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EUROSTAT'S LABOUR PRODUCTIVITY INDICATORS (LPIs)

Methodological note and quality aspects¹

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1. Introduction

Labour productivity indicators (LPIs) are of interest to EU policy makers and researchers to analyse trends at national level. They are also used at the level of the EU or the euro area as a whole or at regional level. For instance, changes in the nominal unit labour cost across the economy as a whole is one of the key indicators to monitor potential macroeconomic imbalances in the EU as part of the European Semester process of macroeconomic coordination. More detailed indicators, including industry or regional breakdowns, can be useful to analyse the drivers or effects of overall trends in more detail. Eurostat has therefore started to publish the additional indicators described in this document to inform and guide users.

With this piece of work, Eurostat meets one of its objectives of extending its publication of labour productivity indicators (LPIs) to better meet the policy needs of the European Semester and the EU digital agenda. The aim of this document is to help improve understanding of this collection of indicators and promote its use.

The LPIs included in this collection are based on national accounts data that Member States send to Eurostat under the ESA 2010 transmission programme (TP)². This ensures quality and comparability across the EU Member States, since the ESA 2010 Regulation prescribes that the quality of national and regional accounts data sent to Eurostat is assessed according to the quality criteria set out by Regulation (EC) No 223/2009 on European statistics³. Data availability is very high since the data used to calculate these indicators are compulsory, so gaps are mainly related to confidential or unpublishable data.

Eurostat calculates these indicators using harmonised sources and methods (using national accounts data and the same formula for all countries). In the interest of comparability, countries may also publish similar indicators using methods and/or sources available at national level but not applicable to all countries.

This collection of indicators has been assessed and evaluated in the framework of Eurostat's 'Growth and Productivity Accounts' project that involved Member State experts and experts from the Commission's Joint Research Centre (JRC) and The Vienna Institute for International Economic Studies (wiiw). One of the aims of this project was to develop methods and indicators on growth and productivity (satellite) accounts to be used by national, EU and international users for macroeconomic analysis of national accounts data and economic policies of the EU and its Member States. In this context, these indicators were assessed and reviewed from a methodological point of view, and the previous collection complemented with new indicators.

Though the aim has been to select indicators that are as useful and comparable as possible, some specific aspects need to be borne in mind when reading specific indicators, especially in terms of comparability over time, countries, industries and regions. The explanations in this document aim to inform users on these aspects to facilitate their understanding and use of the indicators.

The paper is organised as follows: Section 2 gives an overview of the structure and main features of the additional indicators, Section 3 presents an overview of the specific aspects users should bear in mind. Section 4 outlines each indicator in a standard way and Section 5 provides the sources of information in annex.

² <https://ec.europa.eu/eurostat/en/web/products-manuals-and-guidelines/-/ks-01-13-429-3a-c>

³ The method, structure and assessment indicators of the quality assessment process are defined in Commission Implementing Regulation (EU) 2016/2304. Quality reports have been published since 2018: <https://ec.europa.eu/eurostat/web/products-statistical-reports>

2. Overview of additional labour productivity indicators

The indicators portrayed in this collection rely on national accounts data that Member States send to Eurostat in line with the requirements of the ESA 2010 transmission programme (TP).

All indicators are either calculated as a ratio of two variables or as a ratio of two indicators (e.g. nominal unit labour cost). Users can use published data to derive productivity indicators on their own, but the selection made by Eurostat aims to provide a set of ready-to-use indicators with explanatory metadata. Following the analysis and discussion of indicators in a dedicated task force⁴, the directors of macroeconomic statistics agreed on this collection of indicators in June 2021. This new collection adds new indicators to the previous set of productivity indicators and is presented in Table 1. These indicators are detailed in Section 4, together with a description of the underlying formula and basic methodological prescriptions for its correct use and interpretation.

Table 1. List of disseminated labour productivity indicators

Labour Productivity Indicators (LPis)	TOTAL ECONOMY								BY INDUSTRY (A10/A21)				BY REGION (NUTS2)				BY REG. - IND. (NUTS2-A10)						
	level		growth rate		Index	%EU27		level		growth rate		Index	%EU27		level		growth rate		Index	%EU27			
	EUR	PER	3y	2015=	CP	EUR	3y	2015=	CP	EUR	3y	2015=	CP	EUR	3y	2015=	CP	EUR	3y	2015=	CP		
	NAC	HW	5y	10y	PPS	NAC	5y	10y	NAC	5y	10y	NAC	5y	10y	NAC	5y	10y	NAC	5y	10y	NAC	5y	10y
Compensation per employee	◆	◆				+	+							+									
Compensation of employees per hour worked	◆	◆				+	+	+					+	+							+	+	+
Nominal labour productivity per person employed						◆								+						+			
Nominal labour productivity per hour worked						◆								+							+		
Real labour productivity per person employed			◆	+	◆					+	+	+									+	+	
Real labour productivity per hour worked			◆	+	◆					+	+	+									+	+	
Nominal unit labour cost based on hours worked			◆	◆	◆					+	+	+											
Nominal unit labour cost based on persons employed			◆	◆	◆																		
Total employment (persons employed) per capita			+	+	+																		
Hours worked per capita			+	+	+																		
Hours worked per employed person			+	+	+					+	+										+	+	

Notes: ◆ already disseminated; + new collection; +^{1/} available by NUTS2 and NUTS3

Each indicator sheet contains a formula using a general notation, together with the following applicable type of LPI breakdowns:

- **Total economy:** these indicators are based on the main aggregated data including GDP and employment in ESA 2010 Table 1. The main indicators on productivity and unit labour costs were already published and used, for example, in evaluation processes such as the MIP scoreboard. Some extra indicators were added to help identify the main drivers.

⁴ The Task Force on Productivity Indicators started in 2019. Its main goal is to improve Eurostat and national productivity indicators and productivity measures in line with the statistical recommendations. The task force is composed of Member States, Norway and representatives from the Commission (ECFIN, EMPL, GROW), ECB, OECD.

- **Industry breakdowns:** the ESA 2010 transmission programme also provides a breakdown by industry with different levels of detail. For total economy data (NUTS0)⁵, there are NACE⁶ A*10 breakdowns published at T+2 and T+9 months with ESA 2010 Table 1, and then detailed breakdowns NACE A*21 at T+9 and up to A*64 (A*38) at T+21 months for gross value added (GVA), compensation of employees (D1) and employment (EMP and HW). This data can be used to derive industry-specific LP and unit labour cost indicators. However, due to specific issues affecting the comparability of the indicators, not all industries (L, O, P, Q, T and U⁷) or units are provided (see the explanation in the next paragraph).
- **Regional breakdowns:** these provide a regional breakdown of the figures available for the national economy. Regional data are classified according to the 'Nomenclature of territorial units for statistics' (NUTS). Indicators available at national level (NUTS0) will be provided and, when possible, for NUTS2 and NUTS3 level.

Indicators are usually provided with different units of measurement to facilitate analysis and interpretation. These transformations are not considered as a different indicator themselves, but stemming from the original formula.

Typically the following units (transformations) are provided:

Let W_t be an indicator. This indicator, as mentioned, is often defined as the ratio of two variables, or two indicators, i.e. $W_t = \frac{X_t}{Y_t}$. There are certain standard transformations for each indicator:

- **Levels:** the direct definition of the indicator, i.e. $W_t = \frac{X_t}{Y_t}$. There is no transformation at all or the transformation is the identity function.
- **Growth:** this transformation includes growth rates and indices.

A growth rate is the result of the calculation of the percentage change over a period of time, e.g. the percentage of change between time period t and time period s is $PCH_s^t = \frac{W_t - W_s}{W_s} \times 100$. An index is a quotient where the value of the indicator in time period t is expressed as a ratio with respect to the value of this indicator in a base time period s : $I_s^t = \frac{W_t}{W_s} \times 100$. Growth rates in percent and indices are closely connected. In fact, $I_s^t = PCH_s^t + 100$. The collection of indicators presented in this document are as follows:

- Previous year percentage change, $PCH_{PRE} = PCH_{t-1}^t = \frac{W_t - W_{t-1}}{W_{t-1}} \times 100$
- 3-year percentage change, $PCH_{3Y} = PCH_{t-3}^t = \frac{W_t - W_{t-3}}{W_{t-3}} \times 100$
- 5-year percentage change, $PCH_{5Y} = PCH_{t-5}^t = \frac{W_t - W_{t-5}}{W_{t-5}} \times 100$
- 10-year percentage change, $PCH_{10Y} = PCH_{t-10}^t = \frac{W_t - W_{t-10}}{W_{t-10}} \times 100$

⁵ <https://ec.europa.eu/eurostat/web/nuts/correspondence-tables/postcodes-and-nuts>

⁶ <https://ec.europa.eu/eurostat/web/nace-rev2/overview>

⁷ NACE Rev.2 sections: L – Real estate activities O – Public administration and defence; compulsory social security; P – Education, Q – Human health and social work activities, T – Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use and U – Extraterritorial organisations and bodies.

- Index with base year 2015, $I_{2015}^t = \frac{W_t}{W_{2015}} \times 100$
- **Purchasing power standards:** when any of the variables used to calculate the indicator are expressed in monetary terms to provide a meaningful comparison across different geographical areas, they can be transformed to account for purchasing power standards (PPS).

The indicators expressed in PPS are calculated by dividing the variables expressed in current prices, in euro or the national currency, by a purchasing power parities index. Purchasing power parities (PPP) are indicators that convert different currencies to a common currency and, in the process of conversion, equalise their purchasing power by eliminating the differences in price levels between countries. When indicators are valued at the same price level, they reflect only differences in the volumes⁸.

In the European Union, common practice is to express the PPP of one country with the average purchasing power of one euro in the EU. In other words, it indicates how many units of national currency you need in that country to maintain the purchasing power of one euro in the EU.

The PPS-transformed indicator of country k for time period t consists of:

$$PPS_{k,t} = \frac{W_{k,t}}{PPP_{k,EU}} \times 100$$

%EU: this transformation represents the value of an indicator with respect to the EU value, i.e. the %EU of the indicator of country k for time period t consists of:

$$\%EU_{k,t} = \frac{W_{k,t}}{W_{EU,t}} \times 100$$

In other words, the percentage with respect to the EU27, where $\%EU_{EU,t} = 100$.

Although it is always possible to make this kind of transformation, as long as the EU indicator is available, it usually makes sense if the magnitude of the indicator is comparable and meaningful with respect to the EU value. This transformation is significant for physical indicators such as those based on population, employment and persons, as well as in PPS-transformed indicators, and in situations where the EU value is merely the aggregate of the values for individual countries.

However, calculating an indicator into current prices, unlike PPS values, can be less meaningful due to the differences in reference price levels across countries.

The next section provides information on the main methodological aspects affecting the comparability of interpretation of some indicators or units.

3. Methodological notes

In this section, we describe some methodological aspects that concern the LPI database presented in this document. It provides the main findings of the quality evaluation that underpin this selection of indicators. The quality analysis covers not only derived productivity-related indicators, but also input data. The final choice of indicators was based on those parts of the ESA 2010 transmission programme, and taking into account that derogations granted by the Commission to EU Member States for compulsory data were temporary and would all have expired by 2020. For instance, it did

⁸ For further information see: [Eurostat-OECD Methodological Manual on Purchasing Power Parities](#)

not include indicators based on jobs since data availability is low because providing this data is voluntary under the ESA 2010 transmission programme.

The considerations expressed here have a dual purpose:

- a) to provide users with the main results, focusing on data availability and the comparability of these indicators;
- b) to provide a set of recommendations to ensure correct use of these indicators and prevent misuse.

3.1. Industry coverage

Users constantly ask to extend LPIs to provide industry-specific breakdowns. However, this can only be done after an evaluation of the quality of such indicators broken down by industry and understanding the level at which the indicators are of sufficient quality for dissemination.

The choice for those indicators available in this dataset has been A*21 for the NUTS0 geographical disaggregation and A*10 for NUTS2 or NUTS3 (when possible). There is a significant decrease in the availability of many pieces of input data for the production of these LPIs, mainly in the A*64 breakdown since beyond A*21 many datasets are sent only on a voluntary basis.

However, in the final choice, Eurostat decided to exclude some industries, mainly when the comparability or meaning of productivity indicators based on imputed rents, or on data from a non-market sector where activities subject to market competition is controversial.

For instance, for non-market activities, figures are often obtained by using the cost method. Similarly, regarding the rent of owner-occupied dwellings in the absence of a sufficiently large rental market, the ESA 2010 (par. 3.79) suggests using the user-cost approach. Hence, these data are not comparable with the data of regular market industries since value added or output in non-market activities is often measured through input methods. Given that market prices are not available, value added is calculated as the sum of compensation of employees, consumption of fixed capital and other taxes less subsidies on production, with compensation of employees being the highest component by far (around 75% in EU countries).

Any increase in the value of intermediate consumption will not affect the value added, since this increase of intermediate consumption implies an identical increase in output. By contrast, any increase in compensation of employees implies an identical increase in value added. Using the cost approach to obtain a measure of output has direct implications for the productivity analysis.

Any increase in compensation of employees (value added), when there is no change in the labour input (or in composition or in volume), will result in an increase of the nominal productivity but this should not account for an increase in real productivity (volume). However, even if there is an increase in employment (in volume or in composition) which accounts for the compensation increase, nominal and real productivity remain almost unchanged. In this situation, any analysis of either labour productivity or total factor productivity will be affected by these shortcomings in the

underlying data⁹. In addition, including the output of services of owner-occupied dwellings achieved without employment would raise the average level of productivity.

Consequently, Eurostat decided to exclude the following industries from its LPIs presented at industry level:

- L - Real estate activities;
- O - Public administration and defence, compulsory social security;
- P - Education;
- Q - Human health services, Residential care and social work activities;
- T - Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use;
- U - Activities of extra-territorial organisations and bodies.

Nevertheless, these activities are included in the total economy indicators.

3.2. Regional breakdowns

Together with the demand for a more detailed industry breakdown, users commonly ask for regional disaggregation of statistics. Similar to industrial breakdown, this also requires making a thorough evaluation of the quality of such indicators broken down by regions.

Users should note that a larger disaggregation may imply a higher dispersion of data. In survey-based estimates, larger samples mitigate the degree to which unusual results may appear, depending on the sample survey design. In administrative-data-based estimates, missing and incomplete data can have a significant influence in more disaggregated domains. This means that users can expect greater variance at the higher degree of disaggregation (i.e. at regional level) due to statistical effects and data source issues.

Volatility can be even higher in the case of double disaggregation, by industry and by geographical area, especially for small industries and small areas. Opening or closing a local unit, an unusual event (the sale of a patent, the construction of a highway, or a change in energy prices) may have a considerable impact on the indicators. In these cases, growth rates can be even more affected. It is recommended to calculate average growth rates for longer time periods to mitigate the effects of volatility. It is also recommended that users take into account specific data flags available in the Eurostat database to account for breaks in time series and changes in sources and methodologies.

⁹ For more details, see OECD (1997) *Productivity Measurement For Non-Market Services*, Document STD/NA(97)14. Available at <https://www.oecd.org/sdd/na/2666071.pdf>.

3.3. Data comparability of labour input

Labour productivity indicators are built on the basis of data on different measures of labour input: persons employed (employees and self-employed) and hours worked.

3.3.1. Comparing employment data and derived labour productivity indicators (LPIs)

The typical data sources used by countries for employment statistics, i.e. distinguishing employees and self-employed workers, are the labour force survey (LFS), population census (PC), business statistics (BS), administrative sources and other sources (see Ward, Zinni and Mariana, 2018, Box 2.1 for further details).

- As we can see in Tables 2 and 3 in the annex, these sources can vary for employees and self-employed persons. A single source is often not enough, so employment is estimated based on a combination of two or more main sources. Most countries report employment in terms of persons (PER) using LFS as the main source. However, to produce a final estimation of the employment statistics, adjustments are necessary to fully align the employment figures with the production boundary concept of the national accounts.
- These adjustments are country-specific and depend on the sources used (see Ward, Zinni and Mariana, 2018, Annex for details). They can have an effect on international comparability, despite countries using the same main sources.

An additional remark is necessary on estimating employment and industry-level LPIs.

According to ESA 2010, persons who have more than one job are only recorded in the industry of their primary activity. The rationale is to avoid counting the same person twice in different industries and ensuring that the sum of persons across industries matches the total number of persons of the whole economy. This has a direct effect on the LPIs at industry level when indicators are calculated on the basis of this employment measure. This compromises comparability across industries since the number of persons working in an industry as their second job affects output not input.

Hence, comparing productivity indicators across industries can be affected by different intensities of workers in secondary activity. A comparison over time within the same industry implies that we are assuming a constant share of workers in the industry as their second job. This could compromise the comparability of LPIs based on persons in terms of levels across countries and across industries if the share of second-job workers in that industry fluctuates. Consequently, analysing LPIs based on persons by industry should be limited to growth rates (not levels) at most (assuming that the share of persons working in the industry as their second job remains stable over time).

For comparisons at industry level (cross-industry or cross-country), LPIs based on jobs would be more suitable than LPIs based on the number of persons employed. Unfortunately, reporting the number of jobs is only voluntary under the ESA 2010 transmission programme and its coverage is low across countries.

3.3.2. Comparing hours worked data and derived labour productivity indicators (LPIs)

In line with ESA 2010, hours worked is a preferable and theoretically better measure of labour input to persons and jobs. It provides a better account of country and industry specificities, such as part-time work and secondary work. However, a precise and comparable measurement is needed for it to be a better measure.

Following a collection of updated metadata on the sources and methods of employment estimates in 2018, via [a joint ESTAT-OECD questionnaire](#), an analysis by the OECD pointed out some accuracy and comparability issues. They relate to the use of a direct or indirect approach for estimates and the adjustments made for hours worked when labour force surveys are the main or only source (see Ward, Zinni and Mariana, 2018, Box 2.1 for further details). Although this variable is theoretically better, comparing LPI levels based on hours worked needs to take into account some measurement differences across countries.

While some inaccuracies are not a major problem for international comparisons, those caused by estimation methods based on direct/indirect approaches make comparisons only possible when the direction and the size of the biases are homogeneous. A comparison of the level of hours worked, and derived LPIs based on them, would be meaningful among countries that use a similar method of estimation but is not recommended for countries that use different methods.

Nonetheless, comparisons of growth rates remain unaffected. There is no empirical evidence that growth rates are affected by the use of different sources and methods, beyond a higher degree of volatility in the estimation methods using actual worked hours in the week of reference of the survey, instead of usual hours worked. A comparison of the growth rates of hours worked and derived LPIs still yields useful results regardless of the method and sources used by countries. See the annex for further information.

3.4. Regional data comparability

Several factors that affect input data have an influence on labour productivity indicators making them less comparable across countries and regions. The main factors are described below.

3.4.1. Different price dynamics for nominal data

Users comparing nominal productivity growth across geographical areas should take into consideration that inflation levels are likely to be different. From a time perspective (see Section 3.6 below), it is also not ideal as observed nominal growth is overestimated due to inflation. Therefore, comparisons should be made in real terms. Static comparisons (in the level or share compared to a reference) are more suitable, but require the factor of the next paragraph to be corrected.

3.4.2. Different price levels for data not adjusted for purchasing power parities

It is useful to have both adjusted and unadjusted indicators for purchasing power standard (PPS). Theoretically, it would make sense to compare unadjusted figures for highly tradeable products because units competing in the same market would encounter the same international prices for the same products. However, although many services have become tradeable (i.e. consulting services) their pricing levels remain very different because they mainly reflect local market conditions (i.e. wages), which allow cheaper regions to gain market share by offering lower prices. Therefore, if the purpose is to compare all geographical areas, it is better to use indicators adjusted for PPS.

If the comparison is limited to particular geographical areas, unadjusted indicators could be a better alternative. Current data restrict the comparison to current prices, since regional PPS indicators are not available, despite some efforts (Olislager and Konijn, 2016). For example, when comparing Vienna with Bratislava, it is probably better to use unadjusted indicators. Price differences between Vienna and Bratislava might be smaller than differences in prices between Bratislava and the rest of Slovakia, as the national PPS is a weighted average of the country.

3.4.3. Cross-border/cross-region commuters

For some regions, GDP per capita is higher than GDP per person employed. This can be a result of multiple factors. EU regions with the highest GDP per capita show a net commuter inflow that tends to increase GDP per capita in regions where these commuters are employed and decrease it in their regions of residence. For instance, this is the case of the Brussels region. Other factors include higher labour market participation rates, lower unemployment rates and a higher proportion of the working-age population. This is mainly an issue in regional indicators for main activity hubs. Therefore, we need to be cautious in the analysis of indicators based on population at NUTS2 and NUTS3 levels, especially for capital and main activity hub areas.

3.4.4. Differences in methodology

Different methodologies also affect geographical comparability. Levels might not be comparable, whereas, as seen in Section 3.2, growth rates (or indices) tend to mitigate these effects over the long term as these factors are usually structural. However, growth rates do not completely eliminate the differences: country-specific shocks can affect structural factors (price level and dynamics, etc.), consequently affecting the comparability of the indicators in the short term (also for geographical disaggregation). The share (or percent gap) compared to a reference (i.e. EU27_2019) should not be applied to data that are not comparable in terms of level.

3.5. Comparing labour productivity across industries

3.5.1. The impact of the non-market economy on labour productivity indicators

As seen in Section 3.1, Eurostat, like others institutions (e.g. OECD), limits the publication of productivity indicators by industry. This is because the comparability or meaning of productivity indicators of industries where output is based on imputed rents or on data from non-market sectors with activities not subject to market competition (where output is often obtained by the cost method) is simply too low or does not yield meaningful results.

Measuring the productivity of the non-market economy using the same approach as for the market economy is controversial, as mentioned in Section 3.1.

Nominal labour productivity (NLPR) by institutional sector¹⁰ formulas are:

$$NLPR_{S1}^{HW} = \frac{B1G_{S1}^{CP}}{EMP_{S1}^{HW}} \text{ vs } NLPR_{S13+S15}^{HW} = \frac{B1G_{S13+S15}^{CP}}{EMP_{S13+S15}^{HW}}$$

S1 stands for the total economy, and the non-market sector is mainly composed of the government sector (S13) and the non-profit sector (S15).

Analysis carried out with available data show that the NLPR of the total economy is different to that of the non-market economy. Hence, this difference is likely to have an impact on LPIs when compared as follows:

- Over time because the gap between $NLPR_{S1}^{HW}$ and $NLPR_{S13+S15}^{HW}$ is not stable for most countries.
- Across countries because the gap is significantly greater in some countries than in others, and some countries even have opposite trends.
- No conclusions can be drawn across industries because data broken down by institutional sector and industry are not available under the ESA 2010 TP. But we can expect that the larger the share of non-market production, the larger the expected gap. The share of non-market production could also be relevant for cross-country differences.

As a consequence, and as mentioned in Section 3.1, Eurostat does not publish LPIs for industries L, O, P, Q,T and U.

¹⁰ We use nominal labour productivity for this analysis since real labour productivity cannot be calculated since real gross value added by institutional sectors is not available.

3.5.2. Differences in the estimation method for hours worked and comparability issues

Two factors can also be important in employment composition when comparing indicators across industries.

First, as we saw in Section 3.3.1, at industry level, all hours worked in one industry are recorded in the corresponding activity where they are performed, regardless of whether it is a person's primary or secondary job. However, persons are accounted for only in their main job.

Therefore, hours worked in a secondary activity are included, but not the corresponding number of persons working in that activity if this is their second job. This limits comparability for the indicators 'hours worked per person' and 'compensation per employee' by industry, especially if there is a high number of second-job workers in the industry, or if the share of second-job workers varies greatly across industries. For this reason hours worked per person by industry is only proposed in growth rate and not in level. At the whole economy level, this issue is not relevant since all hours worked and persons are pooled together.

Second, as noted in Section 3.3.2, users should bear in mind the differences in the level of hours worked due to the use of different estimation methods. This is only relevant when making international comparisons between countries that use different estimation methods. It does not affect comparisons of industries within the same country. So when assessing and calculating LPIs based on persons and hours across industries and countries, users should study and take into account these issues.

Making a comparison over time implicitly assumes that the share of persons working in a second job within an industry remains stable over the long term. Making this comparison across countries for the same industry or different industries assumes not only a similar share of persons with a second job but also that the method used to estimate hours worked does not affect the level of hours worked (see the annex).

Having consistent historical data available on national and regional accounts is essential for the economic analysis. In line with the ESA 2010 TP, countries provide time series of national accounts indicators to build labour productivity indicators back to the reference year 2000 (regional) and even to 1995 (national).

In addition to methodological factors that could produce breaks¹¹ in the series, the main constraint for time comparisons of LPIs is the price dynamics of LPIs based on monetary figures. Nominal figures can play a major role, creating a bias in the analysis. Therefore, growth and trends analysis should preferably be performed using chain-linked volumes without forgetting that they are not additive. Price fluctuations are taken into account when producing LPIs based on chain-linked volumes.

¹¹ For instance, there were breaks in the 2010 figures in PL, IE and GR in 2010 for employment and in GR for GDP. These breaks in input data affecting indicators are flagged in the same way as input data are flagged in Eurobase. If different flags result from combining multiple input data into indicators, the same hierarchy that for data transmission should apply (see Eurostat C2/NAWG/2020/CN 1087, page 7).

3.6. The impact of employees and self-employed persons in the nominal unit labour cost (NULC)

Although employee remuneration is clearly available in national accounts under compensation of employees, the labour compensation of the self-employed comes under mixed income. This information (B3G- mixed income) is usually available from annual sector accounts only at total economy level. There is no distinction in the mixed income between the returns on capital and on labour for the work carried out by the self-employed.

Some assumptions are needed to calculate the share of mixed income that represents the contribution of the labour of self-employed to production. In some countries and in particular in some institutional sectors (notably households and unincorporated enterprises), the share of self-employed in the labour force may be significant and very different. This may lead to inconsistencies when comparing the indicator across countries.

Therefore when calculating this indicator it is conventionally assumed that the average labour compensation per hour worked of the self-employed is the same as that of an employee within the same production activity.

The definition of the nominal unit labour cost (NULC) takes into account only employees in the numerator¹², whereas the figure in the denominator indicates all employment, i.e. employees plus self-employed:

$$NULC_{HW} = \frac{D1_{SAL_{HW}}}{RLPR_{HW}} = \frac{\frac{D1}{SAL_{DC}}}{\frac{B1GQ}{EMP_{DC}}}$$

The denominator corresponds to real labour productivity (RLPR) for the total economy institutional sector (S1). Implicitly, this assumes that the productivity of the self-employed is equal to employee productivity.

An alternative to try to evaluate this assumption would be to analyse this effect on the nominal labour productivity (NLPR) of the total economy sector (S1) with and without excluding the household sector (S14): $NLPR_{S1\ excl.\ S14}^{HW} = \frac{B1G_{S1\ excl.\ S14}^{CP}}{SAL_{S1}^{HW}}$ vs $NLPR_{S1}^{HW} = \frac{B1G_{S1\ excl.\ S14}^{CP}}{SAL_{S1}^{HW}}$

This analysis has some limitations:

- Using data sent under the ESA 2010 transmission programme, this comparison is only possible for the whole economy and not by industry, since data split by institutional sector and industry are not required. However, this comparison at the whole economy level is useful to give us an idea of the relevance of the issue. If the issue is relevant at the whole

¹² The numerator of this indicator should calculate the total labour cost of all employed persons (employees and the self-employed). However, as mentioned above, this information is not readily available for the self-employed; the assumption is that the hourly compensation of employees is the same as that for the self-employed for the same work.

economy level, we may expect that at the industry level this issue becomes more relevant as the total figure is the result of the compensation of the different pieces.

- Although the gross value added (B1G) in the denominator of the NULC is expressed in chain-linked volumes (CLV), we have to make the comparison with B1G in current prices (CP) because data for B1G by institutional sector are only sent in current prices, under the ESA 2010 transmission programme.
- Data on hours worked by employees are only available for the total economy sector (S1) since countries do not have to send data by institutional sector and working status under the ESA 2010 TP. However, the number of employees in the institutional household sector (S14) is really small compared to S1; therefore, SAL_{S1}^{HW} is a good proxy for the input of employees in S1 excluding S14.

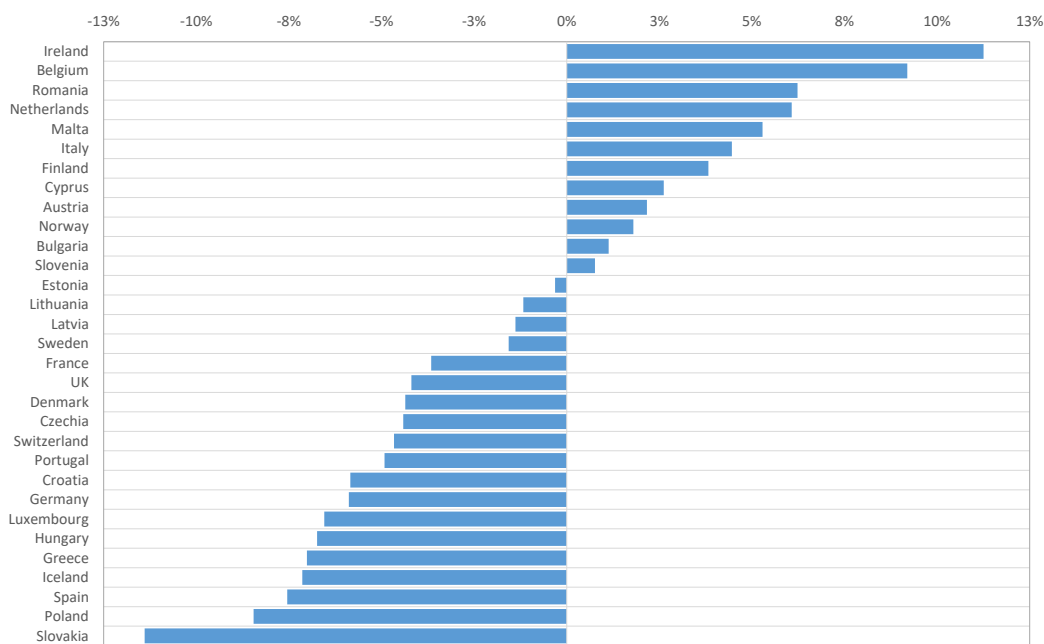


Figure 2. Average annual gap (S1 vs S14) in the evolution of nominal labour productivity, 1995-2018

Source: Own illustration based on Eurobase

This provides an idea of the discrepancies in changes to productivity for employees and self-employed.

For most countries, the results show that the evolution of NLPR for S1 and S1 excluding S14 are similar. However, there are differences between EU countries. In general, the gap does fluctuate over time, i.e. there is a trend. However, for most of the countries, the trend has been stable and there are no peaks. Only seven countries (BG, CY, EE, LT, LV, NO and RO) show fluctuations (with peaks and/or shifts from negative to positive gaps). With this in mind, we can consider the average gap representative for most countries.

This gap between S1 and S1 excluding S14 comprises two factors: the share of self-employed in total employment and the differential in productivity between the self-employed and employees. Therefore, any changes in either of these two factors can have an impact on the gap, either to offset or widen the gap.

Thus, the implicit assumption that self-employed productivity equates employee productivity might have an impact on the NULC indicators when compared:

- over time because the gap evolves over time for all countries;
- across specific countries where the average gap (mainly for countries where this average gap can be considered representative) is significantly greater than for others (see Figure 2).

No conclusion can be drawn in terms of the productivity of the self-employed. The gap can be expected to be wider in industries where the share of self-employed persons is higher, for instance primary industries and most services except K (financial and insurance activities) and O-Q (public administration and defence; compulsory social security; education and human health and social work activities).

The top half of the sheet provides the name and the code for each indicator. Then, it provides a definition of the indicator with the basic formula and the units of the variables the indicator.

It then provides a description of the indicator and the variables making up the indicator, and what this indicator represents.

Each sheet provides a table summarising the availability of the indicator. This shows the dimensions (geographical and activity breakdowns) that the indicator is available for. It also specifies the comparability recommendations of the indicator, e.g. whether comparisons are best made:

- over time, i.e. comparing one moment in time to another moment in time;
- geographical, i.e. comparing countries or regions;
- between industries, i.e. comparing one industry with a different industry.

To clarify the information available in each table, please see the example in the image below.

				VALUATION				
				Current prices				
				TRANSFORMATION				
COLLECTION		NACE	COMPARABILITY	Level	Growth	PPS	% of EU	
TOTAL ECONOMY or REGIONAL BREAKDOWNS	NATIONAL ACCOUNTS	Total	Time					
			Geographical					
		A*21	Time	▲	✓			
			Geographical	▲	✓			
			Industries	▼				
	REGIONAL ACCOUNTS NUTS2	Total	Time			✓		
			Geographical		▼	✓		
		A*10	Time					
			Geographical		✓			
			Industries					

There is also a regional breakdown to NUTS2 in terms of growth rate. This information across geographical units (G) should be compared with caution.

This indicates that the LPI is available in levels, with a national breakdown (NUTS0) and breakdown by activities (A*21). Where the figures are comparable over time (T) and across geographical units (G) and the information among industries (I) should be compared with caution.

The regional breakdown by NUTS2 and A*10 is also available

The last part of each sheet provides a conclusion under the heading 'other information'. This summarises the key points on the comparability assessments and provides some brief methodological clarifications, specifying where the issue is described in the methodological notes section.

① Definition

Compensation per employee of total of the economy for time period t is calculated by dividing compensation of employees at current prices by the number of employees in the domestic concept:

Formula

$$D1_SAL_PER = \frac{D1}{SAL_PER_DC} \times 1000$$

Units

CP_MEUR

Million euro

THS_PER

Thousand persons

Description

D1 is compensation of employees at current prices. Labour input is measured as the number of employees in the domestic concept (SAL_DC), i.e. persons engaged by contract in a productive activity for a resident unit and receiving remuneration, regardless of their place of residence. This indicator represents the average income earned by each employee.

Availability and comparability recommendations

				VALUATION					
				Current prices					
				TRANSFORMATION					
COLLECTION		NACE	COMPARABILITY	Level	Growth	PPS	% of EU		
TOTAL ECONOMY or REGIONAL BREAKDOWNS	NATIONAL ACCOUNTS	Total	Time	▼	✓	▼	✓	▼	✓
			Geographical	▼	✓	▲	✓	▲	✓
		A*21	Time						
			Geographical						
	REGIONAL ACCOUNTS NUTS2	Total	Time	▼	✓			▼	✓
			Geographical	▼	✓			▲	✓
		A*10	Time						
			Geographical						
			Industries						

Other information

Country comparability is recommended in PPS. At ordinary current prices, country comparability is distorted by differences in price levels, implying different purchasing powers. The PPS correction enables users to compare the indicator across countries. It is not possible to compare the indicator over time since this is a nominal indicator affected by different inflation trends. This is also true for PPS and % EU since PPS correction does not imply inflation correction. See Sections 3.4.2 and 3.6 for further details.

Industry breakdowns are not provided since comparability is problematic because employees with a second job are accounted for only in their principal job in the main activity. This is not a problem when looking at the economy as a whole. See Section 3.5.2 for further details.

4.2. Compensation of employees per hour worked

D1_SAL_HW

① Definition

Compensation per hour worked by industry or by total economy for time period t is calculated by dividing compensation of employees at current prices by the number of hours worked by employees in the domestic concept:

Formula

$$D1_SAL_HW = \frac{D1}{SAL_HW_DC} \times 1000$$

Units

CP_MEUR

Million euro

THS_HW

Thousand hours worked

Description

D1 is compensation of employees at current prices. Labour input is measured by total hours worked. Total hours worked is the most appropriate measure of labour input for the national accounts and represents the aggregate number of hours actually worked by employees (SAL_DC), i.e. persons employed by contract in a job for a resident unit and receiving remuneration regardless of their place of residence. This indicator represents the average income paid for each hour worked.

Availability and comparability recommendations

				VALUATION					
				Current prices					
				TRANSFORMATION					
COLLECTION		NACE	COMPARABILITY	Level	Growth	PPS	% of EU		
TOTAL ECONOMY or REGIONAL BREAKDOWNS	NATIONAL ACCOUNTS	Total	Time	▼	✓		▼	✓	
			Geographical	▼	✓		▲	✓	
		A*21	Time	▼	✓			▼	✓
			Geographical	▼	✓			▼	✓
	REGIONAL ACCOUNTS NUTS2	Total	Time	▼	✓			▼	✓
			Geographical	▼	✓			▼	✓
		A*10	Time	▼	✓			▼	✓
			Geographical	▼	✓			▼	✓
			Industries					▲	

Other information

It is not possible to compare this indicator over time since this is a nominal indicator affected by different inflation trends. The PPS correction enables users to compare the indicator across countries but PPS correction does not mean that inflation is corrected and time comparisons are not possible. The method used to estimate hours worked varies from country to country. This has a significant influence on the result of this value, which hampers comparison across countries for level, and % of EU.

Comparisons are recommended for countries that use a similar method to estimate hours worked (see Annex tables), or among industries within the same country. See Sections 3.4.2 and 3.3.2 for further details.

4.3. Hours worked per employed person

HW_EMP

① Definition

Hours worked per employed person for time period t is calculated by dividing total hours worked by persons employed in the domestic concept. Unlike previous indicators, this indicator covers both employees and the self-employed:

Formula

$$HW_EMP = \frac{EMP_HW_DC}{EMP_PER_DC}$$

Units

THS_HW Thousand hours worked

THS_PER Thousand persons

Description

Labour input, i.e. employment, is measured in hours and persons to provide the average hours per employed person working in jobs covered by the national accounts. Employment is measured in the domestic concept (EMP_DC), i.e. employees or self-employed persons engaged in a productive activity for a resident unit and receiving remuneration regardless of their place of residence. This indicator represents the average number of hours worked by each employed person in the economy.

Availability and comparability recommendations

				VALUATION					
				Hours worked					
				TRANSFORMATION					
COLLECTION		NACE	COMPARABILITY	Level	Growth	PPS	% of EU		
TOTAL ECONOMY or REGIONAL BREAKDOWNS	NATIONAL ACCOUNTS	Total	Time	▲	✓	▲	✓	▲	✓
			Geographical			▲	✓		
		A*21	Time			▲	✓		
			Geographical			▲	✓		
			Industries			▲			
	REGIONAL ACCOUNTS NUTS2	Total	Time	▲	✓	▲	✓		
			Geographical			▲	✓		
		A*10	Time						
			Geographical						
			Industries						

Other information

Since this indicator is based on volume figures (hours and persons) it is possible to make time comparisons. Comparing the levels across countries can be affected by the different methods used to estimate hours worked from country to country and it is recommended only for countries that use a similar method. For growth rates, this comparison is recommended as we have noted that this does not affect the rate of change. See Section 3.3.2 for further details.

Industry breakdowns for levels are not provided because persons holding more than one job are classified as employees or self-employed according to their main job and this share may vary from industry to industry. Industry breakdowns for the growth rate are provided, since a comparison is possible assuming that the share of persons employed in a second job is stable (more likely for short-term comparisons). This is not a problem when looking at the economy as a whole. See Section 3.5.2 for further details.

4.4. Hours worked per capita

HW_HAB

① Definition

Hours worked per capita for time period t is the result of dividing total hours worked by persons employed in the domestic concept by total population:

Formula

$$HW_HAB = \frac{EMP_HW_DC}{POP}$$

Units

THS_HW Thousand hours worked

THS_PER Thousand persons

Description

Employment measured in hours encompasses all the hours worked by persons engaged in productive activities that falls within the production boundary of the national accounts. It is measured in the domestic concept (EMP_DC), i.e. employees or self-employed persons engaged in a productive activity for a resident unit and receiving remuneration regardless of their place of residence. The figure for the total population is defined according to the concept of residence of a country (see ESA 2010 par. 11.06). Hence, total population consists of all persons, national or foreign, who are permanently settled in the economic territory of the country, even if they are temporarily absent from it.¹³ This ratio determines, to some extent, the number of hours accrued in the productive process in a period that can be attributed to each resident in the economy.

Availability and comparability recommendations

				VALUATION				
				Hours worked				
				TRANSFORMATION				
COLLECTION		NACE	COMPARABILITY	Level	Growth	PPS	% of EU	
TOTAL ECONOMY or REGIONAL BREAKDOWNS	NATIONAL ACCOUNTS	Total	Time	▼	✓	▲	✓	
			Geographical	▼	✓	▲	✓	
		A*21	Time					
			Geographical					
			Industries					
	REGIONAL ACCOUNTS NUTS2	Total	Time					
			Geographical					
		A*10	Time					
			Geographical					
			Industries					

Other information

This indicator is provided only at NUTS0 total economy level since POP indicators are related to a geographical dimension and only make sense for the whole economy of the territory (not by industry). The second reason not provide activity breakdowns is that employed persons holding more than one job are classified as employees or self-employed only according to their main activity. This is not a problem when looking at the total economy. See Section 3.4 for further details. PPS makes no sense for this indicator since it is based on volume figures. Users should be cautious when comparing between countries since the methods to compile hours worked may differ from country to country. It is recommended for countries that use a similar method to estimate hours. For this reason, geographical comparisons are not recommended for levels and % of EU. Comparisons can be made for growth rates as this is not altered by different methods used. See Section 3.3.2 for further details.

¹³ The proper way to calculate this ratio is to refer to working-age population. However, in ESA 2010 information on age is not provided.

4.5. Nominal labour productivity per hour worked

NLPR_HW

① Definition

Nominal labour productivity per hour worked for total economy over a given time period t is calculated by dividing GDP in current prices by hours worked:

Formula

$$NLPR_HW = \frac{B1GQ}{\frac{EMP_HW_DC}{\times 1000}}$$

Units

<i>CP_MEUR</i>	Million euro
<i>THS_HW</i>	Thousand hours worked

Description

GDP is a measure of the total economic activity taking place in an economic territory which leads to output meeting the final demands of the economy. GDP is measured at current prices. Hours worked include total hours worked by all persons engaged in production in the domestic concept, i.e. by employees and self-employed persons, in either primary or secondary activity, engaged in a productive activity for a resident unit and receiving remuneration regardless of their place of residence. This ratio, expressed in euro per hour worked, indicates to some extent how much economic production activity in nominal prices in a given a period can be attributed to each hour worked in the economy.

Availability and comparability recommendations

				VALUATION			
				Current prices			
				TRANSFORMATION			
COLLECTION		NACE	COMPARABILITY	Level	Growth	PPS	% of EU
TOTAL ECONOMY or REGIONAL BREAKDOWNS	NATIONAL ACCOUNTS	Total	Time				▼
			Geographical				▲
		A*21	Time				
			Geographical				
	REGIONAL ACCOUNTS NUTS2	Total	Time	▼	▲		▼
			Geographical	▼	▲		▼
		A*10	Time				
			Geographical				
			Industries				

Other information

This indicator is published in Eurobase for the total economy and it is calculated in percentage of the EU27 in PPS. Indicators in PPS cannot be compared over time due to inflation effects. This indicator across geographical units should be compared with caution because of the different methods used to estimate hours worked (see Sections 3.6 and 3.3.2).

At regional level, this indicator is not corrected for different purchasing power parities across countries, since PPS figures are not available for NUTS2 and using national PPS can be misleading (see Section 3.4.2).

It is recommended to make comparisons between countries when they use a similar method to estimate hours worked (see the annex).

4.6. Nominal labour productivity per person employed NLPR_PER

① Definition

Nominal labour productivity per person employed in the economy over a given time period t is calculated by dividing GDP in current prices by employed persons.

Formula

$$NLPR_PER = \frac{B1GQ}{EMP_PER_DC}$$

Units

<i>CP_MEUR</i>	Million euro
<i>THS_PER</i>	Thousand persons

Description

GDP is a measure of the total economic activity taking place in an economic territory. It is measured at current prices. Labour input is measured as the number of employed persons in the domestic concept, i.e. persons engaged by agreement in a productive activity for a resident unit and receiving remuneration regardless of their place of residence. This ratio, expressed in euro per person, indicates to some extent how much total economic activity in nominal prices in a given period can be attributed to each employed person in that economic territory of reference.

Availability and comparability recommendations

				VALUATION				
				Current prices				
				TRANSFORMATION				
COLLECTION		NACE	COMPARABILITY	Level	Growth	PPS	% of EU	
TOTAL ECONOMY or REGIONAL BREAKDOWNS	NATIONAL ACCOUNTS	Total	Time				▼	
			Geographical				▲	
		A*21	Time					
			Geographical					
			Industries					
			Industries					
	REGIONAL ACCOUNTS NUTS2 AND NUTS3	Total	Time	▼	✓			▼
			Geographical	▼	✓			▼
		A*10	Time					
			Geographical					
			Industries					
			Industries					

Other information

This indicator was already published in Eurobase for the total economy and it is calculated in percentage of EU27 in PPS. Since different purchase parities do not correct for price dynamics, it cannot be compared over time due to inflation effects. See Sections 3.4.1 and 3.4.2. Since this indicator is based on persons and not on hours, it is possible to compare the figures across countries for the total economy. However, different purchase parities and different price dynamics at levels are not corrected, so that comparison over time is not recommended. See Sections 3.4.1 and 3.4.2. The Indicator is not provided at industry level since PPS figures are not available at industry level.

At regional level, the indicator is not corrected for different purchasing power parities across countries since PPS are not sent to Eurostat for NUTS2 and using national PPS can be misleading. See Section 3.4.2. For this reason, comparisons over time is not recommended. See Section 3.6.

4.7. Nominal unit labour cost based on hours worked NULC_HW

① Definition

The nominal unit labour cost based on hours worked is the ratio between the indicator ‘compensation of employees per hour worked’ and ‘real labour productivity per hour worked’ for the same time period t :

Formula

$$NULC_{HW} = \frac{D1_{SAL}_{HW}}{RLPR_{HW}}$$

Units

CP_{MEUR}/THS_{HW}	Million euro per thousand hours worked
$CLVXX_{MEUR}/THS_{HW}$	Million euro per thousand hours worked

Description

This indicator represents the ratio of nominal labour cost to real labour productivity. It is usually considered as a measure of price competitiveness. In fact, it is a ratio of the average cost of hours worked over real productivity, which is interpreted as the average cost of labour per unit of output (real labour productivity). However, the numerator (compensation per hour worked) refers only to employees, while the denominator (real labour productivity, in terms of hour worked) refers to all employment (including the self-employed). The indicator implicitly assumes that the productivity of the self-employed is equal to employee productivity (see Section 3.6).

Availability and comparability recommendations

				VALUATION				
				Current prices				
				TRANSFORMATION				
COLLECTION		NACE	COMPARABILITY	Level	Growth	PPS	% of EU	
TOTAL ECONOMY or REGIONAL BREAKDOWNS	NATIONAL ACCOUNTS	Total	Time		▼	✓		
			Geographical		▼			
		A*21	Time		▼	✓		
			Geographical		▼			
	REGIONAL ACCOUNTS NUTS2	Total	Industries	Time				
				Geographical				
			A*10	Time				
				Geographical				
		BREAKDOWN by INDUSTRIES (ECONOMIC ACTIVITIES)	Total	Time				
				Geographical				
			A*10	Time				
				Geographical				

Other information

This indicator is provided only in terms of growth rate. Despite it being a nominal indicator, it is common practice to analyse growth trends as a way to assess changes to the level of competitiveness of the workforce.

The different methods used by different countries to estimate hours worked hampers the accuracy of this comparison (see Section 3.3.2).

4.8. Nominal unit labour cost based on persons

NULC_PER

① Definition

The nominal unit labour cost based on persons is the ratio between the indicator ‘compensation of employees per employee’ and ‘real labour productivity per person employed’ for the same time period t :

Formula

$$NULC_PER = \frac{D1_SAL_PER}{RLPR_PER}$$

Units

CP_MEUR/THS_PER Million euro per person

$CLVXX_MEUR/THS_PER$ Million euro

Description

This indicator represents the ratio of nominal labour cost to real labour productivity. It is usually considered as a measure of price competitiveness. In fact, it is a ratio of the average cost of employees over real productivity, which is interpreted as the cost of labour based on persons per unit of real productivity. However, the numerator (compensation per employees) refers only to employees, while the denominator (real labour productivity, in terms of persons employed) refers to all employment (including the self-employed). The indicator implicitly assumes that the productivity of the self-employed is equal to employee productivity (see Section 3.6).

Availability and comparability recommendations

				VALUATION			
				Current prices			
				TRANSFORMATION			
COLLECTION		NACE	COMPARABILITY	Level	Growth	PPS	% of EU
TOTAL ECONOMY or REGIONAL BREAKDOWNS	NATIONAL ACCOUNTS	Total	Time		▼	✓	
			Geographical		▼	✓	
		A*21	Time				
			Geographical				
	REGIONAL ACCOUNTS NUTS2	Total	Time				
			Geographical				
		A*10	Time				
			Geographical				
			Industries				

Other information

This indicator is provided only in terms of growth rate. Despite it being a nominal indicator, it is common practice to analyse growth trends as a way to assess the change in the level of competitiveness of the workforce.

At industry level, persons with more than one job are only accounted for in their main job in their main activity. Hence, to make comparisons, we must assume that the share of persons with a second job by industry is similar across countries and remains stable over time. When looking at the total economy, secondary jobs do not alter the result since all industries are pooled together. See Sections 3.3.1 and 3.5.2.

4.9. Total employment (persons employed) per capita EMP_HAB

① Definition

Persons employed per capita in a given time period t is calculated by dividing total employment (in terms of persons) by the total population:

Formula

$$EMP_{HAB} = \frac{EMP_{DC}}{POP} \times 100$$

Units

THS_PER	Thousand persons
THS_PER	Thousand persons

Description

This indicator represents the percentage of persons in employment against the total population. Employment is measured in the domestic concept (EMP_DC), i.e. employees or self-employed persons engaged in a productive activity for a resident unit and receiving remuneration regardless of their place of residence. Total population consists of all persons, national or foreign, who are permanently settled in the economic territory of the country, even if they are temporarily absent from it. Figures for the total population are taken from the national accounts. This source does not split population by age group, so the ratio represents employment per capita. It is a proxy for the activity rate, but taking total population instead of the working-age population.

Availability and comparability recommendations

				VALUATION			
				Persons employed			
				TRANSFORMATION			
COLLECTION		NACE	COMPARABILITY	Level	Growth	PPS	% of EU
TOTAL ECONOMY or REGIONAL BREAKDOWNS	NATIONAL ACCOUNTS	Total	Time	▲	✓	▲	✓
			Geographical	▲	✓	▲	✓
		A*21	Time				
			Geographical				
	REGIONAL ACCOUNTS NUTS2	Total	Time				
			Geographical				
		A*10	Time				
			Geographical				
			Industries				

Other information

This indicator is provided only at total economy level since POP indicators are only available at the level of the whole economy (not by industry).

Users can compare the indicator over time and across countries for levels, growths and as a percentage of the EU27. See Sections 3.4 and 3.6.

4.10. Real labour productivity per hour worked

RLPR_HW

① Definition

Real labour productivity (based on hours worked) for the total economy over a given time period t is calculated by dividing GDP in chain-linked volumes by hours worked. At industry and regional level, GDP in the numerator is replaced by industry GVA.

Formula

$$RLRP_HW = \frac{B1GQ \text{ or } B1G^*}{EMP_HW_DC} \times 1000$$

Units

CLVXX_MEUR Million euro in CLV
THS_HW Thousand hours worked

At industry level, industry GVA is used. For the total economy, GDP is used instead.

Description

B1GQ and B1G are measured in chain-linked volumes, i.e. volume measures obtained by chain linking a monetary series of a reference year. Labour input is measured as total hours worked by all persons engaged in production in the domestic concept, i.e. hours worked by employees and the self-employed, in either their primary or secondary activity, engaged in a productive activity for a resident unit and receiving remuneration regardless of their place of residence. This ratio, expressed in euro per hour worked, indicates to some extent how much economic production activity over a given period in real terms can be attributed to each hour worked by each employed person within the economic territory regardless of their place of residence, and also how it changes.

Availability and comparability recommendations

				VALUATION			
				Chain linked volumes			
				TRANSFORMATION			
COLLECTION		NACE	COMPARABILITY	Level	Growth	PPS	% of EU
TOTAL ECONOMY or REGIONAL BREAKDOWNS	NATIONAL ACCOUNTS	Total	Time		▲	✓	
			Geographical		▲		
		A*21	Time		▲	✓	
			Geographical		▲		
	REGIONAL ACCOUNTS NUTS2	Total	Time		▲	✓	
			Geographical		▲		
		A*10	Time				
			Geographical				
			Industries				

Other information

This indicator was already published in Eurobase for the total economy. It is now available by industry and by NUTS2. The methods used to estimate hours worked may differ from country to country and hamper the geographical comparability, except for those countries that use a similar method to estimate hours worked. Nonetheless, users can compare this indicator for growth rates as different methods used to estimate hours worked only affect levels and not growth. See Section 3.3.2 for further details.

4.11. Real labour productivity per person employed

RLPR_PER

① Definition

Real labour productivity per person employed in the total economy for a given time period t is calculated by dividing GDP in chain-linked volumes by employed persons. At industry and regional levels, GDP in the numerator is replaced by industry GVA.

Formula

$$RLRP_PER = \frac{B1GQ \text{ or } B1G^*}{EMP_DC} \times 1000$$

Units

CLVXX_MEUR Million euro in CLV

THS_PER Thousand persons

At industry level, industry GVA is used. For the total economy, GDP is used instead.

Description

B1GQ and B1G are measured in chain-linked volumes, i.e. volume measurements obtained by chain linking a monetary series of a reference year. Labour input is measured as the number of employed persons in the domestic concept, i.e. persons engaged by contract in a productive activity for a resident unit and receiving remuneration regardless of their place of residence. This ratio, expressed in euro per person, indicates to some extent how much economic production activity over a period in real terms in a given economic territory can be attributed to each employed person in the territory, regardless of their place of residence. We can also assess how it changes.

Availability and comparability recommendations

				VALUATION			
				Chain linked volumes			
				TRANSFORMATION			
COLLECTION		NACE	COMPARABILITY	Level	Growth	PPS	% of EU
TOTAL ECONOMY or REGIONAL BREAKDOWNS	NATIONAL ACCOUNTS	Total	Time		▲	✓	
			Geographical		▲		
		A*21	Time		▲	✓	
			Geographical		▲		
			Industries		▲		
					▲		
	REGIONAL ACCOUNTS NUTS2	Total	Time		▲	✓	
			Geographical		▲		
		A*10	Time				
			Geographical				
			Industries				

Other information

This indicator was already published in Eurobase for the total economy. It is now available by industry and by NUTS2. Since only growth rates are provided, these can be comparable by industry if we assume that the share of persons working involved in a secondary job by industry remains more or less stable over time. The same applies for comparisons between countries at industry level. For indicators of the total economy, comparability is straightforward. See Section 3.3 for further details.

5. Annex

The following tables show the data sources used for hours worked and employed persons, distinguishing between employees and self-employed workers as reported by countries in the OECD-Eurostat 2018 labour input survey (see Ward, Zinni and Mariana, 2018, Box 2.1 for further details). Moreover, the tables indicate for every source whether it is the main or secondary source.

Table 2. Data sources used for employment figures

Country	Unit	Labour Force Survey				Population Census				Business Statistics				Administrative sources + Other			
		Numbers of employees		Numbers of self-employed		Numbers of employees		Numbers of self-employed		Numbers of employees		Numbers of self-employed		Numbers of employees		Numbers of self-employed	
		Main	Second.	Main	Second.	Main	Second.	Main	Second.	Main	Second.	Main	Second.	Main	Second.	Main	Second.
Austria	Person and job				•						• ^{1/}			+	•	+	
Belgium	Person													+		+	
Bulgaria	Person		•		+					+							•
Croatia	Person	+		+													
Cyprus	Person		•				•		•	+		+		+	•	+	•
Czechia	Person	+		+						•		•			• ^{3/}		• ^{3/}
Denmark	Person				•									+		+	
Estonia	Person and job	+		+													
Finland	Person		•		•					• ^{1/}		• ^{1/}			• ^{3/}		• ^{3/}
France	Person and FTE job		•		•					•				+	• ^{3/}	+	• ^{3/}
Germany	Person		•	+						• ^{1/}				+	• ^{3/}		
Greece	Person	+		+		•	•			• ^{1/}		• ^{1/}			•		•
Hungary	Person	+		+		•	•			•		•			•		•
Iceland	Person and job				•									+		+	
Ireland	Person	+		+						•					•		
Italy	Person and job	+		+						• ^{1/}		• ^{1/}		+	•	+	•
Latvia	Person	+		+													
Lithuania	Person	+		+											• ^{3/}		• ^{3/}
Luxembourg	Person and job		•		•					•		•		+	•	+	•
Malta	Person and job		•		•					•		•		+		+	
Netherlands	Person		•	+						•				+			
Norway	Person			+						•		• ^{1/}		+			•
Poland	Person	+		+						•							
Portugal	Person and job	+		+						• ^{2/}		• ^{2/}		• ^{2/}		• ^{2/}	
Romania	Person	+		+											•		•
Slovakia	Person	+			•					•		• ^{1/}			•	+	•
Slovenia	Person		•		•		•			•		•		+		+	
Spain	Person and job	+		+						•		•			•		•
Sweden	Person	+		+						•					•		•
Switzerland	Person	+		+						•		•			•		•
UK	Person	+		+													
UK (PS)	Job	+		+						•				+			
Total by type of sources		18	8	21	9	-	4	-	3	10	13	7	7	15	17	12	16

Notes: One main source provides the basis of the estimates upon which adjustments might be made. Secondary data sources are used to make adjustments, or to supplement the main data source. 1/ Business statistics include the use of a statistical business register. Business registers are constructed in different ways in different countries, but are typically sourced from multiple primary data sources, principally utilising administrative data complimented by business surveys. 2/ Business statistics and administrative sources are used to estimate job figures. 3/ Most countries report employment in terms of persons using the labour force survey as the main source. However, to make a final estimate of employment, adjustments are needed to fully align the employment figures with the production boundary concept used in the national accounts. Source: Own illustration based on Ward, Zinni and Mariana (2018).

Table 3. Data sources used for the figures on hours worked

Country	Unit	Method	Labour Force Survey				Business Statistics				Administrative sources + Other			
			Numbers of employees		Numbers of self-employed		Numbers of employees		Numbers of self-employed		Numbers of employees		Numbers of self-employed	
			Main	Second.	Main	Second.	Main	Second.	Main	Second.	Main	Second.	Main	Second.
Austria	Job	DM	+		+		+							
Belgium	Person	CM to employees DM to self-emp.			+					+			•	
Bulgaria	Person	DM		•	+		+						•	
Croatia	Person	DM	+		+									
Cyprus	Person	CM			+		+				•		•	
Czechia	FTE and job	CM to employees DM to self-emp.			+		+							
Denmark	Job	Ratio worked/paid hours		•		•		•				+		
Estonia	Person	Regressions	+		+									
Finland	Person	Regressions		•		•	+		+					
France 1/	FTE	CM		•		•	+				•	+	•	
Germany	Person	CM		•	+			•					•	
Greece	FTE and Person	DM	+		+									
Hungary	Person	CM to employees DM to self-emp.		•	+		+				•			
Iceland	Job	CM					+		+		•		•	
Ireland	Person	CM	+		+		+							
Italy	Person	CM	+		+			•		•	+	•	+	
Latvia	Person	DM	+		+									
Lithuania	Person	DM	+		+									
Luxembourg	Person	CM					+		+		+		•	
Netherlands	Person	CM to employees DM to self-emp.			+			•			+			
Norway	FTE and job	CM	+		+						+		+	
Poland	Person	DM	+		+									
Portugal	Job	DM	+		+		+		+		+		+	
Romania	Person	DM with adjustments	+		+									
Slovakia	Person	CM to employees DM to self-emp.			+		+				+			
Slovenia	Person	CM SAL, Ratio worked/paid hours SELF	+		+		+				+	•		
Spain	Person, FTE and job	CM to employees DM to self-emp.	+		+		+				+			
Sweden	Person	DM	+		+			•						
Switzerland	Person	CM	+		+						•		•	
UK	Person and Job (PS)	DM	+		+						•			
Total by type of sources			17	6	25	3	14	5	4	1	9	8	5	9

Notes: One main source provides the basis of the estimates upon which adjustments are made. Secondary data sources are used to make adjustments or to supplement the main data source. Methods: component method (CM), direct method (DM), PS indicates information on labour input in productivity statistics and FTE indicates full-time equivalent. 1/ France applies the component method to estimate hours worked by self-employed but its original basis is the mean hours worked by employees. * Business statistics includes the use of a statistical business register which is constructed in different ways across countries, but is typically sourced from multiple primary sources, principally administrative data complemented by surveys. Source: Own illustration based on Ward, Zinni and Mariana (2018).

The labour force survey is typically the main source of data.

Although the use of different sources may have an impact on the comparability of country estimations, the method used by countries to obtain the final estimate of hours worked is more important than the source itself. The method used can be seen in Table 4.

The two main methods are (see Ward, Zinni and Mariana, 2018 for more details):

- The direct method (DM) annualises average actual weekly hours worked derived from continuous surveys in all weeks of the calendar year. This method is mainly based on the labour force survey and trusts self-reporting of absences, requiring significant adjustments to properly account for holidays.
- The component method (CM) uses the indirect approach. It estimates contractual or usual hours worked per week from surveys (establishment or continuous) or administrative sources and adjusts several components for absences (holidays, sickness, maternity leave etc.) and (paid or unpaid) overtime.

Table 4. Method used to estimate hours worked by countries in Europe

Component Method	Direct Method	Other method
Belgium	Austria	Denmark
Bulgaria	Croatia	Finland
Cyprus	Estonia	Malta
Czechia	Greece	Netherlands
France	Ireland	
Germany	Latvia	
Hungary	Lithuania	
Iceland	Poland	
Italy	Portugal	
Luxembourg	Sweden	
Norway	United Kingdom	
Romania		
Slovakia		
Slovenia		
Spain		
Switzerland		

Source: Ward, Zinni and Mariana (2018)

We can reach two main conclusions about the method used:

- There is a systematic bias in the results of total hours worked for the total economy and by industry: countries using the direct method systematically report more hours than countries using the component method.
- The direct method, being based on actual hours (whereas the component method is based on usual hours), is more prone to high variations in the yearly growth rate of estimated hours worked. These differences, as expected, are greater in the short term and tend to stabilise over the long term.

Therefore, the merits of comparing hours worked in terms of levels (and consequently of derived LPIs in levels based on HW) are questionable, even when looking at the total economy. However, the OECD's evidence does not prove the existence of a bias in international comparisons of growth rates of hours worked and hence productivity growth due to using the direct method to estimate hours worked. This was also confirmed by an independent study carried out as part of the 'Growth and Productivity Accounts' project.

To conclude, evidence shows that there are differences in levels depending on the method used to estimate hours worked but there are no significant differences in growth rates over a period of time. Some differences may exist for some years and certain countries over the short term because the direct method includes actual hours worked, which are typically more volatile than usual hours. However, these differences are mitigated and compensated when looking at longer-term growth rates. For these reasons, looking at the growth rates of hours worked is preferable to looking at levels when comparing countries as there is no evidence of significant biases in growth rates, regardless of the method used to estimate hours worked.

Acronyms

B1G	Gross value added (GVA)
B1GQ	Gross domestic product (GDP)
CLVYY	Chain-linked volume with base year YY
CP	Current prices
D1	Compensation of employees
DC	Domestic concept (i.e. within the border of the economic territory)
EMP	Employment (employees and self-employed)
ESA 2010	European System of Accounts 2010
EU27	From 1 February 2020, former EU28 excluding United Kingdom (i.e. Austria (AT), Belgium (BE), Bulgaria (BG), Croatia (HR), Cyprus (CY), Czechia (CZ), Denmark (DK), Estonia (EE), Finland (FI), France (FR), Germany (DE), Greece (EL), Hungary (HU), Ireland (IE), Italy (IT), Latvia (LV), Lithuania (LT), Luxembourg (LU), Malta (MT), Netherlands (NL), Poland (PL), Portugal PT), Romania (RO), Slovakia (SK), Slovenia (SI), Spain (ES) and Sweden (SE))
FTE	Full-time equivalent employment
GDP	Gross domestic product (B1GQ)
GVA	Gross value added (B1G)
JOB	Jobs
LPI	Labour productivity indicator
HW	Hours Worked
MEUR	Million euro
MNAC	Million of national currency
PC	Percentage
PER	Persons
PPS	Purchasing power standards
PPP	Purchasing power parities
SAL	Employees
SELF	Self-employed persons
THS	Thousand
TP	Transmission programme

Acronyms united by an underscore indicate two connected concepts. For example, SAL_DC stands for number of employees in domestic concept; CP_MEUR stands for million of euro in current prices; CP_PPS_EU27 stands for current prices in purchasing power standards in the EU-27.