

Working Party on Statistics (SWIC), 17-18 November 2005

Development of comparable quarterly unit labour cost indexes for OECD countries

1. Introduction

1 This paper describes a proposal by the OECD Statistics Directorate for compiling quarterly unit labour cost (ULC) indexes across a broad selection of industries using a consistent methodology across all OECD countries. A comprehensive review of available data sources to support this analysis has already been performed and verified by national institutes. The quarterly unit labour indexes proposed in this study would be benchmarked to annual data sources using an optimal statistical benchmarking procedure.

2 The ultimate goal of this project is to develop an ongoing production system for producing quarterly ULC indexes that satisfy the data requirements of OECD users, and to harmonise annual and quarterly ULC indexes currently published by the OECD. The key internal user of these data will be the OECD Economics Department, although the project also aims to provide a comprehensive dataset to support a variety of external user needs including national institutions of OECD Member countries. These data would ideally be published online in conjunction with the OECD productivity database and in the OECD's *Main Economic Indicators* (MEI) publication.

3 This paper is structured as follows: first a brief review of existing sources for ULC indexes is given highlighting the need to harmonise those currently published by the OECD. This is followed by an analysis of key methodological issues, the proposed industries to be covered and possible sources for the required annual benchmark ULC indexes. An assessment of priorities for quarterly indicator variables is then described together with a detailed description of the availability of this data across OECD countries. Some strategies for evaluating the suitability of quarterly indicator variables are proposed together with a strategy for benchmarking quarterly indicator data to more reliable annual data. Finally a brief description of the feedback now being sought from national institutions and prospective users are outlined, together with work required for the next phases of this project.

4 The Statistics Directorate is very interested in the views of SWIC participants on this proposal, and invite comments in particular on the following issues:

- opinions on the possible choices of an annual benchmark variable as discussed in Section 5, in particular whether all (or some) of the adjustments outlined in Section 3 should be performed where possible to improve the methodological relevance of the annual benchmark data;
- opinions on the industries proposed to be covered as outlined in Section 4, and the degree of importance attached to harmonising the quarterly ULC indexes for these industries with the corresponding annual data currently published in the Structural Analysis (STAN) industrial database;
- opinions on the proposed priorities for quarterly indicator variables outlined in Section 6;
- opinions on the proposed approach for quality evaluation and benchmarking as outlined in Section 8;
- opinions on the priority the OECD should give to developing these quarterly ULC indexes.

2. Review of existing sources of unit labour cost indexes

Bureau of Labour Statistics

5 The United States Bureau of Labour Statistics (BLS) produces annual ULC indexes for the Manufacturing sector, for the United States, Canada, Japan, France, Germany, Norway, Sweden, Belgium, Denmark, Italy, Netherlands, Australia, Korea and the United Kingdom. The basic methodology is to use total compensation of employees (CoE) in Manufacturing taken from the Annual National Accounts as the total labour cost measure and divide this by constant price value added (VA) in Manufacturing. However, some notable modifications to this method are:

- for France, Sweden and Canada significant taxes on payrolls and employment are added to the total labour costs measure;
- for all 14 OECD countries covered except Canada and Belgium, the total labour cost measure includes a contribution from the self-employed, where employment estimates for the self-employed are multiplied by average labour compensation for employed persons.

OECD STAN Industrial database

6 The STAN Industrial database provides a comprehensive set of annual ULC indexes for 26 OECD countries¹ for all ISIC divisions² and relevant aggregates of these such as Industry (ISIC divisions C_E); Business Sector Services (G_K); Total Services (G_O); Non Agricultural Business Sector³ (C_K) and All Industries. The method used is the division of compensation of employees by constant price value added sourced from a rolling collection of annual national accounts data from OECD countries. As stated in the introduction, a key goal of this project would be to harmonise the proposed quarterly ULC indexes with the annual data already published in STAN. However, use of existing data from STAN depends to some extent on the treatment of methodological issues for the annual benchmark variable as discussed in sections 3 and 5.

European Central Bank (ECB)

7 The ECB publishes a quarterly ULC index for the Euro area for the following industries: Agriculture (A, B); Industry (C_E); Construction (F); Trade, Transport & Communication Services (G_J); Finance, Property & Business Services (K, L) and; Government Services (M_O). The method is:

numerator = compensation of employees / number of employees;

denominator = constant price value added / total employment.

Consequently this methodology is described as compensation per employee divided by labour productivity, which is interesting given that it is produced on a quarterly basis, whereas the majority of statistics concerning productivity are produced on an annual basis. This also serves to highlight the relationship between ULC indexes and measures of labour productivity.

¹ STAN ULC indexes exclude Turkey, Iceland, Ireland and Switzerland

² Subject to data availability in the countries covered

³ Excluding SIC 70 – Real Estate activities

OECD Main Economic Indicators database

8 The MEI collects and publishes national series of quarterly or monthly ULC indexes for the Manufacturing industry for Germany (monthly, Mining & Manufacturing), Japan (monthly), Spain (quarterly), United Kingdom (monthly) and the United States. The method generally used by those countries involves dividing total Gross Wages and Salaries (GWS) by gross output volumes. In addition some NSOs (e.g. ISTAT) and policy institutes (e.g. Reserve Bank of Australia) in other OECD countries publish ULC indexes for a (generally limited) range of industries using a variety of methodologies.

OECD Economics Department's Economic Outlook and Analytical Database

10 The OECD's *Economic Outlook* database, published at 6 monthly intervals, contains time series for the following quarterly ULC indexes including two year ahead forecasts:

- ULC – unit labour cost of total economy;
- ULCB – unit labour cost in the business sector;
- ULCM – unit labour cost of the manufacturing sector.

11 The current sources used for these series are varied and computations involve a number of approximations, interpolations and use of proxy indicators. The Economics Department has recognised the limitations of these data and are evaluating the Statistics Directorate's proposal as outlined in this paper as an opportunity for upgrading their data sources for ULC indexes. Consequently the opportunity of harmonising both annual and quarterly ULC indexes published by the three OECD Directorates (i.e. ECO, STI and STD) is a realistic goal for this project.

3. Key methodological issues to consider when estimating ULC indexes

12 The simplest approach for estimating a ULC index is to divide compensation of employees by constant price value added (measured at basic prices) using data from national accounts sources (i.e. annual and / or quarterly depending on the frequency required). However, there are three main problems with applying this simplistic approach, particularly from the viewpoint of achieving comparability across countries.

1. Ownership of Dwellings

13 The national accounts item 'Ownership of Dwellings' is part of ISIC division K, sub-division 70: Real Estate, which contributes on average around 10% of GDP in most OECD countries⁴. This 'output' is essentially a national accounts concept of the provision of housing services by a dwelling to its occupants and in reality has nothing to do with the relationship between output and labour costs. Consequently it should ideally be removed from calculations of ULC indexes which cover ISIC division K. If included it has the potential to distort the comparability of ULC indexes across countries, in particular where there are large differences in the level or, more importantly, changes over time across countries in the contribution of 'Ownership of Dwellings' to value added.

14 At present, the annual ULC indexes in the STAN database attempt to account for this in the Business Sector (ISIC C_K) by subtracting from value added the contribution of SIC 70 – real estate activities. However a lack of data availability of value added estimates for SIC 70 results in Business

⁴ Taken from a quote in the metadata from the OECD STAN industrial database.

Sector data not being available⁵ for Belgium, Mexico, New Zealand, Poland, and Portugal and only for a limited time period for Canada and the Czech Republic. Also, whilst ownership of dwellings is the major part of SIC 70, subtracting all of the SIC 70 contribution from value added excludes the relevant contribution of other real estate activities which are associated with the supply of labour (e.g. the activities of real estate agents). An alternative would be to subtract the items ‘imputed rents for households’ and ‘actual rents for households’ which are components of household final consumption expenditure and may be considered a more accurate approximation of the contribution of ownership of dwellings to value added. Data for these items is currently available for 19 countries in the OECD Annual National Accounts database.

2. Exclusion of the self-employed

15 Compensation of employees as defined in the national accounts does not include labour compensation for the self-employed which is covered in the item ‘operating surplus and mixed income’. However, the output of the self-employed contributes to value added and thus introduces an inconsistency between the numerator and denominator when deriving ULC indexes. If an adjustment is not made to the labour compensation measure to account for the impact of the self-employed, this has the potential to distort the comparability of ULC indexes across countries if there are large differences in the level or, more importantly, changes over time in the number of self-employed persons across countries. Also, this impact is likely to vary across industries, as some industries are more likely to have a higher proportion of self-employed persons (e.g. Agriculture) than others.

3. Taxes on employment

16 Taxes on employment to business (e.g. payroll tax), which can be an important labour cost, are included in value added at basic prices but are not included in compensation of employees. Conceptually this is a problem because an increase in say the rate of payroll tax, all other things being equal, would cause a fall in the ULC index (as value added increases whilst compensation of employees is unchanged) when in fact it should cause an increase. Consequently if an adjustment is not made to account for taxes on employment comparability of ULC indexes across countries may be adversely affected, particularly if there are large differences in the level or, more importantly, changes over time across countries in taxes on employment.

17 The major problem in overcoming these conceptual issues is the availability of required data to make the necessary adjustments, in particular for the desired industry breakdowns proposed below. Another issue to consider is that if the data required to make these adjustments exists for some countries and not others then making the adjustments where possible introduces another factor to distort international comparability. Any such adjustments would only be considered for the annual benchmark variable, as performing adjustments to quarterly indicator data would not be feasible both from a data availability (and reliability) and timeliness perspective.

4. Industries proposed to be covered

18 The selection of industries for which this project aims to produce quarterly ULC indexes is essentially a compromise between the priorities of likely user needs and the availability of sufficiently reliable data. There appears to be a clear or at least traditional demand to produce quarterly ULC indexes for the Manufacturing industry, the *Economic Outlook* dataset also contains estimates for total business

⁵ STAN does not publish ULC indexes in any industry for Iceland, Ireland, Switzerland and Turkey.

sector and total economy. The fact that quarterly ULC indexes for service industries are not widely published may reflect an historical lack of data availability rather than an absence of demand. Consequently this project proposes to estimate quarterly ULC indexes for service industries where possible, to complement the annual ULC indexes currently published in the STAN database. Therefore, based on an initial investigation of data availability and perceived user demand, it is proposed to produce quarterly ULC indexes for the following industries and aggregates.

1. *Whole Economy*
2. *Industry (ISIC C_E: Mining; Manufacturing; Electricity, Gas & Water)*
3. *Manufacturing (ISIC D)*
4. *Construction (ISIC F)*
5. *Market Services (ISIC G_K: Retail & Wholesale Trade; Accommodation & Restaurants; Transport & Communication; Finance; Property & Business Services)*
6. *Business Sector excluding Agriculture (ISIC C_K)*

19 Note that the Business Sector would ideally be defined on an institutional sector basis but due to a lack of available data it is necessary to approximate this by an aggregation of the most relevant industries⁶. However the appropriateness of compiling such an activity based measure as a proxy of the business sector has been discussed over many years across OECD departments without consensus being reached. Nonetheless, this is seen as the most practical approach by both the Statistics and Science and Technology Directorates. This above choice of industries would also represent a subset of the industries for which annual ULC indexes are published in the STAN database thus providing the opportunity to harmonise the compilation of annual and quarterly ULC indexes for these industries.

5. Choice of annual benchmark variable

20 There appear to be three possible choices as to the source for compiling annual benchmark ULC indexes for the desired industries listed above, each with some advantages and disadvantages.

Bureau of Labour Statistics

21 The BLS is one of the primary benchmark sources currently used for the OECD's *Economic Outlook*; however it only contains annual data for 14 countries and only for manufacturing. The BLS does make adjustments for employment taxes and the self-employed but only for a selection of countries as outlined in paragraph 5.

OECD STAN Industrial database

22 The STAN Industrial database provides a comprehensive set of annual ULC indexes which could be used as a benchmark for virtually all OECD countries and for all of the desired industry breakdowns. It also provides ULC indexes for the Business Sector excluding Agriculture minus ISIC sub-division 70 (Real Estate), although only for 20 countries due to a lack of data availability in some countries as

⁶ Also, as discussed above it would be desirable to exclude 'Ownership of Dwellings' which is the main contributor to ISIC sub division 70: real estate, from the ULC indexes for Whole Economy, Market Services and Business Sector excluding Agriculture.

explained in paragraph 14. However if it is preferred to make adjustments for the self employed and employment taxes where possible as discussed in Section 3 then the STAN ULC indexes in their current form could not be used in many cases. Also, appropriate annual data now exists for some of the countries previously excluded from the ULC indexes on the STAN database. Consequently, this project provides the ideal opportunity to review the methodology and country coverage in the STAN database to ensure a harmonised approach for the dissemination of OECD data on ULC indexes can be implemented.

OECD Annual National Accounts database

23 The OECD Annual National Accounts (ANA) database contains comprehensive data for the majority of OECD countries with required industry breakdowns for constant price value added⁷ and compensation of employees. It also contains data for the self-employed for some countries in some industries which may allow adjustments to be made to compensation of employees. Similarly, data on imputed and actual rents for households taken from household final consumption expenditure tables could be used as an approximation of ownership of dwellings and be subtracted from constant price value added, but only for 19 countries. However, this source does not provide information on employment taxes.

Analysis of potential annual benchmark sources

24 One advantage of using ANA data is that adjustments could be made to both the numerator (i.e. compensation of employees) and the denominator (i.e. constant price value added) to account for the self-employed and ownership of dwellings. However this would also introduce a degree of inconsistency between countries because data does not exist in all countries and / or all industries to perform these adjustments. In addition, these adjustments would not be applied to the quarterly indicator series and thus their impact would only come through revisions via application of the benchmarking process after the annual data become available. Having the numerator and denominator as separate input variables would also allow them to be benchmarked separately to their quarterly indicators⁸.

25 It is possible that different sources could be used as the annual benchmark variable for different industries and aggregates, although this would complicate the transparency of the process when explained to users.

26 Ultimately the Statistics Directorate (STD) would like to seek the opinion of potential key users before choosing the annual benchmark variable, thus feedback from SWIC participants is sought on whether in principle it is preferable to:

- take the most simplistic approach which would be consistent across all countries by using compensation of employees divided by value added and obtain all annual benchmark data from the STAN database whose principal source is annual national accounts data collected from national statistical organisations, or;
- try to obtain the most methodologically correct annual benchmark for each country within each industry. This will depend on the availability of data to make the required adjustments to compensation of employees and constant price value added⁹. If this approach is taken, then the

⁷ However value added data are not available for the proposed Business Services and Business Sector excluding Agriculture aggregates, which would need to be compiled from their component industries.

⁸ This issue is explored further below in the Section on Evaluation and benchmarking.

⁹ It may also be worthwhile to perform some sensitivity analysis to examine the impact of making these adjustments to evaluate their impact on the quality of the resultant series

resultant annual benchmark ULC indexes should replace those currently published in the STAN database.

6. Choice of quarterly indicator variables

27 It is proposed to benchmark quarterly indicator variables to their annual counterparts using a statistical procedure for which different options are discussed in Section 8 on Evaluation and benchmarking. Constant price value added (VA) and compensation of employees (CoE) from the quarterly national accounts (QNA) are considered the target quarterly indicator variables for the ULC index. That is, it is not realistic to consider making adjustments on a quarterly basis to account for the deficiencies in these variables for forming an ideal ULC index. However, these variables are not available from the QNA for a large number of OECD countries or for the degree of industry detail required. Consequently, proxy variables will need to be considered and a priority between possible alternative proxy variables needs to be established. The following processes have been used to identify and prioritise proxy variables to guide the data collection process. Ideally, all quarterly indicator data used in this analysis would be seasonally adjusted, provided seasonality exists in the associated series.

Constant price value added

Target variable: Constant price VA at basic prices by required industries from the QNA

Proxy variable: Gross output indicator, e.g. index of production

Compensation of employees

Target variable: Compensation of employees by required industries from the QNA

Proxy variables: In decreasing order of preference as shown below.

1 *Gross wages and salaries*

28 Gross wages and salaries forms the major part of CoE and may be available on an industry basis where CoE is only provided at more aggregated levels within a country's QNA.

2 *Labour cost index multiplied by an index of hours worked*

29 A labour cost index should be defined as an index which measures changes in gross labour costs per hour worked. It should not be adjusted for quality or compositional changes and should have the broadest possible scope in terms of coverage of labour costs. The ideal measure of labour input is total hours paid. The scope would generally be paid employees (i.e. exclude the self-employed) unless the annual benchmark for compensation of employees was adjusted for the self-employed in which case hours paid for total employment would be preferred if available (i.e. includes the self-employed).

3 *Hourly earnings index multiplied by an index of hours worked*

30 An hourly earnings index should have the broadest possible scope of employee earnings (i.e. capture all workers such as those employed full-time (FT) and part-time (PT), and all earnings such as overtime and bonuses etc.). The ideal measure of labour input is total hours paid. The scope would generally be paid employees (i.e. exclude the self-employed) unless the annual benchmark for compensation of employees was adjusted for the self-employed in which case hours paid for total employment would be preferred if available (i.e. includes the self-employed).

4 *Weekly or monthly earnings multiplied by an employment measure*

31 A weekly or monthly average earnings index should have the broadest possible scope of employee earnings (i.e. capture all workers such as FT and PT, and all earnings such as overtime and bonuses etc.). The required measure of labour input would be total employees¹⁰ (i.e. excluding the self-employed), unless the annual benchmark for compensation of employees was adjusted for the self-employed in which case total civilian employment would be preferred if available.

7. Availability of quarterly indicator variables

32 The matrix in Attachment 1 provides a comprehensive reference of data availability by OECD country for calculating quarterly ULC indexes on the basis of the preferred quarterly variables as outlined above. This matrix was established after an investigation of potential data sources ranging from OECD databases (Quarterly National Accounts – QNA, and Main Economic Indicators – MEI), Eurostat (New Cronos) databases, investigations of Member country national statistical organisations’ websites and by emailing well established country contacts (for a small number of countries). The relevance of these data sources has also been verified by national statistical organisations through the OECD Short-Term Economic Statistics Expert Group (STESEG).

Data available from the OECD Quarterly National Accounts database

33 The OECD QNA database maintained by the Statistics Directorate (STD) is the central repository for all QNA data received by STD. All countries are asked to complete a quarterly questionnaire that is then fed into the database. The questionnaire has been harmonised with Eurostat and in some cases the data is received from Eurostat directly. QNA is the preferred data source for both constant price value added and compensation of employees, and for a large percentage of Member countries both these statistics are available.

34 The QNA database aims to provide the standard A6 industry breakdown: Agriculture (A_B); Industry (C_E); Construction (F); Retail & Wholesale Trade, Accommodation & Restaurants, Transport & Communication (G_I); Finance, Property & Business Services (J_K); Other Services (L_O). A limited number of countries provide additional disaggregations, which for the purpose of this project is required for Manufacturing (D). The desired aggregates of Market Services (G_K) and Business Sector excluding Agriculture (C_K) are not available and need to be compiled from existing data. As CoE data is in current prices this is a simple case of adding together the component industries data. However for constant price VA data such an addition is not valid¹¹ where countries compile annually chain-linked volume indexes¹² and chain linking of the required industrial components will be performed by the secretariat.

35 The QNA database can supply all the required constant price VA data for eight countries and all but Manufacturing for a further 17 countries. For CoE, the QNA database can supply all the required data

¹⁰ Using an index of hours worked in conjunction with an average or monthly earnings index would cause a bias if there were a shift between the proportion of full-time and part-time employees.

¹¹ The addition of quarterly time series which are annually chain linked volume indices across industries is only valid from the most recent linking point – which usually applies to the most recent two years of data.

¹² This is the case, or will be case by the end of 2005, for almost all OECD Member countries.

with the exception of Manufacturing for 12 countries¹³ and CoE at the total level only for a further 7 countries.

Sources for proxy quarterly indicators

36 As outlined in paragraph 27 above, where QNA data is not available proxy sources need to be considered. For constant price VA, the main area not satisfied by the QNA database is for Manufacturing. However, proxy data in the form of an index of industrial production for Manufacturing exists for all required countries in the MEI database. In the case of Japan and the United States, many proxy sources are required for value added as both countries do not compile quarterly national accounts using the production approach. There are a few areas where no suitable proxy data was found for constant price VA and these are indicated as shaded cells in the data availability matrix in Attachment 1.

37 The need for proxy indicators of CoE is much greater, but as outlined in paragraphs 27-30, there can be a number of options for compiling these proxy indicators. However, the further one moves from the target indicator the suitability of the proxy indicator for producing quarterly ULC indexes is likely to become more questionable. Data for gross wages and salaries (GWS), the preferred proxy variable, exists for at least some of the required industries (mostly for the manufacturing industry) for 18 countries. There is a split between the EU countries that can only provide GWS data for Manufacturing (D), Industry (C_E) and Construction (F) and non EU countries who can provide GWS data for most of the breakdowns required. The GWS data for the EU countries can be downloaded directly from Eurostat whereas for the other countries this data can be found on their NSO websites.

38 There are six countries where the proxy for CoE will be calculated using their labour cost index (LCI) *multiplied by* hours worked. These are all EU countries¹⁴ and as such the data can be provided by Eurostat. Eight countries will provide a CoE proxy for at least one industry using weekly or monthly earnings data *multiplied by* employees. All of this data will be sourced from either the NSO website or the MEI database¹⁵.

8. Evaluation and Benchmarking

39 This Section outlines a range of technical issues that will need to be taken into account when estimating and evaluating the quality of the quarterly ULC indexes produced in this project.

8.1 Combining industries to form required aggregates

40 As noted previously in this paper, direct estimates for Market Services (G_K) and Business Sector excluding Agriculture (C_K) will not be available and will therefore have to be aggregated from individual industry components. The following method is proposed for the different types of quarterly indicator variables available.

¹³ These 12 countries are all from the European Union, and there is a push for other EU countries to produce this data as part of the Principal European Economic Indicators (PEEI) initiative.

¹⁴ The labour cost index data published by Eurostat is only published by the national institutes for Sweden, Portugal, Spain, Belgium and Finland. This may raise questions regarding data quality for the other countries that are not prepared to publish this data.

¹⁵ For some countries seasonally adjusted data is not provided. In these cases the OECD would create the required seasonally adjusted series.

- for constant price VA, relevant industry estimates will be aggregated using an annual chain linking methodology;
- for constant price VA proxies, namely indices of industrial production, aggregate annually chain-linked indexes will be created by using weights for the contributing industry segments derived from annual constant price VA data;
- for CoE, relevant industry estimates will be summed;
- for GWS as a proxy for CoE, the GWS data will be expressed in index form and aggregate annually chain linked indexes will be created by using weights derived from annual CoE data for the contributing industry segments;
- for LCI*hours or Earnings*Employee as a proxy for CoE, all inputs will be expressed as indices and multiplied together to form a proxy index of CoE. Aggregate annually chain-linked indexes using weights derived from annual CoE data for the contributing industry segments will then be calculated.

8.2 Assessment of quarterly indicator variables

Comparison with annual benchmark

41 The quarterly indicator variables proposed in the data availability matrix in Attachment 1 will be assessed in a number of ways to determine their suitability for producing quarterly ULC indexes. The first requirement will be to observe the relationship between a proxy annual ULC index derived from the proposed quarterly indicator series in comparison to the true annual benchmark ULC index. In addition, comparisons between annual benchmarks and quarterly indicators for the components (i.e. quarterly indicators for constant price VA and CoE) could also be made. Basic techniques to compare these series would be to:

- view graphs of the annual benchmark variables compared to the temporally aggregated quarterly indicators;
- assess the correlation between the proxy and benchmark measures at annual level, obviously with the higher the value of this correlation the better. This assessment can also be done through a regression with the annual series derived from the quarterly indicator series as a predictor of the annual benchmark series (with series expressed as indices and / or as an annual growth rate series). In this case the usual diagnostic checks for a regression model (R-squared, t-stats, residual analysis) should be performed. A possible dynamic relationship between the quarterly indicator and the annual benchmark measure should also be tested¹⁶;

42 Where the proposed quarterly indicator variables are from the QNA, it is likely that for most countries the historical quarterly series for constant price VA and CoE will already have been benchmarked to the countries annual national accounts yielding the above analysis redundant¹⁷. However

¹⁶ The rationale behind this proposal is that, if the 'true' quarterly Data Generating Process takes the simple first order dynamic form $y_{t,h} = \phi y_{t-1,h} + \mathbf{x}'_{t,h} \boldsymbol{\beta} + \varepsilon_{t,h}$, $t=1, \dots, T$, $h=1,2,3,4$, the annual model implied by temporal aggregation is $y_t = \phi^4 y_{t-1} + \mathbf{x}'_t \boldsymbol{\beta} + \varepsilon_t$, $t=1, \dots, T$, where in both cases ε is a white noise error term.

¹⁷ In this case, it is proposed to accept the quarterly ULC index as the best measure possible.

in many cases, as seen in the data assessment matrix in Attachment 1, it is proposed to use QNA as the source for constant price VA but some other source as a proxy for CoE. In this case, it would be useful to evaluate more closely the quality of the quarterly proxy indicator for CoE which will directly influence the quality of the resultant ULC index. Also, if it is decided to perform adjustments to the annual benchmark sources of constant price VA and CoE to account for employment taxes, self-employed etc. (see paragraphs 12-17) then the types of evaluations described above will still be relevant where QNA is the quarterly source. However, the impacts of these adjustments on the annual series should be isolated because in most cases they would not be expected to be reflected in the quarterly indicator series.

Other assessments of quality

43 Another important issue will be to assess the consistency between specific industry ULC indexes and aggregate indexes. Comparisons of quarterly ULC indexes produced through this project with those currently compiled nationally would also need to be made and any significant differences explained.

44 The size of revisions for the quarterly ULC indexes which arise from revisions to the input source series is also an issue of interest. This may be difficult to consider in the initial stages of this project which will use historical time series which are generally not subject to further revisions. However this is an issue that should be closely evaluated when experimental estimates start to be produced on a quarterly basis.

45 If a quality indicator shows a reasonable relationship over time in comparison to the annual benchmark but is extremely volatile in regards to quarterly movements, then some form of smoothing may be required to produce a more robust estimate of movement on a quarterly basis. Consequently measures of volatility of the proposed quarterly indicator series will be assessed.

46 The potential reliability of a certain type of quarterly proxy variable (e.g. monthly earnings multiplied by employment) could possibly be assessed by examining the performance of this proxy against the target variable (e.g. compensation of employees from QNA) where both these variables are available for a country on a quarterly basis. However it may be difficult to generalise on the likely quality of a potential quarterly indicator variable in one country based on an analysis of the quality of this variable in other countries.

8.3 Benchmarking

Historical benchmarking

47 We propose that the quarterly ULC indexes be 'benchmarked' to their respective annual ULC indexes. This benchmarking process essentially adjusts the quarterly indicator series to be consistent with the annual benchmark series and there are a variety of benchmarking methodologies available to perform this reconciliation. This project proposes to evaluate standard benchmarking techniques such as those proposed by Denton (1971) and Chow and Lin (1971), along with other procedures adapted to deal with log-transformed and/or trended data (Fernández, 1981, Di Fonzo, 2003). As discussed in paragraph 42, the benchmarking process will not be required if all the annual and quarterly source data is from the national accounts and the annual data is not adjusted for its deficiencies as discussed in section 3 and 5.

48 As mentioned previously in this paper, another important issue is whether the quarterly ULC indexes or their components should be benchmarked to their annual counterparts. That is, one could consider benchmarking the quarterly proxy indicators of CoE (i.e. the numerator of the ULC index) and constant price VA (i.e. the denominator of the ULC index) to their annual counterparts and thus deriving the final benchmarked quarterly ULC index, rather than benchmarking the quarterly indicator ULC index directly. Performing benchmarking of the component series would facilitate a broader range of analyses as

described within this Section and will be used to at least some extent in the data evaluation phase of this project. However benchmarking the ULC index directly may be easier from an operational sense when an ongoing quarterly compilation process is implemented.

49 The historical benchmarking process will allow further detailed assessment of the likely quality of the quarterly indicator series – by reviewing the direction and magnitude of the revisions to the quarterly indicator series arising from the benchmarking process.

50 Experimental quarterly ULC indexes using both direct and indirect benchmarking were compiled for France and Germany in Manufacturing (Di Fonzo, 2005) based on the data sources referenced in Attachment 1. The results of this analysis showed little difference between the direct and indirect methods, although the benchmarked quarterly indexes produced by the direct method were slightly less volatile.

Preliminary benchmarking / Nowcasting

51 The purpose of this project is to produce the most reliable quarterly ULC indexes possible. Therefore, the historical relationship between the quarterly indicator variables and their annual benchmarks determined in the historical benchmarking process described above should be used when estimating the quarterly ULC indexes in real time. The methodologies used for historical benchmarking will also generate a preliminary benchmarked series. That is, a series which uses the quarterly indicator variables to extend the time series based on the benchmarking model. These estimates should be compared with some `basic` procedures for preliminary benchmarking, e.g. extrapolation via rates of change of the quarterly indicator series.

52 The method proposed to evaluate the forecasting performance of the above models is to conduct a rolling-forecast experiment. In other words, to use say m years to calculate one-year-ahead quarterly forecasts: m annual auxiliary regressions are estimated up to year T , then $T+1, \dots, T+m-1$, and the relevant quarterly forecasts for year $T+1, \dots, T+m$ are calculated, yearly aggregated and, finally, compared to the annual historical record of the series in terms of RMSE. To get significant results, at least 6 or more years should be considered in the experiment. An important by-product of this work is the ability of evaluating (by simple graphs) the constancy of the estimated parameters of the auxiliary regression model.

53 The above test was performed by Di Fonzo (2005) for quarterly ULC indexes in Manufacturing for France and Germany. The results showed that the method of Fernandez produced the most reliable model for the preliminary benchmarked estimates in comparison to the methods of Denton and Chow & Lin. The Fernandez technique models change in the indicator series whereas the Denton and Chow & Lin methods model levels. In addition, Fernandez is a regression based technique which tends to smooth the quarterly changes in the indicator series. All of these methods are available in the windows based benchmarking software ECOTRIM¹⁸ which is the system that will be used in the eventual production process. Based on the preliminary research undertaken thus far, the Fernandez technique will most likely be adopted.

8.4 Final evaluation of quarterly indicator variables

54 After the application of the above tests arising from the analysis of available historical time series, there will need to be some form of overall assessment made and consequent recommendations. These will propose whether the available quarterly indicator variables appear to be of sufficient quality to use for producing quarterly ULC indexes on an ongoing basis. Following this, an experimental set of quarterly

¹⁸ This software was developed by Eurostat.

ULC indexes would be produced, being updated on a monthly basis. A process of ongoing review to assess the performance of these indexes would then be undertaken.

9. Feedback being sought and planned future work

55 This investigation has so far revealed that significant potential exists to produce a comprehensive set of comparable quarterly unit labour costs indexes across the majority of OECD countries for a broad range of industries and interesting aggregates, and to harmonise ULC indexes published by the OECD. Before proceeding further with this work as outlined below, feedback on the following key issues is requested from SWIC representatives:

- opinions on the possible choices of annual benchmark variable as discussed in Section 5, in particular whether all (or some) of the adjustments outlined in Section 3 should be performed where possible to improve the methodological relevance of the annual benchmark;
- opinions on the industries proposed to be covered as outlined in Section 4, and the degree of importance attached to harmonising the quarterly ULC indexes for these industries with the corresponding annual data currently published in the STAN database;
- opinions on the proposed priorities for quarterly indicator variables outlined in Section 6;
- opinions on the proposed approach for quality evaluation and benchmarking as outlined in Section 8;
- opinions on the priority the OECD should give to developing these quarterly ULC indexes.

Plans for future work

56 The following points summarise the key elements of future work proposed for this project:

- obtain feedback on the specific proposals outlined in this paper from SWIC and other potential internal and external users;
- finalise the data sources to be used and extract the relevant data;
- estimate historical time series and submit these to the evaluation and benchmarking processes;
- present results to SWIC and selected internal and external users with recommendations on which quarterly ULC indexes are sufficiently reliable to be produced on an ongoing basis;
- develop a process for producing experimental quarterly ULC indexes, updated on a monthly basis;
- ongoing review and evaluation including comparisons for consistency with existing ULCs, particularly those produced by national institutes;
- harmonisation of ULC indexes disseminated in official OECD publications.

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Attachment 1 Data Availability Matrix for deriving quarterly ULC indexes

Country	Total		D		C_E		F		G_K		C_K(7)	
	VA	CoE	VA	CoE	VA	CoE	VA	CoE	VA	CoE	VA	CoE
Australia	QNA	QNA	QNA	GWS	QNA	GWS	QNA	GWS	QNA	GWS	QNA	GWS
Austria	QNA	QNA	Index - MEI	GWS or LCI*Hours	QNA	QNA	QNA	QNA	QNA	QNA	QNA	QNA
Belgium	QNA	QNA	Index - MEI	GWS or LCI*Hours	QNA	QNA	QNA	QNA	QNA	QNA	QNA	QNA
Canada	QNA	QNA	QNA	GWS	QNA	GWS	QNA	GWS	QNA	GWS	QNA	GWS
Czech (1)	QNA	Earnings * Employee	Index - MEI	GWS or LCI*Hours	QNA	GWS or LCI*Hours	QNA	GWS or LCI*Hours	QNA	LCI*Hours	QNA	LCI*Hours
Denmark	QNA	QNA	Index - MEI	GWS or LCI*Hours	QNA	QNA	QNA	QNA	QNA	QNA	QNA	QNA
Finland (4)	QNA	QNA	Index - MEI	GWS	QNA	GWS	QNA	GWS	QNA	LCI*Hours	QNA	LCI*Hours
France	QNA	QNA	Index - MEI	GWS	QNA	QNA	QNA	QNA	QNA	QNA	QNA	QNA
Germany	QNA	QNA	Index - MEI	GWS	QNA	QNA	QNA	QNA	QNA	QNA	QNA	QNA
Greece	QNA	QNA	Index - MEI		Index - MEI							
Hungary	QNA	Earnings * Employee	Index - MEI	GWS or LCI*Hours	QNA	GWS or LCI*Hours	QNA	GWS or LCI*Hours	QNA	LCI*Hours	QNA	LCI*Hours
Iceland	QNA	Earnings * Employee										
Ireland	QNA	QNA	Index - MEI	LCI*Hours	QNA	QNA	QNA	QNA	QNA	QNA	QNA	QNA
Italy	QNA	QNA	Index - MEI	GWS	QNA	QNA	QNA	QNA	QNA	QNA	QNA	QNA
Japan (5)	QNA	QNA	Index - MEI	Earnings * Employee	Index - MEI	Earnings * Employee		Earnings * Employee	Index - MEI	Earnings * Employee	QNA / MEI	Earnings * Employee
Korea	QNA	Earnings * Employee	QNA	Earnings * Employee	QNA	Earnings * Employee	QNA	Earnings * Employee	QNA	Earnings * Employee	QNA	Earnings * Employee
Luxembourg (6)	QNA	QNA	Index - MEI	LCI*Hours	QNA	QNA	QNA	QNA	QNA	QNA	QNA	QNA
Mexico (2)	QNA	QNA	QNA	GWS	QNA	QNA	QNA	QNA	QNA	QNA	QNA	QNA
Netherlands	QNA	QNA	Index - MEI	GWS	QNA	QNA	QNA	QNA	QNA	QNA	QNA	QNA
New Zealand (3)	QNA	Earnings * Employee	QNA	Earnings * Employee	QNA	Earnings * Employee	QNA	Earnings * Employee	QNA	Earnings * Employee	QNA	Earnings * Employee
Norway (8)	QNA	QNA	QNA	Earnings * Employee	QNA	Earnings * Employee	QNA	Earnings * Employee	QNA	Earnings * Employee	QNA	Earnings * Employee
Poland	QNA	QNA	Index - MEI	GWS or LCI*Hours	QNA	QNA	QNA	QNA	QNA	QNA	QNA	QNA
Portugal (9)	QNA	LCI*Hours	Index - MEI	GWS or LCI*Hours	QNA	GWS or LCI*Hours	QNA	GWS or LCI*Hours	QNA	LCI*Hours	QNA	LCI*Hours

Country	Total		D		C_E		F		G_K		C_K(7)	
	VA	CoE	VA	CoE	VA	CoE	VA	CoE	VA	CoE	VA	CoE
Slovakia	QNA	Earnings * Employee	Index - MEI	GWS or LCI*Hours	QNA	GWS or LCI*Hours	QNA	GWS or LCI*Hours	QNA	LCI*Hours	QNA	LCI*Hours
Spain	QNA	QNA	Index - MEI	GWS or LCI*Hours	QNA	QNA	QNA	QNA	QNA	QNA	QNA	QNA
Sweden	QNA	QNA	Index - MEI	LCI*Hours	QNA	QNA	QNA	QNA	QNA	QNA	QNA	QNA
Switzerland	QNA											
Turkey	QNA	QNA	QNA	Earnings * Hours	QNA		QNA		QNA		QNA	
UK (10)	QNA	QNA	QNA	LCI*Hours	QNA	LCI*Hours	QNA	GWS or LCI*Hours	QNA	LCI*Hours	QNA	LCI*Hours
United States (11)	QNA	QNA	Index - MEI	GWS	Index - MEI	GWS	Index - MEI	GWS	Index - MEI	GWS	Index - MEI	GWS
EMU (12)	QNA - ES	EuroStat	QNA - ES	EuroStat	QNA - ES	EuroStat	QNA - ES	EuroStat	QNA - ES	EuroStat	QNA - ES	EuroStat

Data needed

Footnotes:

- Earnings come from MEI and total employees come from EuroStat.
- It could be possible to publish CoE_Total and F but there is an issue with the Mexican employee numbers data that will need to be resolved first.
- All data would have to come from the QES - Weekly Earnings, Weekly Paid Hours, Employees (excludes agriculture).
- Country contact has suggested that GWS be used.
- C_K_VA could be calculated by weighting but would exclude construction.
- Manufacturing CoE for Luxembourg can be calculated but the series starts in 2004Q4.
- In some cases summary components don't exist, weighting the sub-components will be required to compute the total.
- Has recently released an LCI index that combined with Hours could be used.
- CoE at the Total level excludes L_O but this could change after a feasibility study currently underway.
- G_K and C_K_VA and CoE could be calculated via weighting the current QNA Volume index and LCI*Hours results.
The resulting CoE series would only have a very short time series starting in 2000Q1.
- G_K (and therefore C_K) could be calculated using the new services survey or Retail Trade + Wholesale Trade as a proxy.
- All data could be sourced via EuroStat but in some cases would require weighting and/or aggregation.

Table Definition:

- VA:** Chained Constant Prices, Gross Total Value Added at Basic Prices
CoE: Compensation of Employees at Current Prices
QNA: Quarterly National Accounts data sourced directly from the OECD's QNA database
Index MEI: Index sourced via MEI database
GWS: Gross Wages and Salaries, sourced via either EuroStat or NSOs.
LCI*Hours: Labour Cost Index sourced via EuroStat multiplied by Hours Worked sourced via EuroStat
Earning*Employees: Weekly/monthly earnings sourced via either MEI or NSOs multiplied by employees sourced via either EuroStat, MEI or NSOs
Earning*Hours: Weekly/monthly hourly earnings sourced via either MEI or NSOs multiplied by hours worked sourced via either EuroStat, MEI or NSOs

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