TRAINFORTRADE

Strengthening knowledge and skills through innovative approaches for sustainable economic development

Module 6

New Areas of Work and Analytical Topics

Participants Manual

Training Course on International Merchandise Trade Statistics (IMTS)

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Forward

E-learning course on international merchandise trade statistics

International trade in goods are an increasingly important part of global commerce. International Merchandise Trade Statistics (IMTS) play a vital part in monitoring, analysing and projecting macroeconomic developments in individual economies and the world economy. IMTS are well developed and international standards have been defined in the IMTS 2010 to harmonize standards and practices. However, many measurement issues and comparability problems remain. Increasingly the important phenomenon of globalization, entailing the internationalization of production and sales and new forms of delivering goods and services to customers across countries, new developments in information and communication technologies and the growing importance of e-commerce requires new approaches and poses new methodological challenges.

The objective of this e-learning course on IMTS is to provide more easily accessible and rather complete training material for those involved in the collection, compilation, analysis and dissemination of IMTS.

The main goals are to enhance statisticians' ability to apply the most recent internationally agreed recommendations on IMTS, define best possible data sources, set up adequate collection systems, and enhance statistics compilation processes. Furthermore, the course would communicate the importance of quality, metadata, timely dissemination, and links to economic analysis and national policy objectives. The training would guide trainees on how to better use the internationally available guidance, especially the IMTS Concepts and Definitions 2010 and the related Compilers Manual.

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- UNCTAD, Division on Technology and Logistics, Knowledge Development Branch, Human Resources Development Section/TrainForTrade;
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1. INTRODUCTION

International trade is defined, in the Balance of Payments as in the System of National Accounts, as the whole set of international transactions in items that are outcomes of production activities. The term "international merchandise trade statistics" (IMTS) refers to a specialized multipurpose domain of official statistics concerned with the provision of data on the movements of goods between countries and areas.

This module on 'New areas of work' describes the linking of Trade data with Central Business Register (CBR), Business Statistics (BS) and National Accounts (NA), Trade Indices and Seasonal Adjustments.

This module is based on the recommendations contained in chapter XI of 'IMTS: Concepts and Definitions 2010' (IMTS 2010), on supplementary topics, as well as on the following chapters of 'IMTS: Compilers Manual' (IMTS 2010-CM): chapter XI on integrating trade and business statistics; chapter XXVIII on external trade indices and chapter XXIX on seasonal adjustment.

International trade statistics play a vital role in the assessment of every economy. Combining them with additional information from other sources, particularly business statistics, significantly enriches them, providing a closer view of traders and their characteristics such as size, sector of economic activity or level of concentration. This allows for a deeper analysis of the impact of trade on employment, production and value added, essential in a globalized world where economies are increasingly interconnected.

Many users need more information than trade values by country or by commodity: they require information on prices and volumes as well. It is thus recommended that all countries produce and publish, both volume indices and either price or unit-value indices for their total imports and exports. Countries are also encouraged to compile and publish, where appropriate, seasonally adjusted monthly and quarterly international merchandise trade data on a regular basis.

2. IMTS 2010 recommendations

IMTS 2010 new recommendations

Supplementary topics (chap. XI)

58. External trade indices: Produce and publish volume (quantum) indices and either price or unit value indices for total imports and exports on a monthly, quarterly and annual basis. Calculate and publish such indices for commodity groups of particular importance to countries on at least a quarterly and annual basis (para. 11.1) *Unchanged*

59. Seasonally adjusted data: Compile and publish, where appropriate, seasonally adjusted monthly and quarterly international merchandise trade data on a regular basis; provide information on the adjustment methods, data quality, etc. in the metadata (paras. 11.3-11.4) *Updated encouragement*

60. Linking business and trade statistics: Integrate the trade register with the business register and take steps towards an integrated system of economics statistics for data compilation and analysis (para. 11.6) *New encouragement*

3. LINKING BUSINESS AND TRADE STATISTICS

Need for linking business and trade statistics

Linking and integrating trade and business statistics are important for data compilation and for analytical purposes. A major development in economics statistics in recent years has been the establishment and use of national statistical business registers (SBRs) which not only provide a framework and basis for the conduct of business surveys but also allow the linkage of information from different data sources, potentially leading to significant efficiency and quality gains in data collection. Further, the integration of data from different sources provides new information for many analytical purposes that would not otherwise exist. Accordingly, IMTS 2010 (paras. 11.5-11.6) encourages countries to integrate their trade register with their business register and to take steps towards establishing an integrated system of economics statistics for data compilation and analysis.

Recommendation

Countries are encouraged to integrate their trade register with their business register and to take steps towards establishing an integrated system of economics statistics for data compilation and analysis. Further examples of the applications of linking trade and business statistics will be provided in the updated version of IMTS Compilers Manual.

Integrated approach for international merchandise trade statistics

Reconciliation of data from customs and non-customs sources, and reconciliation of results with related statistics, are important aspects of an integrated approach to foreign trade statistics. An integrated approach to foreign trade statistics means in particular that their compilation is, to the largest extent possible, integrated and harmonized with the compilation of all other basic economic and business statistics. Despite their long history of constituting a separate and distinct statistical domain and their reliance (in most countries) on custom records as their main data source, foreign trade statistics should be seen as an integral part of business statistics in respect of compilation and dissemination, in order that their full potential as a main source of information on globalization may be realized.

Vision for the future of trade statistics

At its forty-first session, the UN Statistical Commission adopted new international guidelines for merchandise trade statistics and statistics for international trade in services. In February 2011, the Global Forum on Trade Statistics was organized as a follow-up to the 2010 Statistical Commission decisions on trade statistics. In this forum, trade statisticians and policy makers agreed on a vision for the future of international trade statistics and called for the improvement of the relevance of international trade statistics by connecting trade information and integrating it with its economic, social, environmental and financial dimensions while minimizing the response burden, and to improve the statistical production process by better defining and organizing cooperation among national stakeholders. In a background note by UNSD, Eurostat and the World Trade Organization entitled “International trade information system in 2020” (“Vision 2020”), which was endorsed by major international organizations active in the area of trade statistics, concrete goals for the future of trade statistics were formulated, including the integration of statistics on the trade of goods and services and the integration of trade statistics with other business statistics that concern international aspects.

Trade in value added

There is very strong interest by policymakers and other user groups in analysing the global value chains (broadly understood as the participation of multiple countries in the production of a single product and their respective contribution to the value added associated with a given product) and their impact on employment and economic development. There have been multiple case studies by researchers aiming to analyse the share of value added generated in individual countries during the production of single products. It should be noted that these studies were usually focused on a very limited number of products, and the methodology of such calculations is still being debated. To provide broader measures of global value chains, another approach is being developed, one that attempts to construct and use global input-output tables in order to identify linkages between countries in the production

processes and to derive various indicators relevant to the assessment of such linkages. Some statistical offices are cooperating with researchers in such studies, mostly by making available to them data on trade and national input-output tables. Compilation of the new data items introduced in IMTS 2010 (chap. VIII) might further assist in the analysis of global value chains. However, the feasibility of the provision of any additional data relevant to the estimation of trade in value added on a routine basis has to be assessed by individual countries themselves.

Potential benefits of integrating trade and business statistics

In general terms, the potential benefits of integrating trade and business statistics are additional and better information without major costs, as well as potential cost savings through efficiency gains. One very specific and important goal is to gain more information about traders and their specific characteristics, such as size, sector of economic activity, and level of concentration. This will allow a deeper analysis of the impact of trade on national employment, production, value added and competitiveness in a globally integrated economy in which many countries frequently participate in the production of one single product. Also, integrating trade and business statistics can allow more information to be obtained about specific trade transactions such as goods for processing and intra-firm trade, or provide information for other statistical domains such as transport statistics. Further, trade statistics can be part of a business micro-data set or data warehouse allowing analysis for many different purposes. A further benefit is that the integration of trade and business statistics on the micro-level allows for checks of consistency between both sets of statistics.

Potential costs of integrating trade and business statistics

The basic requirement for integrating trade and business statistics is a functioning business register and the entry of a uniform national business identification number on the customs declaration. The development and implementation of these two elements can take a long time and require major efforts. Also, business registers need to be maintained on an on-going basis. Further, integrating different statistics requires significant efforts. Pursuing an integrated approach to trade and business statistics is likely to require major investments in existing statistics and strong efforts to overcome existing institutional arrangements and legal obstacles.

Integrating trade and business statistics in data compilation: possibilities and examples

The core elements for the integration of trade and business statistics are:

(a) The availability of a functioning and up-to-date statistical business register (SBR), which assigns a unique identification number for all registered business entities (e.g., enterprises, establishments or local units) and which either contains or can be linked with relevant information on current activities of those entities;

(b) The mandatory entry on the customs declaration of a unique identification number of the company on whose behalf the declaration is lodged and

(c) The establishment of an electronic and automatic link between the identification number used for declaration purposes and the SBR identification number, if they are different.

Example 1

The taxonomy of statistical outputs developed by Italy

To provide business analysts and policymakers with information about key actors and drivers of competitiveness in global trade, a change from a product-based towards a business-oriented perspective in the compilation of trade statistics is required. The link between the list of trade operators and the business register provides the gateway for developing an array of new outputs. The National Statistical Institute of Italy (ISTAT) developed a taxonomy of statistical outputs which could be achieved from the linkage between trade and business statistics at the enterprise level. The core of this new statistical framework is the business register. Three different types of output, depending on the level of integration achieved, are differentiated: Type one: by reclassifying trade flow by trade operators, where the trade operator is identified by the VAT code, it is possible, for instance, to derive trade statistics based on the number of trade operators by products and markets Type two: if trade figures are linked and integrated with the business register using the trade operator ID code matched to the company register ID code, statistics based on the business characteristics of exporting and importing enterprises can be derived. Type three: a full integration of trade and business statistics is achieved when the business register is further linked to and integrated with existing business surveys, administrative and fiscal data, and special surveys on globalization, inter alia, on multinationals and international sourcing. This allows the conduct of in-depth analyses of trade and business activity.

New statistics and future developments in Italy

ISTAT has experience in the production of new integrated trade statistics of types one and two. A large set of tables on trade operators and exporting and importing companies is published in the Foreign Trade Statistics Yearbook, providing information on the business structure of the exporting community. Further, ISTAT has developed new statistics on the spatial distribution of exports and on the contribution of multinational enterprises (MNEs) to foreign trade, and provided additional analyses on firms involved in international trade. ISTAT is in the process of setting up a firm level data warehouse that integrates a number of national surveys, data on foreign trade in goods, outward and inward multinational enterprise data and international databases, which will allow to effectively monitor the behaviour of firms deeply engaged in globalization. One challenge is that product-based and enterprise-based surveys are not fully harmonized. Also, there is a need for benchmarking and calibration with respect to different target populations. The intention is to make this warehouse accessible to researchers, taking into account confidentiality constraints. In the case of Italy, there are no additional costs for respondents.

Example 2

Linking trade and business statistics: experience of Brazil

The SISCOMEX system of Brazil integrates the tracking and administrative, customs and exchange control of foreign trade. It is linked to all commercial information through the national code for companies (CNPJ) and the national code for individuals (CPF), which are mandatory fields for the declarations of exports and imports. When a company enters its code, SISCOMEX accesses automatically the database of companies registered at the Ministry of Finance, through which the code is confirmed and all commercial information is transferred (complete address, city, State, national code of economic activity, number of employees, etc.). The national code for companies consists of 14 digits: the first 8 digits represent the company group, the following 4 digits represent the enterprise (filial) and the last 2 digits are used to validate the complete number. This system allows the generation and dissemination of a wide array of special reports, such as on exports by company size, industry or State. Information deemed confidential is accessible only to the enterprise itself and authorized Government officials, while the public information is available on the Internet online system AL/ICEWE/B2 (http://aliceweb2.mdic.gov.br).

Example 3

OECD-Eurostat trade by enterprise characteristics (TEC) database

TEC is a joint OECD-Eurostat exercise in which data sets are compiled by linking micro-data (data at trader level) with business registers. Under the guidance of the OECD Steering Group "Business Economic Statistics and Trade (BEST)", a first OECD set of linkage tables was sent out to participating non-EU-OECD member countries in June 2007. However, the tables currently provided by countries are frequently not fully comparable across countries and over time. Future goals are improved access to micro-data, improved comparability, and inclusion of additional enterprise information. Regarding EU member States, the revision of EU trade statistics legislation makes the annual compilation of these statistics compulsory from reference years 2009 and 2010 onwards.

Ensuring the quality of the linked data sources and of the linked/integrated data: country and regional experiences

Linking data sources: matching rates–experience of the United States of America

The United States Census Bureau collects export data at the transaction level from two main sources: the Automated Export System (AES) and the Canada Data Exchange. Transaction level data includes trade value, product codes, partner country, and the trader's unique identifier. The trader's unique identifier for AES records is the trader's Employer Identification Number (EIN), issued by the United States Internal Revenue Service, and for Canada's records, it is the trader's name. Transaction level data are linked to enterprise characteristics in the Census Business Register using the trader's unique identifier and the EIN or company name in the Business Register. Enterprise characteristics include employment and industry classifications. While the AES linkages are fairly straightforward, the records of Canada are associated with some complicated name matching routines and manual matching procedures. The quality of the linked data is very good as seen by the high match rates. The United States Census Bureau typically matches about 89% of the export value to the Business Register, and AES match rates exceed 94%, while Canada match rates are lower, close to 74%. Import transaction level data are also matched to enterprise characteristics in the Census Business Register. Import traders' unique identifiers are all reported as EINs, making these linkages also fairly straightforward. Initial match rates have been about 87%, but should improve as matching routines are refined. Both export and import linkages are used to create the Exporter and Importer Databases and the Profile of US Importing and Exporting Companies, which is the publication that constitutes an offshoot of the databases. The first exporting company profile was published with 1987 data, with annual publications since 1996. The importing company profile was added to the publication beginning with 2009 data.

Linking of trade operator with the statistical unit: experience of the European Union

The feasibility of linking external trade data with business registers has been tested in a series of pilot data collection rounds. The objective of these studies was twofold: first, to investigate to what extent and under what conditions micro-data linkages are possible; and second, to define new statistics which could be derived from the combined data set. At the conceptual level, the methodology can be simplified through presentation in the following framework: First, a linkage is established between trade operators and legal units in business registers. Second, the trade value of each trader, by product code and partner country, is combined with the main enterprise characteristics (economic activity and number of employees) retrieved from the business registers. Third, specific indicators are calculated. The quality of statistics based on data linkages depends to a very large extent on the matching rates between source data sets. The results of the pilot data collection rounds have shown that, in most cases, the matching rates were very high, particularly when measured in terms of trade value.

Business registers – experience of the European Union.

Business statistics are usually derived from surveys of businesses. Business registers are normally used as a tool for the preparation and coordination of surveys. They detect and construct the active population of statistical units (enterprises, local units and enterprise groups) from administrative units (legal units) and include information on their identification, demographic, economic and stratification characteristics, the control and ownership of units, and links with other registers. Business registers are also used as a source of information for statistical analysis of the business population and its demography. Although business register data cover only a few key economic variables (e.g., employment and turnover), they can be used to obtain comprehensive data with detailed breakdowns across a full range of activities, in contrast with data collections such as those of structural business statistics which are largely based on surveys and are limited in scope. The business registers play an important role in bringing trade statistics closer to the business statistics. The links between legal units in the business registers and intra- and extra Union trader identification codes need to be recorded in the business registers. Thus, the business registers provide a tool for linking detailed external trade micro-data with the statistical units utilized in business statistics.

Generation and dissemination of additional information: possibilities and examples

Tables published within the TEC framework developed by Eurostat and OECD

The Trade by Enterprise Characteristics (TEC) framework defines a harmonized set of indicators describing various aspects of the structure of international trade from the viewpoint of the characteristics of enterprises. Since the aim of these indicators is to describe enterprises rather than products, the activity sector of the trader is used as the primary classification in each indicator. There are five indicators which are available both for trade flows (imports and exports) and for intra- and extra-EU trade. All indicators use the enterprise as the statistical unit and are expressed in terms of number of enterprises and trade value. The indicators are obtained by linking data on the micro-level.

Indicators of trade by enterprise characteristics (TEC)

1. Trade by activity sector and enterprise size class

Trade by activity sector and enterprise size class shows the contribution of each economic activity and size class (measured in terms of number of employees) to total trade. This makes it possible, for instance, to analyse the impact of external trade on employment and to estimate the importance of small and medium-sized enterprises.

2. Concentration of trade by activity

External trade is typically concentrated on a few enterprises. This indicator shows how much of the total trade is accounted for by the top 5, 10, 20, etc., enterprises.

3. Trade by partner countries and activity

Trade by partner countries shows how many enterprises were trading with certain partner countries or country zones, and the trade value they accounted for. This makes it possible to identify most typical exports or imports markets.

4. Trade by number of partner countries and activity

Number of partner countries shows how geographically diversified the exports markets are. For imports, it shows the number of countries from which goods are imported.

5. Trade by commodity and activity

Trade by commodity and activity allocates the trade of each commodity to the economic activity of the trading enterprise. This shows which sectors were involved in the trade of each product group

Trade by enterprise characteristics: an alternative approach

IMTS 2010 (para. 11.6) encourages countries to take steps towards establishing an integrated system of economics statistics for data compilation and analysis and to integrate their trade register with their business register. However, faced with the growing demand for information from users regarding the link between international flows of goods and national economic activity, and in the absence of a link at the micro-level, enabling the identification of companies in the customs records and industrial surveys, counties might opt for the alternative of building a macro-level correlation table between the classifications of industries and products. Countries may find this correspondence useful when analysing trade flows by activity categories. However, the approach as described in previous examples, i.e., to identify the activity of the trader and perform appropriate aggregations, should be given preference whenever possible (see IMTS 2010, para. 3.29).

Integrating trade information in business statistics

Business statistics contain limited information on external trade. By linking trade and business statistics, the wealth of information on the demography and activities of businesses can be supplemented with detailed trade information, allowing the analysis of the impact of trade on businesses.

Special surveys of trading enterprises

Often, certain information, such as trade between related enterprises or goods for processing without change of

ownership, cannot be derived from customs records. The link with the business registers allows the conducting of surveys of specifically identified enterprises whose aim is to obtain such information. Also, special surveys of trading enterprises could be used to explore the link between trade in goods and trade in services.

Trade statistics as part of a geospatial information system

At its forty-first session, held in February 2010, the UN Statistical Commission recognized, in paragraph (b) of its decision 41/110 on global geographic information management, the importance of the integration of geographical and statistical information and the opportunities provided in that context by the swift development of information technology, noting that national statistical offices are playing an increasing role in such integration. Linking trade information to the business registers allows regional analysis of trade patterns; for example, the Secretariat of Foreign Trade of the Ministry of Development, Industry and Foreign Trade of Brazil publishes, using the address of the enterprises, a report on trade balance by States and municipalities (see para. 11.13). Linking this trade information with localized employment or tax information (e.g., average wages, employment rate, enterprise and personal tax revenue) allows a detailed analysis of economic impact of trade.

Required institutional and working arrangements

Agreement on a joint vision and commitment to integrating trade and business statistics

The cooperation of different departments within the same agency and of different agencies responsible for different parts of the business statistics programme is required for the development and implementation of a programme of integrated economic statistics. The cooperation itself and the development and implementation of such a programme require the commitment of significant human resources and the willingness to accept changes in existing practices. It is therefore crucial that the concerned agencies and departments within agencies agree, or at least accept, the goal and vision for an integrated system for business and economic statistics.

Statistical business register and data access at compilation

In many countries, more than one organization or agency is involved in trade and business statistics (e.g., the national statistical institute, the customs authority, the central bank and other agencies). The establishment of a statistical business register, which would provide a uniform basis for data collection by various agencies and ensure coherence of data compiled in various statistical domains, requires legal arrangements to allow sharing and use of information on individual enterprises among these agencies - information that would be otherwise subject to confidentiality.

Access to and use of information

Business registers and data warehouses contain sensitive information about businesses. According to principle 6 of the Fundamental Principles of Official Statistics, individual data collected by statistical agencies for statistical compilation, whether they refer to natural or legal persons, are to be strictly confidential and used exclusively for statistical purposes. The generation of enterprise micro-data from trade statistics and its combination with information from existing business statistics require solving issues of confidentiality and the protection of highly sensitive business data.

4. TRADE INDICES

Need for external trade indices

Many users need more information than trade values by country or by commodity, and require information on prices and volumes as well. The information on the development of prices and volumes is generally presented in the form of indices. It is recommended that all countries produce and publish, on a monthly, quarterly and annual basis, both volume (quantum) indices and either price or unit-value indices for their total imports and exports. Countries are also encouraged to calculate and publish such indices for commodity groups of particular importance to countries at least quarterly and annually.

Some important uses of external trade indices

External trade indices are in general used to eliminate the effects of price changes and obtain trade volume estimates. National accounts require a decomposition of measures of value into price and quantity for the calculation of its real flows. Government departments and international agencies use price indices to define, evaluate and resolve trade policy issues. They constitute a key tool for tariff and quota negotiations, as they provide an indication of the inflation of imports and exports as well as the international competitiveness of various industries and sectors. Moreover, business analysts and economists use international trade indices for analysis and research in respect of such questions as the causes of the real economy effects that price changes have on trade.

Levels of aggregation

The level of detail required in the index numbers of imports and exports is not necessarily the same for all the purposes for which they are used, and national statistical offices need to strike a balance among the various demands of different types of users. For some purposes, no detailed information on the price changes of individual commodities is required; for others, the usefulness of the price statistics depends entirely on the commodity breakdown that can be made available. For instance, while tariff policy decision making and the analysis of the effects of trade on employment and productivity by industry often require highly disaggregated prices, macro-economic studies focused on a country's terms of trade and its balance of payments require aggregate measures of price and volume trends of exports and imports.

Macro-economic uses

From the perspective of national accounts, price and volume indices of external trade in goods play an essential role in the estimation of macro-economic aggregates in constant prices. Exports and imports in supply and use tables (SUTs) at current prices are deflated by foreign trade price and/or unit value indices at the product level in the process of obtaining supply and use tables in constant prices. Also, exports and imports in constant prices are a necessary input into general macro-economic forecasting and model-building, as well as analyses of balance of payments.

Micro-economic uses

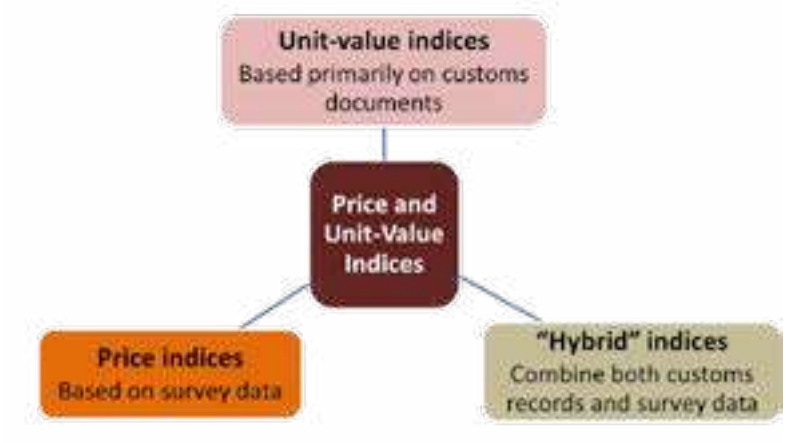
Disaggregated measures of price changes are especially relevant for uses that entail the transmission of inflation across national boundaries and within those boundaries, from one sector to another. Studies that serve tariff policy discussions also require the availability of highly disaggregated prices to the extent that could go well beyond the most detailed level of a purely statistical commodity classification. Also, there is increasing interest in understanding the relative importance of price based versus quality based competition. The need for detailed answers to questions like these cannot be satisfied through utilization of traditional price and value indices at the macro-economic level.

Divergent objectives of users of external trade indices

Statistical agencies often face divergent demands for measures of price and volume changes in external trade, and it is not always clear how the different objectives of users should be ranked. In this complex situation, a statistical agency must choose among the various strategies open to it strategies that have to do with both sources of data

and methods of calculation. The choice of approach must also be pragmatic, taking into consideration resource constraints, data availability and the practical feasibility of the selected methodology. The objective is to produce, subject to the usual budgetary constraints, the best measures possible for changes in the prices and volume levels of both imports and exports, detailed, to the extent possible, by major commodity groups and partner countries.

Price and unit value indices



Two kinds of indices may be produced to reflect prices for imports and exports: unit-value indices that are based primarily on customs documents and export/import price indices that are based on survey data. Both approaches have strengths and weaknesses. Although price indices are generally preferred on methodological grounds, in practice countries may not have the resources available to compile that information. Many countries compile only unit-value indices, while others compile and use both price and unit-value indices in a complementary manner. In addition, "hybrid" indices that combine both customs records and survey data may also be produced.

Alternative data sources

The main options available in terms of data sources are the use of customs records, the implementation of specific surveys of exporters and importers, and the taking advantage of other established domestic price surveys. Additional alternatives include relying on other data providers such as commodity boards and associations of exporters and importers, and utilization of price indices of partner countries as proxy or supplementary indicators.

Advantages of data from customs records

An important advantage of average unit values is that they effectively increase the number of price observations used to calculate the index, thereby reducing sample variance. Although the customs source often excludes transactions of very low value and/or volume, as well as special transactions (e.g., those that are kept confidential on the grounds of national security, etc.), they often provide an almost full coverage of the transactions on which the target population of a foreign trade index should be based on and are more frequently updated than most other data sources. Also, when the statistical agency has access to individual customs records, working with detailed data can support the compilation of trade indicators at the micro-economic level for various analytic purposes, especially when linked to other statistical sources through business registers.

Advantages of data from direct price surveys of imports and exports

There are various advantages often associated with the use of survey data for the estimation of foreign trade indices. One such advantage is the improved possibility of controlling ex ante for potential biases and variability due to non-price factors, including changes both in the mix of products in the market basket and in the quality of the items being priced. Also, through direct surveying of exporting and importing firms, the risk of using erroneous data (e.g., due to misclassification) can be mitigated, granted that there are appropriate communication channels for providing

guidelines and feedback to respondents. Moreover, depending on the details collected from survey respondents in terms of product specifications and attributes, survey data open the possibility of carrying out quality adjustments using, for instance, hedonic methods. Further potential advantages of price surveys include improved timeliness, as in some countries price data from surveys are available earlier than unit values from customs records, and improved coherence with other price indices (such as producer, construction, wholesale/retail and consumer price indices).

Heterogeneous product categories in detailed customs records data

The main drawback in the use of custom records is that product codes, even at the most disaggregated level for which "unit values" can be calculated, often refer to heterogeneous sets of goods, while extensive direct enquiries of firms aimed at controlling for important price determining characteristics in each individual transaction (e.g., terms of sale, timing of contract, and specific model attributes) are normally not feasible. This implies that an increase or decrease in unit values based on averaging values and quantities from customs records may be due to unidentifiable non-price effects which impair the measurement of pure price changes. This is especially the case for complex products like electronic appliances (computers, cell-phones, audio visual equipment), large industrial machinery, etc., which may have heterogeneous units of quantity and price-determining characteristics even at the most detailed level of the commodity classification. Also, data from customs records are usually unsuitable for capturing average price changes of products that experience substantial technological change.

Errors in filling customs declarations

International experience has shown that large differences between the highest and lowest prices (unit value range) for single commodity codes are often due to errors in filling out the customs declarations themselves. For instance, declarants may have difficulties in choosing the correct commodity code, filling in the correct partner country or reporting the correct unit of quantity. To some extent, this can explain the fact that the distributions of unit values are often skewed even at very fine levels of detail (say, the HS eight-digit level).

Simplification of customs declarations requirements

The compilation of unit-value indices presupposes the existence of administrative and regulatory procedures whereby importers and exporters are required to provide enough details on their individual transactions through customs records or other specific surveys (e.g., the Intrastat system). However, as national authorities move towards simplification or even elimination of customs documents, the relevance of administrative records for statistical purposes may diminish in relative terms.

Incomplete coverage and small sample sizes of price surveys

Survey-based external trade indices require having an appropriate survey frame from which to select a sample of establishments for collection of information on a set of well-defined commodities whose overall price changes are representative of all transactions taking place. The survey frame should be representative of the target population, that is, of all entities engaged in imports and exports of goods. However, the fact that survey frames based on the statistical business registries normally identify only businesses that engage in regular export and import operations can be a source of concern in cases where a significant fraction of total trade is carried out by casual importers or exporters. Also, sample surveys are usually expensive, and consequently sample size is often limited by budget constraints and also the burden on respondents. Having a small sample size may in turn lead to biased estimates and imputations if not adequately controlled within a well structured and coherent statistical design. Achieving such control is a difficult task in itself.

Trade-off between availability and comparability in specifications of price surveys

Although, in principle, it is possible to produce a highly detailed definition of the characteristics of the products to be priced through surveys, in practice, there exists a trade-off between the level of detail in the specifications of items and the ability of survey respondents to consistently match these specifications over time. As in the case of elementary unit-value indices based on data from customs records, survey-based price indices may also suffer to

some extent from not comparing like with like, especially if the specifications of the product varieties being priced are too loose, and shifts in the relative share of different price-determining characteristics remain unknown. These difficulties are compounded by the fact that the total number of transactions per respondent per period of time may be relatively small, making it necessary to collect average prices over longer periods of time instead of prices for individual transactions.

Example 4

Experience of Canada

Statistics Canada compiles an International Merchandise Trade Price Index (IMTPI), which is a composite price index designed to express, in a single index, price changes that involve a range of commodities. In order that realities of price movement may be accurately reflected, a fixed basket of goods is chosen which are representative of, and correlated to, the rest of the commodities in the trade universe. The index is based on a non-random sample of import and domestic export commodity classes. Data are extracted from administrative files and derived from other Statistics Canada surveys and/or other sources. International trade price and volume indices are constructed on the basis of unit values derived from detailed customs- based data and survey price indices taken from Canadian and foreign sources. As a general rule, unit values are retained for relatively homogeneous commodities such as primary and semi-manufactured goods; and proxies are used for heterogeneous commodities, particularly manufactured goods ready for final use. Several organizations provide the International Trade Division with proxies that are used as price relatives in the calculation of the Laspeyres and Paasche price indices. As Canada's economy is very much interconnected with that of the United States, the United States Bureau of Labour Statistics producer price index is used as a proxy for the prices of some Canadian imports from the United States.

Estimation formulas. Fixed (Laspeyres) and current (Paasche) weighted price indices are calculated monthly, quarterly and annually on a customs and balance of payments bases for all countries and for the United States. The International Trade Division of Statistics Canada also calculates trade values at constant dollars on a balance of payments basis through use of the chain Fisher formula with a base reference year. They are available from 1981 to the present on a monthly and a quarterly basis.

Error detection and imputation. Once the Laspeyres and Paasche indices have been calculated, a method described by Hidiroglou and Berthelot (1986) to identify outlying observations is used by a module. The Historical Trend Method is also adopted and used to identify transactions within an aggregation that are abnormal for a given period. The error detection process is carried out only at the first stage of aggregation in the construction of the International Merchandise Trade Price Index. If a unit value is identified as an outlier during the error detection process, and if the price analyst with the help of the subject-matter specialist also considers this unit value an outlier, then the unit value will be imputed manually.

Quality evaluation. The quality of this index is maintained by the few trained analytical experts assigned to this area, who develop a thorough knowledge of the domain. Much time and effort are devoted to detecting and following up unusual fluctuations over time in the pricing patterns of goods. Prior to dissemination, the price indices are analysed and historic trends reviewed.

5. SEASONAL ADJUSTMENTS

Need for seasonally adjusted data

Monthly and quarterly data on international merchandise trade statistics are an important tool for economic policymaking, business cycle analysis, modelling and forecasting. However, they are often characterized by seasonal fluctuations and other calendar or trading day effects, which mask other characteristics of the data that are of interest to analysts. Seasonal adjustment is a process of estimating and removing seasonal or calendar influences from a time series in order to achieve a better knowledge of the underlying behaviour. Countries are encouraged to compile and publish, where appropriate, seasonally adjusted monthly and quarterly international merchandise trade data on a regular basis.

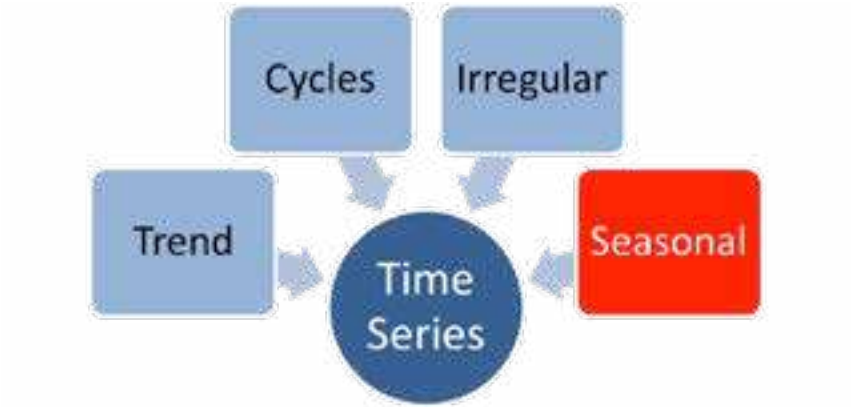
Seasonal adjustment method

Because national circumstances vary from one country to another, no preferred seasonal adjustment method is recommended. If seasonally adjusted data is published, it is recommended that information on the adjustment methods, data quality, etc. be provided by countries in their metadata.

Concept of seasonal adjustment

Seasonal adjustment is the process of estimating and removing effects in a sub-annual time series that occur at about the same time and magnitude each year, as well as calendar-related systematic effects that are not stable in annual timing, which are often large enough to mask other data characteristics. Removing the seasonal component allows for an easier comparison of long- and short-term movements across sectors and countries and further contributes to an understanding of the non-seasonal behaviour which is often of interest for economic policymaking, business cycle analysis, modelling and forecasting.

Components of time series



A time series is generally considered to consist of trend, cycle, seasonal and irregular components.

The trend, cycle and irregular components together reflect long-term movements lasting many years, fluctuations relating to the business cycle, and unforeseeable movements of all kinds. The seasonal component of a time series represents the movement within the year, and includes the effect of climatic and institutional events that are repeated regularly throughout the year, as well as calendar-related systematic effects that are not stable in annual timing, such as trading day and moving holiday effects. Seasonal adjustment is the process of completely eliminating the seasonal component from the original time series.

Tools used for seasonal adjustment

Seasonal adjustment is typically accomplished with the assistance of free and publicly available software packages, the most widespread of which are TRAMO-SEATS (supported by the Bank of Spain) and X-12-ARIMA (supported by

the United States Census Bureau). As the seasonal component is not precisely defined, seasonal adjustment often depends on the a priori hypotheses underlying the model chosen and upon the software and specifications chosen.

Preliminary treatment of data prior to seasonal adjustment
Seasonal adjustment begins with a preliminary process of identifying and removing outliers, adjusting for those calendar effects that are not stable in annual timing, and identifying an appropriate decomposition type.

Graphical analysis. Preliminary treatment of the data should begin with a graphical analysis of the series in order to identify potential problems with the data, select appropriate parameters, and determine how to perform the seasonal adjustment. Relevant preliminary graphical analysis should examine the length of the series, the presence of strange values, the structure of the series, the presence of possible breaks in seasonality, and the decompositions scheme.

Outliers. Since most seasonal adjustment methods use procedures and filters that are sensitive to outliers, these should be identified and removed before estimating the seasonal components. Outliers clearly due to errors in the data should be discarded. However, since outliers not due to error typically contain information about key events, these should be reintroduced into the data after seasonal adjustment.

Calendar effects. Calendar effects are regular effects that do not necessarily occur in the same month or quarter each year but that can be identified and removed from the series. These effects include holidays whose exact timing shifts systematically each calendar year and the variation in the number of times each day of the week occurs in a given month or quarter. These effects must be corrected for using standard seasonal adjustment tools, so as to prevent misspecification of the model or a compromising of the overall quality of seasonal adjustment. The decision to correct for other effects, such as temperature, school holidays or bridge holidays, should be made on a case by case basis.

Decomposition. The decomposition scheme specifies how the trend cycle, seasonal and irregular components combine to form the original series. Additive decomposition assumes that the components of the time series behave independently of each other. In particular, the size of the seasonal oscillations is independent of the level of the series. Multiplicative decomposition, often chosen by default in seasonal adjustment software packages, assumes that the components of the series are interdependent and thus that the size of the seasonal variation increases and decreases with the level of the series.

Choice of seasonal adjustment approach

TRAMO-SEATS and X-12-ARIMA are currently the most commonly used seasonal adjustment approaches. TRAMO-SEATS is based on a parametric approach (where the model structure is specified a priori), while X-12-ARIMA is based on a non-parametric approach (where the model structure is determined from the data). A third possible approach is to use structural time series models, provided that they allow for a complete calendar and outlier treatment and include an adequate set of diagnostics. The consistent use of a common set of seasonal adjustment packages will improve transparency and comparability of seasonally adjusted time series across countries.

Seasonal adjustment and consistency with annual data

Annual trade totals based on seasonal adjustment will not automatically (or conceptually) be equal to the corresponding annual trade totals based on unadjusted data. Specifically, the annual totals of the unadjusted series and the seasonally adjusted series will be equal only when the series are adjusted additively, the seasonal pattern is fixed from one year to the next, and there are no trading day adjustments. The impact of working days, moving holidays and other calendar effects change from one year to the next. Moving seasonality also implies that the impact of the seasonal effect will vary across years. Nonetheless, the process of ensuring that seasonally adjusted values sum to their unadjusted annual values, known as benchmarking, can be conducted using seasonal adjustment software.

Direct versus indirect seasonal adjustment

Direct seasonal adjustment is performed if all time series, including aggregates, are seasonally adjusted on an

individual basis. Indirect seasonal adjustment is performed if the seasonally adjusted estimate for a time series is derived by combining the estimates for two or more directly adjusted series. Indirect seasonal adjustment should be preferred when the component series that makes up the aggregate series have both distinctively dissimilar seasonal patterns and adjustments of good quality. Direct seasonal adjustment should be the approach of choice when the corresponding series have similar seasonal patterns and summing the series may reduce the amount of unexplained variation.

Reasons for revisions to seasonally adjusted data

Revisions of seasonally adjusted data occur for two main reasons. Seasonally adjusted data may be revised as the consequence of a revision of the unadjusted data, which may be the result of an improvement in the information set. Revisions of seasonally adjusted data can also occur because of a better estimate of the seasonal pattern due to new information provided by new unadjusted data and to the characteristics of the filters and procedures for removing seasonal and calendar components. The challenge is to strike a balance between the precision of seasonally adjusted data and their stability over time. Revisions of seasonally adjusted data should be carried out in accordance with a coherent, transparent and officially announced revision policy, and should not be more frequent than the revisions to the raw data. In this regard, it is good practice to keep the model specification for seasonal adjustment as stable as possible over time, and to coordinate the timing of revisions to the model specification with the timing of major revisions of the raw data.

Trade-off between frequency and accuracy

How seasonal adjustment is carried out has implications for the revision policies. At one extreme, there is so-called current adjustment, which minimizes the frequency of revisions and concentrates the revisions mainly within a predefined review period. At the other extreme, there is so-called concurrent adjustment, which maximizes the accuracy of the adjusted data at any given point, but leads to more revisions, often from the beginning of a series, with many of them small and moving in opposite directions. In practice, other procedures are utilized, based on a combination of these two extreme approaches.

The decision regarding whether a changed time series should be published in its entirety is influenced by several factors. On the one hand, there is an incentive from a methodological perspective to treat all values identically, so as to ensure that calculations are easy to understand and to replicate. However, it is nevertheless questionable whether a newly added figure actually contains information relevant for significant revisions to the estimation of the usual seasonal fluctuations in previous decades. As a means of balancing the information gain and the revision horizon, the revision period for the seasonally adjusted data is often limited to being between three and four years longer than the revision period for the unadjusted data.

Quality of seasonal adjustment

Absence of residual seasonality. The most fundamental requirement of seasonal adjustment is that there be no estimable seasonal effect, known as residual seasonality, still present in the seasonally adjusted series. To detect residual seasonality and residual trading day effects, validation should be performed using spectral diagnostics as well as other tools included in the seasonal adjustment packages, perhaps complemented by graphical diagnostics and statistical tests from external statistical packages. Both TRAMO-SEATS and X-12-ARIMA provide a wide range of quality measures and diagnostics for this purpose.

Stability and lack of bias. Other important requirements for good seasonal adjustment are a lack of bias in the level of the series and stability of the estimates. A lack of bias implies that the level of the seasonally adjusted series is similar to the level of the original series. Stability of the estimates implies that the inclusion of new data into the estimation procedures will not result in large changes in the estimates. Large revisions can indicate that the estimates are misleading or even meaningless.

Specific issues

Length of series. A series that is under three years in length cannot be seasonally adjusted accurately with either TRAMO-SEATS or X-12-ARIMA. It is possible, however, to adjust these series using alternative, less standard, procedures. For series that are long enough to run X-12ARIMA or TRAMO-SEATS but remain quite short (three to seven years), some instability problems can arise. Several empirical comparisons have been carried out to assess the relative performance of X-12-ARIMA and of TRAMO-SEATS on short time series.

Seasonal adjustment of shorter series. It is good practice to evaluate the results of seasonally adjusting shorter series over an extended period before deciding whether to publish them or not. For instance, it is important to check for consistency and reliability for each period (monthly or quarterly). As a general rule, when the series are shorter than seven years, the specification of the parameters used for pre-treatment and seasonal adjustment has to be checked more often (e.g., twice a year in order to deal with the higher degree of instability of such series).

Series requiring non-standard seasonal adjustment. Some series can be characterized by highly specific features which preclude the application of standard seasonal adjustment methods. Such features include high non-linearity, absence of a clear signal due to a dominant irregular component, unstable seasonality, a high number of outliers, and heteroskedasticity. In such cases, ad hoc treatment should be carried out.

Data presentation

Data can typically be presented in raw, seasonally adjusted, calendar-adjusted only or trend cycle form. The raw data contain all the characteristics of the time series. As the seasonally adjusted data contain the trend cycle and the irregular components, they contain the "news" of the series. Much of the discussion on trend cycle analysis focuses on the so-called end point problem. Since the trend cycle values at the end of the series are usually estimated by extrapolation, the estimated trend cycle for the most recent data is very uncertain and can suffer from phase shift problems. Particular care is required at turning points, where it often takes months until the new correct direction of development appears. In addition, it is good practice to monitor discrepancies between the trend of raw data and the trend of seasonally adjusted data.

In all cases, the information contained within the press release should reflect the principles of ensuring transparency and assisting users in making informed decisions.

Example 5

Country examples

Example of Germany. In Germany, the seasonal adjustment of foreign trade data as well as of other important economic indicators entails close collaboration between the Central Bank and the Federal Statistical Office. The original data collected by the Federal Statistical Office are seasonally adjusted and calendar-adjusted by both institutions using the same X-12-ARIMA procedure (which represents the evolution of the well-known X-11 model developed by the United States Bureau of the Census). As a second step, both institutions examine the results and have to decide in common whether any of the processing parameters that are crucial for the quality of the results have to be adjusted or not. In the case where the parameters are changed, the calculation of seasonally adjusted figures is repeated by both institutions. In this way each institution verifies the calculation of the other. This shared approach results result in the publication of an agreed upon product, which eliminates the risk confusing the users of trade statistics.

Example of Italy. In Italy, monthly trade time series are seasonally adjusted by means of TRAMO-SEATS (Windows version). In particular, intra- and extra-European Union series (at import and at export) are adjusted directly and separately, while the series referring to total trade (intra- and extra-European Union) at import or at export are obtained indirectly as sums of the corresponding seasonally adjusted series, owing to the well-known aggregation problem. The models selected by TRAMO-SEATS are revised at the beginning of a new year, but the estimated SA coefficients are revised monthly as soon as a new observation is added to the series. While this approach obviously implies the need for some revisions for the nearest time lags, it gives more consistent overall-year information as compared with raw data. The selected models are available to researcher or users on request.

Example of the United States of America. Monthly merchandise trade series are seasonally adjusted using factors that are produced once a year during an annual revision cycle. Factors are produced for each month of the coming 12-month period, and are revised for the previous three years. The X-13ARIMA-SEATS program is used to analyse data series and generate the seasonal adjustment factors. Data are aggregated into total import and export five-digit end use commodity groupings, which are examined for trading day variation and seasonality. The end use commodity classification system combines data into broad categories based on principal uses of the commodities; utilization of the system ensures methodological consistency with quarterly adjusted balance of payments data. Seasonal factors are generated for those groups that show significant predictable seasonality. The factors are used to adjust the data in the most detailed end use categories. These detailed adjusted data are then summed to the one-digit end use level for release with the monthly merchandise trade totals.

Example of Norway. In the case of monthly data, the main figures for import and export are adjusted seasonally using X-12-ARIMA, in addition to a number of selected series at the two-digit level of SITC. A few monthly data series at the three-digit level of SITC are also adjusted. In the case of quarterly data, seasonal adjustments are applied to volume indices on total imports and exports in addition to some selected series as described above in the case of monthly figures. Norway's External Trade Division is assisted by one or two experts, when needed, who support all fields dealing with seasonal adjustments in Statistics Norway. These experts also participate from time to time in the conduct of a more in-depth evaluation of the methods used.

REFERENCES

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