This is in line with the principle of change in economic ownership (unlike the situation in

34 An exception is made for several special goods and movements, such as electricity and trade in sea-going ships and aircrafts. See also the Compilers guide on European statistics on international trade in goods, 2015 edition, https://ec.europa.eu/eurostat/documents/3859598/7027786/KS-GQ-15-010-EN-N.pdf.

35 In TEC, this is the table: Concentration of trade by NACE Rev. 2 activity.

36 See also https://ec.europa.eu/eurostat/statistics-explained/index.php?title=International_trade_-_services. The main methodological references used for the production of ITSS are the International Monetary Fund's (IMF's) Balance of Payments and International Investment Position Manual (IMF, 2010); the

ITGS). The supply of services may also be broken down by the way they are provided, taking into account the location of the supplier and customer when the service is supplied. This is also described as services provided by their modes of supply (MoS): cross-border delivery (Mode 1, e.g. digital services), consumption abroad (Mode 2, movement of client, e.g. tourism), commercial presence (Mode 3, foreign affiliates and capital movement) and the delivery of services through the physical presence of natural persons abroad (Mode 4, e.g. onsite physical services). That extended definition of services is known as international supply of services. Mode 3 types of transactions are covered by foreign affiliates statistics (FATS, see point 4.1.3) and are not included in the ITSS.

ITSS criteria for treating outsourced processing (known as goods for processing) were updated following the introduction of BPM6. Inward and outward flows of processed goods that do not change ownership should no longer be recorded as trade in goods but should instead be measured in terms of the value of their processing fee within services. Historical data have not been compiled according to those principles and have not been adjusted after the revision, so this methodological change means that annual comparable statistics on international trade in services are in principle only available from 2010 onwards.

As with trade in goods, these statistics provide monetary values by type of service and by partner country. The trade value of services is the value of services traded between residents and non-residents at market prices. In the case of transactions between affiliated businesses, enterprises may use 'transfer prices'. These transactions cannot be considered as market transactions, so would ideally be replaced by market prices.

A common approach to capturing most types of services is to survey a representative sample of the population that is engaged in international trade in services and then to extrapolate this to estimate the total the total trade. This is the most common method of collecting statistical data on international trade in services within the EU. However, the methods used to define the population and draw the samples can vary largely from one country to another. In addition, the amount of information collected in the surveys varies: some countries do not collect information on destination for smaller businesses and others do not collect either the partner or the type of service for small businesses. Administrative sources are often used for compiling financial and insurance services (e.g. value added tax data). A household survey and tourism statistics are some of the data sources used for compiling travel services (also including, in many countries, the value of goods purchased by travellers). Transport services are often estimated.

ITSS could be used to construct the following GVC-related indicator:

<Export and import of manufacturing services><#6>

Manufacturing services cover processing and assembly of goods by firms that are not the economic owner of these goods (i.e. the service flow related to inward (import) and outward processing (export) as a consequence of goods being sent abroad for processing). The indicator captures the degree of importance of such production arrangements in the total of trade flows. Conceptually, this indicator is equal to #4.

4.3.3. Trade by enterprise characteristics: TEC and STEC

Traditional statistics describe imports and exports by type of good/service and partner country in separate stovepipes. Additional statistics have been developed in response to statistical needs and technological developments. Many NSOs are now **developing linked trade and business micro-datasets** from which new policy-relevant statistics on economic globalisation are derived. Doyle (2017) notes that this process involves important methodological challenges, e.g. managing different microdata-linking procedures, mitigating incomplete source data and grossing up, dealing with large and complex businesses, and confidentiality issues in data dissemination.

Examples of microdata linking (MDL) (see Section 6.3) that are already practised by Eurostat are trade by enterprise characteristics (TEC) and service trade by enterprise characteristics (STEC).

The main objective of the goods TEC is to bridge the gap between two major statistical domains which have traditionally been compiled and used separately: business statistics and ITGS [37]. Statistics on TEC are compiled by

United Nations' manual on statistics of international trade in services (United Nations, 2010); and the Extended Balance of Payments Services classification (EBOPS 2010).

37 TEC is an official statistic in the EU.

linking intra- and extra-EU trade microdata with business register data. 10 datasets are currently available:

- trade by type of trader
- trade by activity sector and enterprise size class
- concentration of trade by activity
- trade by partner country and activity
- trade by number of partner countries and activity
- trade by commodity and activity
- trade by type of ownership
- trade by export intensity
- trade by activity sector
- trade by partner country and size class

STEC data provide information on services traders by breaking down traditional services trade statistics by firm size, firm ownership and industry [38]. For example, STEC data highlight industries in which foreign-owned enterprises dominate the trade in services. Statistics on STEC are similarly compiled by combining trade data with business register data. The breakdown by trading partner location is currently limited to intra-EU, extra-EU and world. Not all EU Member States have produced STEC tables in the past, but the tables have now become a mandatory part of the ITSS as part of the EBS (Eurostat, 2023).

Existing TEC/STEC tables can be used to construct other indicators [39]:

< Export and import of manufacturing services by firm characteristics (TEC and STEC)><#2>

To get a better understanding of the traders in GVCs, it is necessary to divide them into categories and link the trade of each category. Splitting trade by ownership (and ideally by product as well) gives initial insights into the role of foreign subsidiaries in the host economy (i.e. affiliate trading should be isolated from external trading within a GVC). Adding more detail with two-way traders shows how they are integrated into a GVC (i.e. mainly importing and selling in the host economy, mainly exporting or something else [40]). One further improvement could be to categorise two-way traders in more detail according to the heavy/light vs exporting/importing matrix.

A selection of examples:

< Export and import of manufacturing services by type of trader (one-way/two-way) (% in total export or import)><#2a>

< Share of two-way traders (firms exporting and importing), as a percentage of total traders (firms exporting or importing)<#21a>

< Trade value (export plus import) of two-way traders, as a percentage of total trade (export plus import)><#21b>

This indicator describes the share of trade that can be attributed to firms that are likely to be involved in GVC trade, as measured by being a two-way trader (i.e. enterprises simultaneously engaged in importing and exporting).

< Export and import of manufacturing services by foreign-owned firms (% in total export or import) ><#2b>

Ownership type is intended to describe the variety of enterprises according to their global status. Distinguishing between domestically and foreign-controlled enterprises is of particular interest because of the important role of foreign affiliates. Furthermore, if domestically-controlled enterprises with affiliates abroad are distinguished from all domestically-controlled enterprises, the population of MNEs can be ascertained.

<Trade by export intensity><#2c>

This indicator describes the heterogeneity of firm contributions to trade. Export intensity categorises enterprises according to the importance of foreign markets in their sales. Recent developments in the area of GVCs have raised a question regarding the heterogeneity of enterprises. It has traditionally been assumed that enterprises in the same activity sector are homogenous in terms of production and trade. However, this assumption

38 See the compilers guide TEC: https://ec.europa.eu/eurostat/web/products-manuals-and-guidelines/-/KS-GQ-20-003; and the compilers guide STEC : https://ec.europa.eu/eurostat/web/products-manuals-and-guidelines/-/KS-GQ-16-007.

39 https://ec.europa.eu/eurostat/statistics-explained/index.php?title=International_trade_in_goods_by_enterprise_characteristic.

40 This reflects complex sourcing strategies or multinational activities (Antràs & Chor , 2023).

is questionable, especially in the globalised economy and given differences in involvement and position in GVCs.

Indicators 2a, 2b and 2c are currently available for goods. Indicator 2b is also available for services (on an experimental basis). A possible extension could be <Trade by multinational status><#2d>, which is currently not covered in either TEC or STEC.

Although this is not current practice, one can also mention a potential extension of TEC or STEC:

<Decompositions of change in total trade into contributions by type of enterprises (e.g. by ownership, multinational status, firm size)><#4> 41.

This indicator complements other indicators in the sense that other indicators quantify the different extent to which specific types of firms are engaged in GVCs, whereas this decomposition would indicate how this translates into overall changes in total trade value and volumes. Relevant data sources are ITGS, ITSS, FATS, the EGR and business registers.

4.4. National accounts

4.4.1. Trade in value added (TiVA)

NSOs can measure GVCs within the context of the existing System of National Accounts (SNA) in several ways. One approach is to extend the existing SNA production, distribution and use of income, capital, financial, price and volume accounts so that they provide detail on international contributions to the national economy, both in the aggregate and by industry. Such extensions would be based on national SUIOTs supplemented with further detail using sources such as MNE surveys, surveys for BoP purposes, tax data on international financial and non-financial flows and ownership, integrated business statistics and reconciled trade statistics. This can be done with national data only ('national TiVA'), using data from ITGS, ITSS and NA [42]. Extended global supply and use tables, or multi-country IOTs (e.g. Eurostat's FIGARO project [43], the OECD's TiVA accounts or the world input-output table (WIOT)) would complement such extended SNAs [44].

The other approach to measuring GVCs, which is the main focus of the UN Handbook on Accounting for Global Value Chains, is the development of GVC satellite accounts and associated institutional-sector accounts that focus on a specific product or group of products produced within the GVCs operating in a group of key partner countries. Such accounts would be based on existing firm-specific microdata, publicly available microdata, existing input-output coefficients, and existing (or newly collected) information on governance and business functions.

The GVC satellite accounts and institutional-sector accounts are also developed within, and can be linked to, the SNA accounts (distribution and use of income, capital, financial, price and volume accounts). Such satellite accounts would have the advantage of providing a supplementary framework for developing new measures, without overburdening or reducing the accuracy or consistency of the core accounts. There is a strong connection between an expanded multi-country supply and the use table and a GVC satellite account (in fact, a GVC satellite account can in many ways be seen as a natural extension of an extended SUT in that it focuses on a specific set of products produced in a GVC). However, a GVC satellite account would make it possible to add flexibility and highlight flows and interactions that may not be visible with a more structured and aggregated set of extended supply and use tables.

In addition to the description of the economic cross-border production activities of the lead enterprise and supplying enterprises, the coordination and governance of the GVCs can be described using the institutional-sector accounts of the SNA. The institutional-sector transactions between the enterprises in GVCs delineate their behaviour in taking different degrees of control by taking ownership positions in the supplying enterprises in the chain through FDI or

41 CBS publishes such information. See, for example, for multinational status: http://opendata.cbs.nl/statline/#/CBS/nl/dataset/84747NED/table?dl=54ED2.

42 For example, Statistics Netherlands produces annual estimates of domestic value added and employment embodied in its exports to 25 countries: https://opendata.cbs.nl/statline/#/CBS/en/dataset/83728ENG/table?dl=6AC3B.

43 Based on FIGARO, Eurostat has aggregate figures on CO_2 emissions for the EU as a whole, from both a consumption (footprint) and production perspective. See https://ec.europa.eu/eurostat/databrowser/view/EGI_CO2_1/default/table?lang=en.

44 For instance, Hoekstra et al. used the World Input-Output Database to study the worldwide growth of CO_2 emissions in 1995-2007 (Hoekstra, Michel, & Suh, 2016). They found that 18% of this growth could be ascribed to (the net effect of) offshoring economic activities from high-wage countries to low-wage countries. The former emit relatively less CO_2 than the latter. This type of analysis can easily be performed for other variables, such as net offshored value added or net offshored employment.

other forms of control through market dominance for the purposes of production, tax and financing.

Moreover, the institutional-sector accounts for GVCs provide an economic overview of the optimisation of the distribution of value added and related income across the different countries through transactions in goods, services, income, assets and liabilities in its network of affiliate and non-affiliate enterprises (depending on the economic and regulatory environment of the countries in which the GVCs of the lead enterprises operate [45]).

This GVC satellite accounting framework is complemented by the GVC framework of integrated business statistics, which should provide the firm-level statistics in the GVC network. Global enterprise profiles and related global and national business registers should identify the domestic and cross-border mechanisms of control and ownership established by the lead enterprises in their firm networks. These profiles should clarify the structure, transactions and positions for compiling the multi-partner country supply and use (SUT) and institutional-sector accounts for a GVC's specific industries. The integrated business statistics will make it possible to determine the impact on the firm-level statistics and indicators on key variables such as employment, income, productivity and international trade within the GVCs (as compared with enterprises not participating in the GVCs within a specific GVC industry).

The satellite account for GVCs consists of a set of multi-partner country supply and use Tables (GVC-SUTs) and a set of extended institutional-sector accounts. The approach used in the handbook for the development of GVC satellite accounts involves a national perspective for a multi-partner country presentation of the accounts. The focus of this handbook is to provide further information on a framework within the SNA that explicitly identifies economic activities, products and transactions that are specific to a single GVC. These accounts build on a set of information that is generally available (for example, in LCUs where profiling is carried out for large MNEs) and needs to be taken into consideration within the context of GVC business functions and governance structures.

Once the mapping of relevant products and business functions has been developed, multi-partner country GVC-SUTs can be constructed to explicitly show the supply and use of GVC-relevant products by GVC-specific industries for the GVC-related main partner countries. Multi-partner country GVC-SUTs therefore make it possible to zoom into a global chain of supply and use of products by industries for the specific GVC.

The construction of these tables starts with the compilation of national SUTs with a common breakdown of industries and products. The breakdown at industry level explicitly identifies the relevant ISIC divisions/groups for the GVC. Similarly, the breakdown at the product level explicitly identifies the GVC-relevant products.

Multi-partner SUIOTs are required in order to better understand these relationships. These SUIOTs can range from global to regional and from regional to industry-specific [46]. The construction of inter-country SUIOTs involves four main building blocks of (official) source data: NA (as a benchmark), a national supply and use and input-output framework, international merchandise (goods) and services trade data and business statistics [47].

TEXT BOX 2

FIGARO (Full International and Global Accounts for Research in input-Output analysis)

As previously mentioned, several initiatives have been developed to measure the macroeconomic perspective of GVCs. Eurostat and the JRC developed FIGARO (Full International and Global Accounts for Research in input-Output analysis [48]). The information describes the economic links between industries and countries, which can be used to fully map a GVC. For example, how much value added by

45 Bohn et al. have shown how to determine in which country domestic value added embodied in exports ultimately ends up as income (Bohn et al., 2021).

46 The construction of global SUIOTs is by no means a simple exercise. It requires the harmonisation of many national datasets with common classification systems and common conceptual accounting standards, as well as (and perhaps most importantly) the reconciliation of bilateral international trade statistics.

47 Inter-country SUIOTs are by definition valued at basic prices, including for both exports and imports. The importance of basic prices is due to the fact that basic prices (unlike purchaser's prices) do not include trade and transport margins (TTM) and tax-less subsidies (TLS) on products. These factors would so distort the input structures of the inter-country use table that further input-output analysis in terms of GVCs would not be possible.

48 https://ec.europa.eu/eurostat/web/esa-supply-use-input-tables/information-data

industry A in country B is embodied in the production for final demand of industry C in country D. FIGARO is now produced annually according to a preannounced timetable. It currently contains the EU Member States, the EU's 18 main trading partners and a 'rest of the world' category. The number of industries is 64 and the time range is 2010-2021.

4.4.2. Current initiatives to improve national accounts

Business statistics **microdata** have been used to increase the granularity of the existing SUIOTs in NA. Of particular relevance to the measurement of GVCs is the use of MDL to identify the existence of specific global production arrangements. Hiemstra et al. (2016) have, for instance, tried to trace such arrangements by combining several firm-level sources (Hiemstra, Chong, Arentsen, & Kessels, 2016). They note that, while the available statistical sources do not always comply with the requirements of SNA 2008, the resulting inconsistencies can be useful in detecting global production arrangements. However, it appears that MDL alone cannot do the trick. The complex nature of the global production arrangements meant that additional information ultimately had to be requested from enterprises in order to determine the value of the corresponding trade flows.

Another example is the use of distributed microdata (DMD) analysis by the OECD and Statistics Denmark to identify GVC arrangements in the Nordic countries [49]. Each NSI of the countries involved (Denmark, Finland, Norway and Sweden) constructed a MDL database that combines sources as structural business statistics, FATS and trade statistics – using harmonised variable codes and database structures. Linking these data sources makes it possible to reflect enterprise heterogeneity by identifying enterprises not only by employment size and trading activity (trader/non-trader) but also by group status (independent/belonging to an enterprise group), by nationality of ownership (domestically/foreign-owned) or by any combination of these firm characteristics. The data infrastructure was then used to overcome some of the shortcomings of the current TiVA information by introducing firm-based characteristics to better reflect the heterogeneous nature of GVC integration – including size (e.g. SMEs (dependent and independent)); ownership (i.e. foreign and domestically-owned enterprises) and trading status (i.e. trading and non-trading companies). The report on Nordic countries in Global Value Chains [50] highlights the benefit and the necessity of combining international micro-aggregated data with statistics based on national accounts to improve insights into GVCs (Statistics Denmark, 2017). An OECD expert group is currently compiling a handbook describing this type of work, with practical guidance and best practices [51].

4.5. Foreign direct investment (FDI)

A resident entity in one economy can seek to obtain an interest in an enterprise resident in another economy. Unlike the UCI, where the owning business has a majority vote, a direct investment is an enterprise in which a foreign investor owns 10% or more of the ordinary shares or voting rights (for an incorporated enterprise) or the equivalent (for an unincorporated enterprise) [52].

FDI plays a key role in the globalisation process as an important element of international relations and their development. FDI supplements trade and creates more direct and deeper links between economies. It is a source of extra capital, encourages efficient production, stimulates technology transfer and fosters the exchange of managerial know-how. It therefore improves the productivity of businesses and to make economies more competitive.

Data on FDI, a component of the BoP financial account, can be used to monitor the external commercial performance of different economies [53]. Whether this is also relevant to GVC measurement depends on the particular type of FDI.

49 In DMD, a common protocol is used to extract micro-aggregated information from countries' harmonised firm-level data sets. This involves the assembly of microdata by participating NSOs and the running of common software to retrieve the indicators and statistical moments or to conduct statistical analyses. The output of these modules (i) can be stand-alone tables of (non-disclosive) cross-country results or (ii) generate indicators to augment publicly available cross-country industry data sets. For an outline of the DMD approach, see (Bartelsman, van Leeuwen, & Polder, 2016).

50 https://www.dst.dk/pubfile/28140/NordGlobChains

51 OECD Expert Group on Extended Supply and Use Tables - OECD.

52 National authorities, the ECB and Eurostat follow a methodology for the compilation of FDI statistics which is largely harmonised. The methodology is defined in (OECD, 2009) and (IMF, 2010). However, cross-country comparability is hampered by methodological differences.

53 https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Foreign_direct_investment_-_flows

Firms choose to invest in countries that they find attractive. They have various reasons to do so (e.g. if they are entering a new market or using local labour and knowledge). The size of new investments relative to GDP indicates how foreign firms perceive the host economy. However, it is usually not possible to distinguish between GVC and non-GVC activities. For instance, if a company implements an internationalisation strategy that is based on taking controlling interests in companies in other countries, it is not straightforward to determine whether (or to what extent) this involves GVC-related activities with a strategic or purely financial interest[54]. FDI statistics are available as[55]:

a. EU direct investment positions (by country and economic activity)
b. EU direct investment flows (by country and economic activity)
c. EU direct investment income (by country and economic activity)

In addition to BoP statistics, one possible (partial) alternative for FDI information is the Register of Institutions and Affiliates Database (RIAD), which is described in point 6.2.6.

54 For instance, BBVA's purchase of Garanti bank in Türkiye to create Garanti BBVA cannot be considered as a GVC activity. However, if BBVA had purchased a Turkish IT company to develop a new banking app for BBVA in its home country of Spain, this investment would clearly be considered as a trace of the activity of a GVC.

55 https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Foreign_direct_investment_-_flows

5

Challenges with current measurements

5.1. Introduction and overview

As discussed in Chapter 1, current measurement methodologies entail critical challenges and limitations to capture the complexity of and fast-paced changes in GVCs and their impact on critical issues for our economies and societies. This section presents the most relevant challenges identified in this project and some reflections on potential strategies to manage them. Suggestions for improvement are presented in Chapter 6. One general problem is that opportunities to extract relevant GVC are quite recent, and many series are therefore only available for a short time range. Another general issue is that the available information is rather fragmented. This framework document is a first step towards bringing together indicators on various aspects of GVCs.

Table 4 provides a first overview of current gaps. These gaps are considered further in the rest of this chapter.

TABLE 4

Overview of identified gaps in current measurement frameworks

Statistical framework	Identified gaps
GVC survey	• lacks information on the actual value or value share of the sourcing activity in monetary terms;
	• lacks information on the enterprise's past sourcing activities (absence of annual panel data);
	• lacks information on the current structure of the GVCs in which an enterprise is engaged;
	• smaller enterprises (with fewer than 50 employees) are missing;
	• perspective of resourcing enterprises in outsourcing is largely missing.
FATS	• outward FATS (OFATS) do not necessarily include the foreign affiliates that are resident in other EU Member States;
	• inward FATS (IFATS) provide more restricted coverage of the service sector;
	• different definitions of UCI are being used. This might lead to misclassification, which directly impacts statistics involving foreign ownership or multinationals.

Statistical framework	Identified gaps
Trade statistics (general)	• only one node is provided (the importer or the exporter). Indirect trade is therefore not covered;
	• additional information on the foreign trade partner is lacking;
	• there is a lack of information on affiliated (intra-group) trade;
	• it is difficult to distinguish GVCs from other forms of trade (i.e. market from non-market governance types);
	• it is generally unknown whether a good or service is for final or intermediate use;
	• it is not possible to determine the contribution of imports to exports;
	• import and export flows by country are not mirrored by the export and import flows of the partner country (trade asymmetries).
Trade statistics (services)	• no full coverage of all services that are being traded;
	• trade asymmetries in services are substantially larger (in terms of quantity) than in goods;
	• fewer details on categories and geographic regions than on trade in goods.
National accounts (NA)	• production functions and import/export intensity are treated as homogenous across all industries;
	• basic prices are used;
	• transactions in intangible assets are not covered.
Foreign direct investments (FDI)	• information about incoming or outgoing transfers of income is at a very aggregated level. All non-financial corporations are treated together, without any split into industries and/or type of enterprise.

Source: Own elaboration.

5.2. Issues in the GVC survey

The first data issue is the fact that the GVC survey questionnaire does not provide information about the actual value or value share of the sourcing activity in monetary terms. It would be possible to devise questions that ask about the financial side of (international) sourcing decisions but, enterprises are expected to find these difficult to answer or to be unwilling to share such information. The questionnaire already concerns strategic decisions made in the past, so asking for financial details could be a step too far. However, it might be possible to use MDL to get this type of data (this approach has been tested in a pilot of an extended GVC survey – see Annex 3).

The second data issue is the lack of information on the enterprise's past sourcing activities and the current structure of the GVCs in which an enterprise is engaged [56]. These data are relevant because information on the sourcing of business functions concerns sourcing decisions made several years earlier, rather than current sourcing.

Enterprises that are asked for information regarding the distant past may provide inaccurate answers due to recall bias. The GVC survey therefore asks for information on sourcing activities for a reference period of 3 years (e.g. 2018-2020 for the 2021 international sourcing survey). This still excludes the year in which the data are delivered and does not allow the recovery of data before the first wave of the survey (or long before the date of the enterprise's entry into the sample). The final point under this data gap specifically concerns the absence of annual panel data. Within the current format of the questionnaire, a partial solution would be to add a question on the exact year of the sourcing activity (i.e. in which of the years under consideration most of the sourcing activity took place). Gathering the data in this way would make it possible to construct a pseudo-panel data set, even though data are only available every 3 years. However, in the 2017 round of the survey, Statistics Netherlands found that recall bias is likely because enterprises reported that most of the sourcing activity took place in the final year of the

56 A related factor is the absence of yearly data on sourcing decisions.

reference period. The question did not distinguish between business functions; and one can argue that introducing this dimension would increase the burden on respondents and that the expected data quality would be low [57]. In the above-mentioned pilot with an extended international sourcing survey, some items were nevertheless added onto (worldwide employment per) business functions. The results of the pilot are reported in point 6.1.2.

The third data issue in the current GVC survey results from the fact that countries are not obliged to report data for enterprises with fewer than 50 employees. Only a few countries (e.g. Denmark) include enterprises with 20-49 employees in the sample. It is clear from previous surveys that larger firms are more likely to outsource business functions, but the current population set-up will make it difficult to get a good picture of the extent to which smaller enterprises are engaged in GVCs (at least from a sourcing-perspective).

The fourth data issue is that the survey is currently set up from the perspective of an outsourcing enterprise. This set-up might not reflect common practice in some counties; it is often suggested that these countries (e.g. an EU Member State like Romania or a non-EU country like India) are more likely to be at the receiving end of sourcing decisions made in other countries. The current survey does not make it easy to investigate such cases [58].

The first and second data issues will be discussed and partly addressed in the pilots later on in this document. The third and fourth data issues are not covered later in this document but can easily be addressed by, in the third case, expanding the sample to include smaller enterprises and, in the fourth case, including questions for enterprises that might have been on the receiving end of international sourcing decisions.

5.3. Issues in FATS

In the past, two data gaps related to this survey were identified in the literature: (i) in IFATS, the foreign-owned enterprise population cannot be identified in the group of trading enterprises, so information about their imports, exports and sourcing practices cannot be isolated; and (ii) in OFATS, no further information about the outward investors is collected. This situation now seems to have improved due to the possibilities to link data. FATS data can be combined with business register data and additional statistics such as ITGS and the ITSS to obtain this kind of information (this is already standard practice for TEC and STEC – see point 4.2.3).

Other issues still remain, however. OFATS do not necessarily include the foreign affiliates that are resident in other EU countries and IFATS provide more restricted coverage of the service sector. As a result, under the EBS Regulation, the coverage of OFATS is extended by including all foreign EU affiliates (in addition to the current coverage of foreign non-EU affiliates). Moreover, OFATS will have been extended by including data on all foreign-controlling enterprises and domestic affiliates controlled by residents of the compiling country regarding the three main variables (number of enterprises, turnover and persons employed) [59]. The main problem for most of the national data compilers is the precise identification of the UCI necessary for establishing the geographical breakdown of IFATS data (see the definitions in Section 2.2). Besides a lack of information, there are different concepts of ultimate control (e.g. global decision centre, global group head and ultimate beneficial owner). Incorrect attribution of UCI leads to a misclassification problem, which impacts statistics that directly involve foreign ownership or multinationals (although it could argued that it does not really matter in some cases whether an enterprise is classified as the head office or an affiliate). The extent of this problem is, however, reported to be rather limited [60]. The EuroGroups Register (EGR) is delivering increasingly reliable information on EU enterprise groups and this will lead to a further improvement in this respect [61].

5.4. Issues in trade statistics

Trade statistics for both goods and services face a series of challenges when used as a source for the measurement of GVCs. Current measurement methodologies cannot guarantee full coverage of GVCs for several reasons. Firstly, trade data provides only one node: the importer or the exporter. Alternative sources (e.g. EU VAT data) would

57 Moreover, the EBS regulations limit the number of variables (similar to questions) allowed in the GVC survey to 20.

58 See, for instance, the Indian survey on ICT-enabled services (Saha, 2020) (Ministry of Commerce and Industry, 2018).

59 Publishable data on EU affiliates in OFATS have been included since 2021 at the CBS.

60 Another challenge here is that Member States can decide whether or not natural persons can be the UCI. At the CBS, the UCI is never a natural person, due to difficulties in determining their residency.

61 See the dynamic version of the European Business Statistics Manual (Chapter 5): https://ec.europa.eu/eurostat/statistics-explained/index.php?title=European_business_statistics_manual.

make it possible in some cases to link the exporter in one country and the importer in another country, so as to arrive at two nodes. However, not all NSIs have these data at their disposal. For the foreign trading partner, the domestic NSI usually does not have any additional information besides an identification number or VAT number (for intra-EU trade). Information on the foreign partner (including its industry and region) is generally not available. In addition, linking more than two nodes is not possible with the current data, so enterprises abroad and/or in the domestic economy that are involved at earlier or latter stages of the value chain are not captured.

Secondly, it is not always easy to distinguish GVCs from other forms of trade. It may be difficult to know whether the economic owner changes or not, although this might be (partly) solved by identifying the FGPs and merchanting [62]. Likewise, TEC tables are only based on the ITGS concept and not on the BoP concept, but it would in general be possible to take this into account. Moreover, it is in general unknown whether the good or service is for final or intermediate use. This problem could be reduced by combining product classifications such as the BEC. Discrimination and measurement of goods produced under subcontracting operations is also difficult because data on subcontracting is scarce. If there is no change in economic ownership, then the flow of goods (e.g. in inward/outward processing) does not count as international trade from an NA perspective.

Thirdly, there is a lack of information on affiliated (intra-group) trade. Information on affiliated trade is still scarce, especially by source/destination country and product type. Progress has been made with mapping MNEs in terms of ownership structure and there is information on the activity and performance of affiliates and their head offices, but information on intra-firm flows of goods and services remains rather thin. This shortcoming distorts trade data as a source of GVC measurement because an increasing part of trade is associated with MNEs. International trade in goods and services is increasingly intra-firm trade (UN Draft Handbook on Accounting for GVC, 2019). Unlike transactions with non-affiliates, intra-firm trade flows are not determined by the market and prices may not reflect their true market value. This concern is reinforced by firm incentives to use such intra-firm flows and transfer pricing in order to minimise the international tax burden (tax avoidance).

Fourthly and finally, it is not possible to isolate the value of imported intermediary products in the value of exports (i.e. to determine the contribution of imports to exports). Accounting for the value of foreign content in exports has mainly been investigated from the aggregate perspective (through TiVA, for instance, and recently through FIGARO (see Text box 4). Researchers have also attempted to separate the domestic and foreign components in value added by using as much microdata as possible (Kee & Tang, 2016) (Vrh, 2019), but these efforts rely on very specific assumptions that do not hold in a more general setting (for example, when a substantial part of trade goes through wholesalers).

5.4.1. Statistics on trade in goods

ITGS features substantial trade asymmetries, in the sense that import and export flows by country are not mirrored by the export and import flows of the partner country. Progress has been made in recent years [63], but these issues have still not been entirely resolved. There are various reasons why trade asymmetries arise (Javorsek, 2016) and most of them require international or bilateral coordination in order to address them [64]. Such efforts currently seem to be common practice albeit with practical issues because of confidentiality [65]. This situation is due to improve thanks to the new framework for European business statistics (EBS), which provides a legal framework for statistical offices to exchange microdata on international trade in goods for the purposes of improving the consistency of bilateral trade statistics (microdata exchange (MDE)).

Customs data and the survey on intra-EU trade include a nature of transaction code, which would be useful for identifying production arrangements. A nature of transaction code is used to indicate the type of transaction, which is being declared in the supplementary declaration, and especially to clarify whether the movement of goods involves a transfer of economic ownership and whether there is financial compensation (e.g. straightforward sales or acquisitions, goods sent for processing, return shipments

62 See point 6.3.1. It should be noted that the issue on ownership is broader than this (for example, inward/outward processing does not have to imply FGP if it entails the outsourcing of a single production step among many other steps that are carried out in-house).

63 The most notable progress made has been the establishment of microdata exchange between NSOs regarding intra-EU trade.

64 Besides asymmetries that arise due to differences in data and uncoordinated processing, there are more obvious reasons such as diverging valuations of trade flows (free-on-board (fob) vs cost-insurance-freight (cif)) and the definition of the trade system (i.e. inclusion or exclusion of custom warehouses and free zones). See also https://ec.europa.eu/eurostat/documents/7828051/8076585/Asymmetries__trade_goods.pdf.

65 Existing task forces in the ITGS domain that regularly discuss these issues include ITGS TF Compilation & Quality and ITGS TF Methodology.

or free-of-charge goods). Codes 4 and 5 refer to goods sent for processing and goods returned following processing and allow the identification and valuation of trade flows associated with production abroad [66]. Some Member States have already used this information to improve statistics on GVCs, but it is less clear in other cases whether the information has enough detail and quality (Boutorat, Loog, & Luppes, 2018).

5.4.2. Statistics on trade in services [67]

Trade in services is generally more difficult to measure than trade in goods. Measurement of trade in goods is often based on almost full coverage, but for services one often has to rely on a sample survey.

Moreover, bilateral asymmetries in services trade data are a long-acknowledged phenomenon (Landefeld, 2015) (Markhonko, 2014). In total services in intra-EU trade, reported exports systematically exceed the imports reported by the corresponding country. It has also been noted in this context that guidelines are open to different interpretations. Asymmetries in data for trade in services may arise for a variety of reasons, including diversity of compilation methods (business surveys, bank-reporting system, administrative sources), different thresholds in the surveys and administrative sources, diverging assumptions used in modelling-based estimates, and misclassifications (partner country, service item, goods vs services).

In addition, ITSS are less detailed than ITGS with respect to service categories and the geographical dimension. Geographical coverage seems to have increased over the years, but the number of services categories distinguished is still limited (compared with goods and, for instance, industry classifications such as NACE and ISIC). For instance, broad categories such as 'manufacturing services' and 'computer services' are not detailed any further in the EBOPS classification.

5.5. Issues with the national accounts approach

The main challenges when measuring GVC using NA are a consequence of the features and limitations of IOTs. Current methodologies do not easily deal with the heterogeneity between enterprises with the same activity. Production processes and related inputs and outputs from abroad and the domestic economy vary greatly within each industry and the implications of such variations are not considered when using aggregated data as inputs for GVC measurement. However, the rich detail of business statistics makes it possible to overcome most of these limitations.

First, I/O analysis involves strong homogeneity assumptions (common production functions, import intensity and export intensity) which may not hold even for companies within the same industry. The conventional approach to addressing the problem of heterogeneity has been to provide more detail by aggregating enterprises at lower levels of the industrial classification system (e.g. three- or four-digit groupings rather than two-digit groupings, subject to confidentiality restrictions being preserved). This approach may not be optimal, however, either in terms of reducing heterogeneity within aggregations or in terms of processing burdens. That is not to say that industrial classification systems are completely obsolete. It would serve little purpose, for example, to devise an optimal system that does not retain some means of classifying enterprises on the basis of their activity (e.g. manufacturing versus services), if only because these remain the key prisms that users look through when analysing production. It does nevertheless remain the case that other approaches to tackling heterogeneity can and should be considered.

A more radical approach is arguably needed. Such an approach would require the role of foreign affiliates in the economic territory and affiliates abroad to be captured explicitly (and visibly) in the core accounts and in the development of GVC-related (i.e. TiVA) indicators. It would also require improved information on the trade relationships of categories of enterprises (e.g. exporter and non-exporter). Equally important would be the need to fully articulate income flows into and out of the economy and, in particular, from which category of enterprises (e.g. industrial sector) these arise. All this necessary information is already present in the area of business statistics. It can be used to compile extended supply and use tables and extended IOTs. There industries are split by enterprise type (for instance, metal manufacturing is split into non-MNE metal manufacturing and MNE metal manufacturing).

Second, a general problem would remain even if one were to tackle the heterogeneity issue. The resulting extended

66 The term production abroad is often used to describe factoryless goods production (FGP) rather than processing. The difference is that processing involves a movement of raw materials and/or end products to/from the Member State where the economic owner is established. This is not the case for FGP.

67 Lemmers, Measuring the Economic Contribution of Firms and Activities in Terms of National Income, 2022

SUIOTs would be estimated using basic prices [68]. Any attempt to assess the full value chain by decomposing only basic prices would be severely compromised because the high-value activities (e.g. R&D, design, marketing and distribution) would be completely absent from the decomposition. These activities are often conducted in-house and there is therefore no observable transaction. In these cases, the contribution is included within the value added of the main activity of the firm. A further complication is the increasing importance within GVCs of factoryless producers, which outsource physical production (either at home or abroad) but control the overall production process (focusing control on activities such as specification, design, R&D and marketing) which to some extent reflects the upgrading process underpinning GVCs.

Third, accounting practices and the use of transfer prices to optimise taxes in MNEs may compromise the geographic allocation of the added value of services. Transactions in intangible assets [69] are particularly important in this regard. In ITSS, payments for the use of these produced and non-produced assets are often recorded as purchases (intermediate consumption) by one affiliated enterprise from another. They are often not recorded as such, however, and are instead implicitly recorded under primary income payments (such as investment income or reinvested earnings in the balance of payments). In the former case, the value added of the affiliate using the assets is lower, because the value added generated through ownership of the asset appears in the accounts of the affiliate that owns it. In the latter case, however, the value added of the affiliate using the asset is higher, because there is no intermediate consumption, and the 'ultimate' beneficiary (the owning affiliate) records no value added but instead receives primary income from the using affiliate [70]. Domestically owned enterprises have less possibilities for tax planning than MNEs. Using detailed enterprise data to separate them from MNEs will improve the estimates about the actual location where value added is realised, but these estimates may still be inaccurate.

5.6. Issues in FDI statistics

There is a lack of information on the role of international transactions of enterprises in current account transactions. Information on incoming or outgoing transfers of income is generally at a very aggregated level (for example, all non-financial corporations are taken together, without a split into industries and/or type of enterprise). Transfers of income (e.g. dividends, interest and reinvested earnings on FDI) vary significantly by industry and some transfers can only occur within MNEs. If only the aggregate information is available, one cannot see how much the domestically-owned MNEs and the foreign-owned MNEs each contribute to gross national income (GNI). Both groups will have substantial incoming and outgoing transfers of income, but this information is usually only available for non-financial corporations taken as a whole. Furthermore, it is useful to have the information at industry level as well to see how much an individual industry contributes to GNI.

The OECD and IMF (2018, 2019) have noted the absence of information on the role of MNEs in current account transactions and conducted a stocktaking survey. They propose a framework to provide supplementary data that highlights the role of MNEs in the current account, covering both trade in goods and services and direct investment (DI) income. Several items could be included in an annual GVC reporting exercise:

- profits paid out to foreign parents
- dividends paid out to domestic and foreign entities
- rents paid to domestic and foreign entities
- interest paid to foreign and domestic entities
- reinvested profits

This information is already available in sectoral accounts but only at a very aggregated level (for example, the total amount of dividends paid by non-financial corporations to foreign entities). These data would ideally be collected at enterprise level and published at industry level (possibly with a further split into non-MNEs, domestically-owned MNEs and foreign-owned MNEs). It would provide insights into what is happening with their gross operating surplus, how much remains in the domestic economy and how much is transferred abroad. The fact that an enterprise would pay interest to a bank that would pay dividends to

68 The basic price is the amount receivable by the producer from the purchaser for a unit of a good or service produced (as output minus any tax payable) plus any subsidy receivable by the producer as a consequence of its production or sale. It excludes any transport charges that are invoiced separately by the producer (EC/IMF/OECD/UN/World Bank, 2009).

69 i.e. those recognised as produced in the SNA (e.g. research and development, and software), non-produced (e.g. brands) and other knowledge-based capital (e.g. organisational capital such as management competencies).

70 In both cases, however, the ultimate 'income' generated by the asset ends up on the books of the owner (at least in theory, because even the very concept of ultimate owner is a complex issue – see Section 3.6).

foreign residents would make it possible to use an input-output framework to estimate the amount of the domestic financial flows that ultimately ends up abroad. However, this kind of detailed data is not yet commonly collected at the enterprise level.

However, it is sometimes possible to fit some of the pieces of the puzzle together using business statistics, enterprise information and NA. For example, Nelisse (2021) and Statistics Netherlands (2022) did so in two interconnected projects that were partly funded by Eurostat. Nelisse splits the Dutch non-financial corporations into four groups: foreign-owned multinationals, Dutch-owned multinationals, large enterprises non-multinationals and SME non-multinationals (Nelisse, 2021). His careful analysis of the ownership of enterprises allowed him to draw several conclusions, including that the amount of income that should be attributed to foreign owners was being underestimated. The GNI of the Netherlands was revised downwards by a total of EUR 16 billion in 2020. Statistics Netherlands (2022) has built on this data and split the information between the four groups by industry (Lemmers, 2022). It then estimated the above-mentioned domestic financial flows. One result was that 3%, 10% and 33% of the value added in non-MNEs, Dutch MNEs and foreign MNEs were flows abroad respectively.

6

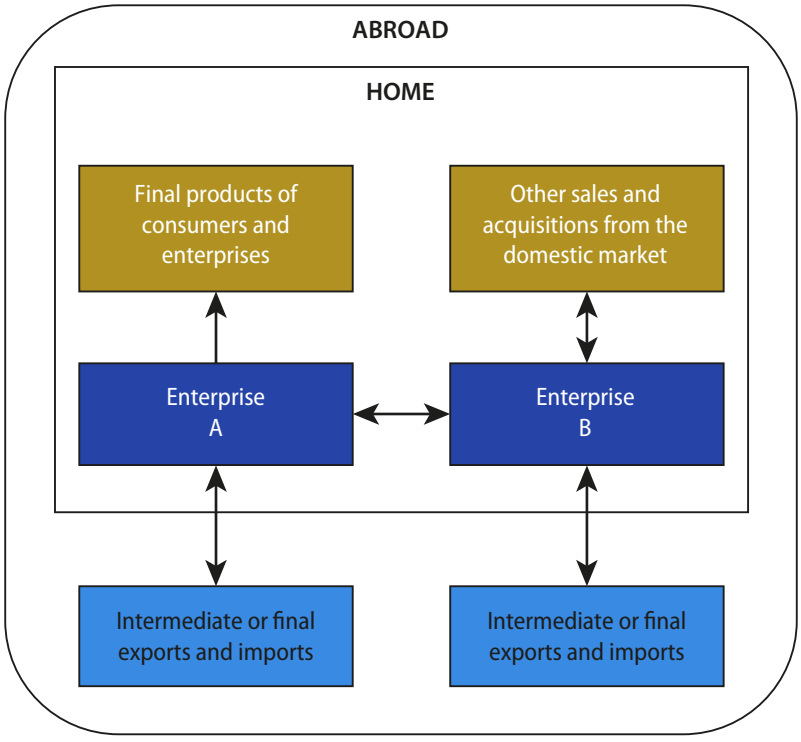
Suggestions for improvements

6.1. Introduction

The statistical measurement of GVCs has already improved considerably since the introduction of international sourcing surveys (see Chapter 4), but significant gaps remain (see Chapter 5). Moreover, recent developments and (emerging) trends make it all the more important to improve the reliability of GVC statistics (see Section 1.3). For example, many intra-firm activities are still not being captured.

FIGURE 13

Simplified representation of intra-firm relationships



Source: Own elaboration.

In this chapter, we describe some concrete ways to improve the measurement of GVCs. In doing so, we largely follow the structure of Chapter 5. We first describe how current business statistics can be improved (one way to do this is by extending the GVC survey). We then describe the contribution that the use of firm-level microdata can make. We finally describe possible improvements to international trade statistics, national accounts and financial statistics.

6.2. Improve business statistics

6.2.1. Improve measurements of global production at national level

A logical starting point for better coverage of GVCs is to expand national business statistics by including items that describe the link with global production (at least in part). Each of these statistics has its own specific scope and thus also covers a limited specific part of global production. but combining the various extensions makes it possible to draw a reasonably complete picture of GVCs .

Structural business statistics (SBS) describe the structure and performance of businesses in the EU at a very detailed sectoral level. In the items related to turnover, value added and employees, a split could be added between production at home and abroad. At the most aggregate level, this extension would give an impression of the extent to which a firm is part of global production.

The value and quantity of industrial goods produced (mainly manufactured) is covered by the EU PRODCOM survey[71]. Of particular relevance to the measurement of GVCs is the 'production under subcontracted operations' variable. The subcontractor is another independent link in the value chain. The variable could thus be used to identify specific production arrangements. It should nevertheless be noted that this variable does not necessarily cover international arrangements, because the subcontractor could be based in the same country as the contractor (so there would be no global value chain). Moreover, even if the subcontractor is based abroad, a GVC arrangement does exist but is not necessarily an international sourcing arrangement (see Section 2.5). Strictly speaking, sourcing only applies if the function has been moved and the subcontracting is not just being used to buy new products and/or functions (i.e. expansion). However, one can argue that those cases are still relevant for GVC measurement. On both aspects, follow-up questions can be added to PRODCOM:

<Production under subcontracted operations, domestic versus foreign subcontractors><#8a>

<Production under subcontracted operations related to reallocation of production abroad><#8b>

The **GVC survey**[72] is the main existing source for information on (international) sourcing and value chain behaviour at the firm level. This survey has been expanded over the years. The focus is no longer solely on the sourcing of business functions, but on shedding light on value chain behaviour and decisions made at the firm level (see point 4.1.2). However, there are still several issues with the GVC survey (see Section 5.2).

Section 5.3 and Annex 3 identify four data gaps in the analysis of GVCs. These gaps do not necessarily stem from the GVC survey itself, but the survey might be a logical platform to ask questions on such GVC arrangements. In the fourth pilot of the international sourcing survey in the Netherlands (covering 2018-2020), several items have therefore been added to the questionnaire to attempt to (partly) cover these four data gaps:

1. intra-group trade;
2. indirect trade;
3. worldwide employment-per-business function;
4. factoryless goods production.

In the subsequent points, we will describe how potential extensions to the GVC survey can be used to fill each of these respective gaps.

6.2.2. Measuring intra-group trade with an expanded version of GVC survey

MNEs are able to take advantage of worldwide production networks by assigning specific tasks to firms in specific regions of the world and by intra-group trade at transfer

71 The PRODCOM survey uses a product classification that is usually referred to as the 'PRODCOM list'. PRODCOM can thus refer to both the original survey and the classification that is included in the survey.

72 The statistical unit of measurement in the GVC survey is the enterprise.

prices (Davies, Martin, & Parenti, 2022). Little is known about the size of **intra-group trade**, which is one of the important data gaps identified by Sturgeon (Sturgeon, 2013).

In the fourth voluntary wave of the GVC survey in the Netherlands, subjective questions were added in order to get an idea of the importance of intra-group trade, both from the perspective of identifying enterprises that predominantly or exclusively trade within the group and from the perspective of trade value and value added. Traders and trade value are discussed in the remainder of this section. Annex 1 contains a lower-bound estimate of export value and an estimate of value added associated with intra-group trade.

Five additional items on intra-group trade have been added to the GVC survey questionnaire (see Annex 3 for a detailed description). These items make it possible to identify enterprises that either (i) predominantly export and/or import goods and/or services within their group or (ii) exclusively export goods and/or services within their group.

Five basic GVC-related indicators can be constructed on the basis of these additions:

<Share of enterprises exporting goods predominantly within international enterprise group (as a share of all enterprises, or all enterprises belonging to a group)><#13a>

<Share of enterprises importing goods predominantly within international enterprise group (as a share of all enterprises, or all enterprises belonging to a group)><#13d>

<Share of enterprises exporting services predominantly within international enterprise group (as a share of all enterprises, or all enterprises belonging to a group)><#13b>

<Share of enterprises importing services predominantly within international enterprise group (as a share of all enterprises, or all enterprises belonging to a group)><#13e>

<Share of enterprises exporting goods and services exclusively international enterprise group><#13c>

Table 5 shows the shares of enterprises per NACE-category for both groups of enterprises in the total of Dutch enterprises that have indicated that they belong to a group. In total, one third (34%) of all Dutch enterprises that belong to a group trade predominantly within their own group (this is almost 10% of all enterprises in the sampled population). Of this 34%, 7% trade exclusively within their own group, while the remaining rest trade predominantly but not exclusively within their own enterprise group.

TABLE 5

Share of Dutch enterprises in the international sourcing survey sample that belong to a group that indicates that it is trading goods and services predominantly or exclusively with other enterprises within the group (2020 (goods), 2019 (services), by NACE and by firm size) [73]

NACE section	Description	Size class	Predominately export	Predominately import	Exclusively export
B	Mining and quarrying	Total	36%	39%	0%
C	Manufacturing	Total	24%	25%	5%
D	Electricity, gas, steam and air conditioning supply	Total	32%	32%	9%
E	Water supply; sewerage; waste management and remediation activities	Total	13%	17%	4%
F	Construction	Total	17%	15%	4%
G	Wholesale and retail trade; repair of motor vehicles and motorcycles	Total	31%	47%	4%
H	Transporting and storage	Total	19%	20%	5%
I	Accommodation and food service activities	Total	36%	16%	17%
J	Information and communication	Total	19%	36%	8%
K	Financial and insurance activities	Total	23%	16%	10%
L	Real estate activities	Total	38%	5%	0%
M	Professional, scientific and technical activities	Total	31%	26%	13%
N	Employment activities	Total	20%	21%	8%
Total	Medium-sized enterprises	50-249	27%	32%	7%
Total	Large enterprises	GE250	23%	24%	7%
Total	Total	Total	26%	30%	7%

Source: GVC Survey 2021, CBS, Netherlands.

On the assumption that the terms 'predominantly' and 'exclusively' in the questions can be interpreted as 'at least 50% of the value of imports/exports' and '100% of the trade value' respectively, it is possible to obtain some meaningful quantitative analysis by linking (MDL) the trade data to these enterprises.

At least six GVC-related indicators can be constructed in this way:

<Value of goods exported by enterprises indicating to be exporting goods predominantly to affiliates><#14a>

<Value of services exported by enterprises indicating to be exporting services predominantly to affiliates><#14b>

<Value of goods imported by enterprises indicating to be importing goods predominantly from affiliates><#14c>

<Value of services imported by enterprises indicating to be importing goods predominantly from affiliates)><#14d>

73 The response data are weighted.

<Value of goods exported by enterprises indicating to be exporting goods and services exclusively to affiliates><#14e> 74

<Value of services exported by enterprises indicating to be exporting goods and services exclusively to affiliates><#14f>

Table 6 shows the result for the value of intra-group trade (in EUR billions) for the Netherlands in 2020 for both groups of firms. The total values for group (i) were: export of goods (EUR 8.1 billion), import of goods (EUR 45.2 billion), export of services (EUR 17.1 billion) and import of services (EUR 11.8 billion). Assuming that at least 50% of the total value refers to intra-group trade, the respective values accounted for 0.8% of total goods exports, 5.3% of total goods imports, 3.4% of total services exports and 2.5% of total services imports. The entire total values for group (ii) can obviously be included. Summing up the results for both groups, the value of total export of goods amounted to EUR 10.2 billion (2.1% of total exports of goods) and the total value of export of services amounted to EUR 25.2 billion (10.2% of total exports of services).

TABLE 6

Value of international trade (EUR billions) by Dutch enterprises that indicate that they are trading (i) predominantly or (ii) exclusively with other enterprises within the group; and share in the total number of enterprises belonging to a group (%), 2020 (goods), 2019 (services), by NACE and by firm size

		Predominantly within group				Exclusively within group	
NACE section	Size class	Goods exports (2020)	Services exports (2019)	Goods imports (2020)	Services imports (2019)	Goods exports (2020)	Services exports (2019)
B	Total	0.1	1.3	0.2	0.0	0.0	0.0
C	Total	5.3	0.8	13.2	0.5	3.9	0.8
D	Total	0.0	0.0	0.4	0.1	0.0	0.0
E	Total	0.0	0.0	0.0	0.0	0.0	0.0
F	Total	0.0	0.0	0.5	0.0	0.0	0.0
G	Total	2.4	6.5	25.8	1.1	1.6	0.4
H	Total	0.0	0.6	2.4	0.2	0.2	0.9
I	Total	0.0	0.0	0.0	0.0	0.0	0.1
J	Total	0.0	0.2	0.7	1.2	0.0	0.3
K	Total	0.0	0.0	0.0	0.1	0.0	0.3
L	Total	0.0	0.0	0.0	0.0	0.0	0.0
M	Total	0.2	7.3	1.9	8.6	0.4	11.1
N	Total	0.0	0.2	0.1	0.0	0.0	2.6
Total	50-249	4.6	5.7	28.0	9.7	3.6	13.6
Total	GE250	3.4	11.3	17.2	2.1	2.5	3.0
Total	Total	8.1	17.1	45.2	11.8	6.1	16.6

74 This is equal to the actual value of affiliate trade.

Source: GVC Survey 2021, CBS, Netherlands.

Thus, even considering that the Netherlands is an open economy with a relatively large amount of foreign trade, intra-group trade already accounts for a substantial share of total exports and imports. Moreover, it should be noted that the above-mentioned percentages are really lower bounds. Firstly, values for enterprises that do not predominantly (but do still to some extent) trade within their group are excluded. Secondly, enterprises with fewer than 50 employees are excluded from the international sourcing survey sample. As Table 6 shows, the share of intra-group trade is higher for companies with 50-250 employees than for companies with more than 250 employees – across the board. These initial results suggest that the share of intra-group trade among small firms may also be significant. Thirdly, the values associated with intra-group trade flows probably do not reflect market prices. If intra-group trade were to take place at market prices instead of transfer prices (which is likely), the value of the lower-bound estimates would be underestimated. This underestimation would apply generally to trade flows (i.e. cover all types of companies trading in any form within their group).

6.2.3. Measuring indirect trade with an expanded version of GVC survey

Indirect trade (through wholesalers or third parties) is an important way for enterprises to engage in international trade and to be part of a GVC (Crozet et al., 2013, Gonzales, et al., 2018). Wholesalers play an important role in international trade as facilitators of huge flows of goods at multiple stages in GVCs. Earlier research from Statistics Netherlands has, for instance, shown that 23% of all Dutch exports are exported indirectly (i.e. through wholesalers (CBS, 2019)). For some sectors (e.g. agriculture), the vast majority of exports even take place indirectly (e.g. domestically produced milk in the form of exported cheese). In 2015, 68% of all exports from the Dutch agriculture sector were indirect.

Many enterprises export or import indirectly through wholesalers. This group contains enterprises that are even heavily dependent on this indirect trade. However, in current trade and business statistics (e.g. ITGS, ITSS, IFATS and OFATS) they will not be characterised as enterprises with an international orientation. This makes sense from a trade statistics view because there would otherwise be double-counting in trade flows. From a GVC perspective, however, their international orientation should be captured, at least in business statistics, because these enterprises are in fact part of a border-crossing value chain.

In the extended GVC survey, this group has been identified by a two-step question. Enterprises are first asked to indicate whether they (to a large extent) depend on wholesalers for their sales and/or for their input. The enterprises are then asked to indicate whether they think these goods are eventually exported and/or the inputs have been imported [75]. This is a subjective question that relies heavily on the knowledge of the respondent.

GVC-related indicators can be constructed on the basis of this additional two-step question,:

<Share of enterprises trading through wholesalers><#18a>

<Share of enterprises highly dependent on indirect exports through wholesalers><#18d>

<Share of enterprises highly dependent on indirect imports through wholesalers><#18c>

There is obviously a large overlap between the second indicator #18d and the third indicator #18c, which is captured in the first indicator #18a.

Table 7 shows the shares of these three groups in the entire sample of enterprises in the Dutch international sourcing survey. Over 20% of Dutch enterprises heavily depend on inputs from wholesalers that were previously imported or heavily depend on sales to wholesalers of products that are eventually (certainly or likely) exported.

75 This could in theory refer to goods after or without some processing, but the wording of the question in Dutch is: 'These products are eventually bought by enterprises abroad, so it is safe to assume that the respondent refers to the latter option (goods without processing)'.

TABLE 7

Share of Dutch enterprises heavily dependent on wholesalers for foreign sales and/or foreign inputs, by NACE and by firm size, 2020

		All enterprises in the survey population heavily dependent on[76]			Non-exporting enterprises heavily dependent on either exports or imports
NACE section	Size class	indirect exports	indirect imports	either exports or imports	
B	Total	5.3%	7.9%	7.9%	0.0%
C	Total	11.7%	21.0%	29.0%	0.6%
D	Total	2.3%	7.0%	9.3%	2.3%
E	Total	0.0%	5.5%	5.5%	0.0%
F	Total	4.3%	29.1%	29.5%	7.0%
G	Total	18.0%	21.1%	34.7%	4.5%
H	Total	4.9%	15.8%	18.2%	1.6%
I	Total	3.6%	19.7%	19.7%	3.6%
J	Total	5.4%	4.9%	8.1%	3.3%
K	Total	0.0%	1.8%	1.8%	0.0%
L	Total	0.0%	7.9%	7.9%	4.5%
M	Total	1.0%	6.0%	6.2%	0.7%
N	Total	2.5%	4.7%	5.6%	2.4%
Total	50-249	8.5%	16.0%	21.4%	2.7%
Total	GE250	7.3%	12.8%	18.1%	2.5%
Total	Total	8.3%	15.4%	20.8%	2.7%

Source: GVC Survey 2021, CBS, Netherlands.

Table 7 includes data for a fourth indicator: enterprises that, according to trade in goods statistics (ITGS), do not trade themselves but have nevertheless indicated that (i) they are heavily dependent on wholesalers for either their sales or inputs; and (ii) these wholesalers are most likely exporting respectively importing these goods:

<Share of enterprises trading exclusively through wholesalers<#18b>

Indicator #18b is obviously a subset of the group that is already captured by the first indicator #13a. Overall, 13% of the enterprises belonging to this group (i.e. 2.7% of all enterprises) are not trading themselves. They are therefore completely below the radar of business or trade statistics. Nevertheless, in the information and communication (J) and employment activities (N) sectors, they make up more than 40% of the enterprises that are heavily dependent on wholesalers for trade, and more than 57% in the real estate activities (L) sector. Sector L is admittedly a small one, but this cannot be said for construction (F), where the share of non-trading enterprises is over 23%.

Ideally, similarly to intra-group trade, figures could also be produced for the value of indirect trade. This would then refer to the following three GVC-related indicators:

76 This includes all enterprises that belong to the population of the GVC survey – so not just trading companies. It also includes enterprises that do not export directly (i.e. export themselves).

<The size of exports through wholesalers and other exporting firms, as a share of total export><#19a>

<The size of imports through wholesalers and other importing firms, as a share of total imports><19b>

< Share of value added due to indirect exports of goods through wholesalers><#19c>

In order to build up this indicator from the microdata, one would at least need (i) information on (i) national transactions between enterprises and wholesalers at the micro level, and (ii) data on the value of the exports of the wholesalers that can directly be linked to (other) enterprises within the country. Such microdata is currently not available. At the macro level, estimates of the share of trade value exports through wholesalers have already been made. Using supply-use tables and input-output tables, it has been calculated that over 4% of Dutch GDP in 2015 was earned by exporting through wholesalers and other intermediaries (Statistics Netherlands, 2019) [77].

There is a workaround that gives at least a preliminary indication of size and importance of indirect trade at the micro level. After all, the value added created by the indirectly exporting companies from Table 7 is known (#15d). Table 8 shows that (i) the added value of the enterprises is heavily dependent on wholesalers' sales and (ii) it is likely that their products are eventually exported. Total value-added amounts to EUR 19.2 billion (about 2.4% of the GDP of the Netherlands in 2019).

TABLE 8

Value added (EUR billions) indirect exports (2019)

NACE section	Size class	heavily dependent on indirect exports
B	Total	:
C	Total	7.6
D	Total	0.0
E	Total	:
F	Total	0.4
G	Total	10.0
H	Total	0.1
I	Total	:
J	Total	0.4
K	Total	:
L	Total	:
M	Total	0.1
N	Total	0.6
Total	50-249	8.2
Total	GE250	11.1
Total	Total	19.2

Source: Statistics Netherlands (2019).

The calculated percentage of 2.4% at the micro level is substantially below the 4% earlier found at the macro level. It should nevertheless be noted that the macro study based on IOTs is not limited to enterprises with 50 or more employees. In line with the results found in the intra-group trade extension (see Table 5), it could be assumed that these smaller enterprises might be more dependent on third parties for exporting their goods than larger enterprises. The 2.4% lower-bound estimate might therefore be an underestimate. Here, it can be counter-argued that the wording 'to a large extent' is likely to lead to an overestimate. After all, not all trade goes through wholesalers.

77 Van den Berg et al. (2019) found that one third of all exporting manufacturers enrich their product portfolio by engaging in carry-along trade (CAT) (van den Berg, Boutorat, & Alberda, 2019). These firms export both products that they produced themselves and products that they did not produce themselves to the same destination. This is shown by linking detailed trade in goods statistics and the PRODCOM survey.

6.2.4. Using the GVC survey to measure worldwide employment by business function

The geographic location – especially the global relocation – of business functions within an enterprise group (offshoring or reshoring) is an important policy issue. Enterprises in the domestic economy that belong to an international group might play a very particular role in the group's value-creating activity.

In the current basic version of GVC survey, this is covered by a question that asks whether (and which) business functions have been moved (abroad) over the last 3 years. It therefore does not cover the current state of affairs of an enterprise in terms of domestic and global employment.

Ideally, the various business functions in a GVC are properly specified and the enterprise is asked to evaluate the value added by each function and allocate these values to the different specific geographic origins. However, it can be difficult for a lead firm within a GVC (i.e. the headquarters of an MNE), let alone for a SME, to provide this information [78]. There is therefore a trade-off between the detail of information that can be requested and the administrative burden for the company.

In the extended GVC survey, this trade-off has been made by adding a filter question (namely, whether the enterprise can estimate the total number of employees in the global enterprise group) and only then distributing this number across business functions. The vast majority of enterprises (97%) were able to indicate whether they were part of an MNE group with either a parent or subsidiaries abroad, but only half of the enterprises that had indicated that they were part of an MNE group were able to report the total number of employees worldwide (i.e. to answer the filter question).

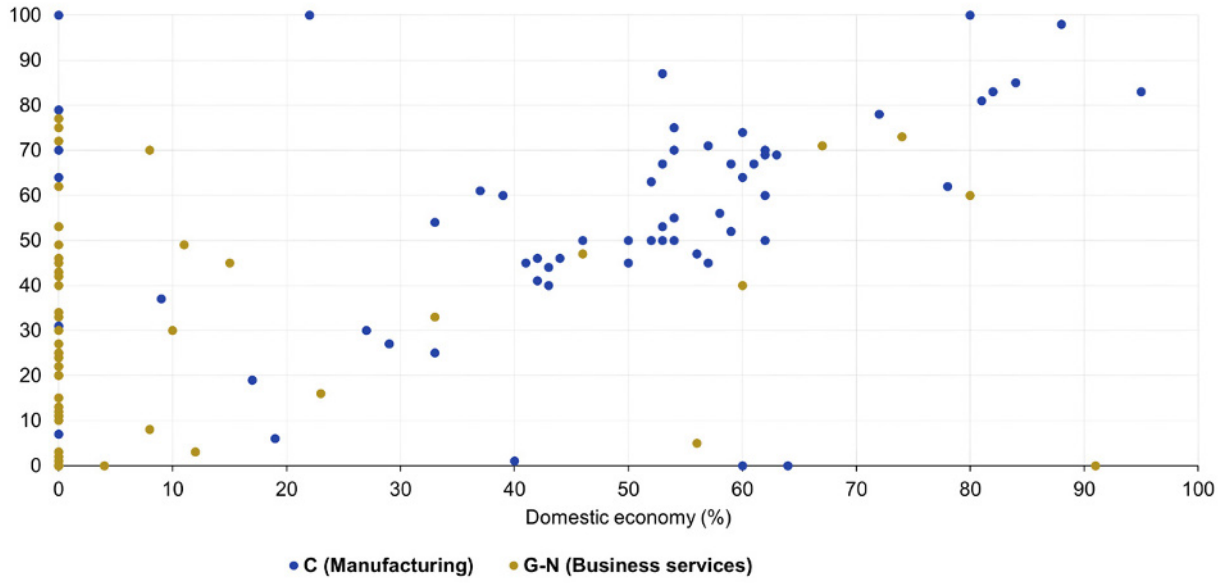
In terms of responses, these initial results do not look that promising; many enterprises seem unable to assign employment-per-business-function figures to the global enterprise group. However, the available data do allow us to achieve the purpose of introducing this question (i.e. to get an impression of the enterprise's role within its global group). Figure 14 shows the share of employment in the 'production' business function in the domestic market and abroad for 176 medium-sized enterprises in the Netherlands. These enterprises have indicated that they belong to a group of enterprises that span multiple countries (they are either subsidiaries of a foreign MNE or the parent of a group operating in several countries), but LCU-profiling shows that they have no group members in the Netherlands [79].

78 For this reason, a deep understanding of how MNEs structure their business functions and how they collect and organise the corresponding information is required in order to design a user-friendly and effective questionnaire.

79 In order to make this analysis, we have to be able to strictly discriminate between employment within the group (per business function) in the domestic market versus the rest of the world. Some LCU-enterprises did not fully respond to the questionnaire, so we cannot perfectly discriminate between the worldwide and domestic parts. As a result and for comparison, we are here showing only the results for enterprises that do not belong to a group of enterprises in the domestic market but that do belong to an international concern. This makes it possible to clearly discriminate between domestic and worldwide employment by business function.

FIGURE 14

Share of employment devoted to the 'production' business function, by (domestic) NACE



Source: GVC survey 2021, CBS, Netherlands.

The scatter plot shows an interesting pattern. The share of labour dedicated to production in medium-sized manufacturing enterprises in the Netherlands is comparable with the commitment of employees to production in the rest of the (foreign) enterprise group, but this picture is completely different for services enterprises in the Netherlands. Many services enterprises commit no employees to the 'production' business function in the domestic market (they lie on the y-axis), but – when considering the international group as a whole – they do commit employees to the 'production' business function.

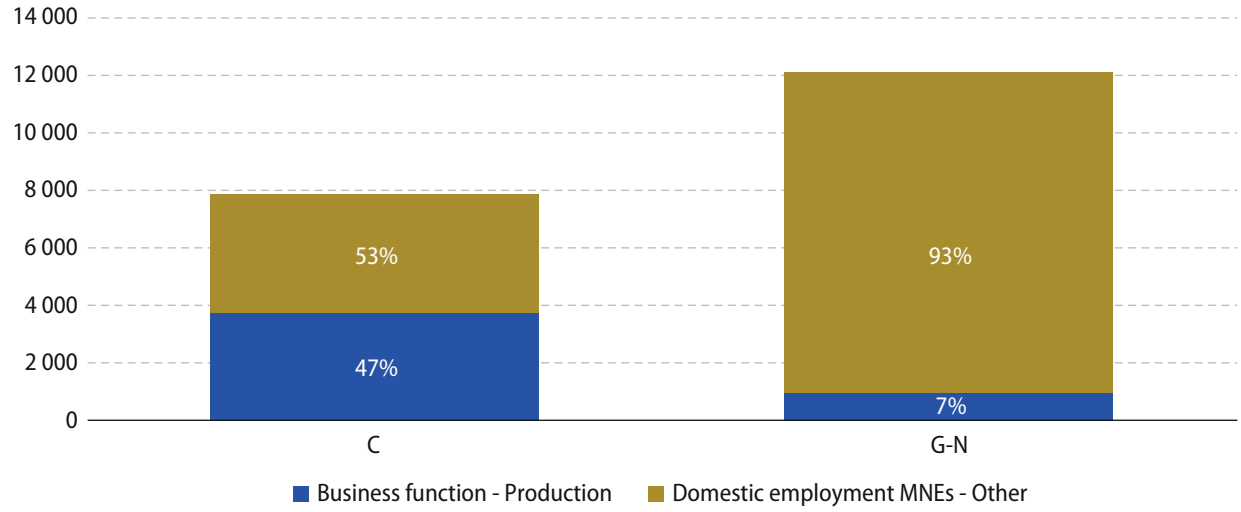
This indicates that services enterprises in the Netherlands might be much more dependent on manufacturing services (in foreign economies) for their business than one would conclude from the (domestically assigned) NACE [80].

An alternative way of presenting the same dataset is to simply compare employment by business function in the domestic economy (Figure 8) with employment by business function abroad (Table 7). Figure 15 shows that about 47% of employment in medium-sized manufacturing enterprises in the Netherlands (i.e. domestic) is committed to production, but only 7% for services enterprises.

80 This is especially so given that the Netherlands has an open trade economy (and companies located there are probably relatively better informed about their international ties than companies located in other countries).

FIGURE 15

Domestic employment in MNEs in the Netherlands



Source: GVC survey 2021, CBS Netherlands.

The picture from Figure 15 changes radically if one takes global employment into account (see Table 9). According to the original classification (see Figure 15), 7% of all employment from enterprises that do not belong to the NACE sections G-N (i.e. 'business services' in the broadest sense) is within the 'production' business function. When the same split is made for worldwide employment, this increases to 27% (lower right quadrant in Figure 14) – so a fourfold increase. In other words, even if an enterprise seems to be services-oriented within the borders of a country, it might very well be dependent on (or at least connected to) production work in a foreign market.

This suggests that enterprises that are a part of global enterprise groups play a rather particular role in the GVC. For example, a design company that is part of a larger global group may focus specifically on certain services (designs) but not produce much itself. That production may take place in another part of the group. The production sites are most probably abroad, where more staff are therefore counted as part of the 'production' business function. From Table 9 it follows that enterprises within the non-production NACE sectors located in the Netherlands (G-N) evidently focus more on services. In any case, they have relatively few staff in the 'production' business function by comparison with the rest of the global group to which they belong.

Uncovering such structures with (business) statistics might give a better understanding of changes in the domestic economy with respect to the expansion or closure of (parts of) enterprises. For example, even though an enterprise that is service-oriented from the domestic economy perspective does not have much to do with production in the domestic market, it might face challenges if the production facilities abroad face labour or capital shortages.

TABLE 9

Worldwide employment, by (domestic) NACE

NACE (domestic)	Location of employment	'Production' business function	Other business functions	Total	% of employment in the 'production' business function
Manufacturing (C)	Domestic	3 664	4 180	7 844	47%
	Worldwide	297 472	237 704	535 176	56%
Services (G-N)	Domestic	861	11 188	12 049	7%
	Worldwide	412 578	1 097 873	1 510 451	27%

Source: GVC survey 2021, CBS Netherlands.

6.2.5. Using the GVC survey to capture factoryless goods production

In point 6.2.4, the specific role an enterprise fulfils (or plays) in a GVC has been indirectly derived from the share of employment by location (domestic or abroad), for production and services respectively. For the latter, NACE sectors have been used as a plausible approximation.

This present point (6.2.5) describes another way to capture the role of the enterprise in a GVC, either inside or outside the global enterprise group. This method is based on a number of questions that directly inquire whether an enterprise either supplies abroad (i.e. exports) or purchases (i.e. imports) cross-border type of activities within a GVC. These cross-border activities are measured by a specific compound set of business functions, namely manufacturing, processing or assembly (MPA) services. MPA refers to a rather specific set of 'global production arrangements', namely **factoryless goods production**. Ideally, with more information available, the prevalence of global production arrangements in general could be described. Here, however, the administrative burden trade-off arises once again.

The ability to separate the production process from the good itself is one of the drivers of the emergence of GVCs. At the extreme, this leads to firms designing and selling goods while fully outsourcing the actual manufacturing of the product (such firms are known as 'factoryless goods providers' (FGPs)). From a GVC perspective, this is a situation where a lead firm that sells a final good does not produce the final goods but, based on its legal ownership, decides within the GVC how, where and by whom the goods are developed and produced.

For the US, Bernard and Fort have used data from the 2007 US Census Bureau Census of Wholesale Trade, the Longitudinal Business Database for 1992 to 2007, and US Customs trade transactions data on 2007 US imports to identify such FGPs (Bernard & Fort, 2015). However, such data are not widely available in the EU's statistical system. The added questions of the international supply and import of manufacturing, processing or assembly services have partially filled this data gap [81].

These additional questions make it possible to construct four indicators on the prevalence of factoryless goods production:

<Share of enterprises doing manufacturing, assembly or processing work for foreign enterprise within enterprise group><#7a>

<Share of enterprises doing manufacturing, assembly or processing work for foreign enterprise outside enterprise group><#7b>

<Share of enterprises sending goods abroad for processing to a processing firm inside the enterprise group><#7c>

81 These questions borrow heavily from a value chain survey conducted by Statistics Canada (2021). See https://www.statcan.gc.ca/en/statistical-programs/instrument/5250_Q1_V2.

<Share of enterprises sending goods abroad for processing to a processing firm outside the enterprise group><#7dc>

The following tables show the results for GVC arrangements where factoryless goods production might be involved, on the supply side (Table 10) and the demand side (Table 11). Overall, factoryless goods production is certainly not unusual: 11% of the enterprises are either doing MPA for or hiring from foreign enterprises outside the group. Factoryless goods production is most prevalent in B: mining and quarrying, C: manufacturing and D: electricity, gas, steam and air conditioning supply – (only on the supply side for sector D). Both sectors B and D are very small sectors, so small differences in numbers of companies lead to relatively large percentage differences. However, the difference between supply (2%) and demand (30%) in sector D is so striking that it cannot be explained away by the small size of the sector.

TABLE 10

Share of enterprises doing assembly or processing work for foreign enterprises outside the same enterprise group, 2021

Outsourcing MAP/NACE sector	International outsourcing	No international outsourcing	Unknown
B	0%	71%	29%
C	30%	63%	7%
D	2%	86%	12%
E	2%	93%	5%
F	11%	88%	1%
G	10%	84%	5%
H	2%	91%	7%
I	1%	98%	1%
J	5%	92%	3%
K	3%	87%	11%
L	0%	90%	10%
M	8%	88%	4%
N	1%	90%	10%
50-249	11%	83%	5%
GE250	11%	81%	8%
Total	11%	83%	6%

Source: GVC survey 2021, CBS Netherlands.

TABLE 11

Share of enterprises hiring other foreign enterprises outside the same enterprise group to do assembly or processing work, 2021

Outsourcing MAP/NACE sector	International outsourcing	No international outsourcing	Unknown
B	29%	55%	16%
C	23%	71%	6%
D	30%	56%	14%
E	5%	88%	6%
F	9%	89%	2%
G	15%	81%	5%
H	2%	90%	8%
I	3%	96%	1%
J	8%	89%	2%
K	3%	87%	11%
L	0%	84%	16%
M	9%	86%	4%
N	2%	87%	10%
50-249	10%	84%	6%
GE250	15%	77%	8%
Total	11%	83%	6%

Source: GVC survey 2021, CBS Netherlands.

At first glance, there seems to be a lot of overlap between the numbers in Table 7 and Table 8. This is presumably because enterprises often indicate that they procure or perform services for enterprises inside and outside the group (i.e. they do not know the difference). However, about 40% of enterprises both perform and procure services for and from other enterprises. The enterprises in this group do distinguish between inside or outside the group. In other words, although the aggregate percentages are often almost the same, these percentages are generated by different enterprises.

6.2.6. Improving information on MNE ownership structure

Combining information on the ownership structure of MNEs with other sources on trade and sourcing can help improve the intra-group picture of GVCs, and the distribution of employment and value added across countries. In this present point (6.2.6), we describe several ways to improve.

Extend coverage of OFATS under EBS

Under EBS, the coverage of OFATS is extended by including all foreign EU affiliates (in addition to the current coverage of foreign non-EU affiliates). Moreover, OFATS are extended by compiling data on all foreign-controlling enterprises and domestic affiliates controlled by residents of the compiling country regarding the three main variables number of enterprises, turnover and persons employed.

Combine business register and EGR data with trade statistics (ITGS/ITSS) and FATS data

Besides giving detailed information on the organisational structure of MNEs, the EGR also provides an opportunity to measure intra-group trade, provided that the information can be linked to registers such as VAT-number-based trade data.

Using the EuroGroups register (EGR) to improve FATS statistics

The EGR could help improve OFATS (e.g. reduce the asymmetries between bilateral OFATS and IFATS (i.e. parent company information from country A versus affiliate information from country B)[82]. This is because one can see in the EGR the entire structure of the foreign part of the group but one may perhaps be able to see part of it in OFATS (depending on how OFATS are built). This would lead to improvements in indicators #9, #10 and #11 (see point 4.1.3) and a new indicator 12.

<Intra-EU affiliate trade><#17>

Indicators #9 to #11 determine the scope for intra-group trade. Indicator 12 would determine the actual affiliate trade (at least intra-EU). Affiliate trade could consist of value chain trade (different parts of the production process or ancillary activities carried out in geographically dispersed locations). For indicator #12, it remains to be seen how these two components can be isolated in practice. The issue here is that in EGR the VAT number is not linked to the business identifier for many countries.

Multinational Enterprise Information Platform (MEIP)

To overcome the problem that NSIs are limited to measuring MNE activities on a country level, the United Nations and the OECD have set up databases using an international and MNE-centric approach, combining traditional data sources (such as annual reports) with innovative data collection methods such as web-scraping (Bavdaž et al., 2020). The main focus is to identify the legal structure across countries. The identifying and economic/financial information includes details on ownership structure, industry code, revenues, assets and the number of employees[83]. Unlike the EGR, it is set up to build from publicly available sources[84], while its structure is aligned as closely as possible with EGR variables (but not based on confidential EGR data)[85].

Activity of MultiNational Enterprises database (AMNE)

The AMNE database presents detailed data on the activities of foreign affiliates in OECD countries (inward and outward activity of multinationals), comparable with the foreign affiliates statistics (FATS) in the EU business statistics (see also point 4.1.3). It contains 17 variables broken down by country of origin (inward investment) or location (outward investment) and by industry (NACE Rev. 2 as of 2008) for 34 OECD countries and all EU Member States. It takes the reported data in the EGR and adds the information from the countries that is reported to the OECD about activities of foreign-controlled enterprises and foreign affiliates abroad that are controlled by residents of the compiling country[86].

Analytical activities of MNEs database (ADIMA)[87]

ADIMA builds on the AMNE database by supplying information about foreign affiliates in the host economy, domestic MNEs and non-MNE domestic enterprises (Cadestin, et al., 2018). It has variables such as output, value added, exports and imports for 59 countries and 34 industries. Some of the data rely on estimation. By linking this data to the OECD ICIOs (inter-country input-output tables) or multiregion input-output tables (MRIOs), these tables are extended by distinguishing the transactions of domestic-owned and foreign-owned enterprises. The newly developed data allow a better understanding of the links between trade and investment. This information also makes it possible to analyse AMNE activities (domestic and abroad) in value added terms and to analyse the

82 This related to asymmetries at the EU level. At the national level, asymmetries are far less common because IFATS is used to determine the OFATS population.

83 The scope was initially (2019) limited to the top 100 MNEs in the world but was later extended to the world's 500 largest MNEs (Pilgrim & Wahlgren, 2023). The inherent disadvantage of many of these supranational and academic initiatives is that they never have complete coverage (e.g. only enterprises listed on a stock market are included; many relevant variables are still missing, and currency effects are not included). Only an official statistical agency might achieve a representative coverage.

84 Primary sources include fiscal annual reports, the Global Legal Entity Identifier Group (GLEIF), PermID, and the US Securities and Exchange Commission.

85 The information of the joint OECD UNSD initiative is available at an annually updated dashboard: https://www.oecd.org/sdd/its/mne-platform.htm.

86 https://www.oecd.org/sti/ind/amne.htm

87 The data are compiled using traditional sources such as companies' annual reports and a number of open big data sources such as the Legal Entity Identifier, Website Hyperlink Graphs, WikiData, OpenStreetMap and Server Security Certificates.

dependencies between foreign affiliates, domestic MNEs and non-MNEs in the host economy [88].

Initiatives outside statistical organisations

Several academic research groups ('corporate research') maintain databases on MNE ownership. KU Leuven for instance has a database with 150 harmonised variables and a time series starting in 1990. The University of Amsterdam runs CORPNET [89]. The coverage of these databases is usually limited (especially in terms of enterprises) and they are not meticulously maintained.

There are also several commercial providers of large databases with information on private companies. Orbis (Bureau van Dijk) is probably the most extensive [90]. Orbis is used regularly in academic research on the activities of MNEs (e.g. in the KU Leuven database). Orbis does nevertheless have some serious limitations (besides the pricing structure). In a recent working paper, for instance, the OECD concluded that '[. . .] results indicate that Orbis is more suitable for studies that: i) take a global perspective rather than make comparisons across countries; ii) analyse top performers and multinationals rather than underperforming firms; and iii) focus on mean performance or changes within firms rather than the entire firm distribution or entry and exit' (Bajgar, Berlingieri, Calligaris, Criscuolo, & Timmis, 2020).

The above-mentioned Register of Institutions and Affiliates Database (RIAD), which is jointly operated by and accessible to all members of the European System of Central Banks (ESCB) might provide a public alternative to the commercial databases. One obvious drawback of the RIAD, however, is that it mainly contains entities from the financial sector [91].

The RIAD's data model covers an extensive set of attributes which can be classified into four categories of information: (1) the identification of units and major characteristics [92], (2) properties that can be used for stratification, (3) demographic developments including corporate actions, and (4) various types of relationships between entities (e.g. ownership or control). The RIAD data model follows the internationally recommended design of business registers [93].

6.2.7. General recommendations to improve overall data quality of business statistics

It is important to resolve inconsistencies between basic statistics and data sources on enterprises or enterprise groups that have a large impact on key macroeconomic statistics [94].

Establish large case units (LCUs) within NSIs to profile 'large cases' [95]

The further development and maintenance of the EGR will come to rely heavily on the construction of so-called 'large case' units within the Member States' NSIs. These are units dedicated to profiling 'large cases' (i.e. enterprises or enterprise groups that have a large impact on key macroeconomic statistics), and to addressing and resolving the inconsistencies between various basic statistics and data sources for these businesses. To construct such LCUs, several microdata sources are combined in a consistent manner on a case-by-case basis. A network of LCUs will be established over the next few years to facilitate the sharing of knowledge about statistical activities on MNEs, and to ensure further collaboration and coordination in this area. NSIs will ultimately have safe access to confidential information through the International Profiling Tool. Another element of this line of work is the Early Warning System procedure, which has the purpose of detecting restructuring events of MNEs that have potential sizeable effects on national and EU statistics.

88 http://www.oecd.org/sti/ind/analytical-amne-database.htm

89 https://corpnet.uva.nl

90 According to the company's website, Orbis has information on more than 400 million companies worldwide. Orbis captures and blends data from more than 160 different sources and treats them so that they are standardised and comparable (https://www.bvdinfo.com/en-gb/).

91 For an overview of the type of institutions included, see: https://www.ecb.europa.eu/stats/financial_corporations/list_of_financial_institutions/html/index.en.html.

92 Apart from several identifiers like the RIAD code, national VAT and identification numbers, the Legal Entity Identifier (LEI) of the entity is, when possible, recorded in the RIAD. For LEI, see https://www.gleif.org/en.

93 Due to the AnaCredit project, the coverage of entities in the RIAD is estimated to grow to 15 million, mostly non-financial, corporations when one includes information on parties involved in credit relationships (Kropp, Thijs, Neudorfer, & Corvoisier, 2017).

94 These are the so-called 'large cases'.

95 The Dutch LCU population in 2018 contained about 360 groups consisting altogether of about 2 100 enterprises.

Exchange of confidential information on MNEs between NSIs [96]

The bilateral and multilateral data exchange between NSIs beyond the EU exchange of microdata (especially on a case-by-case basis and particularly on 'large cases') is viewed as the best way to resolve trade asymmetries. One-off aggregate-level data exchange seems quite easy to organise if there is a common interest, willingness and mutual agreement between the parties, but regular data exchange of confidential microdata in turn requires legislation or at least a lot of administrative and technical work and trust between the parties (Statistics Finland, 2016).

6.3. Using a microdata-linking approach

As noted in the Handbook on Accounting for Global Value Chains, fully understanding the nature of GVCs and global dependencies requires an integrated global view of production and consumption for specific GVC industries (UN Trade Statistics, 2018). However, as pointed out by the World Bank (2020), while most conceptual frameworks and empirical measures related to GVCs are at the country or country-industry level, it is enterprises rather than countries and industries that trade in practice. Using a firm-level approach, one can also distinguish (i) GVCs organised by a lead firm that incurs the bulk of the fixed costs associated with setting up the network of producers for a given production process, from (ii) GVCs that are more decentralised, with individual producers incurring the costs of setting up links upstream and downstream [97].

Microdata-linking (MDL), which entails the combining of microdata on individual enterprises, is an appropriate statistical instrument for measuring the production arrangements of the global firm in industry-specific GVCs. MDL has become one of the most powerful methods in the development of new and more granular statistical information in order to get insights into policy-relevant matters that could not be investigated with existing single-source statistics (at least not without disproportionally increasing the respondents' response burden) (Luppes & Nielsen, 2020) [98].

6.3.1. Using labour force microdata to construct business function tables

Whenever possible, one should attempt to measure (newly defined) economic concepts using available data. The essence is that the response burden on enterprises should remain as low as possible. In the second pilot of this project we show that we can construct employment-per-business-function figures on a yearly basis, without asking enterprises in the GVC survey (see Annex 4). We also take some first steps to overcome one of the critiques of Sturgeon on the current GVC survey: we investigate whether linking personal wage data to occupations and business functions (through a correspondence list) provides us with the opportunity to assign economic value to business functions, broken down by NACE.

Analysis of (the sourcing) of business functions has a big drawback when only international sourcing survey data are consulted; there is – in the existing SBS-data landscape – no obvious way to attach an economic value to the different business functions. This is one of the data gaps that has been identified by Sturgeon (Sturgeon, 2013). A relevant policy issue is, for instance, which type of business functions have been outsourced: 'low-value' (low paid) or 'high-value' (high paid) functions.

Using existing data sources to develop new statistics is preferable to increasing the response burden on enterprises. We have therefore used Eurostat's ISCO-business function correspondence table to construct employment figures by business function, broken down by NACE or size class. Moreover, by adding individual educational-attainment and earnings data from the tax register, we can calculate (full-time) wages earned broken down by NACE and business function. This exercise makes it possible to attribute an average wage to business functions in each NACE and to distinguish between 'high-value business functions' and 'low-value business functions'.

As a first step, survey information on occupations (taken from the Dutch Labour Force Survey) has been combined with survey information from business functions (taken from the regular international sourcing survey), using Eurostat's correspondence table between occupations (ISCO) and business functions. Based on this plausible approximation, we are able to calculate a first indicator:

96 EU legislation accommodates the possibility of transmission of confidential data, both within the European Statistical System (ESS) and within the European System of Central Banks (ESCB).

97 This refers to, for instance, coordination and transaction costs related to engaging in GVC arrangements. See, for instance, (Antràs, Conceptual Aspects of Global Value Chains, 2020).

98 See Section 5.2 and point 6.2.4.

educational attainment per business function. Educational attainment is relevant to GVC measurements because it can be considered as a proxy for skills. An important policy issue is what type of business functions (low-, medium- or high-skill) are outsourced or retained in a country.

Table 12 shows the results for a specific cross-section of the indicator, namely the percentage of employees with a higher educational attainment per business function, by NACE sector. It appears that, within the same business functions, the share of highly educated workers varies quite significantly between sectors. An obvious explanation for this is that certain sectors of the economy require a higher overall level of educational attainment (e.g. J: information and communication; and M: professional, scientific and technical activities), whereas other sectors have lower requirements for the same business function (e.g. 'administrative and management functions' in B: mining and quarrying versus I: accommodation and food service activities).

< Share of high-, medium- or low-skilled workers as a fraction of total workers, broken down by business function and economic><#16>

In a second step, the related occupational-business function survey data have been matched with microdata on wages taken from the Dutch Employment Insurance Agency (UWV or EIA). This enables the calculation of wages (wage sums, average full-time wages and average actual wages) per business function, per NACE, per size class and per level of educational attainment. The first results for the following indicator are presented in Table 13.

<Yearly wages earned per business function, per NACE (as proxy for added value) ><#15a>

<Average full-time wage of workers broken down by business function and economic activity>#15b>

The level of average salary correlates strongly with average education level. Therefore, similarly to the patterns in Table 12, it appears that average wages vary heavily within the same business functions. For instance, certain sectors (e.g. B: mining and quarrying) pay structurally higher wages than other sectors, regardless of the business function. Thus, if statements are made about the (economic) 'value' of specific business functions, the full context of all business functions in all industries should be considered. For example, for the 'marketing and sales' business function, relatively low average wages are generally being paid, but sector K: financial and insurance activities is one of the highest-paid functions. General statements (such as 'mainly the administrative and management function is sourced internationally') therefore hardly contain useful information on the associated economic value or aggregate wage effects of this decision if it is not known in which part (sector) of the economy the actual sourcing took place.

TABLE 12

Percentage of workers with higher educational attainment [99], 2020 (%)

Business functions/NACE section	B	C	D	E	F	G	H	I	J	K	L	M	N	50-249	GE250	Total
Production of goods	28	10	36	30	11	9	6	12	37	72	11	21	9	9	12	10
Distribution and logistics	22	16	25	4	5	12	18	23	19	53	0	47	22	13	19	17
Marketing, sales, and after-sales services	87	55	73	71	41	17	36	33	64	73	59	73	42	37	23	27
Information and communication technology services	53	65	74	63	41	63	69	29	70	81	54	78	60	69	69	69
Administrative and management functions	80	56	65	51	49	53	40	41	70	70	69	79	49	59	59	59
R&D, engineering, and related technical services	89	67	65	58	59	37	62	67	76	93	67	82	59	64	67	66
Other	0	17	17	10	19	17	18	10	67	65	48	61	18	19	25	23
Total	66	36	58	35	33	24	28	19	68	72	57	76	30	38	38	38

Source: LFS (2020).

TABLE 13

Average full-time wage per business function, 2020 (thousands of euro)

Business functions/NACE section	B	C	D	E	F	G	H	I	J	K	L	M	N	50-249	GE250	Total
Production of goods	79	44	65	46	51	33	49	31	41	57	44	46	32	42	41	41
Distribution and logistics	62	50	98	39	43	32	48	27	41	75	30	47	31	38	42	41
Marketing, sales, and after-sales services	95	57	62	48	47	27	54	27	67	100	49	67	32	41	32	34
Information and communication technology services	115	68	72	63	56	55	64	39	60	72	64	64	46	57	63	61
Administrative and management functions	112	75	73	62	65	59	47	41	73	79	63	74	41	63	63	63
R&D, engineering, and related technical services	113	65	77	68	62	46	66	42	54	105	65	62	44	56	63	61
Other	38	44	59	43	44	31	40	24	50	61	50	54	29	36	35	35
Total	100	57	71	52	56	35	49	28	62	77	58	67	34	48	48	48

Source: LFS and EIA data (2020).

99 This includes higher vocational and university education.

The number of workers is known for each of the combinations of business functions and NACE sectors, so the overall sum of wages can now be calculated. This 'national wage bill' is needed as a bench line to quantify the impact of international sourcing of business functions on salaries earned; one of the sensitive questions in the policy debate on globalisation. This impact is calculated by multiplying the net job change by the average wage earned. This is indicator #17c:

< Estimated wage bill of outsourced business functions><#17c>

Table 14 and Table 15 show the net changes in sum of wages for business functions with high and medium/low educational attainment respectively. The overall economic impact of international sourcing is minus EUR 87 million on business functions with high educational attainment and minus EUR 125 million on business functions with medium/low educational attainment – so a total of minus EUR 212 million on the national wage bill [100]. It should be noted that the method presented here does not represent the impact on value added of GDP but is merely a first attempt at economically quantifying the impact of international sourcing.

Taking the overall national wage bill into account, it appears that the largest net changes (losses) in business functions with high educational attainment are in 'production' and particularly in 'R&D, engineering and related technical services' (this suggests a weakening of the Dutch R&D base [101]). In business functions with medium/low educational attainment, 'sales and marketing' is the only business function that has seen a net increase. 'Production' has experienced a relatively large decrease, also by comparison with the losses of the same business function in high educational attainment. This suggests that a sizeable part of production has been moved abroad. Many of the workers that lost their jobs will have found new employment at other (domestic) firms and still be earning a wage. Another delicate underlying assumption is that the jobs that disappeared had (on average) the same wage as those jobs still present in 2020.

100 A large number of cells are left blank. This is because the combination of three dimensions (NACE x business functions x average wages) asks a lot from the data. There are, for instance, too few observations in the LFS to allow an integral and reliable picture to be drawn of the wages earned in each of the business functions.

101 This is obviously subject to the assumption that enterprises within the Netherlands did not invest heavily in R&D during the same period. This is the case, however: BERD in the Netherlands increased by 4.0% in 2020 compared with the previous year. This is in line with the trend of R&D reshoring identified by UNCTAD (UNCTAD, 2020).

TABLE 14

Estimated net change in paid wages bill due to international sourcing of business functions with high educational attainment, 2020 (EUR millions)

Business function / NACE section / Size class	B	C	D	E	F	G	H	I	J	K	L	M	N	GE250	50-249	Total
Production of goods	:	-16.6	:	:	0.4	-0.6	:	:	0.4	:	:	:	:	-1.1	-12.5	-16.4
Distribution and logistics	:	0.3	:	:	:	-0.6	0.3	:	:	:	:	-0.8	:	0.2	-1.3	-0.8
Marketing, sales, and after-sales services	:	-1.2	:	:	:	-5.5	:	0.5	-1.7	:	:	:	:	:	-8.5	-7.9
Information and communication technology services	:	9.3	:	:	:	-3.6	-0.1	0.1	-10.4	:	:	-6.1	-0.5	0.5	-12.7	-11.2
Administrative and management functions	:	-6.1	:	:	:	-10.1	-1.7	0.4	-4.1	:	:	-6.9	-0.6	-9.7	-17.7	-29.1
R&D, engineering, and related technical services	:	-0.4	:	:	:	-1.7	-0.5	:	:	:	:	3.0	0.2	-2.5	2.9	0.8
Other	:	10.1	:	:	:	-4.7	:	:	-11.3	:	:	-16.6	:	2.8	-27.7	-22.6
Total	:	-4.6	:	:	0.4	-26.7	-2.0	0.9	-27.2	:	:	-27.3	-0.9	-9.8	-77.4	-87.3

Source: Microdata linking project using globalisation statistics, CBS, Netherlands, 2020.

TABLE 15

Estimated net change in paid wages due to international sourcing of business functions with medium/low educational attainment, 2020 (EUR millions)

Business function / NACE section / Size class	B	C	D	E	F	G	H	I	J	K	L	M	N	GE250	50-249	Total
Production of goods	:	-96.0	:	:	:	-13.7	:	:	:	:	:	:	:	-37.8	-66.9	-109.7
Distribution and logistics	:	-2.9	:	:	:	-0.5	-0.5	:	:	:	:	-0.3	:	-2.3	-1.2	-4.2
Marketing, sales, and after-sales services	:	-1.0	:	:	:	-0.5	-1.0	1.2	-0.3	11.1	:	-0.4	-0.9	-0.9	4.3	8.2
Information and communication technology services	:	-0.8	:	:	:	-1.1	-0.2	:	:	:	:	-0.3	-0.5	-1.5	-1.6	-2.8
Administrative and management functions	:	-3.5	-0.5	:	:	-9.8	-0.8	-0.6	-0.9	6.6	:	-2.0	-3.2	-8.2	-9.6	-14.5
R&D, engineering, and related technical services	:	-0.2	:	:	:	-0.7	:	:	:	0.9	:	-0.2	-0.2	-1.0	0.2	-0.4
Other	:	-1.5	:	:	0.8	-0.2	:	:	:	:	:	-0.4	:	0.4	-1.6	-1.4
Total	:	-105.9	-0.5	:	0.8	-26.5	-2.5	0.7	-1.1	18.6	:	-3.6	-4.7	-51.3	-76.4	-124.8

Source: Microdata linking project using globalisation statistics, CBS, Netherlands, 2020.

Even though nominal values (as in Tables 13-15) are very insightful, they are less suitable for making statistics, which is sometimes easier with categorised variables. We therefore introduce a split in high-, medium-, and low-value business functions on the basis of two arbitrary cut-offs: if the average full-time wage in Table 13 is below 75% of the overall median wage [102] (EUR 31 500), the business function is considered low-value. If the wage is above 150% of the overall median wage (EUR 63 000), the business function is considered high-value. The remainder is considered medium-value.

Similar to the original nominal values (indicator #19), at least two GVC-related indicators can now be constructed:

<The number of high-(medium-/low-) valued business functions sourced abroad as a percentage of all high-(medium-/low-) valued business functions><#17a>

<The number of high-(medium-/low-) valued business functions sourced abroad as a percentage of all sourced business functions>#17b>

We can now proceed by first counting the number of business functions to which positive employment figures are assigned. So, if 100 enterprises each assign positive employment to exactly 4 business functions, we count a total of 400 business functions. In reality, we count 43 812 business functions with positive employment. From the GVC survey, we find that 1 022 business functions are sourced internationally. Using the approach discussed in the previous section, we find that 24.5% of these cases are qualified as 'high-value' (these are the total of 250 cases in Table 15). The share of internationally-sourced 'high-value' business functions is therefore exactly in line with the share of 'high-value' business functions in the overall population of business functions. In other words, there does not seem to be a tendency to (not) source especially high-value business functions.

At least three points should be taken into account when interpreting the numbers in Tables 13-15. First, the total effect on the wage bill of minus EUR 212 million is not an overall net effect. Of course, many of those that lost their jobs have found new employment at other firms and are currently earning a wage. Second, the method presented here does not represent the impact on value added or GDP. We are attempting in this section to take a first step in economically quantifying the impact of international sourcing. In an ideal world, we would be able to estimate effects on value added and GDP. Third, the interpretation in the previous section assumes that the jobs that disappeared due to sourcing of business functions in 2018-2020 had (on average) the same wage as those jobs still present in 2020. This is not necessarily the case.

102 Overall median wage is EUR 42 000.

TABLE 16

Total number of 'high-value' business functions, 2020

Business function / NACE section / Size class	B	C	D	E	F	G	H	I	J	K	L	M	N	Total
Production of goods	:	:	:	:	:	:	:	:	:	:	:	:	:	:
Distribution and logistics	:	:	:	:	:	:	:	:	:	:	:	:	:	:
Marketing, sales, and after-sales services	:	:	:	:	:	:	:	:	558	:	:	520	:	1 078
Information and communication technology services	:	1 416	:	:	:	:	:	:	:	117	:	493	:	2 026
Administrative and management functions	:	2 292	:	:	808	:	:	:	629	167	:	793	:	4 689
R&D, engineering, and related technical services	:	:	:	:	:	:	:	:	:	:	:	:	:	:
Other	:	2 894	:	:	:	:	:	:	:	:	:	:	:	2 894
Total	:	6 602	:	:	808	:	:	:	1 187	284	:	1 806	:	10 687

Source: GVC survey, LFS and EIA data (2020).

TABLE 17

Total number of internationally sourced 'high-value' business functions, 2020

Business function / NACE section / Size class	B	C	D	E	F	G	H	I	J	K	L	M	N	Total
Production of goods	:	:	:	:	:	:	:	:	:	:	:	:	:	:
Distribution and logistics	:	:	:	:	:	:	:	:	:	:	:	:	:	:
Marketing, sales, and after-sales services	:	:	:	:	:	:	:	:	18	:	:	7	:	25
Information and communication technology services	:	31	:	:	:	:	:	:	:	:	:	26	:	57
Administrative and management functions	:	35	:	:	:	:	:	:	27	7	:	30	:	99
R&D, engineering, and related technical services	:	69	:	:	:	:	:	:	:	:	:	:	:	69
Other	:	:	:	:	:	:	:	:	:	:	:	:	:	:
Total	:	135	:	:	:	:	:	:	45	:	7	63	:	250

Source: GVC survey, LFS and EIA data (2020).

From the GVC survey, we find that 1 022 business functions are sourced internationally, of which 24.5% are 'high-value' business functions (these are the total of 250 cases in Table 15). The share of internationally-sourced 'high-value' businesses functions is therefore exactly in line with the share of 'high-value' businesses functions in the overall population of business functions. In other words, there does not seem to be a tendency to (not) source especially high-value business functions.

As a final note on this pilot, we would like to stress the potential for using individual-level data in the GVC debate. In the current pilot, we show that it is theoretically possible to construct information on business function employment and wages, without having to use information from the GVC survey. In other words, it merely requires a correspondence list between the ISCO and business functions. To construct additional macro tables from the individual-level data, one might consider what other individual characteristics can be exploited. One obvious route might be to introduce a task-based perspective. Based on occupational information, one can estimate the complexity of the tasks at hand, broken down by business function and per economic activity. Similarly, many other characteristics that are available at the individual level can be used to construct macro tables at the business function level.

Changes in the composition between economic activities or over time in the work force and business functions might also be captured in this way. For instance, what kinds of tasks and occupations (and changes in their composition) are related to GVC trade and outsourcing (e.g. 'upgrading' or 'downgrading')? The composition of one particular business function (e.g. 'administrative and management functions') might be very different in structure (in terms of occupations and thus tasks) from one sector to another (e.g. a relatively high or low share of higher management vis-à-vis lower administrative staff).

6.3.2. Using microdata to refine macro-level statistics

As well as using micro-level business statistics to top-down construct entire or partial IOTs, another use of MDL is to either validate or refine macro-level NA statistics. This is the only approach that is currently feasible for all EU Member States, because it does not need tailor-made data or new data collection. Extended IOTs can be compiled that show specific GVC arrangements that would not otherwise be visible in aggregated NA accounts or macro-level trade statistics (see Section 4.3) [103]. Statistics Denmark (2017) and Statistics Netherlands have already implemented this approach (Statistics Denmark, 2017) (Chong, et al., 2019). The latter pilot study focused on the particular role of Dutch SMEs in GVCs. This present point (6.3.2) builds on the results from the same study (see Annex 5).

The first step is to further disaggregate the existing IOT (at the aggregate levels of sections) by five types of enterprises:

- SME non-multinational
- large enterprise non-multinational
- SME domestic (Dutch) multinational
- large enterprise domestic (Dutch) multinational
- foreign multinational

The size of the enterprise group is used for the delineation of enterprises. An enterprise group with fewer than 250 employees is categorised as an SME. An enterprise with 200 employees that is the administrative unit of an enterprise group with 5 000 employees is categorised as a large enterprise [104].

A list of the last two types of enterprises has been compiled using survey data and tax data (domestic multinationals) and using IFATS (foreign multinationals).

Making the actual split is not easy because microdata and the macro (NA) data are different (due to several causes such as different concepts and sources), even when describing the same item, such as the production of the construction industry. These differences can be circumvented by keeping the macro data in their current state and splitting them using shares that are compiled using microdata. To account for the heterogeneity between types of firms, one should make as much use as possible of the breakdowns already present in the data (e.g. the split in Dutch national accounts between trade in goods [105] and services, for which microdata are also available).

103 An OECD expert group is currently compiling a handbook that describes this type of work, with practical guidance and best practices (source: https://www.oecd.org/sdd/na/OECD-Expert-Group-on-Extended-Supply-Use-Tables.htm).

104 Earlier MDL projects (e.g. by Statistics Netherlands (2016) and Statistics Denmark (2017)) have shown that this delineation makes quite a difference (Bartelsman, van Leeuwen, & Polder, 2016) (Statistics Denmark, 2017). Large parts of production are at enterprises with fewer than 250 employees but more than 250 employees in the enterprise group.

105 An important first step for the trade in goods data is to align the original data as much as possible with national accounts. The source statistics measure goods that cross the border, whereas national accounts measure goods that change ownership. The source statistics adapt their data before sending it to national accounts. The original dataset has been used. Where possible, other known adaptations by national accounts (e.g. in the source data) can also be used.

The prerequisites for this method are an IOT and, for each industry that is to be split, the shares of each type of enterprise in the industry for four key variables (production, value added, imports and exports) [106]. These shares are obtained by extensive MDL in the business statistics domain (e.g. international trade in goods and services with structural business statistics (SBS)).

Production and value added are taken from the SBS. Any data (at the level of type of enterprise) is imputed by calculating the median production by employee and the median value added by employee. If no information for a given type of enterprise is available in a given stratum, the median in the same industry of all enterprises is used. Industry-level totals are calculated by adding the totals of each enterprise type in each industry. The share of each enterprise type in production and value added by industry can then be calculated.

A whole range of GVC-related indicators can be constructed on the basis of the detailed IOT:

<Share of exports by type of enterprise, consisting of imports (direct plus indirect)><#22a>

<Share of exports by type of enterprise, consisting of direct imports><#22b>

<Share of exports by type of enterprise, consisting of indirect imports ><#22c>

In principle, only firm-level export data need to be used for this indicator (i.e. the link with NA is not necessary). However, a major drawback of using firm-level export data is that it only gives information on exporters. This might be misleading if the exporter is not the producing firm. The firm-level approach does not calculate value added at the firm due to indirect exports. It also does not calculate total domestic value added due to exports, because the amount of imports (direct and indirect) that an individual firm has used is not known.

The data gap is clear for this indirect part: it is not known what the domestic value chain looks like. Annex 3 describes a pilot to directly and indirectly quantify foreign inputs and value added due to exports; and describes three possible solutions in detail. First, one can use existing data. Some countries have extensive VAT data available for business-to-business transactions. In the extended ISGVC (see point 6.2.3), enterprises identified as not trading themselves but as in fact being part of a GVC. Second, one can devise new statistics on domestic TEC and STEC. One approach is for enterprises to report from the types of enterprises (industry, size and multinational status) from which they buy goods and services and whether these are domestically produced or not; and/or to which they sell their own goods and services. A second approach is to ask enterprises (e.g. in the SBS) for more detail about their inputs ('what are they?') and then link those inputs to industries. Third, one can use the wealth of detail in business statistics to disaggregate NA statistics that lack the detail necessary for policy questions (e.g. on SMEs). This is currently the only feasible option for most EU Member States, so we describe this approach in more detail.

It should nevertheless be noted that this approach is based on several assumptions. These are the assumptions that are generally related to input-output analysis and the assumptions that are related to the method of compilation in the current case. First, as regards the main general assumptions, the sectoral homogeneity assumption is that each input is supplied by one industry only. The proportionality assumption is that the quantity of inputs varies in exactly the same proportion as output. Second, as regards the assumptions in compilation, the current approach assumes that each enterprise in an industry has the same inputs and outputs, and that only the foreign-domestic-in-house proportions may vary. Current data (specially the output data) are relatively rich and can improve this. Miao and Fortanier (2018) identified three further assumptions and provide robustness checks (Miao & Fortanier, 2018). The first assumption is that there is no supplier preference; enterprises have no preference for a type of enterprise when buying from a given industry. The second assumption is that there is no use preference; each type of enterprise produces in the same proportion for domestic intermediate and final demand. The third assumption is that the imports and domestic purchases product-baskets do not change. This third assumption might be relaxed with current data or with new surveys about domestic purchases. However, the first two assumptions are harder to tackle because business-to-business data are required. VAT data might be available in some countries, but in other countries a new survey would have to be designed in which enterprises would not only indicate what they buy from which industry, but also in which proportion they buy them from (e.g. foreign multinationals, domestic multinationals and domestic non-multinationals).

106 The method was introduced in (Piacentini & Fortanier, 2015).

Currently, indirect exports are being calculated via the value chain and are therefore not based on (self-reported) survey results. The underlying data are in the extended IOT that was compiled in a pilot (see Annex 5) and the method to derive results is general input-output analysis (this is described in more detail in Annex 1.) Assuming the calculations based on the NA linkage are correct, initial results for manufacturing [107] (see Table 18) seem to suggest substantial under-reporting in Table 8 [108].

TABLE 18

Example of share of value added in NACE section C (manufacturing), by type of industry, 2016

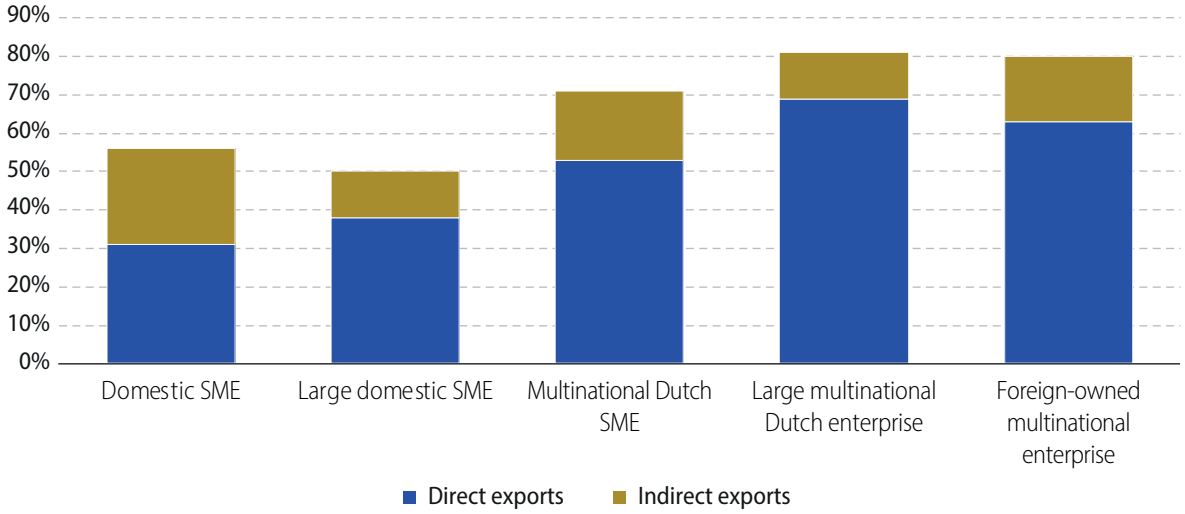
Type of firm	Direct exports	Indirect exports	Total exports
Domestic SME	31%	25%	56%
Large domestic SME	38%	12%	50%
Multinational Dutch SME	53%	18%	71%
Large multinational Dutch enterprise	69%	12%	80%
Foreign-owned multinational enterprise	63%	17%	79%

Source: Microdata linking project using globalisation statistics, CBS, Netherlands, 2020.

Overall, total value added due to exports is (not surprisingly) largest for MNEs (both domestic and foreign). SMEs are relatively more reliant on indirect exports in order to benefit from foreign demand. This is particularly the case for independent SMEs (i.e. those are not part of an MNE). These SMEs are, however, most probably still part of a GVC (one of the 'network modes' depicted in Figure 12).

FIGURE 16

Value added due to exports as share of total value added in manufacturing (%), 2016



Source: Microdata linking project using globalisation statistics, CBS, Netherlands, 2020.

107 Manufacturing is delineated as section C in NACE Rev 2.

108 For the sake of brevity, figures for each type of enterprise in the tables in this section are shown for only one particular sector. Figures for all sectors are included in Annex 5.

The extent to which an industry or a type of enterprise is dependent on foreign markets for inputs to produce for the domestic market can be calculated as imports needed as a proportion to final production for domestic use (i.e. only some foreign inputs are used in production processes). The split between direct and indirect imports (again via the value chain) shows whether the industry and/or type of enterprise is mainly importing itself or is more integrated into a domestic value chain by importing mostly indirectly.

<Value added by type of enterprise and activity (manufacturing/services) due to exports by type of enterprise and activity (manufacturing/services)><#26>

Table 19 presents results for another sector ('construction') [109]. Indirect importing has not been covered in the extended GVC survey, so we have no benchmark figures for this.

TABLE 19

Share of production for final domestic use consisting of direct, indirect and total imports in NACE section F (construction), by type of enterprise by industry, 2016

Type of firm	Direct exports	Indirect exports	Total exports
Domestic SME	11%	15%	26%
Large domestic SME	12%	16%	28%
Multinational Dutch SME	16%	16%	32%
Large multinational Dutch enterprise	17%	15%	32%
Foreign-owned multinational enterprise	29%	11%	40%

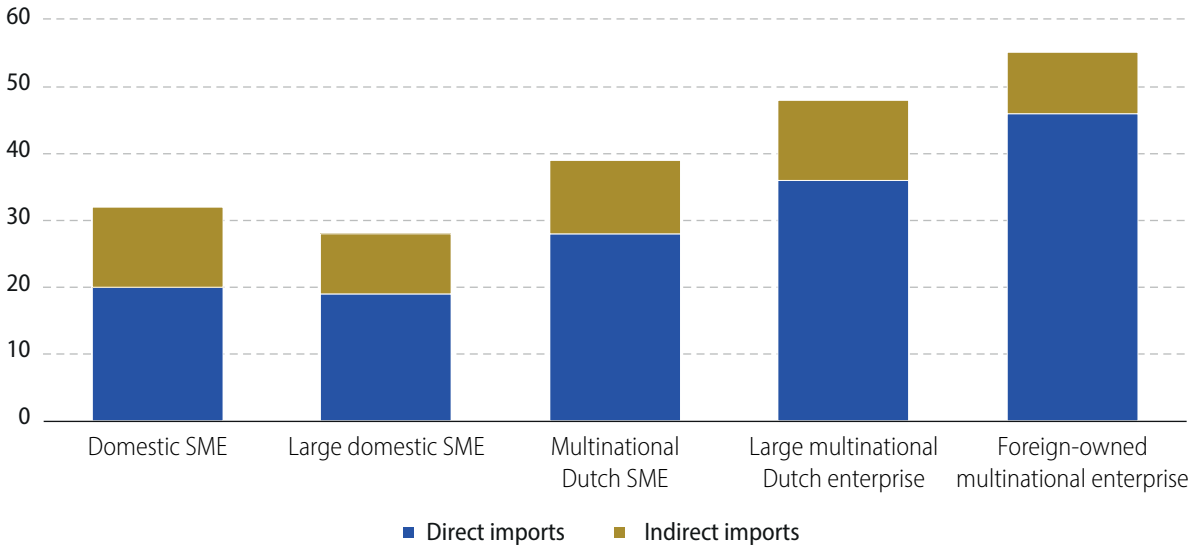
Source: Microdata linking project using globalisation statistics, CBS, Netherlands, 2020.

Overall, MNEs are more dependent on foreign markets not only for their sales, but also for their supply.

109 Construction is delineated as section F in NACE Rev. 2.

FIGURE 17

Imports embodied in final production for domestic use, as a share of production in manufacturing (%), 2016



Source: Microdata linking project using globalisation statistics, CBS, Netherlands, 2020.

<Share of value added, by type of enterprise, due to total exports (direct + indirect)><#28a>

<Share of value added, by type of enterprise, due to direct exports><#28b>

<Share of value added, by type of enterprise, due to indirect export><#28c>

<Share of imports of intermediate goods and services by source embodied in domestic final use of a producer, by type of enterprise><#27a>

<Share of imports of intermediate goods and services by source embodied in exports of a producer, type of enterprise) ><#27b>

Indicator 26 refers to the extent to which an industry or a type of enterprise is dependent on foreign markets for inputs to produce for foreign markets. This is also known as backward integration in GVCs. The numbers will be different from those for indicator 3 due to industry composition. SMEs that mainly produce for the domestic market might be in very different industries from the ones in which SMEs that mainly produce for foreign markets are. Their import patterns (indicator 27) might also be different.

An industry/type of enterprise might be integrated into a GVC due to its presence in a domestic value chain. It would produce for foreign or domestic markets, using imports that it obtained using this domestic value chain. Showing the links between the actual importers and the final users [110] provides insights into the domestic value chain and domestic interdependencies. So, whereas Figure 17 shows total imports embodied in final production for domestic use, Figure 18 shows the source of these imports (i.e. who imported the inputs). Indicator 27 also covers non-GVC trade [111].

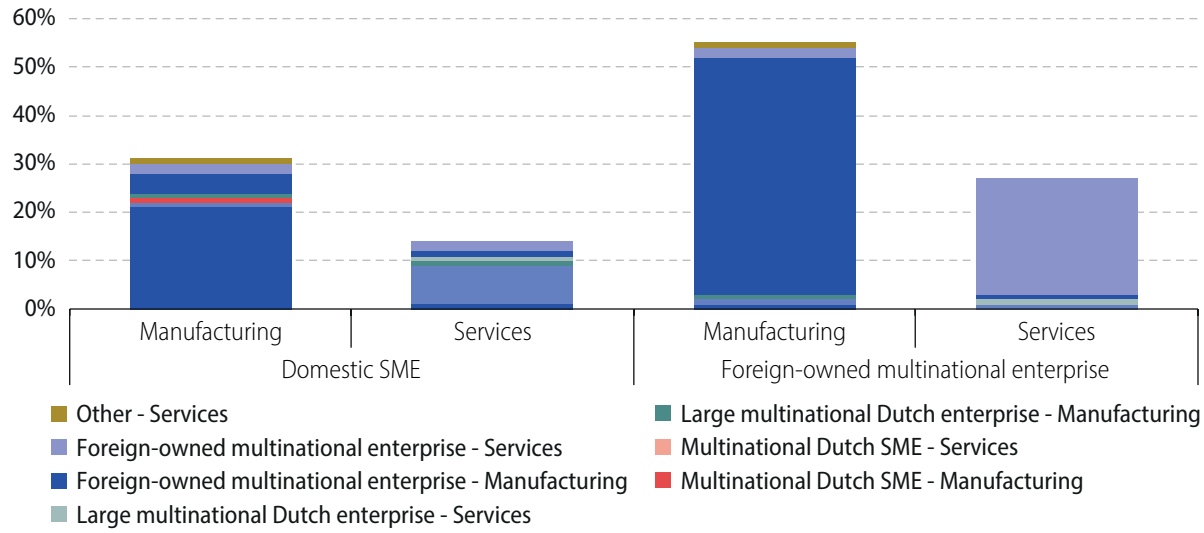
110 The 'final user' is defined as '[the] ultimate node in the value chain before exporting'.

111 The percentages do not add up to 100% but rather to the ratio of imports embodied in final production for domestic use divided by final production for domestic use. 'Manufacturing' includes not only the NACE-sector C: manufacturing per se, but also NACE-sector B: mining and quarrying. All other industries are grouped together as 'services'.

In general, imports coming indirectly via other types of firms are relatively small. Imports are mostly direct. However, imports by foreign-owned manufacturers accounted for 4% of the total value of final production for domestic use by SMEs in manufacturing that are not MNEs.

FIGURE 18

Imports for domestic use, by importer and final user [112]



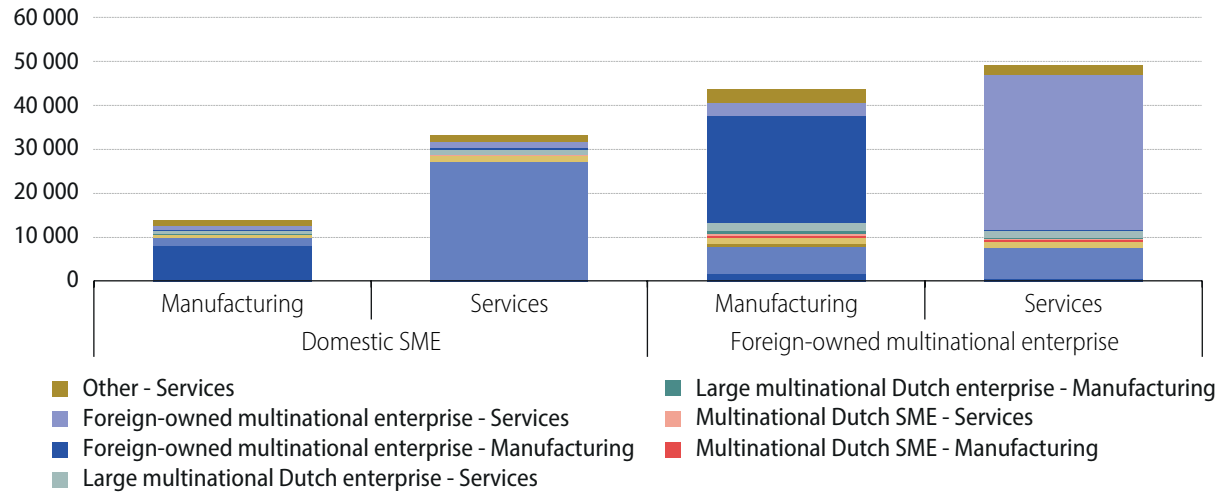
Source: Microdata linking project using globalisation statistics, CBS, Netherlands, 2020.

Similarly, the links between producers of value added and final users (the exporters) provide insights into the domestic value chain and domestic interdependencies (i.e. who is providing a channel to foreign markets for whom?). The indicator reveals a particular part of a firm's value chain, namely whether and to what extent part of the processing of intermediate inputs is outsourced abroad. In Figure 19, for instance, non-multinational SMEs have EUR 15.5 billion value added because they produce somewhere in the supply chain of foreign multinationals. Stated in terms of interdependencies, the trade-off is that these SMEs can reach foreign markets that might otherwise not have been accessible to them, while the multinationals can obtain goods and services via the SMEs that would be more expensive to obtain elsewhere (e.g. abroad). This shows the full-scale operation of a GVC (i.e. one of a relational, modular or market governance type; see Figure 12).

112 Manufacturing is delineated as section C in NACE Rev 2 whereas Services contain sections D-I plus M-N.

FIGURE 19

Value added embodied in exports, by producer and exporter, 2016 (millions of euro)



Source: Microdata linking project using globalisation statistics, CBS, Netherlands, 2020.

6.4. Improving international trade statistics

6.4.1. Harmonising the balancing of international trade in goods statistics

The EBS Regulation has significantly changed regulation of statistics on international trade in goods (Intrastat). The EU statistical offices can exchange microdata on domestic exports to EU countries. Exports of country A are the imports of country B, so the idea is that the reporting of imports of country B from country A can be reduced. The possibility of MDE is expected to open up opportunities to reduce trade asymmetries and to get a better understanding of intra-firm trade flows, at least within the EU (see chapter 6 of the FIGARO manual for details on dealing with trade asymmetries) [113].

In addition, data from customs declarations for extra-EU transactions can be exchanged between the statistical authorities of the Member States within the Custom Data Exchange [114].

Potential applications are:

- exchange of microdata to determine imports/exports from/to the EU Member States;
- use of customs declaration data to identify quasi-transit trade and centralised clearance.

These developments do not directly lead to new indicators or ways of measuring GVCs, but they do improve the quality of several indicators based on trade in goods.

6.4.2. Distinguishing re-exports from domestic exports and imports for re-exports from imports for domestic use

A sizeable part of imports is directly exported. For example, a Dutch trader imports laptops from China via the port of Rotterdam and then sells them to the EU hinterland. For Belgium and the Netherlands, with the ports of Antwerp and Rotterdam, about half of their exports of goods consist of these re-exports (Duprez & Dresse, 2013). Duprez and Dresse also show that the share of re-exports in total exports of goods is 15-20% in several EU Member States. It is useful to know the amount of imported goods that is

113 https://ec.europa.eu/eurostat/web/products-statistical-working-papers/-/ks-tc-19-002

114 National statistical authorities have been exchanging these data via the so-called Customs Data Exchange (CDE) since 2022. Two types of data are exchanged: centralised clearance data and quasi-exports. Customs authorities should in future exchange the centralised clearance data, but NSOs will in the meantime exchange microdata. The reporting obligation for centralised clearance has also shifted since 2022 from the Member State where the customs declaration took place (i.e. the CDE-sending Member State) to the Member State where the goods are physically located (i.e. the CDE-receiving Member State). This has been postponed for quasi-exports. It is not yet clear when quasi-imports will be included in CDE.

actually used in the domestic production and consumption process, and the amount of exported goods that are produced domestically. Furthermore, a split by product and country is desirable because the true trade connection with supplying and buying countries then becomes visible. This is feasible in the EU's statistical system.

Roos described how Statistics Netherlands estimates re-exports by product and country (Roos, 2006). The main ideas are the following. First, firms have to report type of trade in the Intrastat survey and customs declarations. Re-exports are one of the types of trade, but it is known that firms often assign another type of trade to re-exports. However, if they so assign re-exports, this is supposed to be accurate. Second, some products (e.g. tropical fruits) are not or are hardly produced in the domestic economy. These are supposed to be re-exports. Third, if a trader imports and exports much of the same product at detailed level (Roos uses 2 * exports < imports), then these are supposed to be re-exports. Roos found that his results were broadly consistent with those of national accounts. At Statistics Netherlands, the method has been slightly revised with the introduction of the new 'country of origin' item into the survey on intra-EU exports. Nowadays, it is checked whether the country of origin is not 'NL' and, if so, the export flow is marked as a re-export. If no country of origin is available, the method described in this present point (6.4.2) is used.

Lemmers and Wong have described how Statistics Netherlands estimates imports for re-exports by product and country (Lemmers & Wong, 2019). Their main idea is as follows. Consider an enterprise which re-exports a given product. Using information about the trade and transport margin on products [115] they estimate how many imports are needed for these re-exports. They then assume that the imports of that particular enterprise are used for re-exports in the same proportion. This assumption is strong but weaker than a proportionality assumption based on total imports at firm level.

Eurostat's FIGARO manual (chapter 6) explains the use of the QDR methodology to resolve trade asymmetries. This approach integrates national accounts and trade in goods data, categorising them into quasi-transit trade (Q), domestic trade (D), and re-exports (R). As an essential part of the FIGARO project, the QDR methodology provides a balanced perspective on exports originating from a reference country. For trade in goods, the key steps of this methodology involve recoding and combining trade data, imputing non-allocated trade, resolving trade asymmetries through a balancing process, and breaking down these balanced trade flows into quasi-transit trade, domestic trade, and re-exports.

6.4.3. Distinguishing intermediate trade from final-use trade for both goods and services

GVC trade is driven by trade in intermediate inputs. FIGARO uses import use tables to estimate exports and imports for intermediate and final use (chapter 11 of the FIGARO manual) [116]. For manufacturing, the number of intermediate input-producers can be determined (e.g. by subindustry) and the share of exports they account for as a proportion of the total exports of their industry [117]. One could also single out the exports of intermediate products of these firms, which are related to their total production and production of intermediate inputs. The idea here is to get an idea of the own production of intermediate products by comparison with exports, which may include re-exports or purchases from domestic parties.

<Number of industrial intermediate inputs producers exporting, and corresponding share in total trade volume><#23a>

<Exports of intermediate products of firms, related to their total production and production of intermediate inputs ><#23b>

The existing TEC/STEC tables also do not distinguish between different types of products. Isolating the intermediate inputs makes it possible to focus on the part of trade that matters for the GVC. In addition, analysis by foreign ownership and multinationals reveals the differential role of foreign and domestic MNEs (as well as SMEs) in GVC trade. This would shed new light on the role of different types of enterprises in the GVC.

115 Lemmers and Wong use Dutch National Accounts but other sources, such as expert information, are also possible.

116 https://ec.europa.eu/eurostat/web/products-statistical-working-papers/-/ks-tc-19-002

117 Data sources are PRODCOM and ITGS. This does require the combination of trade (custom) data and enterprise data (business statistics) at a detailed level. This is already current practice in some NSOs that have an integrated data infrastructure. However, not every NSO currently has such an integrated system in place.

<Refinement TEC/STEC tables, e.g. trade in intermediate inputs by foreign ownership and or MNE-status><#3>

The indicator makes it possible to describe which groups of firms are more or less involved in the trade in products that are specifically relevant for the measurement of GVC trade. In nature, they are just the same as the existing TEC/STEC indicators, but specifically for trade flows related to GVC trade (see Annex 3).

Using data at enterprise or enterprise group level (aggregated, for example, by NACE section, by partner country (for imports and/or exports) or by type of product imported/exported [118]), one can also derive the following indicators:

<Import value of goods divided by export value of goods><22a>.

<Import value of goods and services divided by export value of goods and services><22b>

<Import value of intermediate goods and services divided by export value of goods and services><22c>

Indicators #22a to #22c would provide a first approximation to determine the ratio of imports to exports at the enterprise level. However, there is some information missing. Firstly, we do not know at the firm-level what imported inputs are obtained from wholesalers and other parts of the supply chain (indirect imports). In addition, we do not know what part of the imports is used for the production of exports and what part for the domestic market (the product portfolio could differ between exports and the domestic market). Nevertheless, focusing on direct imports and assuming that imports are used in a similar way for production across markets can be a plausible approximation (proxy) for an indicator of firm-level value chain integration (e.g. an imbalance between imports and exports).

This missing information can be obtained in several ways. By compiling a 'domestic TEC/STEC', one can create estimates for the suppliers (and the imports they use) of the exporters (i.e. a further breakdown in trade figures in product classification between final and intermediate goods).

One approach is for enterprises to report the types of enterprises (industry, size and multinational status) from which they buy goods and services, and whether these are domestically produced or not; and/or to whom they sell their own goods and services. The country of origin that is currently available in microdata might give a good indication of whether or not the goods are being produced in the exporting Member State and/or to whom the goods and services are being sold.

Another approach is to ask enterprises (for example, in the SBS) more details about their domestic inputs ('what are they?') and then link those inputs to industries [119]. Although it would increase the administrative burden for enterprises, this is information that enterprises can easily provide. It would then be straightforward to match product details to industries. This input information would show more detailed dependencies and the product detail could be linked to specific policy issues. This would also further strengthen the supply side of national accounts. The information is surveyed at enterprise level, so it is possible to use an MDL approach to link it to different types of enterprises.

6.4.4. Using VAT information of exporters and importers to identify intra-group trade [120]

Intra-group trade is a sizeable part of total trade, but there is no information on its size, products, industries or the countries involved. However, this information is relevant to the way economies are tied together economically. Identifying intra-group trade is a major challenge. What is essentially needed is a database with nearly complete business-to-business transactions, in the domestic economy and for international trade. Only a few countries (such as Belgium) currently maintain such a database for

118 The breakdowns cannot obviously be too detailed.

119 See Annex 5 for more detail.

120 For example, Statistics Netherlands receives VAT data on imports and exports within the EU. These show which VAT number is trading with which VAT number. There is a database for public use that contains the corresponding firms (e.g. their name and address). However, this information can only be used to check whether the firm is legitimate or not. It is not permitted to use the information for statistical purposes, even though this would make it possible to make great progress in mapping intra-firm trade within the EU.

domestic trade (see point 6.3.1) [121]. The issue is that even collecting EBS information on foreign trading partners is not planned (see Section 5.3) [122].

Various data sources provide pieces of the puzzle, but no data source can provide the whole picture. A combination of the EGR and intra-Community VAT trade data (ICP) seems to be the best way of mapping cross-border intra-concern trade of enterprises within the EU (Cremers, Mounir, & Polder, forthcoming). ICP has VAT data on intra-EU sales. In cases when the EGR has VAT-ID numbers, indicator #10 can be derived (already discussed in point 6.2.2).

It will be necessary to take some more steps in order to get a complete picture (for example, via web-scraping and/or obtaining other external sources).

Depending on the availability of linkages between firm and VAT data, trade at the national level in value added can be described at firm level. For instance, using the business-to-business transaction database of the National Bank of Belgium (which records VAT-ID to VAT-ID yearly transactions between all Belgian enterprises in the private non-financial sector), Bems and Kikkawa were able to calculate trade in value added in detail (Bems & Kikkawa, 2019). Using comprehensive firm-level data on both domestic and international trade in value added, they found that the traditional sectoral aggregation leads to substantial overestimates of trade in value added – and thus to underestimates of the import content of gross exports).

<Firm-level export value in value added><24>.

<Firm-level product-share weighted backward and forward integration ><25>

6.4.5. Global production arrangements

Research during the first round of IGA grants is providing country-specific examples of how to deal with global production arrangements, albeit mainly by applying the UNECE Guide recommendations in order to correctly implement the principles of economic ownership in national accounts (i.e. how to improve BoP-measurements) [123]. The work has included research into the use of VAT data for ITSS (Norway), classification of factoryless goods producers (FGPs) [124] and special-purpose entities (SPEs) [125], and exploring Nature of Transaction (NoT) codes in the ITGS (Netherlands, Romania).

The following indicators can be defined on the basis of the recommendations from the last two studies:

<Outward processing (Nature of transaction code 4), as % of total export><#5a>

<Inward processing (Nature of transaction code 5), as % of total import><#5b>

These indicators identify the part of trade in goods that is relates to goods sent abroad for processing. They highlight the importance of this type of global production arrangement in overall trade flows.

6.5. Extending existing SNA accounts

6.5.1. Refining national supply-use tables (SUTs) and input-output tables (IOTs)

New information about GVCs has been developed in the realm of national accounts over the last decade. National SUTs and/or national IOTs have been combined with trade data to create multi-region input-output tables (MRIOs). These show a number of things, including relations between an industry A in country B with industry C in country D, or the amount that industry E in country F

121 In the absence of such extensive databases, these networks of business-to-business transactions could still be estimated, however. Statistics Netherlands has constructed such networks, using more aggregated data, parameters from other countries (e.g. the number of suppliers/clients of a firm) and validating these estimates with real data that were available at firm-firm level (Hooijmaaijers & Buiten, 2019). This real data could, for instance, be partially provided by responses to additional questions in the extended GVC survey (see point 6.1.2, under 'indirect trade')

122 In MDE, the receiving Member State receives information about the importer, but not about the exporter in the sending Member State.

123 The IGA-pilots have another perspective (i.e. how to improve BoP measurements) and have not been continued.

124 See the end of point 6.2.1.

125 See Section 2.3 for a definition of SPE.

supplies for final consumption in country G. Some examples are TiVA (Trade in Value Added), WIOD (World Input-Output Database) and FIGARO (Full International and Global Accounts for Research in input-Output analysis) (OECD and WTO OMC, 2012) (Timmer, Dietzenbacher, Los, Stehrer, & De Vries, 2015) (Remond-Tiedrez & Rueda-Cantuche, 2019). These MRIOs can be used to map out GVCs using input-output analysis. For example, it is possible to derive how much value added is generated in industry A in country B due to final demand in country C.

MRIOs are at industry level, but many policies are aimed at types of enterprises such as SMEs, multinationals, family businesses or enterprises led by female entrepreneurs. MRIOs are insufficient to describe the role of such enterprises in GVCs because the usual input-output analysis assumes that an industry is homogeneous. However, an SME in a given industry is far less likely to engage substantially in international trade than a multinational. It is therefore necessary to distinguish different types of enterprises in an industry – not only to improve existing estimates, but also to get a grasp on relations between different types of enterprises. This goal can only be achieved using different types of business statistics, such as trade statistics and structural business statistics (SBS). The business statistics compiled by NSIs using microdata contain the granularity that the NA data lack. Business statistics can explain the substantial heterogeneity between enterprises in an industry. They can be used to split industries (e.g. manufacturing of clothes) in SUTs and/or IOTs by type of firm (e.g. manufacturing of clothes by SMEs).

The OECD terms of reference for the OECD Expert Group on Extended Supply and Use Tables have explained why this is necessary and proposed a work plan for achieving this goal (OECD Expert Group on Extended Supply-Use Tables, 2015) (OECD, 2021); see also (United Nations, 2018). The OECD has devised a method for splitting national IOTs into extended national IOTs and applied it (Piacentini & Fortanier, 2015) (Miao & Fortanier, 2018) (Fortanier, Miao, Kolk, & Pisani, 2020). This has provided valuable insights into the role of, for example, SMEs and MNEs in the national value chain (e.g. the channels that SMEs use to export). It turns out that a large proportion of their value added embodied in export is not in their own exports but in the exports of large enterprises that they supply with goods and services.

In Pilot 3 (see Annex 5), we used an MDL approach to create extended IOTs, using as much of the granularity of enterprise statistics as possible. In these IOTs, the industries are generally split into Dutch-owned SMEs, Dutch-owned large enterprises, Dutch multinationals and foreign multinationals. This makes it possible to gauge the direct and indirect involvement of each type of enterprise in GVCs, which is not possible using only enterprise data. It is possible to use only NA data to do this by industry but not by type of enterprise. With these extended IOTS. one can derive the earlier proposed indicators 26 to 29 (see Annex 6).

The following are two examples of how these indicators yield new information on how GVCs actually work.

- The import of intermediate goods and services by domestic SMEs in manufacturing that are embodied in the exports of Dutch multinationals in manufacturing. This provides additional insights into the backward linkages of Dutch multinationals. What is the domestic source of these imports?
- The value added by domestic SMEs in services that is embodied in exports by foreign MNEs in manufacturing. This provides information on the channels that SMEs use to reach foreign markets.

Several extensions are possible.

- One can add country details from ITGS and ITSS. This approach does not show the complete value chain; how goods and services from SMEs have gone from one country to another; or whether SMEs have reached distant emerging high-growth markets, either by themselves (direct exports) or via the exports of others (indirect exports). The above-mentioned methods were therefore extended further, first by having an extended IOT in the country in question and the rest of the MRIO with industries only (Statistics Denmark, 2017) (Statistics Finland and OECD, 2020), and later to an MRIO fully split by ownership (Cadestin, et al., 2018).
- One can use data at enterprise level to construct extended SUTs to describe other variables, such as energy consumption and carbon emissions ((Xia, Fan, & Yang, 2015); employment embodied in exports (Statistics Finland and OECD, 2020); and primary income related to final expenditure (de Vries, Jiang, Lemmers, & Wei, 2021).

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Annex 1. Overview of indicators

This document sets out a list of potential indicators that highlight different aspects of GVCs. They can be organised according to the following categorisation:

- trade
- processing trade
- MNE and organisational structure
- affiliate trade
- sourcing and business functions
- firm-level GVC integration
- GVC integration by type of firm
- indirect trade
- network structure

Such a categorisation is not unique and there are many other ways to organise the indicator list. Moreover, the categories overlap. The assignment of the individual indicators is not necessarily exclusive.

This point explains the labels that are used, discusses the relevant indicators (including potential sources) and provides details on the calculation.

Trade behaviour

1. Export and import of goods and services by end-use category of product

This indicator breaks down total exports and imports into end-use categories according to the Broad Economic Categories (BEC) product classification. End-use categories relevant to GVC measurement include primary intermediate goods; generic processed intermediate goods and services; specific processed intermediate goods and services; final consumption goods and services. There are eight other product categories (see Annex 2).

Indicator: *(exports or imports) * (end-use category), as percentage of total exports or imports*.

By . . . category

Source: ITGS and ITSS combined with BEC Rev. 5 classification.

Links and references

- https://unstats.un.org/unsd/trade/classifications/Manual%20of%20the%20Fifth%20Revision%20of%20the%20BEC%20(Unedited).pdf
- https://ec.europa.eu/eurostat/web/international-trade-in-goods
- https://ec.europa.eu/eurostat/statistics-explained/index.php?title=International_Trade_in_Services_statistics_-_background

2. Export and import by firm characteristics (TEC and STEC)

TEC and STEC tables contain export and import figures broken down by various enterprise characteristics.

Examples of indicators (selection):

a) *Export or import by type of trader (one-way/two-way) (% of total export or import)*

The indicator describes the share of trade that can be attributed to firms that are likely to be involved in GVC trade, as measured by the type of trader enterprise.

b) *Export or import by foreign-owned firms (% of total export or import)*

Type of ownership describes the heterogeneity of enterprises according to their global status. Dividing enterprises into domestically and foreign-controlled enterprises has specific interest because of the important role of foreign affiliates. Furthermore, distinguishing domestically-controlled enterprises with own affiliates abroad from all domestically-controlled enterprises makes it possible to identify the total population of MNEs.

c) *Trade by export intensity*

This indicator describes the heterogeneity in firm contributions to trade. Export intensity categorises enterprises according to the importance of foreign markets in their sales. Recent developments in the area of GVCs have raised a question on the heterogeneity of enterprises. It has been traditionally assumed that enterprises in the same activity sector are homogenous in terms of production and trade. This assumption is questionable, especially in the globalised economy and given differences in involvement and position in GVCs.

Indicators 2a, 2b and 2c are currently available for goods and 2b is available for services (on experimental basis). A possible extension could be adding the trade by multinational status of enterprises:

d) *Trade by multinational status*

Indicator 2d is not currently covered in either TEC or STEC.

Source: Eurostat TEC and STEC tables.

Links and references

- https://ec.europa.eu/eurostat/cache/metadata/en/ext_tec_sims.htm
- https://ec.europa.eu/eurostat/web/international-trade-in-services/information-data#Concepts%20and%20definitions

3. Trade in intermediate inputs by firm characteristics

This group of indicators is similar to indicator 2. However, it focuses on the product categories suggested in indicator 1. Combining indicators 1 and 2 makes it possible to describe which groups of firms are more or less involved in the trade in products that are particularly relevant for the measurement of GVC trade.

Indicator: *(exports or imports) * (end-use category) * (firm type), as percentage of total exports or imports.*

Sources: ITGS/ITSS combined with BEC Rev 5 classification and TEC/STEC.

Links and references

- https://unstats.un.org/unsd/trade/classifications/Manual%20of%20the%20Fifth%20Revision%20of%20the%20BEC%20(Unedited).pdf
- https://ec.europa.eu/eurostat/web/international-trade-in-goods
- https://ec.europa.eu/eurostat/statistics-explained/index.php?title=International_Trade_in_Services_statistics_-_background

4. Contributions to change in total trade by type of enterprise

This indicator involves decompositions of change in total trade into contributions by type of enterprises (e.g. by ownership, multinational status and firm size). It complements other TEC/STEC indicators, in the sense that other indicators quantify the differential extent to which specific types of firms are engaged in trade or GVCs, whereas this decomposition would indicate how this translates into overall changes in total trade value and volumes.

Indicator: *(change in exports or imports) * (total or by end-use category) * (firm type), as percentage of total base year exports or imports.*

Sources: ITGS, ITSS, FATS, the EGR and business registers.

Links and references

- https://opendata.cbs.nl/statline/#/CBS/en/dataset/84748ENG/table?dl=7ABB5
- https://opendata.cbs.nl/statline/#/CBS/en/dataset/84747ENG/table?dl=7ABB6
- https://opendata.cbs.nl/statline/#/CBS/en/dataset/84746ENG/table?dl=7ABB7

Processing trade

5. Inward and outward processing

This indicator singles out the part of trade in goods that relates to goods sent abroad for processing. It highlights the importance of this type of global production arrangement as a proportion of the total of trade flows.

Indicators:

a) *outward processing (nature of transaction code 4), as % of total exports*
b) *inward processing (nature of transaction code 5), as % of total imports*

Source: ITGS.

Links and references

- Eurostat (2022) European business statistics compilers' manual for international trade in goods statistics - detailed data. 2022 edition. Table 8
- Eurostat (2017) 3rd meeting of the task force on integrated global accounts and global production (IGA TF). 'Statistics on goods under merchanting and goods sent abroad for processing'. Luxembourg, Directorate C, Unit C5.

6. Export and import of manufacturing services

Manufacturing services cover processing and assembly of goods by firms that are not the economic owners of these goods (i.e. the service flow related to inward (import) and outward processing (export) as a consequence of goods sent abroad for processing). The indicator captures the extent to which such production arrangements are important in the total of trade flows. Conceptually, this indicator is equal to indicator #5.

Indicator: *exports or imports of manufacturing services (EBOPS category SA) as a percentage of total exports or imports.*

Source: ITSS.

Links and references

- https://ec.europa.eu/eurostat/statistics-explained/index.php?title=International_Trade_in_Services_statistics_-_background
- UNECE (2015) Guide to Measuring Global Production. Geneva: UNECE

7. Role of firm in processing

This indicator quantifies the number and/or share of firms that are involved in processing trade, as either a principal (i.e. economic owner of the goods) or a processor.

Indicators:

a) *share of enterprises sending goods abroad for processing to a processing firm inside the group;*
b) *share of enterprises sending goods abroad for processing to a processing firm outside the group;*
c) *share of enterprises doing manufacturing, assembly or processing work for foreign enterprise within the enterprise group;*
d) *share of enterprises doing manufacturing, assembly or processing work for foreign enterprise outside the enterprise group .*

As regards the calculation of shares, there are a variety of options for the denominator. One could calculate the indicator not only as a share of all enterprises in the economy, but also as a share of all enterprises belonging to an international enterprise group. See Annex 3 for a quantitative description of the results for the Netherlands.

Source: GVC survey (new questions).

Links and references

- https://ec.europa.eu/eurostat/web/globalisation-businesses/information-data#Available%20data
- UNECE (2015) Guide to Measuring Global Production. Geneva: UNECE

8. Production under subcontracted operations

This indicator describes the extent of international sourcing of production activities by firms in the manufacturing sector. It builds on the PRODCOM survey for information on production under subcontracted operations. It is recommended to extend this information to include (i) a distinction between domestic and foreign subcontractors, and (ii) subcontracting as a consequence of the relocation of production activities.

Indicators:

a) *production under subcontracted operations (domestic versus foreign subcontractors)*
b) *production under subcontracted operations related to reallocation of production abroad*

Source: PRODCOM.

Links and references

- https://ec.europa.eu/eurostat/web/prodcom

MNE and organisational structure

9. Economic significance of foreign affiliates in the domestic economy

These indicators identify the part of various economic variables that can be attributed to affiliates of foreign firms. They measure the importance of foreign MNEs, which are important players in GVCs.

Indicators:

a) *number of foreign affiliates (part of foreign multinationals), by region and origin country*
b) *output: turnover, production and value added*
c) *intermediate inputs and goods and services purchased for resale*
d) *investment*
e) *personnel cost*
f) *R&D expenditures*

These indicators can be broken down by the country of the ultimate controlling institutional unit (UCI).

Source: IFATS.

Links and references

- Eurostat (2012) Foreign AffiliaTes Statistics (FATS) Recommendations Manual. 2012 edition.
- https://ec.europa.eu/eurostat/web/statistical-business-registers/eurogroups-register

10. Economic significance of foreign affiliates abroad

These indicators quantify the size of foreign affiliates controlled by domestic firms but resident in other economies. One of the modes of supply of economic activities abroad is 'commercial presence' by setting up foreign affiliates in the territory of another country, but firms can also organise production across border. The indicators measure how much national firms depend on foreign affiliates for their sales, production or other activities.

Indicators:

a) *number of enterprises with foreign affiliates (domestic multinationals)*
b) *total number of foreign affiliates of domestic enterprises*
c) *turnover*
d) *number of employees*
e) *value added at factor costs*
f) *gross investment in tangible goods*
g) *personnel costs*

Indicator 10a is not currently collected in OFATS. Indicators 8e to 8g are currently voluntary. Data before 2022 only refer to extra-EU affiliates.

These indicators can be broken down by host country.

Source: OFATS and EGR.

Links and references

- Eurostat (2012) Foreign AffiliaTes Statistics (FATS) Recommendations Manual. 2012 edition.
- https://ec.europa.eu/eurostat/web/statistical-business-registers/eurogroups-register

11. Economic significance of multinationals

This indicator gives the number and economic significance of multinationals active in the domestic economy. It brings together indicators 9 and 10, breaking down the firm population by multinational status (part of domestic or foreign multinational) rather than foreign ownership.

Indicators: *see under 10 and 11.*

Source: EGR and IFATS/OFATS.

Links and references

- https://www.cbs.nl/nl-nl/maatwerk/2018/41/multinationals-en-niet-multinationals-2010-2016

Affiliate trade

12. Intra-EU affiliate trade

This indicator quantifies the share of affiliate trade in total intra-EU trade. This describes the extent of trade due to the international organisation of production internal to multinationals ('international insourcing'). It combines information on the group structure in the EGR with information on trade flows between firm entities. Provided that firm entities can be identified by a common identifier (e.g. the VAT number), the value of trade flows between entities within the same group can be aggregated.

A further breakdown can be provided by type of flow (e.g. by end-use category) and firm characteristics (e.g. by industry and firm size).

With additional information on the population of extra-EU group linkages and possibilities of linking extra-EU firm-to-firm trade data (currently unavailable), this indicator can be extended to cover extra-EU affiliate trade as well.

Indicator: *sum of (respectively) imports or exports within enterprise group, as a share of total intra-EU imports or exports.*

Source: EGR combined with VAT declaration with respect to intra-EU trade.

Links and references

- Eurostat (2021) National requirements for the Intrastat system. 2021 edition
- https://ec.europa.eu/eurostat/web/statistical-business-registers/eurogroups-register

13. Firms engaged in affiliate trade (share of enterprises)

Affiliate trade is an important aspect of globalisation. In an ideal world, we would have information on the incidence and size of affiliate trade at the enterprise level, providing indicators like the share of affiliate trade in total trade and the number of enterprises engaged in affiliate trade. This is difficult to achieve in practice, however. We have as a

first step added some questions to the GVC survey. The operationalised indicator from new survey data quantifies the share of firms that are significantly engaged in affiliate trade, and to what extent.

Indicators:

Share of enterprises

a) *exporting goods predominantly within the international enterprise group*
a) *exporting services predominantly within the international enterprise group*
b) *exporting goods and services the exclusively international enterprise group*
c) *importing goods predominantly from the international enterprise group*
d) *importing services predominantly from the international enterprise group*

Depending on the use of the indicators, it might be logical to calculate shares based on different denominators. To get a general picture of the incidence of intra-group trade, it might be desirable to include all enterprises in the denominator. For other applications, however, it might be more informative to use the number of exporting or importing enterprises in the denominator, possibly broken down according to whether or not the enterprises is part of an international group.

14. Value of goods and services in affiliate trade

We can also construct some additional quantitative indicators from the qualitative questions that have been newly added to the questionnaire.

Indicators:

Value of

a) *goods exported by enterprises indicating that they export goods predominantly to affiliates*
b) *services exported by enterprises indicating that they export services predominantly to affiliates*
c) *goods imported by enterprises indicating that they import goods predominantly from affiliates*
d) *services imported by enterprises indicating that they import goods predominantly from affiliates*
e) *goods exported by enterprises indicating that they export goods and services exclusively to affiliates*
f) *services exported by enterprises indicating that they export goods and services exclusively to affiliates*

Source: GVC survey (experimental questions)

Links and references

- See Annex 3

Sourcing and business functions

See Annex 4 for a description of a pilot study that includes the derivation of business-function employment and valuation indicators from the Labour Force Survey and wage data.

15. Average full-time wages per business function, broken down by economic activity

In the absence of value added information or labour costs per business function, this indicator stands in for the economic value of different business functions, broken down by economic activity. Several meaningful indicators can be calculated using the available data (a combination of the Labour Force Survey, information on wage payments and an ISCO-business-function correspondence list).

Indicators:

a) *annual wages earned, broken down by business function and economic activity*
b) *average full-time wage of workers broken down by business function and economic activity*

In (a) we can sketch the economic importance of business functions for the economy as a whole. In (b) we can determine whether workers in the respect business function-NACE breakdown earn relatively high or low wages. Based on the latter, we can ultimately identify whether or not highly-valued business functions are sourced abroad (see indicator 16).

Source: Labour Force Survey (LFS) and the Employer Insurance Agency (EIA) [126].

Links and references

- Eurostat. European Business Statistics Manual. Dynamic edition
- Eurostat's ISCO-BF correspondence table (April 2019 version)

126 In Dutch: Uitvoeringsinstituut Werknemersverzekeringen (UWV).

16. Educational attainment per business function and economic activity

By combining individual-level data from the LFS with the ISCO-business-function correspondence table, this indicator gives a reflection of the required skill (proxy: level of educational attainment) per business functions, broken down by economic activity.

Indicator: *high-, medium- or low-skilled workers as a share of total workers, broken down by business function and economic activity.*

Source: LFS

Links and references

- Eurostat. European Business Statistics Manual. Dynamic edition
- Eurostat's ISCO-BF correspondence table (April-2019 version)

17. Value of outsourced business functions

This indicator can be considered as an application of the calculations done for indicator 12. From indicator 12b, we can assign a monetary value to a business function and, with some cut-off values, determine whether a business function is 'high-value'. This leads to indicators 15a and 15b. Combining indicator 12b with aggregate information from the GVC survey on (highly educated) jobs lost per business function and economic activity leads to indicator 15c.

Indicators:

a) *the number of high-(medium-/low-)valued business functions sourced abroad as a percentage of all high-(medium-/low-)valued business functions*
b) *the number of high-(medium-/low-)valued business functions sourced abroad as a percentage of all sourced business functions*
c) *the estimated wage bill of outsourced business functions*

Source: LFS, GVC survey and EIA data

Links and references

- Eurostat. European Business Statistics Manual. Dynamic edition
- Eurostat's ISCO-BF correspondence table (April-2019 version)

Indirect trade

18. Firms trading through wholesalers

When analysing trade behaviour, enterprises are often categorised as one of the following: 'exporter', 'importer', 'two-way trader' and 'non-trader' (indicator 21). Given that a non-trader can still use products from foreign markets (e.g. through imports and exports through wholesale), the following indicators might provide a better picture of the number of enterprises that play an indirect role in GVCs.

Indicators:

a) *share of enterprises trading through wholesalers*
b) *share of enterprises trading exclusively through wholesalers*
c) *share of enterprises highly dependent on indirect imports*
d) *share of enterprises highly dependent on indirect exports*

In indicator (a) the number of enterprises trading through wholesale can be divided by the total population of enterprises, whereas in indicator (b) it might be more interesting to use the total number of enterprises trading through wholesalers as the denominator. Indicators (c) and (d) show how many enterprises are heavily dependent on wholesale for their sales or exports and for their imports. Here, it might again be interesting to put the total number of enterprises in the denominator.

Source: new questions in the GVC survey, ITGS (for 18b, to identify non-traders)

19. Indirect exports and imports

Having identifiable intra-country transactions between enterprises, one could – in combination with ITGS – calculate indicators 17a and 17b in order to get an idea of the economic importance of indirect exports, either through wholesalers or through the supply of intermediate products to exporting firms. Indicator 19c can be calculated at the enterprise level from the available data from the SBS, new GVC survey questions and the ITGS (to identify non-traders).

Indicators:

a) *share of exports through wholesalers or other exporting firms*
b) *share of imports through wholesalers or other importing firms*
c) *share of value added due to indirect exports of goods through wholesalers*

Source: new questions in the GVC survey, ITGS and SBS.

Links and references

- CBS (2019). Internationaliseringsmonitor 2019-III. Groothandel [Internationalisation monitor 2019-III. Wholesale]. The Hague: CBS (Ch.5., pp. 93-118). Indirect trade calculations based on a method developed in: Wong, K. F., Jaarsma, M. & Voncken, R. (2019).

20. Composition of exports, by type enterprise

The indicator shows the amount of imports that each type of enterprise uses in its exports. This measures the backward integration in GVCs of each type of enterprise. These imports are split into direct imports (by the exporter itself) and indirect imports (imports by other enterprises that arrive at the exporter via the value chain). A further breakdown could be made across industries (for example, imports embodied in exports of SMEs in metal manufacturing).

Indicators:

Share of exports by type of enterprise, consisting of:

a) *imports (total of direct and indirect)*
b) *direct imports*
c) *indirect imports*

Source: an extended IOT. In pilot #3, this was compiled using the existing IOT, the GBR (to assign industry and type of enterprise to enterprises), the SBS, and ITGS and ITSS (see Annex 5 for a detailed description).

Links and references

- terms of reference extended supply and use tables
- firm heterogeneity and trade in value added

Firm-level GVC integration

21. Two-way traders

Firms that simultaneously import and export are likely to be involved in GVCs, either through multinational activity or through sourcing activities (Antràs & Chor , 2023). It is therefore useful to distinguish such traders in trade statistics. The indicators show the share of firms engaged in two-way trading and the share of trade they account for (the latter being already part of TEC/STEC information).

One possible further improvement could be to distinguish more detailed categories of two-way traders according to the matrix heavy/light vs exporting/importing; the type of products according to BEC (#1); or, for instance, multinational status (two-way trading MNEs are the 'most globally engaged' enterprises according to Bernard et al. 1999).

Indicators:

a) *share of two-way traders (firms exporting and importing), as a percentage of total traders (firms exporting or importing)*
b) *trade value (exports plus imports) of two-way traders, as a percentage of total trade (exports plus imports)*

Source: ITGS and ITSS

Links and references

- https://ec.europa.eu/eurostat/web/international-trade-in-goods/information-data#Trade%20by%20enterprise%20characteristics
- https://ec.europa.eu/eurostat/web/international-trade-in-services/information-data#Concepts%20and%20definitions
- Bernard, A.B. & J. Bradford Jensen, J.B. and Schott, P.K. (2009) 'Importers, Exporters and Multinationals: A Portrait of Firms in the U.S. that Trade Goods', NBER Chapters, in: *Producer Dynamics: New Evidence from Micro Data* (513-552), National Bureau of Economic Research.
- Antràs and Chor (2023). *Global Value Chains*. NBER Working Paper No. w28549, Tuck School of Business Working Paper No. 3804547. Antràs, Pol and Chor, Davin, Global Value Chains (March 2021). NBER Working Paper No. w28549, Tuck School of Business Working Paper No. 3804547.

22. Import value relative to export value

For two-way traders (see indicator 21), it is possible to calculate the ratio of import to export value. This indicator describes the international level of integration of the production process. The idea is that the ratio is a plausible approximation for the amount of imports needed for the production of exports. This is plausible as long as one can assume that imports are used more or less proportionally to produce products for exports and the domestic market.

This is a firm-level indicator, which can be summarised by reporting the average, median, variance or other distributional characteristics. Moreover, it can be broken down by firm characteristics.

Indicators:

a) *import value of goods divided by export value of goods.*

b) *import value of goods and services divided by export value of goods and services.*
c) *import value of intermediate goods and services divided by export value of goods and services*

Source: ITGS, ITSS. (Indicator 22c requires combination with BEC – see Annex 2)

Links and references

- Kee, H.L., & Tang, H. (2016) Domestic Value Added in Exports: Theory and Firm Evidence from China. American Economic Review 106(6): 1402–1436.

23. Share of export in total production of industrial intermediate products

This indicator gives the share of export in the total production of industrial intermediate products. It describes the extent to which industrial production serves the international market. A further requirement is using PRODCOM and the classification of goods in BEC to identify intermediate goods (see indicator #1).

Indicators:

a) *number of industrial intermediate input-producers exporting*
b) *exports of intermediate products of firms, related to their total production and production of intermediate inputs*

Source: PRODCOM combined with BEC classification (see Annex 2).

Links and references

- https://ec.europa.eu/eurostat/web/prodcom

24. Export value in firm's value added

This indicator uses business-to-business transaction databases (VAT-ID to VAT-ID records) to identify intragroup-trade.

Indicator: *firm-level export value in value added.*

Source: national B2B-transaction databases.

Links and references

- Ariu, A., Breinlich, H., Corcos, G., Mion, G. (2019) The interconnections between services and goods trade at the firm-level, Journal of International Economics 116, 173-188.
- Bems, R. and Kikkawa, A.K. (2019) Measuring trade in value added with Firm-Level Data. National Bank of Belgium Working Paper No. 278.

25. Firm-level product-share weighted backward and forward integration

Chor et al. (2020) combine meso data on input-output relationships (customs trade statistics) between industries with company data (production statistics) on the composition of international trade in goods. Based on the export and import profile and chain information at industry/goods-type level, indicators can be calculated that, under certain assumptions, indicate at the company level how a company is integrated in the value chain. The basic idea is to calculate for each company a weighted average of the upstream indices using the method of Antràs et al. (2012) for each of the products it imports or exports. The weighting is determined by the share of the product in total imports or exports. The upstream indices by product are obtained by using a link between the product codes and the industry categories.

The 'upstreamness' of an industry (U_i) is a weighted average of the number of stages from final demand at which *i* enters as an input in production processes. Applying the industry measure of upstreamness, the 'production line position' of a firm (which is recorded in microdata trade statistics) can be characterised.

Indicators:

a) *weighted-average upstreamness of a firm's imports*
b) *weighted-average upstreamness of a firm's exports*
c) *difference between weighted-average upstreamness of a firm's imports and exports.*

Source: customs trade statistics and production statistics.

Links and references

- Antràs, P., Chor, D., Fally, Th., Hillberry, R. (2012) Measuring the Upstreamness of Production and Trade Flows. American Economic Review 102(3), 412-16
- Chor, D., Manova, K., Yu, Z (2020) Growing like China : Firm Performance and Global Production Line Position. NBER Working Paper 27795

GVC integration by type of firm

Indicators 26 to 29 are derived from an extended IOT. There are many ways to extend standard IOTs. In the approach that we have used (extensively described in Annex 5), the standard IOT was combined with the GBR (in order to assign industry and type of enterprise to enterprises), the SBS, ITGS and ITSS.

The calculations for these indicators are described in the technical appendix to Annex 2.

26. Value added by supplier and subsequent exporter

This indicator shows how much value is added by suppliers of a certain type of enterprise due to subsequent exports of a certain type of enterprise. A further breakdown could be made between manufacturing and services (e.g. how much value added by SMEs in manufacturing is embodied in exports of large enterprises in services). This shows the interdependencies between the domestic production of types of enterprises and exports of types of enterprises. For example, it shows that large enterprises are an important channel for SMEs to reach foreign markets. This indicator also shows the interdependencies between manufacturing and services by type of enterprise.

Indicator: *value added by type of enterprise and activity (manufacturing/services) due to exports by type of enterprise and activity (manufacturing/services).*

Source: extended IOTs.

Links and references

- terms of reference extended supply and use tables
- firm heterogeneity and trade in value added

27. Imports of intermediate products used for production for domestic final use or exports, by type of enterprise

This indicator shows how imports by one type of enterprise will ultimately be used by a type of enterprise. The final use can be broken down by domestic final use and by exports. A further breakdown could be made between manufacturing and services. This provides relevant information on how one type of enterprise is an important channel for another type to obtain foreign inputs.

Indicators:

a) *share of imports of intermediate goods and services by source embodied in domestic final use of a producer, by type of enterprise*
b) *share of imports of intermediate goods and services by source embodied in exports of a producer, by type of enterprise*

Source: extended IOT.

Links and references

- Terms of reference extended SUTs
- Firm heterogeneity and trade in value added

28. Sources of value added, by type of enterprise

This indicator shows how important exports are for the value added for a given type of enterprise. It can be broken down by direct exports (its own exports) and indirect exports (supplying goods and/or services in the value chain of an exporter). A further breakdown could be made between industries (e.g. the share of value added at SMEs in metal manufacturing that is due to direct and indirect exports). The value added of indirect exports sheds new light on the importance of foreign markets for some types of enterprises.

Indicators:

Share of value added, by type of enterprise, due to:

a) *total exports (direct + indirect)*
b) *direct exports*
c) (*indirect export*

Source: extended IOT.

Links and references

- terms of reference extended supply and use tables
- firm heterogeneity and trade in value added

29. Composition of final production for domestic use, by type of enterprise

This indicator shows the importance of imports for a given type of enterprise. These imports can be broken down into direct imports (by the enterprise itself) and indirect imports (imports obtained via the value chain). A further breakdown could be made between industries (e.g. indirect imports of SME metal manufacturing divided by its final production for domestic use). The advantage of this type of indicator is that the indirect way of obtaining foreign inputs is quantified. Furthermore, there might be substantial heterogeneity between types of enterprises, even when taking industry distribution into account. This would suggest barriers for certain types of enterprises that might be removed by policies.

Indicators:

Share of imports embodied in final production for domestic use, by type of enterprise, due to:

a) *total imports (direct + indirect)*
b) *direct imports*
c) *indirect exports*

Source: extended IOT.

Links and references

- terms of reference extended supply and use tables
- firm heterogeneity and trade in value added

Network structure

30. Distributional information on trade

These indicators measure the extent of diversification and risk exposure inherent in GVC participation. International trade is typically dominated by a few businesses, so this indicator shows the share of the total trade accounted for by the top #5, #10, #20, etc. companies.

These indicators describe whether importers/exporters rely on a small group of suppliers/buyers (i.e. whether the volume of trade at the firm level is concentrated in only a few partners). The intention is to capture the diversification of dependencies.

Trade by number of partner countries shows how geographically diversified the export and import markets are (e.g. does a firm rely on a relatively small number of partners countries for a major part of its trade?).

These indicators already exist for goods (in TEC). For service trade, 2022 is the first reference year for STEC in the new European Business Statistics Regulation.

Indicators:

a) *concentration of exports by enterprise by top-X sellers/ buyers*
b) *concentration of imports by enterprise by top-X sellers/ buyers*
c) *trade by number of partner countries and activity*

Source: Eurostat TEC and STEC tables.

Links and references

- https://ec.europa.eu/eurostat/cache/metadata/en/ext_tec_sims.htm
- https://ec.europa.eu/eurostat/web/international-trade-in-services/information-data#Concepts%20and%20definitions

Annex 2. Calculation of indicators for GVC integration by type of firm

For indicators 26 to 29, we use the extended IOT in which every industry (in the non-financial business economy excluding real estate, B-J plus M-N in NACE Rev 2.0) is split into five classes (non-multinational SME, large non-MNE, Dutch multinational SME, large Dutch MNE, and foreign MNE) – for example, metal industry non-multinational SME. The other industries (e.g. agriculture (A), financial services (K) and government services (O)) are not split.

In the standard IOT, a suffix *i* (or *j*) stands for an industry. Here, where most industries are split, it stands for an industry (e.g. agriculture) or an industry by firm type (e.g. non-multinational SME in the metal industry). The remainder should be called 'items'.

A stylised version of an extended IOT, with less detail, is shown in Annex 5 (Table 43, Table 44 and Table 45).

The following matrices and vectors should be defined as follows:

- Intm – the matrix of intermediate supply, $Intm_{ij}$ is the value of intermediate supply of item *i* to item *j*
- X – the vector of exports by item
- D – the vector of total final domestic use by item
- VA – the vector of value added by item
- Tot – total production by item
- M – imports by item
- A – the technical coefficient matrix, defined as Intm with column *i* divided by Tot_i
- I – the unity matrix, with 1 on the diagonal and zeroes off the diagonal of appropriate dimension
- L – the Leontief inverse, defined as $(I-A)^{-1}$
- Diag(Z) – a matrix with vector Z on the diagonal and zeroes off the diagonal

The interpretation of matrix L is as follows: an element L_{ij} is the value that item *i* has to produce for each unit of final output by item *j*. Elementary input-output analysis [127] can be used to derive GVC indicators. Examples are domestic value added in direct and indirect exports, imports embodied in domestic final use; and imports of item *i* embodied in exports of item *j*. Such GVC indicators can be obtained as follows:

*Set B = diag(VA/Tot) * I * diag(X).*

This is a diagonal matrix where an element B_{ij} is the value added by industry *i* due to its direct exports.

*Set C = diag(VA/Tot) * L * diag(X).*

This is a matrix where an element C_{ij} is the value added by industry *i* due to exports of industry *j*, which has value added due to those exports.

Summing the rows of matrix C yields the value added by industry *i* due to the total exports of the country. Subtracting element B_{ii} yields the value added by industry *i* due to production that is embedded in exports at a later stage of the value chain. One can further aggregate to desired aggregates (for example, totals by firm type or totals by firm type by industry, such as firm type for manufacturing or firm type for services (for a stylised example, see Table 18)).

Similarly,

*Set E = diag(M/Tot) * I * diag(D).*

This is a diagonal matrix in which an element E_{ij} is the value of imports by industry *i* embodied in its direct supply for domestic final demand.

*Set F = diag(M/Tot) * L * diag(D).*

This is a matrix in which an element F_{ij} is the value of imports by industry *i* embodied in domestic final demand directly fulfilled by industry *j* (i.e. who imports for whose domestic final supply).

Summing the rows of matrix E yields the imports by industry *i* due to domestic final demand. Subtracting

127 See, for example, Miller, R. and Blair, P., *Input-output analysis: foundations and extensions*, Cambridge University Press, Cambridge, 2009.

the element E_{ii} yields the imports by industry *i* due to production that is embedded in final domestic demand at a later stage of the value chain.

Instead of summing the row (e.g. the amount of imports that an item has due to direct and indirect domestic final demand), one can also sum the column (e.g. the amount of imports (all items combined) embodied in the supply for final domestic demand of a given item).

Summing rows and columns can also be combined. Two examples may help here. First, consider the matrix C described above. This matrix shows the amount of value added of one item embodied in exports of another item. One can aggregate by type of enterprise (e.g. the amount of value added at SMEs due to exports of large enterprises). One can also combine industry and type of enterprise aggregates (e.g. the amount of value added at SMEs in manufacturing due to exports by large enterprises in services). Second, consider the matrix F described above. One can aggregate by type of enterprise (e.g. the amount SMEs import for production for domestic final demand by large enterprises). One can also combine industry and type of enterprise aggregates (e.g. the amount that SMEs in manufacturing import for production for domestic final demand by large enterprises in services).

Annex 3. BEC product classification

Classification by Broad Economic Categories (BECs) is an international product classification. Its main purpose is to provide a set of broad product categories for the analysis of trade statistics. Its comparative advantage has traditionally been the classification of goods by end-use category. This facilitates a range of analytical applications, such as the relative integration of economies in GVCs.

There are eight top categories of goods and services, which are related to the International Standard Industrial Classification.

TABLE 20

Broad Economic Categories

Category	Description
Category 1	Agriculture, forestry, fishing, food, beverages, tobacco
Category 2	Mining, quarrying, refinery, fuels, chemicals, electricity, water, waste treatment
Category 3	Construction, wood, glass, stone, basic metals, housing, electrical appliances, furniture
Category 4	Textile, apparel, shoes, jewelry, leather
Category 5	Transport equipment and services, travel, postal services
Category 6	ICT, media, computers, business and financial services
Category 7	Health, pharmaceuticals, education, cultural, sport
Category 8	Government, military and other
Total	All products

Source: Classification by Broad Economic Categories Rev.5 (BEC), 2016

In the latest revision of BEC (Rev 5), five dimensions have been applied to these economic categories:

1) **product dimension**: (a) goods and (b) services; this distinction only applies to the end use of intermediate and final consumption; services do not apply to gross fixed capital formation;
2) **SNA end-use dimension**: three categories: (a) intermediate consumption; (b) gross fixed capital formation; and (c) final consumption;
3) **processing**: (a) primary and (b) processed; this distinction only applies to goods and only to intermediate and final consumption (no primary goods as gross fixed capital formation);
4) **specification**: (a) generic and (b) specified; this distinction applies to services and processed goods, applies mostly to intermediate consumption, and could apply in a few cases as a distinction in processed goods for gross fixed capital formation;

5) **durability**: (a) non-durable and (b) durable; this distinction only applies to goods and only to final consumption; all goods for intermediate consumption are non-durable and all goods for gross fixed capital formation are durable.

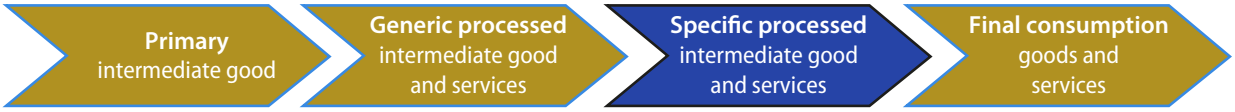
Of special interest to the GVC measurement framework is the new distinction introduced in Rev 5 for both goods and services:

- within intermediate consumption;
- processed goods/services, which can be
  - generic ('commodity') or
  - specified.

The last category ('specified processed goods and/or services for intermediate consumption') can be used to identify GVCs.

FIGURE 20

Value added chain from BEC Rev 5 categories



Source: Adapted from the Classification by Broad Economic Categories Rev.5 (BEC), 2016

Descriptions of the three pilots

Pilot 1. Extending the GVC survey to improve measurement of aspects of GVC

1. Introduction

As part of the GVC framework grant, we investigated the possibility of collecting data on GVC participation by extending existing surveys. In the case of our consortium, it was obvious that we should consider extending the fourth pilot of the international sourcing survey (i.e. GVC survey) with additional questions that potentially add value in the sense that they capture GVC behaviour that was not yet captured within the previous surveys.

In this pilot, we discussed several data gaps and investigated how adding questions to the GVC survey can shed light on these gaps in the context of GVCs and GVC transactions. Based on newly added questions, we also suggest some new GVC indicators. The following data gaps will be touched upon in this pilot:

(1) Intra-group trade
By assigning specific tasks to firms in specific regions of the world and by intra-group trade at transfer prices, MNEs can take advantage of worldwide production networks (Davies et al., 2022). Only little is known about the size of intra-group trade; it is an important data gap identified by (Sturgeon, 2013).

(2) Indirect trade
Indirect trade (through wholesalers or intermediaries) is a significant way for enterprises to engage in international trade and be part of a GVC. Previous research on supply-use tables and input-output tables shows that exports through wholesalers amounted to 47 billion euros, equivalent to 22.9% of total Dutch exports in 2015. The sectors of agriculture and manufacturing (notably the food, machinery and chemical industries) mainly rely on this indirect mode of exporting (Statistics Netherlands, 2019). This export share is associated with about 4% of GDP. Also, indirect trade is recognized internationally as an important way of GVC participation (OECD, 2018).

(3) Worldwide employment per business function
Firms in the domestic economy that belong to an international group might play a particular role in the group's value-creating activity. In order to get a better picture of the role of domestically based enterprises within an enterprise group, we decided to add questions on the employment per business function within the global enterprise group.

In this pilot, we take on the first two data gaps for a more in-depth analysis and the third gap more broadly. The main results from the analyses of the three data gaps mentioned above are the following:

1) Intra-group trade exports are at least 7 billion for goods and 9 billion for services (respectively, 3% and 17% of the total exports of goods and services). These are lower-bound estimates.
2) We estimate that about 3% of GDP is due to indirect exports through wholesalers. This estimate is an upper bound for enterprises in the GVC survey population.
3) Half of the enterprises that report to be part of an international enterprise group cannot report global employment. The vast majority of enterprises that report global employment can distribute the world-wide employment by business functions.

The next section (Section 2) discusses some basic methodological points. Section 3 introduces the questions we added to the GVC survey and notes quantitative analyses. Section 4 calculates several other indicators mentioned in the framework document. The Annex presents all tabulated results from the newly added questions.

2. Data and methodology

Several methodological issues should be mentioned to interpret this pilot's results correctly. The most critical issue is using the GVC weight to make grossed-up figures, e.g. for trade and value-added volumes.

Population weights

The GVC is a survey, and population weights are calculated after all responses are received. These weights are primarily used to make grossed-up figures, e.g. the number of enterprises that source business functions internationally.

This pilot links the GVC survey to several other sources, like ITGS, ITSS and SBS (for value-added numbers). After linking these sources, whenever adding up trade or value-added figures, we use the same GVC weights.

The GVC weights are not designed to add up to the actual total value of the variable, e.g. goods exported. Consider the example in Table 21 below, in which we present an imaginary and complete universe of six enterprises named A, B, C, D, E and F. Three of these enterprises (A, C and F) were present in the GVC survey and received survey weights. The other enterprises did not receive such weights.

TABLE 21

Example of the potential impact of using GVC-survey weights to gross-up non-GVC data

Enterprise	Weights (only if included in the GVC survey)	Weighted		Weighted	
		Goods exports	Share	Goods exports	Share
A	2.4	100	2%	240	4%
B	:	1 000	17%	:	
C	1.5	1 500	26%	2 250	38%
D	:	500	9%	:	
E	:	750	13%	:	
F	2.1	2 000	34%	4 200	72%
Total	6.0	5 850		6 690	

Source: GVC survey 2021, CBS, Netherlands.

The overall sum of goods exported is 5 850 euros. However, when linking GVC data to ITGS and grossing up trade volumes with the weights from the GVC-weighting procedure, we find an overall sum of goods exported of 6 690 euros. The discrepancy between the two figures occurs because the enterprise's trade or value-added volumes are not considered in the weighting procedure of the GVC.

3. Additions to the GVC survey

In this section, we discuss the questions added to the GVC survey. In addition, for intra-group and indirect trade, we also do an MDL exercise to illustrate the usefulness of the new results.

Enterprises trading within the group (B1-B4)

Due to data limitations, intra-group trade is still a widely unexplored subject from an SBS perspective. From a GVC perspective, intra-group trade is vital; by assigning specific tasks to firms in specific regions of the world and trading at transfer prices (Davies et al., 2015), MNEs can take advantage of worldwide production networks.

In the GVC survey pilot, we added five questions about intra-group trade (B1-B5). The phrasing of the questions can be found in Box 1. The first four questions (B1-B4) are hard to quantify precisely. However, if we assume that the term

'predominantly' in the questions can be interpreted as 'at least 50% of the value of imports/exports', we can do some meaningful quantitative analysis by linking (MDL) the trade data to these enterprises.

BOX 1

Additional questions to GVC survey (on intra-group trade)

The following statements concern all imports and exports of goods as well as services in the year 2020, disregarding the monetary value of the transactions. Please, indicate for each of the statements if they apply to your enterprise.

	Yes	No	I do not know	Does not apply
B1. The goods that we exported were predominantly supplied to enterprises within our enterprise group.	[x]	[]	[]	[]
B2. The services that we exported were predominantly supplied to enterprises within our enterprise group.	[]	[x]	[]	[]
B3. The goods that we imported were predominantly supplied by enterprises within our enterprise group.	[x]	[]	[]	[]
B4. The services that we imported were predominantly supplied by enterprises within our enterprise group.	[]	[x]	[]	[]
B5. We only exported goods and services to enterprises within our enterprise group.	[]	[x]	[]	[]

In the table below, we present 2020 data on goods exports and imports and 2019 data on services exports and imports for enterprises that indicate that they mainly trade with foreign enterprises for each particular trade flow. For example, consider the 140 enterprises that are exporting goods predominantly within the group. These enterprises are responsible for 12.5 billion euros worth of goods exports in 2020, about 6% of the total exports of goods in 2020. For goods imports, services exports (2019) and services imports (2019), these percentages amount to 15%, 18% and 7% respectively.

TABLE 22

International trade in goods and services (EUR billions) by enterprises that indicate to be exporting mainly to other enterprises within the group

NACE	Size class	Goods exports (2020)	Goods imports (2020)	Services exports (2019)	Services imports (2019)
B	Total	0.1	0.2	1.3	0.0
C	Total	8.0	13.2	1.1	0.5
D	Total	0.0	0.4	0.0	0.1
E	Total	0.0	0.0	0.1	0.0
F	Total	0.0	0.5	0.1	0.0
G	Total	4.0	25.8	3.7	1.1
H	Total	0.0	2.4	1.5	0.2
I	Total	0.0	0.0	0.1	0.0
J	Total	0.0	0.7	0.5	0.5
K	Total	0.0	0.0	0.3	0.1
L	Total	0.0	0.0	0.0	0.0
M	Total	0.3	1.9	18.2	8.6
N	Total	0.0	0.1	2.8	0.0
Total	50-249	6.9	28.0	18.5	9.1
Total	GE250	5.6	17.2	11.1	2.1
Total	Total	12.5	45.2	29.6	11.2

Source: ITGS (2020) and ITSS (2019).

These figures point to the potential quantitative importance of intra-group trade of goods and services. However, in interpreting these figures, we must remember that we ask whether the respective trade flows are 'predominantly' with an in-group partner. Therefore, we might safely assume that half of the figures in Table 22 are lower bounds. This yields about 3% for goods exports, 7% for goods imports, 9% for services exports and 3% for services imports.

There are three plausible explanations for why these lower bound figures are underestimated, given the nature of the questions, the GVC sample and the nature of the trade data. First, we exclude all intra-group trade of those enterprises that do not predominantly trade with in-group partners, i.e. those that did not tick 'Yes' in questions B1-B4. Second, we only include enterprises which employ 50 or more persons. Smaller enterprises are not included in the GVC sample, even if they belong to a Dutch or foreign MNE. This will arguably also exclude intra-group trade flows. Third, the values associated with intra-group trade flows probably do not reflect market prices. If intra-group trade occurs at market prices instead of transfer prices (which is likely), the value of the lower bound estimates is underestimated.

Enterprises exporting exclusively within the group (B5)

While the first four questions are a bit harder to quantify, even though we arrived at a reasonable lower-bound estimate, the fifth question we added to the survey is much easier to quantify. In this last question, we ask for enterprises that only export within the international group. In Table 23, we present data on exports of goods (2020) and exports of services (2019) by enterprises that indicate they are part of an international enterprise group and that report only exporting to other enterprises within this group. Total exports of the Netherlands (excluding re-exports) amount to 211 billion for goods and 167 billion for services. The figures in Table 23 amount to 3% and 5%, respectively, of the total goods and services exports.

TABLE 23

Exports of goods and services (EUR billions) by enterprises that indicate to be exporting exclusively to other enterprises within their group [128]

NACE	Size class	Goods exports (2020)	Services exports (2019)
Total	Total	6.1	9.0
C	Total	3.9	0.2
D	Total	0.0	0.0
E	Total	0.0	0.0
F	Total	0.0	0.0
G	Total	1.6	0.4
H	Total	0.2	0.9
I	Total	0.0	0.0
J	Total	0.0	0.3
K	Total	0.0	0.3
M	Total	0.4	4.6
N	Total	0.0	2.2
Total	50-249	3.6	7.9
Total	GE250	2.5	1.1
Total	Total	6.1	9.0

Source: ITGS (2020) and ITSS (2019).

4. Potential additions

In this section, we showed some information that was constructed by combining new survey questions with MDL techniques. There are several interesting opportunities to go from here. First, we could consider asking the questions on 'only exporting within the group' and 'only importing from the group'. Second, we might quantitatively expand the questions, for example, by adding percentage categories, like '10%/20%/… of our exports are within group'). Third, we might take a completely different approach and check whether enterprises entirely depend on foreign enterprises that are not part of the same group.

Indirect exports (D1-D3)

Previous research based on supply-use tables and input-output tables shows that a significant portion of GDP (over 4% in 2015) is earned by exporting through wholesalers and other intermediaries (Statistics Netherlands, 2019). However, as the microdata do not exist at the enterprise level, this topic cannot be investigated further. We, therefore, decided to take the first step in this direction by asking questions about the likelihood of an enterprise engaging in indirect exports through wholesalers.

128 The figures in Table 23 should be interpreted as a genuine, but only partly, picture of intra-group trade. A complete picture of intra-group trade flows should yield a higher figure, as seen from the (likely underestimated) lower-bound figures in Table 22.

BOX 2

Additional questions to the GVC survey (on indirect exports)

With the questions below , we would like to gain more insights into how enterprises organize their business and processes from an international perspective. We would also like to get an indication of how many enterprises significantly depend on trade through third parties like wholesalers or other intermediaries.

	Yes	Most likely yes	Most likely not	I don't know
D1. For its sales, does your enterprise largely depend on wholesalers?	[]	[]	[]	[]
D2. Do you expect these products to be exported eventually?	[]	[]	[]	[]
D3. Our enterprise is, to high degree, dependent on products or goods from outside the country that have been imported by a third party, e.g. a wholesaler.	[]	[]	[]	[]

The questions are asked in two parts. First, we ask whether the enterprise depends on wholesalers for their sales. Results show that over 18% of enterprises recognise such dependency. Second, we ask whether these goods will likely be eventually exported (see Box 2). The results show that 689 enterprises heavily depend on wholesalers for their turnover and that their products are eventually exported. This boils down to about 6% of the population.

It is interesting to note that enterprises with 50 to 249 workers depend slightly more on sales to wholesalers (1761/9301 ≈ 19%) than larger enterprises (305/2099 ≈ 15%). Conditional on depending on wholesalers, larger enterprises indicate slightly more often (114/305 ≈ 37%) that the wholesaler exports their products than smaller enterprises (575/1761 ≈ 33%)

Knowing that the wording of the question – 'to a high extent' – is subjective and that the reporting enterprise might not receive administrative proof of the actual export transaction, as a thought experiment, we have looked into the SBS to get a first indication of the value added by these enterprises.

TABLE 24

Value-added (EUR billions) of enterprises that heavily depend on wholesalers for their sales and believe it is certain or likely that their products will eventually be exported

NACE	Size class	Value-added indirect exports (2019)
Total	Total	19.2
C	Total	7.6
D	Total	0.0
F	Total	0.4
G	Total	10.0
H	Total	0.1
J	Total	0.4
M	Total	0.1
N	Total	0.6
Total	50-249	8.2
Total	GE250	11.1
Total	Total	19.3

Source: GVC Survey and Structural Business Statistics (SBS), 2019

In Table 24, we show that the 689 enterprises we found in the GVC survey are responsible for almost 19.3 billion in added value in the Dutch economy, which is about 2.4% of the GDP of the Netherlands. Although comparison is problematic for numerous reasons, these figures align with the earlier estimate of 4% (2015). The major conceptual difference between the current and earlier estimates, as presented in the Internationalisation Monitor, is that the latter not only accounted for trade through wholesale but also accounted for intermediary agents (NACE 461).

Still, we should also note that the 2.4% figure is likely an upper bound, as not all of the sales of the enterprises indicate to be dependent on wholesalers for their turnover might be to wholesalers. Still, we notice here – just as in the previous section – that in the sample selection of the GVC survey, only enterprises employing at least 50 persons are included. Assuming that smaller enterprises might be more dependent on third parties for exporting their goods than larger enterprises, our lower bound estimate of 2.4% might be greater.

However, the main question we have to answer is whether this is a useful first step in analysing an enterprise's dependencies on wholesalers. We seem to get close to an earlier result based on a different source and analysis. This indicates that – with precisely phrased qualitative questions – one might be able to do meaningful quantitative analysis, in which MDL techniques play a crucial role. Given the current absence of data on the micro-level and considering the first basic results, we feel adding these questions might be a start to getting a better grip on and understanding indirect exports at the micro-level.

Worldwide employment per business function (A1 and A2)

To get a better idea of domestically based enterprises' GVC engagement, it might be helpful to have information on working persons per business function for the whole global enterprise group. On top of the available information from SBS and the GVC survey, this could give more insight into the role of the domestically based enterprise within the MNE. On the other hand, it might—for domestic MNEs—be an indication of historic GVC activities, like moving production abroad.

We added one set of questions to the GVC survey to check whether companies that belong to a multinational enterprise group can indicate the worldwide employment per business function. This question is preceded by a filter question that checks whether the person filling out the questionnaire can answer the question correctly; if the respondent is not aware of working for an MNE, we did not ask the question on total global employment within the MNE (and of course the question on employment specified per business function).

BOX 3

Additional questions to the GVC survey (on employment per business function)

The questions below refer to employment in the global enterprise group to which your enterprise belongs. If your enterprise does not belong to an international group of enterprises, indicate so in the next question and skip the rest of this block.

A1. Does your enterprise – at this moment – belong to a multinational enterprise group with a mother or daughters abroad? [Yes; No; Cannot answer]

A2. Please give us your best estimate of the total number of working persons in the global enterprise group at this time. [integer number; I cannot answer this question]

About 3% of respondents could not indicate whether or not their enterprise belonged to an international group at the time of the survey (A1). They are unable to answer the question of whether the enterprise belonged to an international group with a foreign mother or foreign daughters. We interpret this as 'I do not know'.

Of those that indicate that the enterprise is part of an MNE, over half can report total global employment per business function (A2). Once enterprises are also asked for worldwide employment per business function, we find that most of the 2 146 enterprises that report total employment can fully distribute the number of workers across business functions (1 906 of 2 146).

GVC-roles (C1-C4)

In this set of questions (Box 4), we want to identify certain GVC activities, namely the supply and import of manufacturing, processing, or assembly services (MPA). Enterprises engaged in these activities can be identified as active in a certain part of a GVC; some can be labelled as engaging in FGP arrangements.

BOX 4

Additional questions to the GVC survey (on company roles within a GVC)

With the questions below , we would like to gain more insights into how enterprises organize their business and processes from an international perspective. We would also like to get an indication of how many enterprises significantly depend on trade through third parties like wholesalers or other intermediaries.

	Yes	No	I don't know
C1. Our enterprise imports manufacturing, processing or assembly services from enterprises outside the group.	[]	[]	[]
C2. Our enterprise imports manufacturing, processing or assembly services from enterprises inside the group.	[]	[]	[]
C3. Our enterprise supplies manufacturing, processing or assembly services to foreign enterprises outside the group.	[]	[]	[]
C4. Our enterprise supplies manufacturing, processing or assembly services to foreign enterprises inside the group.	[]	[]	[]

We specifically asked the enterprises to respond to the statements presented in questions C1-C4. These questions borrow heavily from a value-chain survey by Statistics Canada (2021).[129]

5. Other GVC-indicators

In the GVC Framework document, we present several potential indicators. In this section, we calculate the indicators that are related to (i.e. can be calculated from) the additional questions in the GVC survey. These are indicators 9a up to and including 9i' and 10a up to and including 10e. The importance of the indicators is discussed in the text in the main document. Here, we calculate the indicators and discuss potential caveats. In some cases, as we will see below, some indicators are still too difficult to capture; they are too demanding for the current data landscape, and we cannot calculate them.

Trading through wholesalers or other third parties

From the GVC survey, we can indicate enterprises that (1) heavily depend on wholesalers for their sales and that indicate that their products are eventually (likely) exported and (2) enterprises that heavily depend on inputs from

129 https://www.statcan.gc.ca/en/statistical-programs/instrument/5250_Q1_V2

wholesalers (or other third parties) that a third party imported. The newly added questions in which we attempt to capture such indirect trade form the basis for indicators 9a, 9b and 9c.

9a – Share of enterprises trading through wholesalers

We ideally get an indicator that identifies all enterprises that export or import indirectly through wholesalers. However, with such a question, we might have captured the majority of enterprises. Instead, we might want to paint a picture of enterprises that significantly depend on wholesalers, either for imports or exports (or both). The results are shown below. We find that over 20% (2 374 out of 11 400) of enterprises heavily depend on inputs from wholesalers that were previously imported or heavily depend (indicator equals 1) on sales to wholesalers of products that are eventually (certain or likely) exported.

TABLE 25

Dependencies on wholesalers for foreign sales or inputs (number of enterprises)

Enterprise category / Size class	50-249	GE250	Total
(0) Not trading internationally via wholesalers	7 306	1 719	9 026
(1) Trading internationally via wholesalers	1 995	380	2 374
Total	9 301	2 099	11 400

Enterprise category / Size class	(0) Not trading internationally via wholesalers	(1) Trading internationally via wholesalers	Total
B	35	3	38
C	1 749	714	2 463
D	39	4	43
E	104	6	110
F	628	263	891
G	1 671	889	2 560
H	735	163	898
I	384	94	478
J	695	61	756
K	268	5	273
L	164	14	178
M	955	63	1 018
N	1 599	95	1 694
Total	9 026	2 374	11 400

Source: GVC survey 2021, CBS, Netherlands.

9b – Share of enterprises not trading themselves but trading through wholesalers

The GVC survey identifies enterprises that heavily depend on wholesalers (or other third parties) for foreign sales or inputs. To quantify the importance of this phenomenon, we can link these variables to ITGS to find how many of these enterprises do not trade themselves. So, the indicator constructed here will be '1' for enterprises not exporting themselves but heavily depending on sales to wholesalers for products that are (for sure or likely) eventually exported. Also, the indicator will be '1' if an enterprise does not import goods but is heavily dependent on foreign inputs imported by wholesalers or other third parties.

TABLE 26

Dependencies on wholesalers for foreign sales or inputs of enterprises that do not trade themselves

Enterprise category / Size class	50-249	GE250	Total
(0) Importing and exporting not exclusively via wholesalers	1 742	327	2 069
(1) Importing and exporting exclusively via wholesalers	253	53	306
Total	1 995	380	2 374

Enterprise category / Size class	(0) Importing and exporting not exclusively via wholesalers	(1) Importing and exporting exclusively via wholesalers	Total
B	21	12	33
C	905	286	1 191
D	16	7	22
E	21	3	23
F	96	19	114
G	738	332	1 070
H	260	61	321
I	63	35	98
J	269	63	332
K	89	27	116
L	13	8	21
M	303	137	440
N	206	52	258
Total	2 999	1 041	4 041

Source: GVC survey 2021 and ITGS, CBS, Netherlands.

9c – Share of enterprises dependent on indirect imports, e.g. through wholesalers

This indicator can be calculated directly from question D3 in the annexe; about 7.1% of enterprises heavily depend on imported products that a third party imports.

Note that a non-negligible share of enterprises indicates that they are not sure, but they are likely to heavily depend on imported inputs indirectly. An additional 8.3% of enterprises give this answer. Over 15% of enterprises are likely to be heavily dependent on indirectly imported inputs.

9d – Share of enterprises dependent on indirect exports through wholesalers

This indicator can be calculated directly from questions D1 and D2 in the annexe; about 6.0% of enterprises heavily depend on imported products that a third party imports.

For this indicator, just as for 9c, a non-negligible share of enterprises (2.2%) indicates that they are not sure but that it is likely that they heavily depend on exports. In total, over 8.2% of enterprises are likely to be heavily dependent on indirect exports.

10a – Share of trade value of exports through wholesalers

In order to build up this indicator from the microdata, one would at least need information on (i) national transactions between enterprises and wholesalers on the micro level and (ii) having data available on the value of the exports of the wholesalers that can directly be linked to (other) enterprise within the country. On the macro level, such estimations can be made (Statistics Netherlands, 2019).

Because the required data is currently not available, we present a slightly different indicator that gives information on the importance of exports through wholesalers at the micro level. This information can essentially be derived from Table 24. Here, we show the value added (from SBS 2019) of enterprises that are heavily dependent on wholesalers for their sales (turnover) and that the products sold to the wholesalers are eventually exported. This value-added amounts to 3% of GDP.

10b – Share of the trade value of indirect imports, e.g. through wholesalers

Again – see 10a – this indicator cannot yet be calculated. The only possible indicator that gives an idea of the importance of indirect imports is already presented in indicator 9c.

FGP or performing manufacturing/ assembly/processing tasks

9h – Share of enterprises doing assembly or processing work for foreign enterprises within the enterprise group

This indicator can be derived directly from question C4 in the annexe: 9.8%.

9i – Share of enterprises hiring other foreign enterprises within the enterprise group to do assembly or processing work

This indicator can be derived directly from question C2 in the annexe: 9.0%.

9j – Share of enterprises doing assembly or processing work for foreign enterprises outside the enterprise group

This indicator can be derived directly from question C3 in the annexe: 11.1%.

9k – Share of enterprises hiring other foreign enterprises outside the enterprise group to do assembly or processing work

This indicator can be derived directly from question C1 in the annexe: 11.2%.

Intra-group trade

9e – Share of enterprises mainly exporting (goods or services) within enterprise group

This indicator combines two variables. In the questionnaire, enterprises indicate whether they are part of an enterprise group with a foreign mother or foreign daughters (question A2 in the annexe). In the second question, we ask whether they export mainly within the enterprise group (questions B1 and B2 in the annexe for goods and services, respectively).

9f – Share of enterprises exclusively exporting (goods or services) within the enterprise group

This indicator is presented in question B5. For indicator 9f, these figures have to be combined, as the indicator does not make a split between goods and services. The results of this exercise are presented in Table 27. Over a quarter (25.8%) of the enterprises that belong to an international group export mainly within the group. This is about 9.1% of all enterprises in the sampled population (11 400).

In interpreting this indicator, note that an enterprise can indicate exporting goods mainly outside the group and exporting services mainly inside the group (or both). In those cases, indicator 9f will be set to '1'.

TABLE 27

Number of enterprises that mainly export goods or services within their group

Enterprise category / Size class	50-249	GE250	Total
(0) Exporting goods or services outside of their enterprise group	2 246	753	2 999
(1) Exporting goods or services within their enterprise group	812	229	1 041
Total	3 058	982	4 041

Enterprise category / Size class	(0) Exporting goods or services outside of their enterprise group	(1) Exporting goods or services within their enterprise group	Total
B	21	12	33
C	905	286	1 191
D	16	7	22
E	21	3	23
F	96	19	114
G	738	332	1 070
H	260	61	321
I	63	35	98
J	269	63	332
K	89	27	116
L	13	8	21
M	303	137	440
N	206	52	258
Total	2 999	1 041	4 041

Source: GVC survey 2021.

9g – Share of enterprises mainly importing (goods or services) from within the enterprise group

Similar to 9f, we can combine data from questions B2 and B3 in the annexe, resulting in Table 28. We find even higher percentages than for indicator 9f; 30.2% of the enterprises belonging to an international group mainly import goods or services from within the group.

In interpreting this indicator, note that an enterprise can indicate that it is importing goods from outside the group and services from inside the group (or both). In those cases, indicator 9f will be set to '1'.

TABLE 28

Number of enterprises that mainly import goods or services within their group

Enterprise category / Size class	50-249	GE250	Total
(0) Importing goods or services outside of their enterprise group	2 075	745	2 819
(1) Importing goods or services within their enterprise group	983	238	1 221
Total	3 058	982	4 041

Enterprise category / Size class	(0) Importing goods or services outside of their enterprise group	(1) Importing goods or services within their enterprise group	Total
B	20	13	33
C	897	294	1 191
D	16	7	22
E	20	4	23
F	97	17	114
G	568	502	1 070
H	256	65	321
I	82	16	98
J	213	119	332
K	98	18	116
L	20	1	21
M	328	113	440
N	205	53	258
Total	2 819	1 221	4 041

Source: GVC survey 2021, CBS, Netherlands.

10c – The value of exports - enterprises indicating to export mainly within the international enterprise group

This indicator can be derived from Table 22; 'If we indeed assume that at least half of this is intra-group trade, we have a certain lower bound of the figure for these enterprises, namely roughly 3% for goods exports, 7% for goods imports, 12% for services exports and 24% for services imports.'

10d – The value of exports - enterprises indicating to export only within the international enterprise group

This indicator can be directly derived from Table 23 in the main text. This amounts to 3% and 17% of the total goods and services exports, respectively.

10e – The value of imports - enterprises indicating that they import mainly from enterprises within the international enterprise group: See indicator 10c.

Pilot 2. The derivation of business-function employment, valuation indicators and wages

1. Introduction

The concept of business functions (BF) plays an important role in value chain analysis, especially regarding (out) sourcing of activities. Sturgeon (2013) [130] and Eurostat (2020) [131] identify several data gaps when measuring business functions in international sourcing surveys. In this pilot, we cover two of these:

1) **The unavailability of yearly data on (sourcing) of business functions**
   Ideally, yearly data would be available on the employment per business function and the (international) sourcing of business functions.
2) **Valuations and in-house costs of business functions**
   The analysis of business functions sourcing would be more valuable when we could attach economic value to a business function.

In this second pilot, we first take steps to overcome these two gaps using data from the Dutch Labour Force Survey (LFS). The LFS contains information on individuals' occupations (ISCO). We link this occupation information to Eurostat's ISCO-BF correspondence table [132], in which occupations are assigned to business functions. This correspondence table allows us to assign most employed individuals – those with a valid ISCO code and a business function linked to that code in the correspondence table – to one of the business functions, as reported at the enterprise level in the international sourcing survey.

Such data linking can help us take the first steps in overcoming the data gaps mentioned above in the following ways:

1) After linking the LFS with Eurostat's correspondence table, we can construct **yearly data on employment per business function**, as individual-level data on ISCO from the LFS is available yearly. This will not only allow us to calculate current employment per business function (as we show below), but in theory, it should also allow us to calculate yearly changes in employment per business function, potentially broken down by enterprise characteristics.[133] In this pilot, we calculate employment per business function for the 2020 LFS and relate this to the employment per business function from the GVC survey. This data gap will be covered in the section *3. Employment per business function*.
2) Moreover, the (theoretical) opportunity of assigning LFS respondents to business functions also opens doors concerning assigning indicators of economic importance (value or in-house costs) to business functions. Once we can assign a person to a business function based on the ISCO code from the LFS, we can also enrich the data with other information, e.g. tax data from this individual. Such a link provides a direct relation between business functions and wages. Based on this linking step, we can (i) calculate wage sums per business function (a reasonable reflection of in-house costs), per NACE and size class, (ii) determine whether a specific business function can be classified as 'high-value', 'medium-value' or 'low-value', and (iii) show whether mainly high-value or low-value business functions are moved abroad. This exercise should be viewed as a first step into

130 https://ec.europa.eu/eurostat/documents/7828051/8076042/Sturgeon-report-Eurostat.pdf

131 https://unstats.un.org/unsd/classifications/ExpertGroup/TSG-CBF2020/Statistical_Manual_on_Business_Functions_v1.4.pdf

132 https://circabc.europa.eu/ui/group/ee836f22-7bdf-4818-8725-cd6f3b13eac4/library/85886593-62aa-432f-acee-98dc92ef8e6f?p=1&n=10&sort=name_ASC

133 The construction of a time series is not covered in this pilot.

overcoming the absence of data, e.g. to produce data on value-added per business function.[134] This data gap will be covered in section *4. High-, medium- and low-value business functions*.

The remaining sections will build upon the work done in the third and fourth sections. In section *5. The impact of international outsourcing on wages*, we look into the possibility of making statements on the impact of international outsourcing on earned wages. In section *6. Additional Indicators for the GVC Framework* we calculate several other indicators mentioned in the GVC framework document.

2. Data and methodology

In this pilot, we will examine three main data sources. First, we have information on employment per business function of enterprises in the GVC survey (including weight to gross up to population totals). Second, we have information on the ISCO code for nearly all working respondents in the LFS. Third, we have information on wage payments to employees.

Using the ISCO-BF correspondence table from Eurostat, we can link every record in the LFS (with occupational information) to a business function. Theoretically, this allows us to construct aggregated statistics on – amongst other things – employment per business function, broken down by NACE and size class, without having to ask enterprises in the GVC survey.

We first make data selection decisions before linking the correspondence table to the LFS. We include individuals in the working-age population 15-67 years old and only include individuals that can be matched with data from the Employer Insurance Agency (EIA; in Dutch: UWV) in order to be able to match with enterprise characteristics. We only need this match on enterprise characteristics to assign a NACE category; we do not gross up employment by ISCO on the enterprise level; LFS data are not suited to make aggregates on such a detailed level.

Several other vital points on the sample need to be discussed:

- In order to match LFS data to the suitable EIA-data records, we assume that the main job in the LFS ('most hours worked') is the same as the main job in the EIA-data ('largest income').
- Furthermore, to make the comparison with GVC survey data reasonable, we only include LFS records from those working in enterprises with more than 49 employees and enterprises within NACE sections B-N.
- Because we use data from the EIA, we only incorporate information from individuals working as an employee or director-majority shareholders (DMS; in Dutch: DGA). This means that (non-DMS) self-employed individuals are excluded from the analysis. Given the low number of enterprises in the GVC survey population (roughly 11 thousand) compared to the number of workers in this population (roughly 3 million), the impact of this omission will be small.
- At a later stage (Section 4), we assign valuations to business functions. Such assignment (high-/medium-/low-value business functions) can only be determined when there are enough LFS observations in each of the NACE x BF cells; a grossed-up/weighted total of 15 000 employees is applied here as a minimum level of observations.

3. Employment per business function

Table 29 presents the employment figures per business function, per NACE and per size class, as reported by enterprises in the GVC survey. When we apply the ISCO-CBF correspondence table to the LFS data, match this data with information from employers (using data from the Employment Insurance Agency), and aggregate the data such that it resembles the format of Table 29, we arrive at Table 30. Table 30 gives almost the same information as Table 29, with the important note that the underlying data used for Table 30 is the LFS survey, and the GVC survey data is not used here. Additionally, to have enough LFS observations, we have to use all first-wave 2020 observations.

Differences between Tables 29 and 30 can be rather significant. Note, for example, that from the LFS, we have about 731 000 people who are – based on their ISCO-code – assigned to the business function 'Administrative and management services'. This is about twice the figure from the international sourcing survey, which is about 378 000.

Many factors can explain the differences between Table 29 and Table 30. A prominent factor might be that the correspondence list links each occupation to only one business function. This might not be in line with reality,

134 It should, however, be very clear that the calculation we do in this pilot do not yield value-added figures per business function. Such figures cannot be calculated using the sources at hand.

at least from the viewpoint of enterprises. For example, enterprises responding to the GVC survey might assign managers in different departments to the respective business functions, whereas in the correspondence list, all managers are assigned to the administrative and management business functions. The same could hold for employees with administrative tasks.

Another factor that explains a part of the overall difference is that about 10% of the workers in the LFS cannot be linked to the EIA data, which means that the overall total in Table 30 is expected to be somewhat higher and more in line with the overall total in Table 29. Note, however, that this would unlikely explain differences in employment distribution by business functions within NACE categories.

TABLE 29

Employment per business function, December 2020 (thousands of persons employed)

Business function / NACE section / Size class	B	C	D	E	F	G	H	I	J	K	L	M	N	GE250	50-249	Total
Production of goods	2	237	2	6	43	36	3	12	7	1	0	12	31	209	184	393
Distribution and logistics	0	30	7	3	5	93	186	1	1	0	0	6	24	253	105	358
Marketing, sales, and after-sales services	0	42	3	2	8	240	11	12	19	8	3	13	57	274	144	419
Information and communication technology services	0	8	1	1	2	13	3	1	70	4	0	6	8	80	39	119
Administrative and management functions	1	42	2	4	25	68	24	11	20	24	8	45	104	227	151	378
R&D, engineering, and related technical services	1	86	6	1	40	22	3	3	18	1	1	67	18	183	85	267
Other	1	90	4	12	45	104	22	37	27	110	15	80	322	629	241	869
Total	6	535	26	28	168	577	253	78	161	148	28	230	564	1 855	949	2 803

Source: GVC survey 2021, CBS, Netherlands.

TABLE 30

Employment per business function, the whole year 2020 (thousands of persons employed)

Business function / NACE section / Size class	B	C	D	E	F	G	H	I	J	K	L	M	N	GE250	50-249	Total
Production of goods	1	147	3	4	43	32	8	2	2	1	3	6	77	193	136	329
Distribution and logistics	1	33	0	4	5	67	117	3	2	1	0	5	63	199	101	300
Marketing, sales, and after-sales services	1	42	1	1	5	370	12	9	17	7	3	18	33	366	152	518
Information and communication technology services	0	20	3	1	5	20	8	0	81	21	1	21	21	135	67	202
Administrative and management functions	2	110	7	7	41	103	65	17	45	91	15	108	119	484	247	731
R&D, engineering, and related technical services	3	61	4	3	22	27	8	1	6	3	3	52	19	139	76	214
Other	0	51	2	5	18	61	15	64	18	20	7	18	156	290	145	435
Total	8	465	19	25	140	679	233	98	171	143	32	228	489	1 805	924	2 729

Source: LFS survey 2021.

4. High-, medium- and low-value business functions

Analysis of the sourcing of business functions has a major drawback when only GVC survey data is consulted – there is no obvious way to attach an economic value to the different business functions, at least not in the existing SBS data landscape. For example, the turnover from a large manufacturer cannot exclusively be assigned to workers in the production business function. This is because supporting services also play an indispensable role in the manufacturer's activities, even though they are not directly linked to producing goods. Additionally, it is not straightforward to distribute a turnover figure across different employees. Other financial information, like in-house personnel costs, might be available per business function (or division or unit) but only within an enterprise's administration and not (yet) in the statistical system.

This part of the pilot aims to assign some meaningful economic value to business functions nevertheless. We do so by using the data constructed for the previous section. While matching information from workers in the LFS to the information from the EIA, we can calculate wages per business function, per NACE, per size class, and even per level of educational attainment.[135]

Average full-time wage per business function

Consider Table 31, in which we calculate the average full-time wage of workers in the different business functions as identified by the correspondence list. Here, we see that wages can vary heavily within business functions, depending on the sector of the economy. Some sectors are paying structurally higher wages than others, regardless of the business function someone is employed in.

135 And various derivations such as wage sums, average full-time wages, and average actual wages.

TABLE 31

Average full-time wage per business function (thousands of euros) [136]

	PROD	DIST	MK	ICT	ADM	ENG_RD	OTH	Total
B	79	62	95	115	112	113	38	100
C	44	50	57	68	75	65	44	57
D	65	98	62	72	73	77	59	71
E	46	39	48	63	62	68	43	52
F	51	43	47	56	65	62	44	56
G	33	32	27	55	59	46	31	35
H	49	48	54	64	47	66	40	49
I	31	27	27	39	41	42	24	28
J	41	41	67	60	73	54	50	62
K	57	75	100	72	79	105	61	77
L	44	30	49	64	63	65	50	58
M	46	47	67	64	74	62	54	67
N	32	31	32	46	41	44	29	34
GE250	41	42	32	63	63	63	35	48
50-249	42	38	41	57	63	56	36	48
Total	41	41	34	61	63	61	35	48

Source: LFS survey 2020 and EIA data.

Consequently, we cannot simply assume that particular business functions represent a high value. This judgment should be made on additional financial and economic information. Take, for example, ADM. Across the board, this is the highest-paid business function in most NACE sectors. However, in financial services (K), the average full-time wage in MK and ENG_RD is substantially higher than that of ADM. Thus, to make statements about high/medium/low-value business functions, we must consider the full context of all business functions in all industries.

High-/medium-/low-value business functions

Nominal values (as in Table 31) offer a good insight into value distribution, but they are less suited to generate helpful statistics, which is easier with categorised variables.

This section illustrates the approach to analysing the valuation of business functions. Our analysis is based on the average full-time wage categories within a business function.

Let us assume two (arbitrary) cutoffs in the wage data of Table 31, say at €31 500 (75% of the overall median salary) and €63 000 (150% of the overall median salary). We are now able to classify business functions as 'low-valued' (indicator = 1 in Table 32) when the average wage in a specific business function is below the lower threshold, and a business function is 'high-valued' (indicator = 3 in Table 32) when the average wage is above the upper threshold. The business function could be classified between these values as 'medium-valued' (indicator = 2 in Table 32). The 0 values in several cells mean there were too few weighted LFS respondents to guarantee sufficient reliability.

136 PROD (production of goods), DIST (distribution and logistics), MK (marketing, sales, and after-sales services), ICT (information and communication technology services), ADM (administrative and management functions), ENG_RD (R&D, engineering, and related technical services), OTH (other business services).

TABLE 32

Low- (1), medium- (2) and high-valued (3) business functions

	PROD	DIST	MK	ICT	ADM	ENG_RD	OTH	Total
B	0	0	0	0	0	0	0	0
C	2	2	2	3	3	3	2	2
D	0	0	0	0	0	0	0	3
E	0	0	0	0	0	0	0	2
F	2	0	0	0	3	2	2	2
G	2	2	1	2	2	2	1	2
H	0	2	0	0	2	0	2	2
I	0	0	0	0	2	0	1	1
J	0	0	3	2	3	0	2	2
K	0	0	0	3	3	0	2	3
L	0	0	0	0	2	0	0	2
M	0	0	3	3	3	2	2	3
N	2	1	2	2	2	2	1	2
GE250	2	2	2	2	2	2	2	2
50-249	2	2	2	2	2	2	2	2
Total	2	2	2	2	2	2	2	2

Source: LFS survey 2020 and EIA data.

Although we used arbitrary thresholds here, Table 32 shows that attaching economic value to business functions is practically possible. We linked the LFS with EIA data and applied the ISCO-CBF correspondence list. A drawback of this heuristic is that it already asks a lot from the data (quality) to arrive at the level of detail presented here. There are too few observations in the LFS to sketch an integral, reliable picture of the wages earned in each of the business functions, especially when data is broken down by NACE classes.

5. The impact of international outsourcing on wages

Linking the LFS and EIA data, as has been done in the preceding paragraphs, allows answering highly relevant questions from a policy perspective. First, how large are the total wage sums in each part of the economy per business function, for instance, broken down by NACE and size class? Second, what is the impact of international sourcing of business functions on the salary earned?

To answer the first question, we present the overall sum of wages earned in 2020 in Table 33. The results suggest that the business function 'Administrative and management services' (ADM) plays a large role in the overall Dutch paycheck. Not only are most people working in this business function (according to the LFS calculations underlying Table 30), but the average full-time wage is also the highest (Table 31). The 'Marketing' business function (MK) seems to play a much smaller role. This is not necessarily due to the number of employed persons (which is relatively high), but because of the low average full-time wages.

TABLE 33

Total actual wages earned per business function (millions of euros)

	PROD	DIST	MK	ICT	ADM	ENG_RD	OTH	Total
B	91	37	56	52	186	298	9	729
C	6 000	1 470	2 181	1 294	7 610	3 736	2 050	24 341
D	174	35	71	174	483	259	80	1 276
E	159	139	62	47	406	187	189	1 189
F	2 065	207	207	272	2 446	1 282	712	7 191
G	861	1 777	6 586	985	5 462	1 060	1 351	18 082
H	346	4 847	567	470	2 500	527	477	9 734
I	48	65	162	12	580	47	895	1 809
J	59	58	961	4 462	2 950	316	804	9 610
K	30	28	614	1 349	6 466	324	1 056	9 867
L	116	3	110	65	822	212	298	1 626
M	247	178	1 045	1 279	7 041	2 884	668	13 342
N	1 578	1 107	650	725	3 600	596	2 425	10 681
GE250	6 747	6 778	8 177	7 747	26 971	7 933	7 252	71 605
50-249	5 027	3 173	5 098	3 440	13 582	3 796	3 763	37 879
Total	11 774	9 951	13 275	11 187	40 553	11 728	11 015	109 483

Source: LFS survey 2020 and EIA data.

To answer the second question – what is the impact of international sourcing of business functions on the salary earned – we first have to calculate the net jobs created, broken down by high education jobs and medium/low education jobs. We then calculate the average wages of highy educated and medium/low educated workers. After calculating these figures, we can multiply the (average) net job change by the wages earned in these jobs, broken down by business function or any other breakdowns. The results are presented in Table 34 and show that the overall economic impact of international sourcing on business functions on the national wage bill of the Netherlands is about minus 212 million euros.

TABLE 34

Net job change due to international sourcing of business functions multiplied by the actual average wage in these jobs (thousands of euros, source: LFS 2020 and EIA data)

High educational attainment								
NACE section/ size class	PROD	DIST	MK	ICT	ADM	ENG_RD	OTH	Total
B	0	0	0	0	0	0	0	0
C	-16 626	284	-1 200	9 344	-6 106	10 098	- 350	-4 556
D	0	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0	0
F	371	0	0	0	0	0	0	371
G	- 551	- 609	-5 510	-3 575	-10 064	-4 743	-1 664	-26 716
H	0	330	0	- 63	-1 740	0	- 496	-1 969
I	0	0	464	96	368	0	0	928
J	368	0	-1 675	-10 382	-4 144	-11 319	0	-27 152
K	0	0	0	0	0	0	0	0
L	0	0	0	0	0	0	0	0
M	0	- 840	0	-6 076	-6 862	-16 588	3 036	-27 330
N	0	0	0	- 546	- 592	0	238	- 900
GE250	-1 125	176	0	549	-9 660	2 772	-2 484	-9 772
50-249	-12 474	-1 326	-8 477	-12 650	-17 688	-27 665	2 920	-77 360
Total	-16 438	- 835	-7 921	-11 202	-29 140	-22 552	764	-87 324

Medium and low educational attainment								
NACE section/ size class	PROD	DIST	MK	ICT	ADM	ENG_RD	OTH	Total
B	0	0	0	0	0	0	0	0
C	-96 018	-2 920	-1 025	- 816	-3 450	-1 479	- 190	-105 898
D	0	0	0	0	- 470	0	0	- 470
E	0	0	0	0	0	0	0	0
F	0	0	0	0	0	756	0	756
G	-13 716	- 494	- 546	-1 050	-9 800	- 224	- 700	-26 530
H	0	- 456	-1 014	- 162	- 832	0	0	-2 464
I	0	0	1 224	0	- 550	0	0	674
J	0	0	- 252	0	- 864	0	0	-1 116
K	0	0	11 124	0	6 624	0	860	18 608
L	0	0	0	0	0	0	0	0
M	0	- 336	- 420	- 260	-1 980	- 430	- 175	-3 601
N	0	0	- 884	- 500	-3 168	0	- 195	-4 747
GE250	-37 774	-2 336	- 854	-1 536	-8 190	360	- 987	-51 317
50-249	-66 924	-1 209	4 347	-1 599	-9 576	-1 558	161	-76 358
Total	-109 734	-4 206	8 207	-2 788	-14 490	-1 377	- 400	-124 788

Source: LFS survey 2020 and EIA data.

At least three points should be considered when interpreting the Figures in Table 34. First, the minus 212 million is not an overall net effect. Of course, many who lost their jobs have found new employment at other firms and earn a wage. Second, the method presented here does not represent the impact on value-added or GDP; in this section, we attempt to take the first step in economically quantifying the impact of international sourcing. Ideally, we could estimate the effects on value-added and GDP. Third, it is assumed that the disappeared jobs had (on average) the same wages as those still present in 2020.

6. Additional Indicators for the GVC Framework

Educational attainment per business function (as a proxy for skill)

Several other indicators can be estimated based on the link between the LFS, the correspondence table and wage information. For example, as an additional proxy for skill per business function, we can calculate the number of highly educated workers per business function. The results show that depending on the economic sector, the share of highly educated workers varies significantly within the same business functions. This is in line with Table 31. Specific sectors of the economy require a higher overall level of educational attainment, whereas in other sectors, there are lower requirements for the same business function.

TABLE 35

Percentage of workers with higher educational attainment

NACE section/ size class	PROD	DIST	MK	ICT	ADM	ENG_RD	OTH	Total
B	28%	22%	87%	53%	80%	89%	0%	66%
C	10%	16%	55%	65%	56%	67%	17%	36%
D	36%	25%	73%	74%	65%	65%	17%	58%
E	30%	4%	71%	63%	51%	58%	10%	35%
F	11%	6%	41%	41%	49%	59%	19%	33%
G	9%	12%	17%	63%	53%	37%	17%	24%
H	6%	18%	36%	69%	40%	62%	18%	28%
I	12%	23%	33%	29%	41%	67%	10%	19%
J	37%	19%	64%	70%	70%	76%	67%	68%
K	72%	53%	73%	81%	70%	93%	65%	72%
L	11%	0%	59%	54%	69%	67%	48%	57%
M	21%	47%	73%	78%	79%	82%	61%	76%
N	9%	22%	42%	60%	49%	59%	18%	30%
GE250	12%	19%	23%	69%	59%	67%	25%	38%
50-249	9%	13%	37%	69%	59%	64%	19%	38%
Total	10%	17%	27%	69%	59%	66%	23%	38%

Source: LFS survey 2020.

Share of 'high-value' business functions in total business functions sourced

First, let us look at how many business functions with positive employment are reported in the GVC survey.

In Table 36, we show that, e.g. 9 322 enterprises have a business function of administrative and management services. Only 3 990 firms report to have a business function in which they produce goods.

TABLE 36

Number of business functions with positive employment

	PROD	DIST	MK	ICT	ADM	ENG_RD	OTH	Total
B	25	26	28	20	28	45	26	198
C	2 160	1 967	2 047	1 416	2 292	2 894	1 442	14 218
D	10	15	28	23	30	39	26	171
E	56	70	84	45	94	68	72	489
F	437	439	538	305	808	546	532	3 605
G	660	1 582	2 064	1 334	2 182	985	1 368	10 175
H	48	704	455	334	704	218	292	2 755
I	152	40	262	88	337	95	309	1 283
J	104	92	558	590	629	395	299	2 667
K	15	8	121	117	167	50	188	666
L	8	7	113	105	143	64	144	584
M	80	149	520	493	793	515	533	3 083
N	235	281	647	359	1 115	296	984	3 917
GE250	687	1 009	1 387	1 217	1 663	1 228	1 252	8 443
50-249	3 304	4 373	6 076	4 013	7 659	4 981	4 963	35 369
Total	3 990	5 382	7 464	5 229	9 322	6 210	6 215	43 812

Source: GVC survey 2021, CBS, Netherlands.

Secondly, Table 37 shows how many business functions were sourced. The numbers show that 'Production' is already sourced internationally relatively often, although it was the least common business function in Table 36.

TABLE 37

Number of internationally sourced business functions

NACE section/ size class	PROD	DIST	MK	ICT	ADM	ENG_RD	OTH	Total
B	0	0	0	0	0	0	2	2
C	121	36	57	31	35	69	29	378
D	0	0	0	0	1	0	0	1
E	0	0	0	0	0	0	6	6
F	2	0	0	0	0	1	0	3
G	26	12	46	14	55	40	5	198
H	3	16	10	1	20	0	1	51
I	0	0	8	8	10	0	0	26
J	8	0	18	21	27	41	0	115
K	0	0	7	0	7	0	7	21
L	0	0	0	0	0	0	0	0
M	17	15	7	26	30	37	37	169
N	7	0	14	7	15	0	8	51
GE250	43	13	10	32	65	33	9	205
50-249	140	68	157	76	134	157	87	819
Total	183	80	167	108	199	189	96	1 022

Source: GVC survey 2021, CBS, Netherlands.

Based on Table 32, we can identify how many of the sourced business functions are assigned the label 'high-valued'. From Table 37, we find that 1 021 business functions are sourced, and from Table 38, we find that of those, 250 (about 24%) are labelled as 'high-valued', neglecting those business functions which we cannot reliably assign to one of the three 'values' (see Table 32).

TABLE 38

Total number of internationally sourced business functions that are of 'high value' [137]

Business function / NACE section / Size class	C	J	K	M	Total
Production of goods	:	:	:	:	:
Distribution and logistics	:	:	:	:	:
Marketing, sales, and after-sales services	:	18	:	7	25
Information and communication technology services	31	:	:	26	57
Administrative and management functions	35	27	7	30	99
R&D, engineering, and related technical services	69	:	:	:	69
Other	:	:	:	:	:
Total	135	45	7	63	250

Source: GVC survey, LFS and EIA data (2020).

137 No values for NACE sections B, D, E, F, G, H, I, L, and N.

Share of 'high-value' business functions sourced as a percentage of total high-valued business functions

When the information from Table 32 and Table 36 are combined, the number of high-value business functions present at firms in the GVC survey population can be derived. We find (Table 39) that of all 43 811 business functions with positive employment in the international sourcing survey, 10 687 (24%) are labelled as 'high-valued'. In turn, 250 (2.33%) of the latter group are sourced internationally (Table 38).

TABLE 39

Number of business functions with positive employment and that are of 'high value' [138]

Business function / NACE section / Size class	C	F	J	K	M	Total
Production of goods	:	:	:	:	:	:
Distribution and logistics	:	:	:	:	:	:
Marketing, sales, and after-sales services	:	:	558	:	520	1 078
Information and communication technology services	1 416	:	:	117	493	2 026
Administrative and management functions	2 292	808	629	167	793	4 689
R&D, engineering, and related technical services	2 894	:	:	:	:	2 894
Other	:	:	:	:	:	:
Total	6 602	808	1 187	284	1 806	10 687

Source: GVC survey, LFS and EIA data (2020).

Notice that, to calculate the percentage correctly, one must add the 250 (sourced in the 2018-2020 period) to the 10 687 (existing at the end of 2020) in the denominator. This is because the business functions that disappeared should technically be divided by the total business functions at the beginning of the 2018-2020 period, not the end of the period. However, this would virtually yield the same result (2.28%). Moreover, the point here is not to make the correct calculation but to present the concept of the valuation of business functions.

138 Note: No values for NACE sections B, D, E, G, H, I, L, and N.

Pilot 3. Use MDL and advanced use of National Accounts to quantity foreign input and output

1. Introduction

In this pilot, we discuss several data gaps and suggest indicators for measuring GVCs. We investigate concrete problems and how these can be solved. The original proposal for funding considered only a solution that takes the strength of business statistics and then uses it to enrich national accounts statistics. This approach will be used to calculate the proposed indicators. However, during the execution of the pilot, based on the discussions with Eurostat, we extended the description of pilot 3 with approaches that solely relied on existing but yet-to-be-developed business statistics, which do not need to be combined with national accounts statistics. The following data gaps will be touched upon in this pilot:

(1) Indirect trade

Indirect trade (through wholesalers or intermediaries) is a fundamental way for enterprises to engage in international trade, and to be part of a GVC (Crozet et al., 2013, Gonzales, et al., 2018) and is recognised internationally as an important way of GVC participation (OECD, 2018) [139]. Previous research based on supply-use tables and input-output tables shows that exports through wholesalers amounted to 47 billion euros, equivalent to 22.9% of total Dutch exports in 2015, while agriculture and manufacturing sectors (notably the food, machinery, and chemical industries) especially rely on this indirect mode of exporting (Statistics Netherlands, 2019[140]). This export share is associated with about 4% of GDP. The new information needed is the indirect imports and indirect exports by industry and type of enterprise (e.g. SMEs vs large enterprises).

(2) Value added and employment related to foreign demand, by type of enterprise

The varying production structures of SMEs, large companies, multinational, and non-multinational firms, as well as the sources and destinations of their inputs and outputs, highlight the importance of foreign markets in contributing to value-added and employment outcomes. Addressing the initial data gap will enable us to better understand the impact of these markets on different enterprise types.

In this third pilot, we will demonstrate how to address the data gaps by incorporating new data and employing a methodology that combines business statistics and national accounts statistics. We will also identify the additional information, data, and methodologies that must be developed to derive further insights. The main results from the first analyses are the following:

1) In 2016, Dutch SMEs had 43 billion euros in direct imports and 32 billion euros in indirect imports. Their direct and indirect exports amounted to 84 billion and 79 billion euros, respectively.
2) In 2016, Dutch SMEs had 77 billion euros of value-added due to their direct and indirect exports. For large enterprises, this was 117 billion euros.

The following section briefly discusses the problems and possible solutions. In section 3 we provide a brief overview of the statistical indicators that will be estimated. Section 4 contains a detailed description of the method and data used to calculate these indicators. Section 5 presents the results.

139 https://www.oecd.org/cfe/smes/ministerial/documents/2018-SME-Ministerial-Conference-Plenary-Session-3.pdf

140 https://www.cbs.nl/en-gb/publication/2019/39/internationalisation-monitor-2019-third-quarter

2. Description of problem and solutions

What we want to know: direct and indirect imports and exports

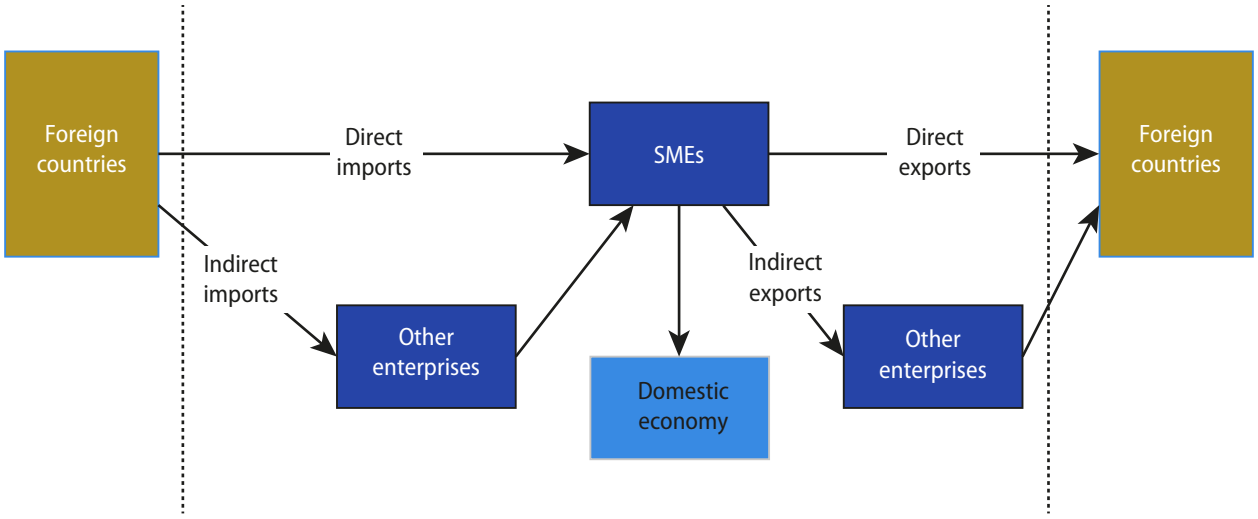
In an ideal scenario, it would be beneficial to understand the extent to which various types of companies rely on foreign and domestic markets. This includes determining the proportion of imports used for production and the share of production that ultimately ends up in foreign markets.

The first query focuses on the level of foreign inputs (imports) used by different enterprises, such as SMEs, in their production processes. These inputs comprise direct imports procured by the firms themselves and indirect imports acquired through the value chain. For example, when an SME in specialized car manufacturing uses products from metal manufacturing that were produced using foreign metal ores. In this case, these imported ores are indirect imports of the SME in car manufacturing.

This is depicted in Figure 1 below. The figure also shows the role of direct and indirect exports. The direct exports are the exports of the enterprise itself. The indirect exports are its produced goods and services that are subsequently embodied in exports of another enterprise. For example, an SME might provide cleaning or security services to a multinational enterprise, mainly producing for foreign markets. Consequently, (a large part of) the services of the SME are embodied in the exports of the multinational: they are indirect exports.

FIGURE 21

A conceptual model of direct and indirect imports and exports



Source: Own elaboration.

Ideally, detailed data on indirect imports and exports would be accessible at the individual enterprise level. This microdata can then be used to compile statistics at any desired output level, such as SMEs, multinationals, 'green firms', and similar.

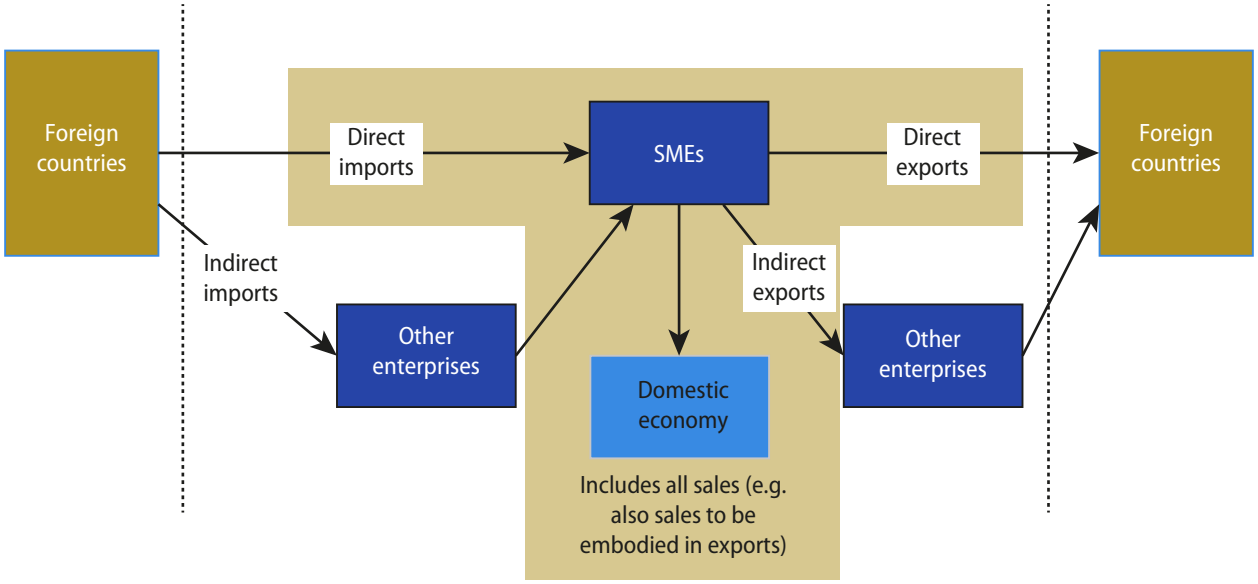
Once it is determined what proportion of an enterprise's production ultimately ends up in foreign markets (e.g. by type of enterprise or an industry), it becomes possible to estimate the proportion of value-added, employment, emissions, and related factors attributable to foreign demand. This illustrates the significance of foreign markets for the enterprise.

What we actually know: direct imports and exports

In current business statistics, only direct imports and exports are known at the enterprise level. Information on indirect imports or exports is entirely lacking.

FIGURE 22

Part of import and export flows covered by current business statistics



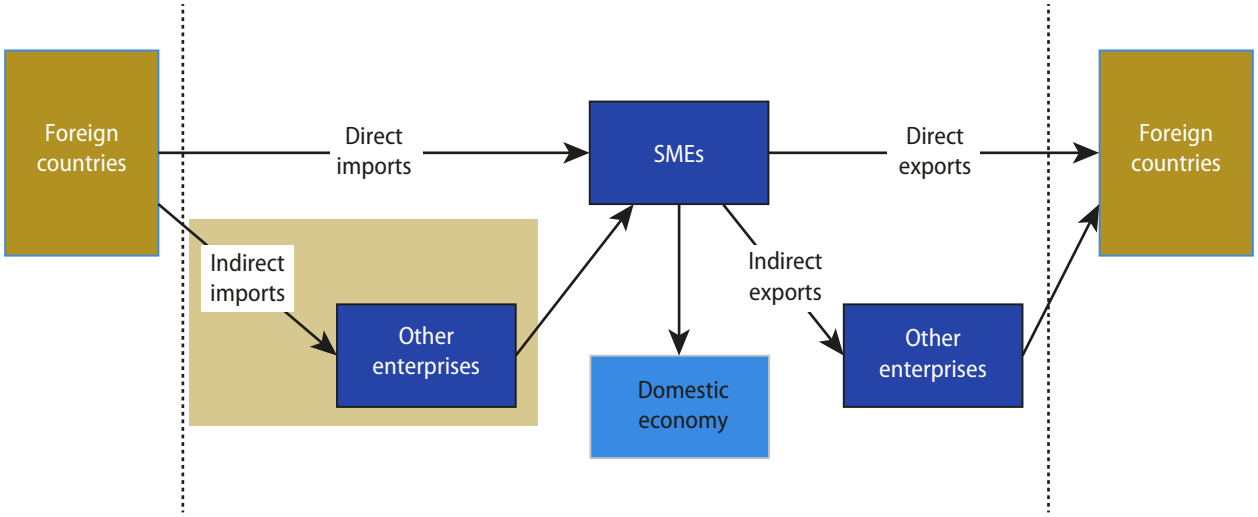
Source: Own elaboration.

Data gap: indirect imports and exports

The imports and exports via the value chain are still missing, i.e. we do not have this information yet. Goods and services are being imported by the suppliers, in production or wholesale. And goods and services sold to domestic firms that use these goods and services to produce for foreign markets.

FIGURE 23

Part of import and export flows not covered by current business statistics



Source: Own elaboration.

In general, the missing information pertains to the flow of goods and services within the domestic value chain - who is selling to whom and the structure of the domestic supply chain..

The way forward: three types of solutions

We see three types of solutions for describing who is selling to whom in the home country or mapping the domestic value chain.

A first solution to address this issue is to map the domestic value chain using microdata, which entails estimating a firm-firm network based on real data. In countries like Belgium, extensive VAT records on business-to-business transactions enable this. However, many countries lack such detailed data. A potential workaround is to estimate the network using more aggregated data parameters from other countries (e.g. the number of suppliers/buyers of a firm) and validate these estimates with available firm-firm-level data. Statistics Netherlands (CBS) adopted a similar approach. Additionally, new questions in the GVC survey (Pilot 1 in the annexe) could provide further information to refine estimates derived from aggregate models. In the event that data is available detailing the quantity of goods and services each domestic enterprise sells to other domestic enterprises, it would be possible to estimate indirect imports and exports by applying some proportionality assumptions.

The second solution is to devise new statistics about domestic TEC and STEC.[141] This can be achieved in several ways, but it would increase the administrative burden for enterprises, which needs to be considered.

One approach is that enterprises report from which types of enterprises (industry, size, multinational status) they buy goods and services, whether they are domestically produced and to whom they sell their own goods and services. This requires enterprises to report the characteristics of their suppliers and buyers accurately. The approach requires that enterprises can indicate whether the inputs are domestically produced or not.

Another approach is to request more detailed information from enterprises regarding their inputs. While output data (such as the detailed PRODCOM statistics for manufacturing) is relatively comprehensive, input information is not as extensive. However, enterprises can easily provide this data. The product details can then be effectively matched to industries, revealing more intricate dependencies and enabling the connection of product details to policy concerns. This approach would also bolster the supply side of National Accounts. As the information is collected at the enterprise level, a microdata linking methodology can be employed to link it with various types of enterprises.

Nonetheless, once again, proportionality assumptions would need to be employed. It is generally not feasible to measure indirect imports and exports at the enterprise level. For instance, SMEs utilise domestic inputs, but the question is how much of these inputs are derived from foreign sources. This would involve examining the foreign and domestic inputs of the producers of these goods and services. Consequently, enhancing supply and use/input-output tables with actual data, rather than relying on assumptions, would be a more effective approach

The third solution is to use the wealth of detail in business statistics to disaggregate National Accounts statistics that lack the detail necessary for policy questions (for example, about SMEs).

This is the only feasible approach for all countries since it does not need tailor-made data or new data collection. One can compile extended input-output tables, demonstrating for instance, relations between SMEs in metal manufacturing and large enterprises in car manufacturing. Chong et al. (2019)[142] used a similar approach, in which they capitalised on the existing microdata linking to compile so-called extended supply and use tables and input-output tables. An OECD expert group currently compiles a handbook describing this type of work, with practical guidance and best practices [143].

3. Description of GVC indicators

This section briefly describes the proposed indicators calculated for the year 2016 using an approach that integrates business statistics and national accounts statistics, as shown in the third solution in the previous section. This approach was specified in the original proposal and is the only one that is currently feasible for all NSAs.

The tables in this section include only specific selections (as an example).

141 Trade in goods Enterprise Characteristics, and Services Trade Enterprise Characteristics.

142 Chong, S., Hoekstra, R., Lemmers, O., Van Beveren, I., Van den Berg, M., Van Der Wal, R. and P. Verbiest (2019), The role of small and medium enterprises in the Dutch economy: An analysis using an extended supply and use table, *Journal of Economic Structures 8*(8).

143 OECD Expert Group on Extended Supply and Use Tables - OECD

1. Share of value added due to direct, indirect and total exports, by type of enterprise by industry

These indicators show at a more granular level how much different types of enterprises in different industries depend on foreign markets for their sales. The indicators consider both direct exports/sales and indirect exports/sales, the latter via the value chain.

TABLE 40

Share of value added in NACE section C (manufacturing) by type of enterprise

Type of enterprise	Direct exports	Indirect exports	Total exports
Domestic SME	31%	25%	56%
Large domestic SME	38%	12%	50%
Multinational Dutch SME	53%	18%	71%
Large multinational Dutch enterprise	69%	12%	80%
Foreign-owned multinational enterprise	63%	17%	79%

Source: Microdata linking project using globalisation statistics, CBS, Netherlands, 2020.

2. Share of production for final domestic use consisting of direct, indirect and total imports by type of enterprise by industry

These indicators show at a more granular level how much different types of enterprises in different industries depend on foreign markets for their inputs to produce for the domestic market. The indicators consider direct imports/acquisitions and indirect imports/acquisitions, i.e. those via the value chain.

TABLE 41

Share of value added in NACE section F (construction) by type of enterprise

Type of enterprise	Direct exports	Indirect exports	Total exports
Domestic SME	11%	15%	26%
Large domestic SME	12%	16%	28%
Multinational Dutch SME	16%	16%	32%
Large multinational Dutch enterprise	17%	15%	32%
Foreign-owned multinational enterprise	29%	11%	40%

Source: Microdata linking project using globalisation statistics, CBS, Netherlands, 2020.

3. Share of exports consisting of indirect and total imports, type of enterprise by industry (including backward integration in GVCs)

These indicators show at a more granular level how much different types of enterprises in different industries depend on foreign markets for their inputs to produce for the foreign market. Again, the indicators cover both imports/acquisitions and indirect imports/acquisitions.

TABLE 42

Share of value added in J: Information and communication by type of industry (%)

Type of enterprise	Direct exports	Indirect exports	Total exports
Domestic SME	5%	9%	14%
Large domestic SME	5%	10%	16%
Multinational Dutch SME	23%	6%	30%
Large multinational Dutch enterprise	17%	6%	23%
Foreign-owned multinational enterprise	34%	6%	39%

Source: Microdata linking project using globalisation statistics, CBS, Netherlands, 2020.

4. Share of imports of intermediate goods and services by source and final user production for domestic final use and exports, type of enterprise by manufacturing/ services (including non-GVC trade)

These indicators show, at a more granular level, how types of enterprises and industries are interwoven when it concerns imports. Namely, they show who imports (source), who ultimately uses it (destination), and whether the imports are ultimately used to fulfil domestic or foreign demand.

TABLE 43

Source and destination of imports used for final domestic use (%) [144]

Final user	Source	Domestic SME		Large domestic SME		Multinational Dutch SME		Large multinational Dutch enterprise		Foreign-owned multinational enterprise	
		M.	S.	M.	S.	M.	S.	M.	S.	M.	S.
Domestic SME	M.	21	1	0	0	1	0	1	0	4	2
	S.	1	8	0	0	0	0	1	1	1	2
Large domestic SME	M.	1	1	18	0	0	0	1	0	3	2
	S.	1	2	0	7	0	0	0	1	1	2
Multinational Dutch SME	M.	1	1	0	0	28	0	1	0	3	2
	S.	1	2	0	0	0	17	1	1	1	3
Large multinational Dutch enterprise	M.	1	1	0	0	0	0	37	0	4	2
	S.	1	2	0	0	0	0	0	15	1	2
Foreign-owned multinational enterprise	M.	1	1	0	0	0	0	1	0	49	2
	S.	0	1	0	0	0	0	0	1	1	24

Source: Microdata linking project using globalisation statistics, CBS, Netherlands, 2020.

144 'M.' refers to manufacturing, while 'S.' refers to services enterprises. Manufacturing consists of "mining and quarrying" and "manufacturing". All other industries are grouped together to "services".

TABLE 44

Source and destination of imports used for exports (%)

Final user	Source	Domestic SME		Large domestic SME		Multinational Dutch SME		Large multinational Dutch enterprise		Foreign-owned multinational enterprise	
		M.	S.	M.	S.	M.	S.	M.	S.	M.	S.
Domestic SME	M.	22	1	0	0	0	0	1	1	4	2
	S.	0	10	0	0	0	0	0	1	1	2
Large domestic SME	M.	1	1	27	0	0	0	1	0	3	1
	S.	0	2	0	11	0	0	0	1	1	2
Multinational Dutch SME	M.	1	1	0	0	30	0	1	0	4	2
	S.	0	1	0	0	0	19	0	1	1	2
Large multinational Dutch enterprise	M.	1	1	0	0	0	0	39	0	4	2
	S.	0	1	0	0	0	0	0	17	1	2
Foreign-owned multinational enterprise	M.	1	1	0	0	0	0	1	0	54	1
	S.	0	1	0	0	0	0	0	0	1	32

Source: Microdata linking project using globalisation statistics, CBS, Netherlands, 2020.

5. Value added by source and final user who produces for exports, type of enterprise by manufacturing/services (including non-GVC trade)

These indicators show at a more granular level how various types of enterprises and industries **are interwoven when it concerns exports**. Namely, it shows who has value added (*source*) due to the exports of whom (*final user*).

TABLE 45

Source and destination of domestic value added embodied in exports (millions of euros)

Final user	Source	Domestic SME		Large domestic SME		Multinational Dutch SME		Large multinational Dutch enterprise		Foreign-owned multinational enterprise	
		M.	S.	M.	S.	M.	S.	M.	S.	M.	S.
Domestic SME	M.	8 193	1 713	151	422	114	128	175	510	539	859
	S.	294	26 986	65	1 100	51	337	91	1 183	193	1 639
Large domestic SME	M.	166	544	3 939	130	33	40	62	158	174	268
	S.	37	660	8	3 119	7	40	13	141	26	190
Multinational Dutch SME	M.	279	800	52	186	3 031	59	87	220	260	392
	S.	103	1 587	23	343	17	6 983	27	371	66	524
Large multinational Dutch enterprise	M.	1 057	3 085	260	764	202	235	11 194	884	1 040	1 543
	S.	171	2 319	41	496	29	151	42	11 159	108	756
Foreign-owned multinational enterprise	M.	1 742	6 212	544	1 538	357	473	618	1 728	24 361	3 071
	S.	527	7 033	101	1 575	80	502	112	1 609	343	35 294

Source: Microdata linking project using globalisation statistics, CBS, Netherlands, 2020.

6. Methodology and data extended input-output table

Introduction

This section explains the methodology and data behind a so-called extended input-output table, an input-output table where industries are split by type of enterprise. A simplified example is given in Table 46 below.

TABLE 46

A simplified example of an extended input-output table

	Manufacturing (SME)	Manufacturing (Large)	Services (SME)	Services (Large)	Value added	Imports	Total production
Manufacturing (SME)							
Manufacturing (Large)							
Services (SME)							
Services (Large)							
Value added							
Imports							
Total production							

We discern the following types of enterprises in our analysis:

- SME non-multinational (domestic SME)
- Large enterprise non-multinational (large domestic SME)
- SME Dutch multinational (multinational Dutch SME)
- Large enterprise Dutch multinational (large multinational Dutch enterprise)
- Foreign multinational (foreign-owned multinational enterprise)

Note that we do not split all industries. In particular, we do not split agriculture, forestry and fishery, financial institutions, imputed rents of owner-occupied dwellings, public administration, education, health and social work activities, other service activities, culture, sports and recreation, and activities of households [145]. The reason is that either there is not enough data available in the Dutch statistical system (e.g. A and K), or it seems unreasonable to split these industries (e.g. L68A and O).

The resulting input-output table has 47 industries that are split and 17 industries that are not split. The exact distinction can be found in the appendix to this pilot.

We use the approach described by Piacentini and Fortanier (2015) to split the tables. This approach combines the rich detail in the microdata with the macro-economic data that is internally consistent (by construction) and relates to well-known numbers such as the GDP. The microdata and the macro data are different, even when describing the same number, such as the production of the construction industry. This is due to several reasons, such as different concepts and sources. One way to deal with this is to keep the macro data as-is and split it using shares compiled using microdata.

The prerequisites for this method are an input-output table, and for each industry that is to be split, the shares of each type of enterprise in the industry are for four key variables. These are production, value-added, imports and exports, an example of which is the share of non-multinational SMEs in production by the metal industry. These shares are obtained by extensive microdata linking in the domain of business statistics, such as international trade in goods and services and structural business statistics.

145 In NACE 2.0, these are respectively A, K, L68A, O, P, Q R, S and T.

Delineation of the enterprises

The main sources for delineating the enterprises are the General Business Register and the list of foreign and domestic multinationals. The General Business Register provides, among others, the industry of an enterprise and the size of the corresponding enterprise group. If the enterprise group employs less than 250 persons and is domestically owned, we categorize the enterprise as a small and medium-sized enterprise (SME). This delineation of SME/large enterprises is closer to the common interpretation of SMEs.

For example, an enterprise with 200 employees and an administrative unit of an enterprise group with 5000 employees are put in the group of large enterprises. This might be better for analysis since this unit has all the advantages of a large enterprise, such as a more extensive network and easier access to funding. Earlier microdata linking projects, e.g. by Statistics Netherlands and the Nordic countries (Statistics Denmark and OECD, 2017), have shown that this delineation makes quite a difference. Large parts of production are at enterprises with less than 250 persons employed but more than 250 persons employed in the enterprise group.

The list of foreign multinationals is compiled yearly during the Inward Foreign Affiliates Statistics (Inward FATS) statistics process. The list of domestic multinationals is compiled using survey data (large enterprises are being asked whether they have foreign subsidiaries) and tax data (which provides information about participation in other enterprises, at home or abroad) at the enterprise level.

Production and value-added

From the structural business statistics (SBS), production and value-added data are obtained at the enterprise level. However, these figures are typically derived from surveys, and the desire is to have totals at the industry level, broken down by type of enterprise. One approach to achieve this is to use the existing weights of the SBS. However, this method is not recommended since these weights usually do not account for different types of enterprises and are calculated solely to yield accurate industry-level data. Due to the survey design, some enterprises within an industry may be over-sampled, while the number of a given type of enterprise within an industry may be low, causing these enterprises to be omitted from the survey. A potential solution is to recalculate the weights; however, we opt for an alternative approach. Namely, to impute the missing data. We do this by calculating the median production per person employed and the median value-added per person employed. This is done at the most granular level of industries and types of enterprise. In cases where no information is available for a given type of enterprise within a given stratum, we use the median within the same industry, considering all enterprises.

The results are totals by industry and type of enterprise. Note that the data includes only what enterprises reported [146]. The Dutch National Accounts have estimates for these at the industry level. We assume that these extra parts are all at the SMEs that are not multinationals and add the estimates to that category, thus arriving at new totals.

Adding the totals of each enterprise type in each industry yields totals at the industry level. Then, the share of each enterprise type in production and value added by industry can be calculated.

International trade in goods and services

Since it is desirable to use as much detail as possible – to account for the heterogeneity between types of firms – we use microdata for trade in goods and services. The Dutch National Accounts has this split in imports and exports as well. Hence, we estimate shares in, e.g. exports of goods and imports of services.

Trade in goods

An essential first step for the trade in goods data is to align the original data as much as possible to National Accounts. The source statistics measure goods that cross the border, whereas National Accounts measure goods that change ownership. The source statistics adapt their data before sending it to National Accounts. We use that dataset. Where possible, we use other known adaptations by National Accounts as well. These can be at enterprise or general levels, e.g. international trade in illegal drugs.

We use the microdata of the imports and exports of goods linked to enterprises (a form of Traders Enterprise Characteristics, TEC). These are aggregated by industry and type of enterprise. This is only partial data because not all trade data can be matched to an enterprise. However, it can be used to compute shares of each enterprise type in imports and exports of goods by an industry.

146 This is why some parts are still missing, e.g. moonlighting and illegal activities such as production of drugs.

Trade in services

Statistics Netherlands has microdata of imports and exports of services linked to enterprises (a form of STEC). These are aggregated by industry and type of enterprise. Again, shares of each enterprise type in an industry's imports and exports are now calculated for services instead of goods.

Splitting the input-output table using the calculated shares

We used the table that was reported in the regular process to Eurostat for the input-output table. The Eurostat input-output table has 64 industries. As mentioned before, 47 of them will be split, and 17 will not be split. The approach is that of Piacentini and Fortanier (2015). More details are available in the Dutch system, and there is more recent data, but those tables consider margins quasi-industry. For our approach, this is not desirable; it is challenging to interpret the supply of a margin industry with no value added or employment.

To compile the desired table, proceed as follows:

1. Use the shares of each enterprise type to split production, value-added and imports in each industry;
2. This yields total intermediate use by enterprise type in each industry since intermediate use = production – value added – imports. Translate these values into shares, e.g. the share of foreign multinationals in total intermediate use by the car industry;
3. Split intermediate use by an industry into intermediate use by an industry by enterprise type using these shares. As a result, the columns in the input-output table are split;
4. The value of total intermediate supply plus final supply minus exports is known for each type of enterprise in an industry. This is the case since production = total supply = total intermediate supply + final supply - exports + exports. Translate these values into shares, e.g. the share of foreign multinationals in total intermediate supply + final supply – exports;
5. Now split intermediate supply + (final supply – exports) for each industry into the parts of each type of enterprise using these shares. As a result, the rows in the input-output table are split.

The entire input-output table has now been split.

7. Results

This section provides some results. The results clearly show that producing the previously discussed indicators is already feasible. However, the results must often be kept confidential due to the details in industries (47) and type of enterprises (5). For instance, there might not be many foreign multinationals in a given industry, or one dominates production or trade. Sometimes, this is even the case when reporting at the highest level of the NACE classification for industries [147]. Therefore, the results in the detailed tables and this section are relatively aggregated.

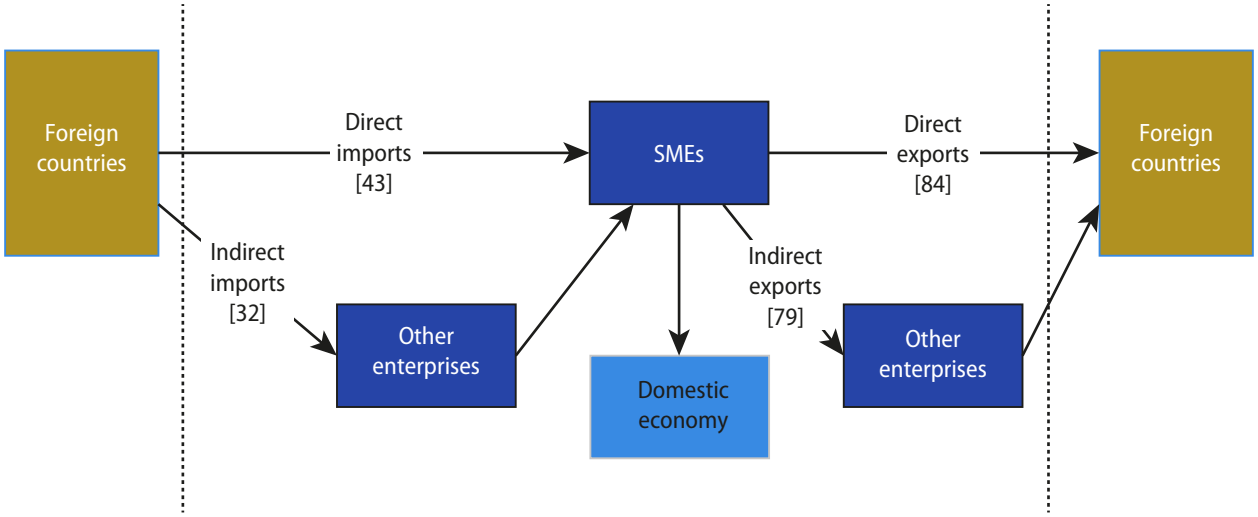
Imports and exports from Dutch SMEs

In the figure below, we have calculated the trade flows as distinguished in the conceptual model (see Figure 21) for a particular type of firm, namely SMEs. The graph shows how SMEs depend on foreign countries for their supply (imports) and sales (exports). Part of the trade flows first through other firms. For example, SMEs import 43 billion euros and use 32 billion euros of imports embodied in their supplies from other domestic firms.

147 'Divisions', such as A: Agriculture, forestry and fishery.

FIGURE 24

Direct and indirect imports and exports of Dutch SMEs, 2016



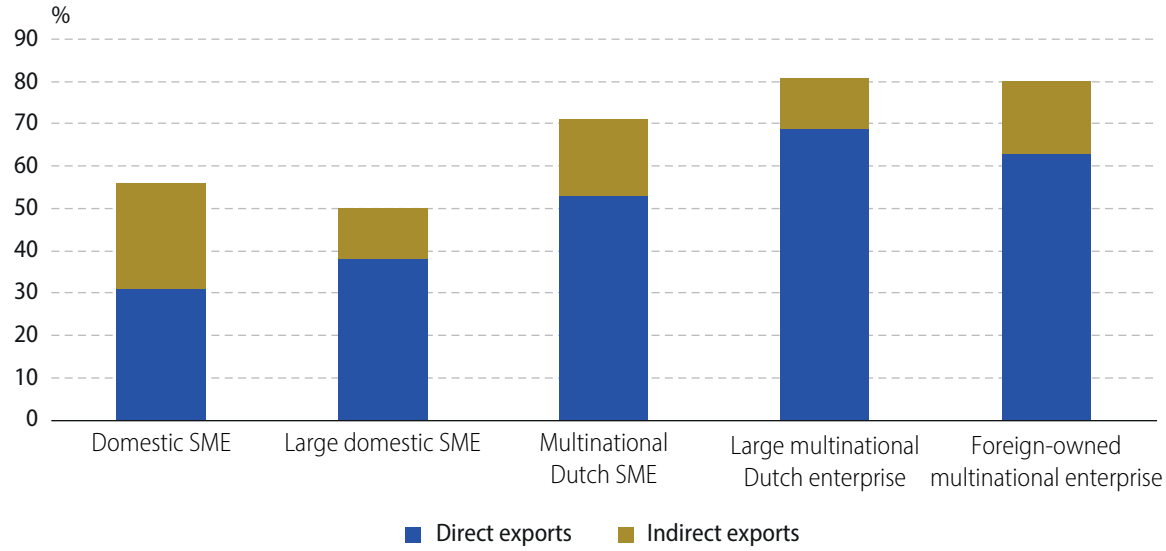
Source: Microdata linking project using globalisation statistics, CBS, Netherlands, 2020.

How important are exports for manufacturing by the different types of enterprises?

Figure 25 shows which part of value added in manufacturing is due to exports. SMEs rely relatively more on indirect exports to benefit from foreign demand. It might come as no surprise that multinationals have higher dependence on exports.

FIGURE 25

Value added due to exports as a share of total value added in manufacturing



Source: Microdata linking project using globalisation statistics, CBS, Netherlands, 2020.

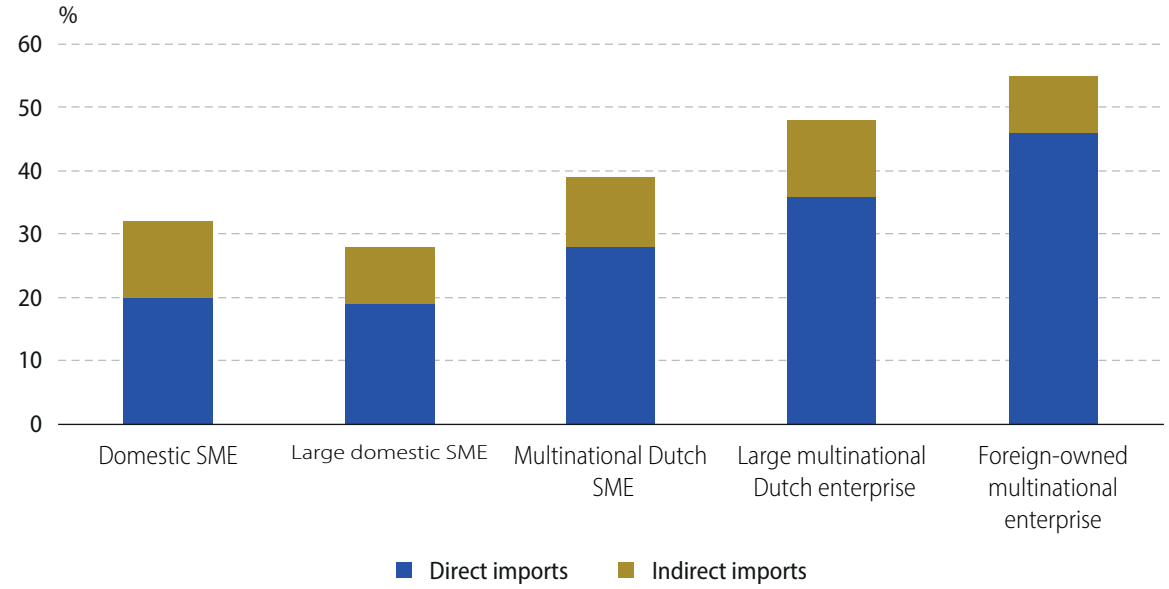
Imports embodied in final production for domestic use

Figure 26 shows how much of the production for domestic use for enterprises in manufacturing consists of imports.

Multinationals do not only depend more on foreign markets for their sales but also for their supply.

FIGURE 26

Imports embodied in final production for domestic use, as a share of production in manufacturing



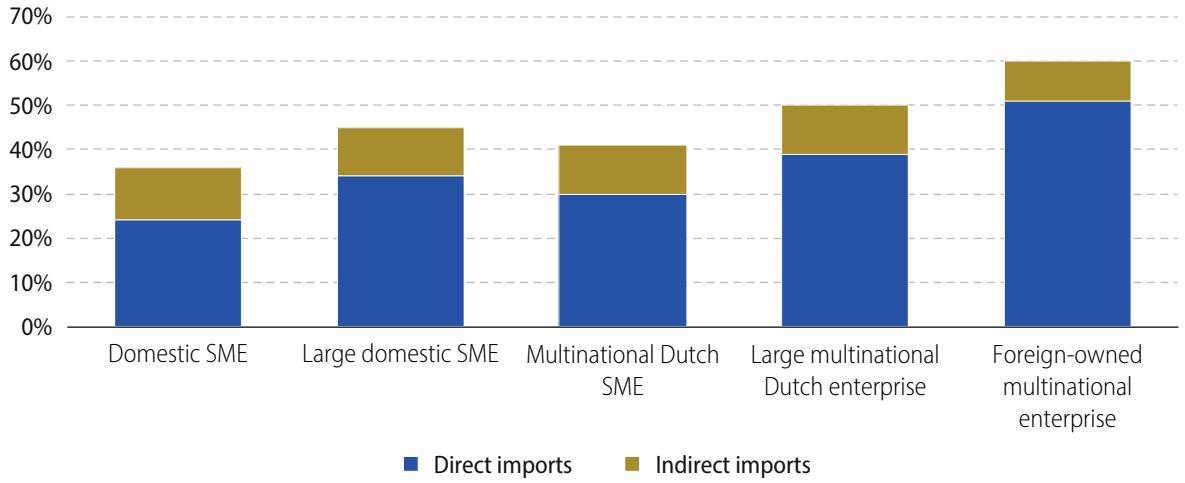
Source: Microdata linking project using globalisation statistics, CBS, Netherlands, 2020.

Imports embodied in exports

Figure 27 shows enterprises in manufacturing how much of their production for exports consists of imports. It is very similar to Figure 7 since one of the main assumptions in input-output analysis is that each output unit is created with the same inputs. Because of the different focus of individual industries, e.g. those mainly focusing on the domestic market have more/fewer imports than exporting industries, there will be minor differences.

FIGURE 27

Imports embodied in exports, as a share of exports by manufacturing



Source: Microdata linking project using globalisation statistics, CBS, Netherlands, 2020.

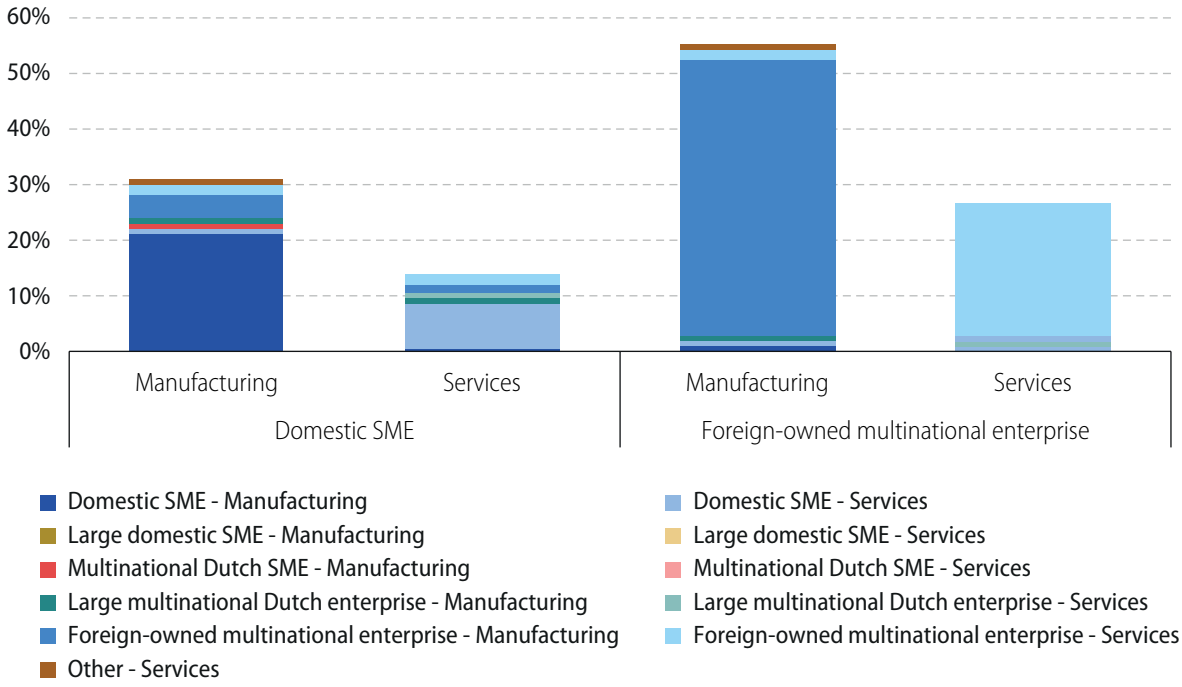
Who imports for whose final production for domestic use

Earlier in this section, we considered total imports embodied in final production for domestic use. Now we show, in Figure 28, what the source of these imports is. Note that the percentages do not add up to 100% but to the ratio of imports in final production for domestic use divided by final production for domestic use. Also, 'manufacturing' is not only 'manufacturing' per se but also includes 'mining and quarrying'. All other industries are grouped as 'services'.

In general, imports coming via other types of firms are relatively small. Imports are mostly direct. Still, imports by foreign-owned manufacturers accounted for 4% of the total value of final production for domestic use by SMEs in manufacturing which are not MNEs.

FIGURE 28

Imports for domestic use by importer and final user [148]



Source: Microdata linking project using globalisation statistics, CBS, Netherlands, 2020.
Note: Manufacturing is delineated as section C in NACE Rev 2 whereas Services contain sections D-I plus M-N.

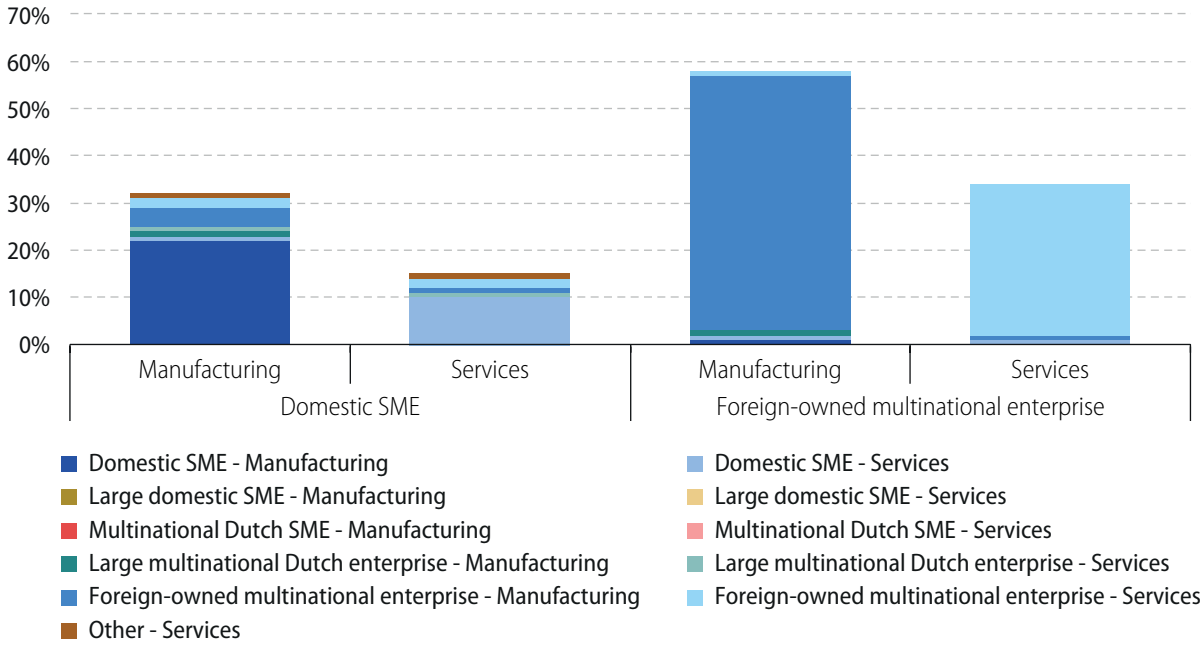
Who imports for whose exports

Like the previous figure, Figure 29 shows the importer of the goods and services embodied in exports. Again, due to standard assumptions in input-output analysis, Figure 10 does not differ too much from Figure 28.

148 Manufacturing is delineated as section C in NACE Rev 2 whereas Services contain sections D-I plus M-N.

FIGURE 29

Imports for exports by importer and exporter



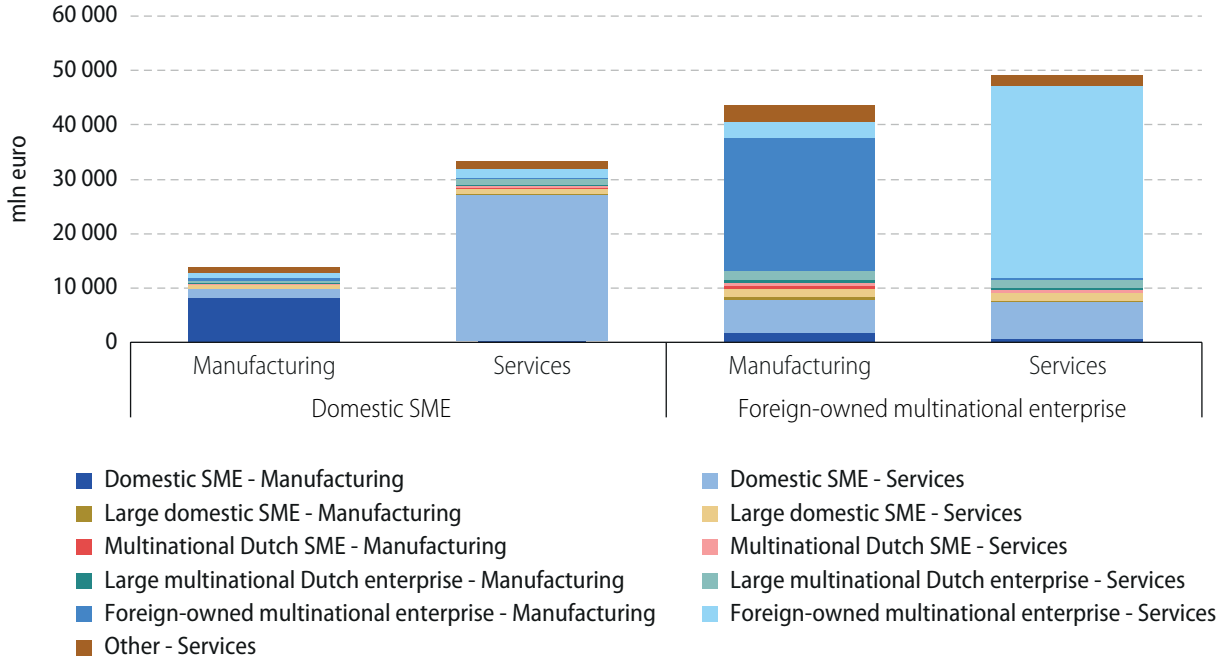
Source: Microdata linking project using globalisation statistics, CBS, Netherlands, 2020.

Who has value added embodied in whose exports

Figure 30 shows several dependencies between types of enterprises. For example, non-multinational SMEs have 15.5 billion value added because they produce somewhere in the supply chain of foreign multinationals. Thus, SMEs can access foreign markets, while multinationals can procure goods and services that may be distinct or more costly elsewhere.

FIGURE 30

Value added embodied in exports by producer and exporter



Source: Microdata linking project using globalisation statistics, CBS, Netherlands, 2020.

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