This document for item 3.2 of the agenda presents a UNSD progress report on Unit Value Indices.

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UNSD PROGRESS REPORT ON UVIS

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Note by UNSD

Background

1. In 2005, the United Nations Statistics Division published National Practices in Compilation and Dissemination of External Trade Index Numbers, which was based on information gathered from 77 countries in the early 2000s. The majority (95%) of respondents use customs records for the calculation of the index numbers of external trade, and for 60% of these, customs records are the sole source of data. For 35% of respondents, customs records are supplemented by other sources such as price surveys, or reports of various governmental agencies or commercial organizations. Only 5% of respondents use price surveys as the sole source of data.

2. The publication showed that indices are calculated applying Laspeyres, Paasche and Fischer formulae. The most frequent combination of formulae (25% of respondents) is that of a Paasche unit value/price index and a Laspeyres volume index. Fourteen per cent of respondents calculate a Laspeyres index for both the unit value/price index and the volume index, while 9% of respondents employ a Fischer unit value/price index and a derived volume index.

3. On December 17, 2009, the IMF published Export and Import Price Index (XMPI) Manual: Theory and Practice, which is a 700 page manual that explores the conceptual and theoretical issues for the compilation of export and import price indices. The first chapter gives a summary of export and import price index methodology and even contains its own annex in which an overview is provided of the steps necessary for developing the external trade indices. The XMPI manual favours the use of prices over unit values in the index calculations.
Progress made

4. In the draft compilers manual for implementing the recommendations of International Merchandise Trade Statistics 2010, a full chapter is devoted to the calculation of external trade indices. This chapter gives a preference to the use of a hybrid method, in which both unit values and prices are taken into account, and also includes two very useful country practices of Norway and Canada. The draft chapter is added as an annex to this note. The manual will be sent for printing later this year.

5. In the context of linking trade and business statistics, it should be considered to derive external trade indices at this very detailed level of data. These micro-data combine the precision of price data with the correct trade weights of unit value data. UNSD recommends to follow-up on this issue in the projects on micro-data linking.

Next steps

6. During 2013, UNSD will do a new worldwide assessment of the national practices in the compilation and dissemination of external trade indices. This assessment should provide a basis for capacity building efforts in this area using the available documents and tools produced by UNSD and IMF.
CHAPTER 28 EXTERNAL TRADE INDICES

28.1. Introduction. This chapter aims to provide guidance on the compilation of unit value and price indices of external trade, which are briefly discussed in IMTS 2010, chapter 11. It provides information for assessing the main advantages and disadvantages of the various approaches for their compilation, as well as their potential complementarities, both from the statistical point of view as well as in terms of their practical implementation.

A. General overview

28.2. 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. In IMTS 2010, 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 (UVIs) 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.

28.3. 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 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. Also, business analysts and economists use international trade indices for analysis and research about such questions as the causes and the real economy effects that price changes have on trade.

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

28.5. Macroeconomic uses. From the perspective of national accounts, price and volume indices of external trade in goods play an essential role in the estimation of macroeconomic 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 SUTs in constant prices. Also, exports and imports in constant prices are a necessary input into general macro-economic forecasting and model-building, as well for analyses of balance of payments.

28.6. Microeconomic uses. Disaggregated measures of price change are especially relevant for uses which have to do with 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 a point 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 competition against quality-based competition. The need for detailed answers to questions like these cannot be satisfied through traditional price and value indices at the macroeconomic level.

28.7. **Divergent objectives of users of imports and exports 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.

B. **Data sources and measurement approaches**

28.8. **Price and unit value indices.** There are three kinds of indices that can be produced to reflect prices for imports and exports: unit-value indices that are based primarily on customs documents, price indices that are based on survey data, and “hybrid” indices that combine both customs records and survey data. 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 or survey-based price indices, while others use both approaches in a complementary manner.

28.9. **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, or using price indices of partner countries as proxy or supplementary indicators.

28.10. **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 microeconomic level for various analytic purposes, especially when linked to other statistical sources through business registers.

28.11. **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 to control ex-ante for potential biases and variability due to non-price factors, including changes in the mix of products in the market basket or changes to the quality of the items being priced. Also, by directly surveying exporting and importing firms, the risk of erroneous data (e.g., due to misclassification) can be mitigated, granted there are appropriate communication channels to provide 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

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to carry 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).

C. Challenges in the application of various approaches

28.12. 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 to firms aimed at controlling for important price determining characteristics in each individual transaction are normally not feasible (e.g., terms of sale, timing of contract, and specific model attributes). This implies that an increase/decrease in unit values based on averaging values and quantities from customs records, may be due to unidentifiable non-price effects that 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.

28.13. 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 often are due to errors in filling 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 for very fine levels of detail (say, 8 HS digit level).2

28.14. 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.

28.15. 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, survey frames based on the statistical business registries normally identify only businesses that engage in regular export and import operations, which is 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 samples size is often limited by budget and burden constraints. 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 which is a difficult task in itself.

Note that large variance of unit values can suggest erroneous declarations as well as heterogeneity in the commodity composition of individual HS codes.
28.16. **Tradeoff between availability and comparability in specifications of price surveys.** Although in principle it is possible to define in a very detailed way the characteristics of the products to be priced through surveys, in practice there is a tradeoff 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. This 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 in order to compute price relatives for consecutive periods of time.

### D. Methodological issues

28.17. **Elementary unit value indices.** The compilation of price indices normally involves a first stage in which price indices for elementary commodity groups are calculated, which are subsequently combined to produces price indices at higher levels of aggregation. In the case of unit value indices based on customs records, elementary price indices are simply unit value ratios in which both the numerator and the denominator are the result of dividing total value by total quantity at the most detailed level of aggregation available (which can be a specific stratum within a particular commodity code, deemed to include relatively homogeneous types of goods). Elementary unit value indices are implicitly weighted by quantity information of each individual record.

28.18. **Elementary price indices.** On the other hand, elementary price indices based on survey data involve the unweighted aggregation of price relatives (i.e., the ratios of directly reported prices over time), as data on the traded value shares, or quantities of the surveyed goods are usually not readily available. Based on the analysis of the properties of various alternatives, one of the preferred formulas for the calculation of elementary price indices is the Jevons index formula, which takes the geometric average of the price relatives (or, equivalently, the ratio of the geometric average of prices in each period). However, this formula is highly sensitive to extreme price decreases, and its practical use may require imposing upper and lower bounds to the individual price relatives used in the compilation. Also, the Jevons index makes the implicit assumption of constant revenue shares, which is equivalent to assuming that quantities fall as relative prices increase.

28.19. **Index formulas at higher levels of aggregation.** Regardless of elementary price indices are based on (quantity-weighted) unit values or (unweighted) price relatives, they need to be combined into aggregate indices for broader categories of goods with the help of a specific weighting structure. There are various alternative formulations for calculating these aggregate indices, and although their detailed discussion is not within the scope of this chapter, some of the most important classes of index formulas are as follows:

(a) Indices based on fixed baskets of goods and services, often referred to as Lowe-type indices, measure the change in the value of a commodity group by holding the quantities of their individual commodities at a constant level. These indices are in general defined by

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3 The design of a price survey may introduce an implicit weighting structure, e.g., through the probabilistic selection of establishments based on their shares in total exports, etc. However, at the elementary level such probabilistic sample designs are not frequently implemented in the compilation of foreign trade price indices. See International Monetary Fund (2009): Export and import price index manual: theory and practice for a more detailed discussion.

4 See *ibid.* for a though discussion of the advantages and disadvantages of alternative formulas for the calculation of elementary price indices.
\[ P_{Lo} \equiv \sum_{i=1}^{n_i} \left( \frac{p_i^t / p_i^0}{q_i^t / q_i^0} \right) s_i^{ob}, \] where

\((p_i^t, q_i^t)\) represents a price-quantity pair for commodity \(i = 1, \ldots, n\) in period \(t\), and \(s_i^{ob} \equiv \frac{p_i^0 q_i^b}{\sum_{j=1}^{n_p} p_j^0 q_j^b}\) is the “hybrid” value share of commodity \(i\) obtained by valuing the quantities of period \(t = b\) at prices of period \(t = 0\). The well-known Laspeyres and the Paasche indices are special cases of a Lowe index, as the former is obtained by setting \(b = 0\), and the latter by choosing \(b = t\). These type of indices are easy to explain to users, and are compiled by many statistical offices in practice.

(b) Another type of index formulas constitutes the class of superlative indices. These are indices that treat symmetrically the prices and quantities of the periods being compared, and in general they are preferable on theoretical grounds. Two specific superlative index formulas are:

(i) The Fisher index, defined as the geometric average of the Laspeyres and Paasche indices:

\[ P_F \equiv (P_L \times P_P)^{1/2} \]

(ii) The Törnqvist index, defined as the geometric weighted average of the price relatives, with weights given by the arithmetic average of value share of each commodity in the two periods being compared:

\[ P_T \equiv \prod_{i=1}^{n} \left( \frac{p_i^t / p_i^0}{q_i^t / q_i^0} \right)^{s_i} \]

where \(s_i \equiv \frac{s_i^t + s_i^0}{2}\).

28.20. Chain indices. If a fixed base index is used, it is a good practice to frequently update the base period (at least every five years), as the quantities used to determine the weight structure become less relevant in describing the actual mix of goods being traded. As an alternative, chain indices are constructed by linking a series of individual indices that bilaterally compare every two consecutive periods, so that in each comparison the weight and price reference periods are moved forward in time. However, chaining should not be made at the sub-annual level, as the seasonal fluctuations in the prices and quantities would cause serious distortions in the chained time series due to the fact that chaining is “path dependent”, i.e., the change in the index between two given periods depends on the price changes that occur in each and all the intervening periods.

28.21. Focus on optimal use of trade data from administrative sources. With this in mind, the methodology used in compiling unit value indices for imports and exports should provide for handling seemingly erratic behavior in customs data, so as to extract as much information as possible from the data available in custom records and other administrative sources. These may entail, among other things, the use of appropriate stratification variables to disentangle between genuine variations in price levels and shift effects in the quality or in the mix of goods reported under a given item specification.

28.22. Error detection and treatment of outliers. The statistical properties of the data used in the compilation of foreign trade indices, either from administrative or survey sources, also need to be examined in detail to identify outliers and correct or eliminate outright erroneous observations.\(^5\) In general, the treatment of outliers from direct surveys is less complicated than for UVI’s, due to the relatively smaller amount of information collected by products and by traders. However, in both instances compilers should try use to the maximum extent possible all the information they have available to determine whether particular data points should be considered outliers or not.

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\(^5\) Statistical analyses may include estimation of univariate densities and cluster analysis to help assess whether a certain strata or commodity classifications may composed by various sub-categories of products with heterogeneous price trajectories.
28.23. **Treatment of quality change.** Compilers of foreign trade indices based on price survey data can handle quality changes by asking survey respondents to provide an estimate of the value of the quality change whenever an item description has changed. An adjustment can be made to the price to separate out the value of the description change from any remaining price change. In some cases where the items being compared are too divergent, the original item needs to be replaced by the new one and the price series started over again from the current period. The use of Hedonic regression models to estimate the value of the quality change for technology products like computers and some computer peripherals is also a good practice currently followed by some countries.

**E. Other issues**

28.24. **Integration of the statistical production process in the compilation of level and index data.** As the compilation of foreign trade indices can reveal the presence of outliers by decomposing value trends into their price and quantity components, it is a good practice to allow for the compilation process of trade indices to feedback into the compilation of raw data, and vice-versa.

28.25. **Need for integrated economic statistics.** In most countries, there is less than complete compatibility between the coverage, methods, classifications and adjustments of price index numbers in external trade and domestic indexes. And yet, these indexes must be related if the mechanism of transmission of inflation across national boundaries and the way in which domestic prices are set are to be properly understood. It is therefore important to develop integrated economic statistics based on common statistical business registers that allow to link customs declarations data and with information gathered from surveys, tax records, and other direct and indirect sources of information.

28.26. **International comparability of external price indices.** Governments as well as the business community show considerable interest in monitoring the performance of their countries vis-à-vis commercial competitors in international markets. While changes in a country's competitive position may be gauged from an analysis of its market shares, one of the key explanatory variables of the change in such shares is the measure of the evolution of relative prices across countries. This highlights the need for countries to compile and make available (in terms of a common currency) mutually consistent measures of price changes for the traded commodities at matching levels of detail.

28.27. **Role of international economic classifications.** While the commodity classifications for the compilation of export and import indices normally follow external trade classifications (HS or SITC), special emphasis should be directed to linking them to those of domestic-price indices, in particular CPC and related national classifications.

28.28. **Use of foreign price indices.** Foreign price indexes could also be used as a 'second best' measure in some special circumstances. For example, if a country's economy is very interrelated to that of another country, there may be specific commodity groups for which they can be considered to be one market, with purchasers in both countries facing approximately the same price movements. If this hypothesis is reasonable, the producer price index of a foreign, closely related economy can be used as a proxy for the price index of imports from that country. Nevertheless, it is important to emphasize that foreign price indices are only an 'indirect' second best way to measure variation of prices of internationally traded goods, and their linkage is generally imperfect and difficult to accomplish.

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6 This is, for instance, a practice currently followed by the United States Bureau of Labor Statistics.
F. Country experiences

1. Norwegian practices

28.29. **Current practices.** The Department of Economic Statistics of Statistics Norway uses unit value data from customs records and combines them with survey-based price data to compute price and volume indices of external trade in commodities. Survey price data are used for some commodity codes for which customs data are not considered acceptable as a source of price statistics. When this is the case, priority is given to Norwegian data sources, and only if this is also not adequate, data from international sources (such as the US Bureau of Labor Statistics) are collected.

28.30. **Use of foreign trade indices in National Accounts compilation.** Detailed data on exports and imports at the HS-8 level are aggregated to the national accounts product level (going from about 6,500 commodities to approximately 700 product categories). Values of exports and imports are used in balancing the National Accounts at current prices. Price information is applied to National Accounts at the detailed CPA level to derive exports and imports at constant prices, and to estimate price changes of components where no price observations exist (namely, intermediate consumption, gross fixed capital formation, and final consumption).

28.31. **Future developments.** It is expected that large importers and exporters will in the future be allowed to lodge consolidated customs declarations on a monthly basis. Although this will have a positive effect in terms of trade facilitation, statisticians will need to rely on fewer data records (due to the consolidation of single transactions into monthly totals) and thus error detection procedures may be further complicated. Also, the general trend towards removal of tariffs and duties, and the inherent customs’ interest in simplifying and facilitating trade procedures, will mean that additional efforts have to be made in order to preserve the quality and coverage of data from administrative customs records. Currently, Statistics Norway’s goal is to replace unit value indices with survey-based price indices for both exports and imports.

2. Canadian practices

28.32. **Current practices.** 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 to accurately reflect the realities of the price movement a fixed basket of goods is chosen which are representative 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 indexes are constructed on the basis of unit values derived from detailed custom base data and survey price indexes 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 indexes. As the Canadian economy is very interrelated to that of the United States, the U.S. Bureau of Labour Statistics producer price index is used as a proxy for the price of some Canadian imports from the U.S.

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7 Statistics Canada’s Industrial Product Price Indexes (IPPI) and Automotive Price Index by Model, as well as data on exports of crude petroleum and natural gas (by pipeline) from its Manufacturing Construction and Energy Division. Price indicators from other organizations include the Bank of Japan’s Export Price Index, price data on electricity from Canada’s National Energy Board, Computer Price Index by Component from the Bureau of Economic Analysis (BEA).
3. **Czech practices**

28.33. **Current practices.** The export and import price index has been calculated for the Czech Republic since 1998. Prices are measured through a national monthly statistical questionnaire, with price relatives collected from both production enterprises and enterprises engaged in foreign trade only—about 580 of them engaged in exports and about 590 in imports. At present, the weight pattern includes approximately 2050 exported and 2100 imported products, raw materials and supplies, which take up a significant share in the value of external trade (both exports and imports). Foreign trade indices are calculated on the basis of invoiced prices (without duties, VAT and consumer tax) which are converted into national currency using the average monthly exchange rates declared by the Czech National Bank. While the price indices reflect thus changes in foreign exchange rates, the breakdown of export and import price index adjusted by exchange rate influences has been published monthly since January 2011. The index is compiled according to the Harmonized System and is converted to suit the breakdown by SITC Rev. 4 main groups. The Czech Classification of Product by Activities (CZ-CPA 2008) for the needs of national accounts and Eurostat. The first estimates are definitive—it means, ordinary revisions (revisions for the purpose of more precise previous estimates without methodical changes or modification of computation concept) are not accomplished.

4. **German practices**

28.34. **Current practices.** The external trade prices indices are an important module within the overall German system of price statistics, which intends to measure the development of prices across all main stages of the economy in a methodologically consistent way. In Germany (Laspeyres) volume indices and (Paasche) unit value indices (UVI's) are calculated and published on a monthly basis in a breakdown by detailed commodities and country groups. The compilation is based on the results of external trade statistics. Even though price indices based on survey data are generally preferred for methodological reasons, UVI’s are calculated as well since they can be derived easily from foreign trade figures already existing and allow a breakdown by detailed commodities in combination with partner countries. In this way a methodologically consistent set of nominal and real export/import figures is available which is based exclusively on foreign trade statistics. By means of volume indices and UVI’s the nominal figures of foreign trade statistics can be split up into a quantity and a value component. Another advantage of UVI’s is that they are calculated on the basis of up to date weighting factors (while calculation of price indices requires unchanging weighting factors of the relevant base year).

28.35. To analyze price changes in foreign trade, apart from UVI’s also “real” price indices are calculated monthly as Laspeyres indices for a large number of commodity groups and by groups of countries. To a large extent the data are obtained through an enterprise survey. Only in exceptional cases other sources (e.g. stock market valuation, market reports) are appropriate to provide actual trade prices. The generation of the survey sample follows a multi-stage procedure. First of all a basket of presentable commodities is defined, which can be derived from foreign trade statistics. In a second step, the reporting enterprises are selected with regard to their share in the total value of the relevant commodities. Finally, the enterprises decide on specific “price representatives” (single cases of sale/purchase) for each of the selected commodities. As a result, the survey covers 6 000 enterprises reporting nearly 10 000 single prices per month. The advantages and disadvantages of a price survey are already described above (see paras. 27.11, 27.15 and 27.15 above). The main methodological issue is to keep the parameters underlying the calculation (selection of goods and enterprises, sample of price representatives, weighting scheme) as constant as possible (according to the Laspeyres-Concept).

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8 The survey is not based on a random sample; the choice of enterprises is “targeted”. Hence it is not possible to estimate sampling errors. Nevertheless the reporting companies can be considered as representative since they are leading in the relevant market segment
5. Italian practices

28.36. Current practices. External trade UVIs in Italy are chained Fisher-type indexes, with each monthly link calculated as the squared root of a Laspeyres-type and a Paasche-type index both based on the previous year. Each Laspeyres and Paasche link is a weighted average of elementary unit value indexes belonging to “product-country of origin/destination-flow” strata, the products being classified according to the Combined Nomenclature at 8-digit level. The total number of elementary strata is around 220,000. Outlier detection procedures are applied to the log-distribution of the elementary unit values (levels) in each stratum to control for the variability inside the strata, mainly due to errors on reported quantities. No imputation method is applied to replace the deleted observation in order not to introduce imputation bias in the resulting distributions. Deleted unit values are taken into account by means of maintaining their original weights in the calculation of the aggregated indexes.

Annex 28.A. The Norwegian experience

1. Unit values from customs records

28.A.1. Frequency and volume of data from customs records processed. Statistics Norway receives administrative data from TAD, the Norwegian customs administration authority, every day. The number of customs data records used by Statistics Norway in the creation of exports statistics has increased 23% since 2000, and for imports this increase has been more than 80%. In 2010, Statistics Norway used about 1.4 million data records of exports and almost 11 million records of imports (representing 44.3% and 99% of Norway's total value of exports and imports, respectively).

28.A.2. Two-step process for unit value calculation. The main body of data in the Norwegian external trade statistics is administrative data from customs declarations (Single Administrative Document, SAD). As the SAD document does not contain a price variable, unit values are derived from the variables value and quantity. This is done based on the total commodity value and quantity, after a two-step validation stage that involves stratification to identify commodity codes where the data may be utilized for price statistics.

28.A.3. Stratification below commodity code level. In the first step, data in each commodity code are stratified below the HS-code level. The aim of the stratification is partly to arrive at more homogeneous strains within the code and, simultaneously, to reduce the overall variation observed on the code level. There are three stratification variables: Enterprise (VAT number), partner country (ISO code) and quantity groups (based on weight or supplementary unit). The choice of the best stratification variable for a commodity code in the reference year is done by means of automated analyses run on the data of the previous year (base year).

28.A.4. Outlier detection and data editing. Before the estimation, the data are run through an editing procedure controlling for extreme prices. The data are subjected to a HB (Hidrioglou-Berthelot)-based procedure for identifying extremes, both on the stratum level and within the strata. Extremes are excluded from further calculations. For each stratum within an eight digit commodity, a set of control variables is calculated. The purpose of this step is to evaluate statistical properties of unit prices resulting from each method of stratification (enterprise, country and quantity group). The indicators are:

(a) Regularity of transactions (number of months in year T-1 with no transactions < 6)
(b) Price variation (coefficient of variation < 0.5)
(c) Value (> 1 per cent of the total value on commodity level)
(d) Quantity (> 1 per cent of the total quantity on commodity level)
28.A.5. **Selection of customs data for the computation of unit value indices.** The ratio between arithmetic average and the quantity-weighted average of the monthly unit values, at the transaction level, is used as a background variable to evaluate the stratification of the data, and choose which method to use for each HS code. Taken together, these indicators give information on stability, magnitude/concentration of the strata. A stratum is accepted if the values of all the indicators are within the required limits. If one or more of the limit values are exceeded for a stratum, the stratum is rejected and is not a part of the calculation of price indices.

2. **Producer Price Indices (PPIs) for external trade**

28.A.6. **Integration of survey data from producer price indices.** For some important commodities, data from customs records are deemed too heterogeneous to yield acceptable price information. To compensate for such shortcomings survey-based price indices are used as indicators in the external trade statistics. In Statistics Norway, the survey which yields produce price indices (PPI) covers both the domestic market, export market, and import market. An important characteristic of the Norwegian system of price statistics is the fact that external trade considerations guide and influence the PPI production, particularly in determining which commodity codes are included in the sample.

28.A.7. **Survey implementation.** Data collection is mainly made via questionnaire, whereby respondents also receive guidance in the form of an information brochure as well as semiannual messages from Statistics Norway. The statistics register employed by Statistics Norway includes all resident firms that produce or deal with the commodities in question and have 10 or more employees. The sample is based on a scheme of probability proportional to size. Prices are collected for selected, well-defined products over time, all of which are classified according to the HS nomenclature. In practical terms, this means that a survey questionnaire makes reference to a specific HS commodity classification, and the respondent has to provide price data for a product model that best suits this commodity description, and the price of this product is reported monthly.

28.A.8. **Index formulas.** Elementary indices are calculated at the HS level, using a geometric mean. Indices at the HS level are then aggregated, using a weighted average, to form a CPA index, and from the CPA level, indices are aggregated to CPA 4 digit, 3 digit, etc. This is done for each of the three markets (domestic, export, and import). Indices above the elementary level are calculated using the Laspeyres formula.

28.A.9. **Imputation.** During the process of compilation of PPIs, missing HS data are imputed using higher levels of aggregation. Sequences of 13 consecutive months are used to calculate a short-term index, whereby the base is always December of the previous year.

3. **Other data sources**

28.A.10. **Alternative sources of price data.** In addition to survey data and customs records, there are special data collection mechanisms in place, including the use of price information from international commodity exchanges and foreign statistical agencies. For internationally traded commodities (refined oil products, nickel etc) price data are collected from London Stock Exchange and London Metal Exchange.

28.A.11. **Use of foreign indicators of price trends.** For other products (especially export and import of capital goods), international price indicators are in some cases considered to be representative also for the price development of the same product group in the Norwegian trade. For instance, data from the US Bureau of Labor Statistics (BLS) are used for about 80 export products and 40 import products.
4. Data validation and editing

28.A.12. Validation of customs data. Data validation procedures are routinely put in place in order to detect errors in the statistical values reported in the customs declarations.

(a) Tests were introduced in 2011 which are applied directly on data as they are entered by declarants of exports or imports. These tests aim to identify obvious errors/data inconsistencies at the first step of data flow, and include: validity checks for commodity and country codes, price verifications based on upper and lower thresholds, quantity checks, and checks for implausible data by commodity or partner. These and other controls are also applied within the Customs Service’s own information systems.

(b) Prior to loading customs data into Statistics Norway's database, some data editing is conducted. Only the transactions involving commodities above 1000 NOK and less than 1 year old are selected, and incomplete declarations are rejected. After loading, automatic corrections are carried out, and validity of codes is checked again. Also, with the aid of statistical tools, probable errors are identified, which may involve unusual prices, partners or commodities, as well as code combinations that seem suspect. All large declarations are subject to data quality control, whereby experience of staff members specialized in checking the data of specific groups of commodities plays a key role.

(c) In cases where Statistics Norway does not have sufficient information to correct obvious errors, a report is sent to Customs specifying the nature of the problem with each suspect transaction. This report is reviewed by Customs and sent back to Statistics Norway with a comment indicating whether any corrective action was taken.

28.A.13. Validation of price survey data. Validation mechanisms are also applied to price survey data submitted to Statistics Norway. These mechanisms include detection of high and low outliers, control of CPA classification, and checks on aggregated data at different NACE levels. If errors are suspected and the data in the questionnaire is insufficient, Statistics Norway would establish direct contact with the respondent in order to obtain further clarification.

28.A.14. Most frequent kinds of errors. Some of the most frequent kinds of errors detected are related to wrong currency and/or exchange rates, as well as errors in the quantities reported. Two specific examples illustrate some of the kinds of errors that have been dealt with in the past. The first one was the case of salmon exports to the European Union that were subject to a punitive duty. As firms filling the declarations were not able to report separately the duty, Statistics Norway had to put in a lot of work in order to correct the statistical value. Another example was the situation created by some companies using computer software to speed up the filling up of customs declarations, which automatically distributed total quantity (weight) of all declared goods according to their individual value shares. As a result, all commodities declared in a single document were implicitly given exactly the same unit value, rendering the information useless for unit value calculations.

5. Institutional framework

28.A.15. Cooperation between Statistics Norway and the Norwegian Customs Administration. There is a good working relationship between Statistics Norway and the Norwegian Customs Administration Authority (TAD) in terms of providing data for statistical purposes, as required by the Statistics Act of 1989. Cooperation between TAD and Statistics Norway is regulated by a formal agreement, which establishes responsibility for contacts between both parties, stipulates that changes made to the existing administrative data systems should be communicated to Statistics Norway, regulates data transmission between TAD and Statistics Norway, gives Statistics Norway the responsibility of compiling a list of all
statistical surveys being conducted, and requires a yearly report on the cooperation. As cooperation with customs personnel is essential during the data validation process, Statistics Norway provides regular training for Customs employees, allowing for improvements at the data source.

**Annex 28.B. The Canadian experience**

28.B.1. *Estimation formulas.* Fixed (Laspeyres) and current (Paasche) weighted price indexes are calculated monthly, quarterly and annually on a Customs as well as on a Balance of Payments basis both for all countries and for United States. International Trade Division also calculates Constant dollars on a Balance of Payments basis with the use of the Chain Fisher formula with a base reference year. They are available from 1981 to present on a monthly and quarterly basis.

28.B.2. *Error detection and imputation.* Once the Laspeyres indexes and Paasche Indexes are calculated, a module uses a method described by Hidiroglou and Berthelot (1986) to identify outlying observations. Historical Trend Method is also adapted and used to identify transactions within an aggregation that are “abnormal” for a given period. The error detection process is only done at the first stage of aggregation in the construction of the International Merchandise Trade Price Index. If during the error detection process a unit value has been identified as an outlier, and if the price analyst with the help of the subject matter specialist also considers this unit value as an outlier, then the unit value will be manually imputed.

28.B.3. *Quality evaluation.* The quality of this index is maintained through the expertise of the few trained analysts assigned to it. They develop a thorough knowledge of the domain. Much time and effort is devoted to detecting and following up unusual fluctuations over time in the pricing patterns of goods. Prior to dissemination, the price indexes are analyzed and historic trends reviewed.

28.B.4. *Disclosure control.* Statistics Canada is prohibited by law from releasing any data which would divulge information obtained under the Statistics Act that relates to any identifiable person, business or organization without the prior knowledge or the consent in writing of that person, business or organization. Various confidentiality rules are applied to all data that are released or published to prevent the publication or disclosure of any information deemed confidential. If necessary, data are suppressed to prevent direct or residual disclosure of identifiable data.

28.B.5. *Revisions and seasonal adjustment.* In general, merchandise trade data are revised on an ongoing basis for each month of the current year. Current year revisions are reflected in both the customs and BOP based data. The previous year's customs data are revised with the release of the January and February reference months as well as on a quarterly basis. The previous two years of customs based data are revised annually and are released in February with the December reference month. The previous year's BOP based data are revised with the release of the January, February and March reference months. Revisions to BOP based data for the previous three years are released annually in June with the April reference month. Factors influencing revisions include late receipt of import and export documentation, incorrect information on customs forms, replacement of estimates produced for the energy sector with actual figures, changes in classification of merchandise based on more current information, and changes to seasonal adjustment factors.