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Labour Cost Index 2008=100

Handbook for Users

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Foreword

Statistics Finland published its first revised labour cost index in June 2009. The base year of the revised index is 2008. In its concepts and methodological descriptions this handbook is based on the publication Cost of an hour worked 2000–2007, Labour Cost Index 2003 = 100. The descriptions and methods of the new index are updated to the handbook as to changes made. The handbook update was prepared by Outi Ahti-Miettinen, Pekka Haapala, Kati Heikkinen, Hanna Jokimäki, Pentti Jonninen, Seppo Kouvonen and Antti Suoperä.

Helsinki, Statistics Finland, September 2013

Hannele Orjala
Director, Business Statistics

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1 What is the labour cost index?

1.1 About the history of the labour cost index

Surveys on labour costs in manufacturing have been carried out in Finland since the 1940s. The regulation-based European Community statistics on labour costs were initiated towards the end of the 1960s, after which basic surveys concerning the level and structure of labour costs have been implemented at periodic intervals. Later on Member States were required to supply calculated statistics on the level and structure of labour costs for the intermediate years as well.

The foundation of the joint European currency has emphasised the need for continuous monitoring of cost development. The original aim was to produce an index describing the price development of a standardised labour input unit, as an example the US Employment Cost Index. However, the production of an index describing the price development of a standardised labour input unit would have required a significant investment into the collection of basic data. Primarily for cost reasons, a decision was made in the end to use a cost index describing the change in average costs instead of a price index, as it was better suited for the existing statistical systems of many of the largest Member States.

Production of the labour cost index was at first based on a gentlemen's agreement of the directors of national statistical institutes of the Member States of the European Union (EU) and it was started in 1996. At the initial stage the index was based on the statistical systems existing in the Member States. In Finland the cost development of hours worked was defined between 1996 and 2002 on the industry level by dividing the monthly earnings for total working hours of a full-time wage and salary earner, determined according to Statistics Finland's index of wage and salary earnings and structure of earnings statistics, by the average labour input for a month. The number of working hours of full-time wage and salary earners was based on Statistics Finland's employment statistics.

1.2 Regulations guiding the calculation of the labour cost index

The experiences gained from the first labour cost index soon showed that to attain sufficient international comparability, the compilation of the index would have to be defined on the basis of an EU regulation. Since 2003 the compilation of the index has been decreed by Regulation No 450/2003 of the European Parliament and of the Council and by related Commission Regulation No 1216/2003 on its implementation. In the first phase the regulation-based statistical obligation related only to manufacturing and private service sector industries. The industry coverage of the index was enlarged by the Commission's new implementing Regulation No 224/2007 to concern from 2007 onwards the industries of so-called welfare services for which the public sector is mainly responsible. The European Parliament yearly monitors the quality of the labour cost index on the basis of a report submitted by the Commission.

The concepts and classifications of the labour cost index are defined in the Commission's implementing Regulation. The index series based on the years 1996 to 2008 is based on the EU's Standard Industrial Classification NACE Rev. 1 of that time. From 2009 the index is based on the EU's present Standard Industrial Classification NACE Rev. 2. In connection with the introduction of the new classification each Member State also had to produce retrospective time series with the new Standard Industrial Classification starting from 2000.

1.3 The theory of the labour cost index

The labour cost index is a unit value index describing quarterly change in average costs per hour worked. In the Regulation concerning the labour cost index the basic formula for a Laspeyres index for period t is defined as follows:

$$LCI_{tj} = \frac{\sum_i w_i^t h_i^j}{\sum_i w_i^j h_i^j} = \frac{\sum_i (w_i^t / w_i^j) w_i^j h_i^j}{\sum_i W_i^j} = \frac{\sum_i (w_i^t / w_i^j) W_i^j}{\sum_i W_i^j}$$

where w_i^t = labour costs per hour worked in industry i in period t
h_i^t = hours worked by employees in industry i in period t and
$W_i^j = w_i^j * h_i^j$ labour costs of employees in industry i in annual period j

The index describing the basic series of the industry's main group level depicts the average change in labour costs in the industry. The indices relating to industry sums are thus formed from the price ratio w_i^t / w_i^j concerning each basic series and from its weight $\frac{W_i^j}{\sum_i W_i^j}$.

The weights must be used in the index calculation within two years from the time period they refer to.

The annual link between the indices of years j and *j+1* is thus of the form:

$$K_{j,j+1} = \frac{\sum_i w_i^{j+1} h_i^j}{\sum_i w_i^j h_i^j}$$

where w_i^{j+1} = average price of the year $(j+1)$ following the base year in industry i,
w_i^j = average price of the base year in industry i,
h_i^j = number of hours worked in the base year in industry i.

The labour cost index is part of statistics on economic trends reacting easily to short-term cost changes. Statistics on labour cost index are published almost in real time within 70 days of the end of the quarter. The labour cost index describes the price pressures caused on the labour market through changes in the wages and salaries sum and in unit cost per hour worked.

The index is also useful when analysing reasons for the change in the wages and salaries sum. It can be used to decompose the change in the wages and salaries sum into price (cost per hour worked) and volume components (number of hours worked) and also to specify the impact of one-off cost components. At the same time it is possible to expand on the analysis concerning both labour productivity and unit labour costs.

The change in unit labour costs can be summarised into the expression:

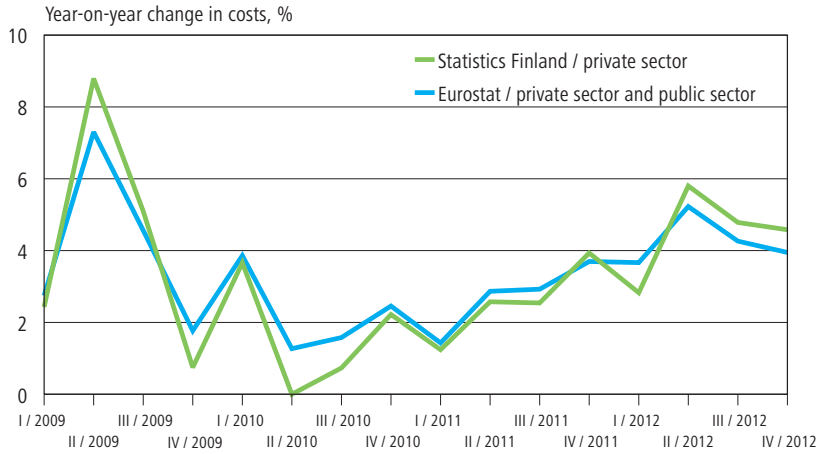
$$\Delta(unit\ \ labour\ cost) = \frac{(\Delta\, volume\ of\ labour\ \ input) * \Delta(average\ cost\ \ per\ hour\ worked)}{\Delta(volume\ \ of\ \ production)}$$

1.4 National and international labour cost index

As the calculation of the labour cost index changed from 2003 to be regulation-based, its production model also had to be re-evaluated in Finland. In compliance with the obligations of the Statistics Act, the production model of the index was still to be built on existing data, in which case the index of wage and salary earnings was of crucial importance. Utilisation of the existing data was intensified by specifying the imputation bases of one-off pay components and by using seasonally adjusted values in measuring hours worked in the working month.

However, the experiences gained from the revised production model soon showed that the objectives of the Regulation could not be reached when using the available basic statistics. Work on an index based on quarterly collected empirical cost data was started in 2005 and publication of data at the beginning of 2009. Data collection began in the private sector in 2007 and in the local government sector in 2010. The data of the central government sector are based on the administrative TAHTI register. Since 2007 the index derived from empirical data has

Figure 1A.
Change in labour cost per hour worked compared with the corresponding quarter of the previous year according to Eurostat and Statistics Finland in 2009–2012



been based on the Standard Industrial Classification TOL 2008 (NACE Rev.2).

The labour cost index released by Eurostat, the Statistical Office of the European Communities, is based for Finland on empirical basic data from 2009 onwards. According to the EU Regulation, from the statistical year 2007 onwards the index must also cover industries O to S, for which mainly the public sector holds responsibility. The labour cost index data in the central government sector are derived directly from the State Treasury's TAHTI register and do not require separate data collection. The data cover all government agencies. In the local government sector, data collection began with the three largest municipalities in 2008 and was gradually extended to cover the entire local government sector by 2012. For the time being the effect of the local government sector has been estimated in the index series Statistics Finland has supplied to Eurostat on the basis of average earnings of the index of wage and salary earnings. The costs of the congregations are not at this stage yet taken into account when determining the cost development of the EU's index. At the moment, Eurostat releases the index for Finland only on the industry level. The index has, until 2012, been produced only as a raw series, that is, unadjusted for working days and seasonal variation. In the autumn of 2012, a seasonally adjusted index for the private sector has been produced as the time series became long enough for working day and seasonal adjustments. The government's seasonally adjusted indices are also calculated for the index series that are delivered to Eurostat.

Figure 1A shows that the inclusion of the public sector lowered the change in average costs in 2009, raised it in 2010 and 2011 and lowered it again in 2012.

The national labour cost index is released quarterly around 70 days after the end of the quarter on Statistics Finland's Internet pages. The national index also covers all industries. Data are released on the main industry sums, six main groups (C, F, G, H, J and K) and on four sub-industries of manufacturing (food industry, forest industry, chemical industry and metal industry), as well as on the central and local government sectors' industry sums.

2 What does the labour cost index measure?

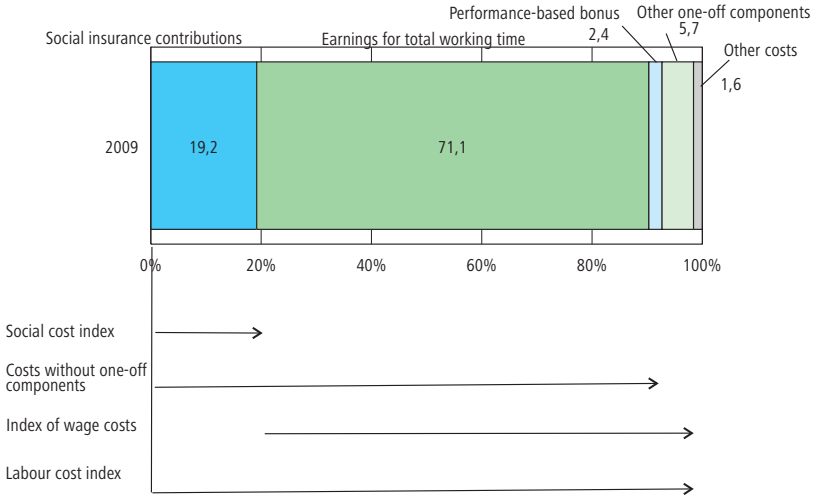
2.1 The structure of the labour cost index

The labour cost index is a unit value index measuring the quarterly change in average labour costs per hour worked. On the main group level of the industry the index describes the change in average costs. The cost development of industry sums is determined by weighting the cost development of the industry main groups with cost weights derived from the previous year or the year before it.

The change in labour costs is broken down to three sub-indices:

– The index of wage costs measures the change in wages and salaries calculated per hour worked. Wage costs include all pay and bonuses according to Section 13 of the preliminary tax withholding act (No 1118/1996), thus also costs incurred by payments in kind and incentive stock options.
– The social cost index measures the development of employers' statutory and voluntary social insurance contributions calculated per hour worked. The change is measured on the basis of the payment rate, so the time of payment or possible retrospective or refunded payments do not influence the cost development.
– The labour cost index without one-off pay components measures the change in wage costs and social costs without extraordinary or one-off pay components. Such are typically performance-based bonuses, holiday bonus, holiday supplement, part of seniority increments paid in hourly paid branches and costs raised by incentive stock options and contractual pay increases paid retrospectively from previous pay periods.

Figure 2A.
Labour cost index and structure of labour costs in 2009



2.2 Focus on costs per hour worked

The data suppliers' responding possibilities are ensured by using in the collection of basic data the concepts applied in payroll accounting in the branch in question. The collection of basic data thus makes use of four forms, which are presented in Appendix 3 of this handbook. The form for hourly-paid branches is used in enterprises where a significant part of the personnel are under collective agreements for hourly-paid employees, such as manufacturing, motor vehicle sales and transport. The education form is used by those employers in education where the working time of the teaching personnel is based on compulsory teaching time, not total remu-

neration. In service enterprises, use is made of a questionnaire where data on part-time personnel is separated from the total data for the enterprise. Part-time are all service relationships where an employment contract for part-time employees is valid. In addition to the education form, a public sector form where data for full-time and part-time employment as well as hourly-paid personnel are separated is used in the local government sector. Comparability between data from different branches is ensured by means of processing rules connected to the production process.

Data collection intends to guarantee the comparability between the volume of the paid wages and salaries sum and hours worked. The data supplier must report the wages and salaries paid in the pay periods ending during the statistical quarters. This may include pay components paid retrospectively from previous quarters or one-off pay components. The reported number of hours worked must correspond to the amount of pay remunerated. Therefore, for example overtime hours must be recorded in the statistical quarter during which most of the overtime pay is remunerated.

Number of employment relationships at the end of the statistical reference period

Data suppliers must report the number of paid employment relationships at the end of the statistical reference period. Employment relationships of those on unpaid leave for over two weeks (e.g. laid off, military service, sickness leave or daily allowance part of parental leave) are not taken into account. In hourly-paid branches hourly and monthly-paid employment relationships are presented separately, in service branches full-time and part-time employment relationships. In the local government sector, full-time and part-time employment as well as hourly-paid personnel are separated.

Number of working hours

The labour cost index describes the change in labour costs per hour worked. The total number of hours worked is defined in accordance with Council Regulation (EC) No 2223/96 of 25 June 1996 on the European system of national and regional accounts in the Community.

Employers are not always able to provide reliable information on the number of hours worked. In that case Statistics Finland imputes the number of hours worked either on the basis of paid hours or compulsory teaching hours. Reporting the number of hours of work always includes information on the type of labour input reported:

– Hours worked: All employers report the work input of hourly-paid employees as hours worked and approximately one-half of employers report the work input of monthly-paid employees as hours worked. The number of hours worked by the hourly-paid can usually be determined direct from payroll accounting. A working time monitoring system is generally

Table 2A.
Data content collected quarterly for the labour cost index

	Hourly-paid in manufacturing	Monthly-paid in manufacturing	Services	Teaching personnel in education	Non-teaching personnel in education	Public sector
Statistical period	x	x	x	x	x	x
Number of employment rel. at end of period	x	x	x	x	x	x
Number of hours worked	–	either	either	x	x	x
Number of hours paid	–	or	or	–	–	x
Number of teaching hours	–	–	–	x	–	–
Volume of teachers' other work than teaching	–	–	–	x	–	–
Number of paid sickness leave	–	–	–	x	–	x
Wages and salaries subject to withholding tax	x	x	x	x	x	x
Monetary pay for hours worked	x	–	–	–	–	–
Sunday and overtime pay premiums	x	–	–	–	–	–
Wages and salaries paid for hours not worked	x	–	–	–	–	–
Pay for extra and overtime work	–	x	x	x	x	x
Performance-based bonuses	x	x	x	x	x	x
Other extraordinary or one-off pay	x	x	x	x	x	x
Ordinary wages and salaries	–	–	–	x	x	x
Tariff of social insurance contributions, %	x	x	x	x	x	x

needed for reporting the number of hours worked by monthly-paid employees. The number of hours worked can be calculated by deducting paid and unpaid absences from the theoretical working hours and by adding overtime hours to it. Only extra and overtime hours compensated during the statistical quarter are recorded as overtime hours. Hours actually worked also include paid working time used for personnel training.
- Paid hours: The hours included in regular working time for which employees have been paid normal, raised or lower pay (long sickness leaves) are reported as paid hours. Mid-week holidays on working days are also included in the paid working time for monthly-paid employees. Paid working time during holiday is defined according to the normal period at work. Paid working time also comprises time off granted due to shortening of working hours.
- Teaching hours: Teaching hours of full-time or part-time teachers working under a working time arrangement based on compulsory teaching time must be reported according to compulsory teaching. When determining the number of teaching hours teachers' all overtime hours are taken into consideration. The number of hours worked in education is imputed by multiplying compulsory teaching time with the coefficient 1.5 and by adding to the value derived other hours worked than those based on compulsory teaching. For full-time teachers the number of days absent due to sickness is also specified, which in part supports the calculation of hours worked.

Wages and salaries subject to preliminary withholding tax in total

Wages and salaries subject to preliminary withholding tax comprise pay and bonuses including benefits in kind paid during the pay period ending during the quarter in accordance with Section 13 of the preliminary tax withholding act. Wages and salaries include the pay paid for the labour input in the period in question, that paid retrospectively for other than the above reported labour input and remuneration paid one-off or at regular intervals. Wages and salaries subject to preliminary withholding tax comprise such as wage costs arising from exercising of incentive stock options. In the inquiry concerning education a specification is requested of ordinary wages and salaries.

Monetary pay for hours worked by the hourly-paid

Monetary pay for hours worked by the hourly-paid is reported mainly according to the practice used in the agreement sector. Monetary pay for hours worked includes monetary pay paid on the basis of direct work performance, that is,
- Time-based, contract and premium pay,
- Sunday and overtime pay premiums,
- Various supplements for shift work, evening and night work, and
- Supplements for adverse working conditions.

The compensation granted for adjustment of working hours should always be included in pay for hours not worked regardless of the practice in the agreement sector. This is done to advance the comparability of statistics production between agreement sectors and to ensure coherence between wage costs and paid hours.

Pay premiums for extra, Sunday and overtime work for the hourly-paid

Pay premiums for overtime and Sunday work and work done during weekly period of time off included in monetary pay for hours worked are specified for hourly-paid employees.

Pay of the monthly-paid paid for extra and overtime work

Pay for extra and overtime hours included in wages and salaries subject to preliminary withholding tax is specified in the inquiry. It is pay received by the wage and salary earner for work done outside regular working hours determined on the basis of hours worked. Regardless of the payment basis, the pay includes all pay components paid for extra and overtime work, also that paid on the basis of work-related shift, Sunday or public holiday work.

Pay of the hourly-paid for working hours not worked

The pay included in wages and salaries subject to withholding tax for other than hours worked paid on the basis of working hours is specified for the hourly-paid, that is,
- Wages and salaries paid during annual leave,
- Compensation during public holidays,
- Compensation for shift leave,
- Wages and salaries paid during absence due to illness or an accident,
- Pay related to child birth and child care,
- Separate allowance or pay paid for adjusting working time,
- Compensation for travel, and

– Compensation for on-call work.

Performance-based bonuses
The performance-based bonus and cash-based profit-sharing included in wages and salaries subject to withholding tax are reported for both hourly-paid and monthly-paid employees. Agreements are made about systems concerning performance-based bonuses at each enterprise. The performance-based bonus is generally based on the financial result, realisation of productivity or development targets. The bonus usually accumulates in longer periods than a pay period. It is based on other than direct work performance.

Other extraordinary or one-off pay
Other extraordinary or one-off pay included in wages and salaries subject to withholding tax is reported for both hourly-paid and monthly-paid employees. These pay components are not typically included in the wage and salary earner's continuous remuneration paid for each pay period. Other extraordinary or one-off pay includes such as:
– Holiday bonus and holiday supplement,
– Cost incurred by exercising of incentive stock options,
– Seniority increment or similar paid at irregular intervals
– Allowance for time off in compensation for shortened working hours paid at irregular intervals,
– Emergency call-out allowance,
– Pay related to ending of an employment relationship (pay for the period of notice without the obligation to work, redundancy pay),
– One-off component paid on the basis of the collective agreement,
– Initiative bonuses, and
– Pay increase paid retrospectively from the previous quarter.

Teaching hours in education
For teaching personnel following the working hours of compulsory teaching, reported is the number of teaching hours held in the quarter (full-time and part-time teaching personnel). The labour input is reported separately as teaching hours held and as other than teaching hours. The labour input of other personnel must always be reported as hours worked.

Club and remedial teaching hours in education
For teaching personnel following the working hours of compulsory teaching, reported is the number of club and remedial teaching hours held during the quarter (included in teaching hours reported).

Other than teaching hours in education
For full-time teaching personnel, other working hours than teaching (e.g. hours during planning and training according to collective bargaining agreement). Preparatory and subsequent work related to compulsory teaching hours is not reported here as they are imputed.

Paid days of absence due to sickness
Paid (incl. partly paid) days of full-time teaching personnel following the working hours of compulsory teaching due to sickness absences and family leaves. Sickness absences and family leaves of part-time teaching personnel and other school personnel are not reported.

Ordinary wages and salaries in education and the local government sector
For education and local government sector reported is the ordinary wages and salaries actually paid in the statistical reference period, which, in addition to basic pay, includes allowances of fixed amount, such as seniority allowances, remote area allowance, language allowance and allowance for shop stewards. The concept of ordinary wages and salaries is needed when paying wages and salaries during annual leave and sick leave and maternity leave, for instance.

One-off hourly fees in education
In education pay for extra and overtime work included in wages and salaries subject to withholding tax. In teaching only overtime hours compensated as one-off hourly fees are interpreted as extra and overtime work, not annual weekly overtime hours compensated monthly by the same sum throughout the year. Working time compensated by a leave of similar length is not counted in extra and overtime work.

Tariff of social insurance contributions
The change in labour costs caused by social insurance contributions is evaluated by means of payment tariffs. When determining the costs the change in the enterprise's personnel structure should be taken into account. In contrast, the effect of the payment period, such as back payments, refunds of payments or advance payments, are meant to be excluded from the measured cost development.

The cost tariff caused by social insurance contributions is usually determined at the beginning of the year in accordance with the new

charge criteria and after that they stay the same throughout the year unless there are significant changes in the personnel structure or the social insurance contributions of the enterprise. For example, in 2009 the general reduction in social security contributions lowered enterprises' social cost tariff by 0.8 per cent from the beginning of April.

The tariff must cover enterprises' all statutory and voluntary social insurance contributions, that is,

- Employment pension contributions,
- Pensions paid by enterprises direct to their employees,
- Employers' social security contributions,
- Statutory and voluntary accident insurance payments,
- Unemployment insurance contributions,
- Group life insurance contributions, and
- Costs from other voluntary insurance related to use of labour input.

Statistics Finland determines the value of the enterprise's social costs on the basis of the payment tariff and the wages and salaries sum.

3 Classifications and weight structure

3.1 Industry

The calculation of the labour cost index is based on the Standard Industrial Classification. The EU's Regulation requires submittal of the results according to the main groups of the new TOL 2008 as well as on separately defined industry sums. In the national publication cost development is also specified for four key manufacturing industries (food industry, forest industry, chemical industry and metal industry).

The classifications of the indexation stage determine the classification level used in the collection and processing of the data. The sample used in the collection of basic data is stratified according to the main industry group, which specification may be the basis for the basic series of the chain-linked index as well. Data suppliers are requested to specify the basic data for the key industries by industry unit. In practice, the specification of costs by industry is actually made only in a few enterprises.

The revised Standard Industrial Classification NACE Rev. 2 was introduced in the printouts of the labour cost index (2008=100) at the beginning of 2009. At the same time, the index based on empirical data for the years 2007 and 2008 was released in accordance with the new classification. The indices of the previous base year (2003 = 100) are published only according to the old Standard Industrial Classification (NACE Rev. 1.1).

3.2 Classification of costs

By definition, labour costs refer to total costs incurred by employers in the employment of employees. Labour cost items and the total number of paid personnel are defined in Commission Regulation No 1737/2005 concerning implementation of statistics on labour costs.

Table 3A.
Classification of labour costs

D1	Compensations of employees
D11	Wages and salaries
D111	Wages and salaries (excluding apprentices)
D1111	Direct remuneration, bonuses and allowances
D11111	Direct remuneration, bonuses and allowances paid in each pay period
D11112	Direct remuneration, bonuses and allowances not paid in each pay period
D1112	Payments to employees' savings schemes
D1113	Payments for days not worked
D1114	Wages and salaries in kind
D11141	Company products
D11142	Staff housing
D11143	Company cars
D11144	Stock options and share purchase schemes
D11145	Other wages and salaries in kind
D112	Wages and salaries of apprentices
D12	Employers' social contributions
D121	Employers' actual social security contributions (excluding apprentices)
D1211	Employers' statutory social contributions
D1212	Collectively agreed, contractual and voluntary social security contributions
D122	Employers' imputed social contributions
D1221	Guaranteed remuneration in the event of sickness
D1222	Employers' imputed social contributions for pensions and occupational health care
D1223	Payments to employees leaving the enterprise
D1224	Other employers' imputed social contributions
D123	Employers' social contributions for apprentices
D2	Vocational training costs
D3	Other expenditure paid by the employer
D4	Taxes
D5	Subsidies received by the employer

The cost concept used in the labour cost index covers from table 3A compensations of employees (D1). When describing the cost development a more general classification level may well be used and focus can be put on the key cost concepts. Thus the costs of vocational education (D2), employer's other costs (D3), and subsidies received by the employer (D5) can be excluded from the quarterly cost description (they are included in the description area of the labour cost survey). The cost item taxes (D4) is not relevant in Finland. As shown in Figure 2A, around 1.6 per cent of labour costs remain outside quarterly cost monitoring.

Table 3B.
Cost weights of the total labour cost index in 2009 and 2012

		Weight structure 2009 share %	2012 share %
Private sector			
B	Mining and quarrying	0,3	0,3
C	Manufacturing	35.6	31.9
D	Electricity, gas, steam & air conditioning supply	2.2	1.3
E	Water supply, waste management, etc.	0.2	0.5
F	Construction	7.1	7.3
G	Wholesale and retail trade, etc.	14.6	13.5
H	Transportation and storage	5.8	8.2
I	Accommodation and food service activities	3.0	1.9
J	Information and communication	7.4	8.5
K	Financial and insurance activities	4.4	5.1
L	Real estate activities	1.1	0.9
M	Professional, scientific and technical activities	5.7	5.4
N	Administrative and support service activities	4.4	5.2
O	Public administration, etc.	1.0	1.2
P	Education	1.4	2.3
Q	Human health and social work activities	2.4	4.2
R	Arts, entertainment and recreation	2.1	0.9
S	Other service activities	1.4	1.1
Total		**100.0**	**100.0**
State sector			
J	Information and communication	0.4	0.6
K	Financial and insurance activities	0.1	0.1
L	Real estate activities	1.0	0.9
M	Professional, scientific and technical activities	11.3	13.0
N	Administrative and support service activities	3.3	0.1
O	Public administration, etc.	79.3	81.6
P	Education	2.2	1.6
Q	Human health and social work activities	1.9	1.6
R	Arts, entertainment and recreation	0.6	0.6
Total		**100.0**	**100.0**
Local government sector (large municipalities and joint municipal authorities)			
D	Electricity, gas, steam & air conditioning supply		0.1
E	Water supply, waste management, etc.		1.2
F	Construction		0.4
H	Transportation and storage		1.2
I	Accommodation and food service activities		2.0
J	Information and communication		0.5
L	Real estate activities		0.6
M	Professional, scientific and technical activities		3.0
N	Administrative and support service activities		2.3
O	Public administration, etc.		8.8
P	Education		1.1
Q	Human health and social work activities		75.2
R	Arts, entertainment and recreation		3.5
S	Other service activities		0.1
Total			**100.0**

3.3 Weight structure

The labour cost index is a chain-linked index where industry-specific indices are weighted together with industry-specific cost weights. For each year use is made of value share weights calculated from the previous year for the cost item in question (wage costs, social costs, costs total, costs without one-off items). However, weights calculated for the year 2007 were used both in the index starting year 2007 and in the following year. Because the coverage of the index varies by industry, the used weight structure may differ somewhat from the structure of Statistics Finland's Business Register, for example.

The indexation of labour costs is made so that the change in average costs in the industry is determined from the aggregates defined on the industry level. In the calculation process level data are thus produced for each quarter on the key index variables, that is, wages and salaries sum, social costs, number of hours worked and costs without one-off items.

Use of endogenous weights in the system ensures the internal coherence of the index series and their weight structure.

4 Sample of the labour cost index

The description area of structural statistics concerning earnings and labour costs (structure of earnings statistics, labour cost survey) does not include small enterprises with under 10 wage and salary earners and of the industries agriculture, forestry and fishing, or public administration. The target population of the labour cost index is both by its size category and industry more exhaustive than this. The target population of the index also covers small enterprises regardless of their size and of the industries, public administration. Of the industries thus only agriculture, forestry and fishing are left outside the theoretical population of the index.

On the other hand, small enterprises have, due to practical reasons, still been excluded from the empirical survey frame. In general, all enterprises employing at least 30 wage and salary earners are selected to the survey frame. However, in the industries dominated by small enterprises, construction (F), trade (G), accommodation and food service activities (I), real estate activities (L), professional, scientific and technical activities (M) and administrative and support service activities (N), all enterprises employing at least 20 wage and salary earners are selected to the survey frame. In terms of the local government sector, municipalities with over 5,000 inhabitants and all joint municipal authorities have been selected for the survey frame. The aim is that the population of the statistics would cover at least 60 per cent of the wages and salaries sum of the industry.

The survey frame of the population is formed annually in September by utilising the file in the Business Register formed for the statistics on private sector wages and salaries. The frame is based on the update situation (t-1) at the end of the year preceding the statistical reference period (statistical year=t). The same survey frame is used for estimating all quarters of the statistical year. However, preliminary data on the first two quarters of each statistical year are based on the survey frame of the year (t-2) preceding the reference period.

The survey frame for the year 2007 was based on the Business Register of mid-2006. At that point the sampling frame did not yet include information on the industry of enterprises in accordance with TOL 2008 (NACE Rev. 2). The industry according to the new classification was determined for the frame using the conversion key based on the old industry code. Only afterwards it was found that the TOL 2008 code formed with the key involved considerable inaccuracy.

4.1 Allocation

The EU Regulation requires compilation of statistics on changes in labour costs both on the level of the whole national economy and separately for each main industry group. In addition, for the sake of the national statistics and the efficiency of the sampling frame it is necessary to follow the internal cost development of manufacturing on a rough level as well. For the sampling design manufacturing is divided into seven sub-industries (see Table 4A). The allocation of the sample by industry is thus based on presumed use – a specific industry stratum is reserved in the sampling frame for each index according to the publication objective.

The average unit costs per hour worked are known to vary somewhat depending on the size of the enterprise. Enterprises are skewed as to size, the presumed non-response rate is higher for small enterprises and large enterprises cover the majority of the wages and salaries sum. In the survey frame the representativeness of all size enterprises is meant to be ensured for the collected data. The survey frame for the private sector is therefore stratified by the number of wage and salary earners into five size categories.

When determining the sampling ratios of strata the sample is allocated so that as accurate and unbiased estimates as possible could be produced for the population so that useful estimates could be obtained for the output variable from each subgroup. When using the Neyman allocation, the coefficients of variation for the estimates of some industries would become large especially on the main group level of the new Standard Classification of Industries. If the aim was to have as small coefficients of variation as possible for the estimates of all industries, the coefficient of variation for the estimate of the whole population would then rise.

Table 4A.
Theoretical sampling ratio by strata in 2007–2013

		–50	50–100	100–250	250–500	500–
Mining	**B**	1.00	1.00	1.00	1.00	1.00
Food industry	**C1**	0.35	0.30	0.45	1.00	1.00
Textile and clothing industry	**C2**	0.35	0.35	0.45	1.00	1.00
Wood industry	**C3**	0.15	0.15	0.20	0.50	1.00
Paper industry	**C4**	1.00	1.00	1.00	1.00	1.00
Chemical industry	**C5**	0.50	0.30	0.45	1.00	1.00
Metal and metal product industry	**C6**	0.15	0.10	0.15	1.00	1.00
Electronics industry	**C7**	0.65	0.45	0.75	1.00	1.00
Other industry	**C8**	0.08	0.08	0.10	0.30	1.00
Electricity, gas and air conditioning supply	**D**	0.25	0.25	0.70	1.00	1.00
Water supply	**E**	1.00	1.00	1.00	1.00	1.00
Construction	**F**	0.30	0.70	0.65	1.00	1.00
Trade	**G**	0.08	0.15	0.25	0.60	1.00
Transportation and storage	**H**	0.60	0.60	0.40	1.00	1.00
Accommodation and food service activities	**I**	0.08	0.10	0.20	1.00	1.00
Information and communication	**J**	0.25	0.20	0.30	0.70	1.00
Financial and insurance activities	**K**	1.00	1.00	1.00	1.00	1.00
Real estate activities	**L**	0.40	0.70	0.75	1.00	1.00
Professional, scientific and technical activities	**M**	0.15	0.20	0.30	1.00	1.00
Administrative and support service activities	**N**	0.15	0.25	0.25	1.00	1.00
Public administration	**O**	1.00	1.00	1.00	1.00	1.00
Education	**P**	0.20	0.40	0.40	1.00	1.00
Human health and social work activities	**Q**	0.08	0.15	0.15	0.45	1.00
Arts, entertainment and recreation	**R**	0.45	0.60	0.75	1.00	1.00
Other service activities	**S**	0.20	0.20	0.50	1.00	1.00

The allocation of stratum-wise sampling rates was based on two-phase power allocation. Choosing the power 0.5 (i.e. square root) was used to ensure results fit for publication both on the levels of the national economy and main industries while the aim of performing the allocation in two phases was to guarantee optimal allocation of the sample with respect to different size enterprises. The construction of sampling rates was started by determination of sample sizes for all 25 industry strata, in the second phase for all size strata of the industry. The anticipated non-response rate was taken into account in sample size determination.

Table 4A presents the targeted theoretical sampling ratios. Attainment of results fit for publication requires data collection from all enterprises in certain small industries. In most industry strata the sample selected covers all enterprises employing at least 250 wage and salary earners.

4.2 Drawing of the sample

The sampling method used is simple stratified random sampling without replacement. In terms of the private sector, the sample unit is an enterprise and the sample criteria are the enterprise's industry and size category. A random sampling number defined for each enterprise in the frame is used in drawing the sample. This is utilised in the annual update of the sample. Table 4B presents the key parameter figures of the original sample drawn for the year 2007. No major changes have taken place in the figures since 2007.

The sample of the labour cost index is updated yearly. In that connection the industry and size strata for the enterprises belonging to the survey frame are defined according to the new frame and enterprise closures are removed from the frame and new enterprises are added to it. The size and allocation of the additional sample are decided by comparing the realised sampling ratios with those according to the target design (Table 4A).

So far only a few operating enterprises have been removed from the sample drawn for the

Table 4B.
Sample of the labour cost index for the year 2007

Branch/ Stratum	Size of sample, enterprises (n)	Population, enterprises, (N)	Sample ratio, % (n/N)	Wage and salary earners in the sample, Business Register (Tn)	Wage and salary earners in population, Business Register (TN)	Share of wage and salary earners in the sample (%)
Total	2,040	6,814	29.9	598,807	895,262	66.9
B	17	17	100.0	1,792	1,792	100.0
C	435	1,542	28.2	196,975	290,124	67.9
D	27	63	42.9	7,293	9,582	76.1
E	20	20	100.0	1,798	1,798	100.0
F	296	707	41.9	41,448	57,329	72.3
G	221	1,343	16.9	85,865	143,532	59.8
H	178	290	61.4	42,148	51,066	82.5
I	36	259	13.9	13,462	23,462	57.4
J	112	350	32.0	37,887	60,228	62.9
K	143	143	100.0	33,809	33,809	100.0
L	45	93	48.4	2,879	4,580	62.9
M	110	503	21.9	16,666	37,194	44.8
N	150	655	22.9	63,588	88,896	71.5
O	18	18	100.0	8,527	8,527	100.0
P	66	184	35.9	11,574	19,015	60.9
Q	55	335	16.4	14,755	35,714	41.3
R	49	86	57.0	5,807	7,692	75.5
S	62	206	30.1	12,902	20,986	61.5

year 2007. This is due to considerable natural rotation of enterprises, or their closures or mergers of operations. In addition, a few data suppliers have been granted transition times for responding or, for compelling reasons, an exemption from reporting data concerning working hours. Once the inquiry has become established, the significance of rotation will grow.

In the local government sector, simple random sampling without return is also used as a sampling method. The sampling unit is a municipality. As the index was extended to include industries that mainly operate in the public sector, the sample initially in 2008 to 2011 only included the three largest municipalities. In 2011, 17 large municipalities and 20 largest joint municipal authorities were added in the sample. For the 2012 sample, municipalities with fewer than 50,000 inhabitants were drawn for the sample and more larger joint municipal authorities were also included in the sample. Thus the municipal sample has expanded gradually to cover the entire municipal sector. So far, only the data of the 20 largest municipalities and 20 largest joint municipal authorities are used in index calculation.

4.3 Estimation

Before the calculation of final estimation coefficients, the survey frame is stratified again to correspond to the industry and size data at the beginning of the statistical reference year. Some of the enterprises in the sample have contracted during the year preceding the statistical year below the lower limit of the frame. Enterprises not belonging to the frame but having answered to the inquiry are taken to the survey data without a weighting coefficient. The same survey frame, updated to the level at the beginning of the year, is used for estimating all the quarters of the statistical year.

Estimation of the change in labour costs is based on cost and labour input estimates estimated on the industry main group level (=index basic series). The average wage cost per hour worked in stratum h (or $\overline{W}_h$) is defined from the expression

$$\overline{W}_h = \frac{Y_{hi}}{T_{hi}} = \sum_{i=1}^{n_h} y_{hi} \,/\, \sum_{i=1}^{n_h} t_{hi}$$

where

Y_{hi} = total of wages and salaries sum of enterprises i in stratum h,
T_{hi} = total of hours worked in enterprises i in stratum h,
y_{hi} = wages and salaries sum of enterprise i in stratum h,
t_{hi} = sum of hours worked by enterprise i in stratum h,
i = enterprise
h = stratum

The basic data collected with the sample are raised to the industry level with the traditional Horwitz-Thompson estimator. There the estimation coefficient based on the inverse of the sampling probability is defined from the survey frame by strata on the basis of the wages and salaries sum share of the responded enterprises. Estimation is based on the wages and salaries sum of the wage and salary indices of each quarter.

$$k_{hi} = \frac{1}{\frac{\sum_{i=1}^{n_h} p_{hi}}{\sum_{i=1}^{N_h} P_{hi}}}$$

where

p_{hi} = wages and salaries sum in the responded enterprises i in stratum h
P_{hi} = total of wages and salaries sum of enterprises i in stratum h,
i = enterprise,
h = stratum

Specific estimation coefficients are defined for each quarter using the same survey frame corresponding to the situation at the beginning of the year. Enterprises included in the frame that have not responded but have been found to have closed operation or merged during data collection are interpreted as having responded. So-called fading enterprises are regarded as having responded only if their response is included in the data.

5 Calculation of the labour cost index in practice

5.1 Processing of the data

5.1.1 Preliminary control of data

The enterprises selected to the sample provide data on different quarters through an Internet application. For this process written replying instructions are supplied to the enterprises. Basic data concerning the enterprise are pre-filled on the form, but respondents can also update them. The respondent has access to the response values concerning the preceding quarter as well. If the enterprise has had significant activity in several industries, the data are requested separately for each industry unit. The application mainly contains restrictions related to value ranges. In error cases the system notifies of erroneous values. Erroneousness of the data does not, however, prevent them from being submitted.

The basic data collected with the electronic data collection application are pre-checked before entering them in the database. In practice, the preliminary control has two parts: controlled are compulsory data *(numbers of wage and salary earners, definition basis and number of hours, wages and salaries sum subject to withholding tax, tariff of social insurance contributions and statistical period)* as well as the respondent's contact details. Erroneousness of the data does not prevent them from being entered in the production database.

In connection with the preliminary control the return monitoring code is also updated, the alternatives being *deficient, returned or non-responded*. The correction is in practice made either by putting clearly deducible correct data in place of erroneous data or by asking the data supplier for additional information. The data on the respondent's activity are also checked during the preliminary control phase. The changes are entered in the database with the alternatives: *closed, merged, fading (number of wage and salary earners clearly lower than in the frame)*.

5.1.2 Database controls

The aim of the controls made in the database is to ensure that the basic data on labour costs per hour worked/paid reported by data suppliers are truthful and to indicate probably untruthful values for further actions.

When the data collection for an individual enterprise starts, the logicality and level of key basic data (number of wage and salary earners, number of hours worked, wages and salaries sum) are ensured. Controls on enterprises having previously answered to the inquiry are based on the quarterly change in data concerning each enterprise. On data entered in the database controlled are:

- Quarterly change in unit cost calculated per hour worked/paid,
- Change in the definition basis of hours,
- Summation of hourly-paid employees' pay specification, and
- Change in the tariff of social insurance contributions.

The control process relating to the quarterly change of unit cost per hour worked goes as follows:

1. The enterprise's labour cost per hour worked/paid without one-off components is compared with the enterprise's corresponding value in the previous quarter.
2. The comparison group of the enterprise is defined according to the industry stratum defined for the enterprise.
3. Control limits are determined for each comparison group on the basis of the decile distribution relating to the unit change in wage costs. The smallest change is defined as the lower limit for the change in wage costs - the change limit corresponding to the first decile (D10). Correspondingly, the biggest quarterly change is used as the upper limit – the change limit corresponding to the last decile (D90).
4. An observation value remaining within the limits is accepted. Observation values below the lower limit and above the upper limit are marked as outliers and they are printed on the control list.

The list of those printed on the control list (good 20 per cent of all observations) is checked manually by retrieving the data to the correction display of the application. When the data to be controlled are checked the correction display shows the parameters and their quarterly changes calculated from the data of the previous and current quarters. When controlling, use can also be made of a micro level hourly cost report, which shows the long-term development of enterprises' hourly costs.

5.1.3 Imputation of labour input data

The labour cost index measures the change in labour costs calculated per hour worked. With a few exceptions, data suppliers can report the labour input of hourly-paid employees in hours worked. In contrast, over one half of the labour input of monthly-paid employees is given as paid hours – not worked. The imputation application concerning the number of working hours ensures that in addition to the data on empirical hours (hours worked vs. paid), data defined with the regression model on the number of both hours worked and paid hours are always available for each data supplier.

Data on the number of hours worked based on imputation are used when the enterprise has reported labour input in paid hours. Imputed data on the number of hours worked are also used to replace empirical basic data of unsatisfactory quality, which, despite attempts, could not be corrected in the control phase. The share of qualitative changes is under five per cent of the labour input. When available are quarterly data on both the number of the enterprise's paid hours and hours worked, it is also possible to follow the change in paid free-time and its effects on the development of labour costs.

The imputation of the labour input of hourly-paid and monthly-paid employees in manufacturing and in service industry is based on separate models. The model specifications of these regression models (structure and functional form) are very similar **simple log models**. The models are made for groups formed separately on the basis of industry strata in each quarter. The imputation goes as follows:

1. The dependency of reported paid hours is estimated between enterprise-specific features (e.g. for monthly-paid employees in manufacturing: numbers of full-time and part-time employees in the current and previous quarters, number of paid hours in the previous quarter, in the service sector the share of part-time employees). In the models the explanatory variables used are the number of full-time and part-time wage and salary earners (or the relative share of the number of part-time employees) and the square root of the number/share both at the beginning and end of the statistical quarter. The square root transformation of numbers is used as the explanatory variable of paid hours, because the marginal effect on total labour input caused by an increase in labour force is smaller for large enterprises. At first a problem caused by the skewness of basic data made it more difficult to estimate labour input in large enterprises – there were no balanced basic data on large enterprises reporting hours worked and paid hours.
2. Predictions concerning paid hours are calculated both for enterprises reporting hours worked and paid hours using the coefficients of enterprise-specific features estimated in stage 1. The imputation is based on the linear combination of estimated coefficients and for missing data, of enterprise-specific features.
3. Estimated is the dependency of the reported hours worked on the imputed paid hours. In the models the explanatory variable used is the number of paid hours and its square root.
4. Predictions concerning hours worked are calculated both for enterprises reporting hours worked and paid hours using the coefficients of the enterprise-specific features estimated above.

Thus those enterprises that reported the data in paid hours (hours worked) a prediction is made on the number of paid hours (hours worked) and imputed number of hours worked (paid hours) is calculated.

The models are presented in Appendix 2 of this handbook. Public sector data suppliers can report work input as hours worked so no imputations are needed in the local or central government sector.

5.1.4 Finalising the processing of the data

At the concluding stage of data processing the numbers of both hours worked and paid hours are imputed for each respondent (see Section 5.1.3). In manufacturing imputation is made separately for hourly-paid and monthly-paid employees.

At the finalising phase of data processing the processor of the data decides for each respondent left erroneous on the control list, whether to use for labour input a calculated prediction or empirical data on the number of hours worked. Dubious labour input data printed on the control list can be accepted with a code reserved for that purpose. If an acceptance sign is not defined for the enterprise printed on the control list, a prediction is used. The share of these cases is under five per cent.

5.2 Compilation of the labour cost index

The labour cost index is a chain-linked index where industry-specific cost changes are weighted together with the cost weights of the preceding year (or the year before that). In practice, the index is calculated by defining from the sample the average cost of the industry main group calculated per hour worked, by determining its change compared with the base year and by weighting together the industry-specific series with cost weights. The index formula defined in the Regulation concerning the compilation of the index leaves some scope for national applications.

The index calculation process goes as follows:

1. The average cost of the index base year (2008) is defined for each basic series determined by the industry's main group and in manufacturing (C) for each sub-series (see Section 4). The average cost of the basic series (or sub-series) of the base year is the arithmetic mean, i.e. non-weighted, of the average costs for the quarters of the year 2008.
2. For each statistical quarter the arithmetic average cost of the basic series (or sub-series) is defined with the current working hour weights.
3. For each statistical quarter the ratio of the average costs of the basic series to the average cost of the base year is defined and the index figure concerning the quarter in question is determined.
4. The cost change concerning each industry sum (e.g. industries B-S) is calculated in comparison with the index base year by weighting the index relating to each basic series with the value share weight concerning the cost item derived from the previous year. The value share weights are defined from the basic data of the labour cost index, for which reason the value shares of the starting year of data collection, 2007, have to be used for the calculation of the indices relating to the industry sums for both 2007 and 2008.
5. The change in the index relating to the industry sum is defined from the statistical quarter to the last quarter of the previous year. The index figure relating to the industry sum is derived by chaining - that is, by multiplying the point figure of the last quarter of the previous year by the percentage change occurring until the statistical quarter.
6. The calculation of the annual index relating to industry sums advances in a similar way. The calculation of annual means is based on the arithmetic mean of the series, weighted by working hours.

5.3 Adjustments for seasonal variation and working days

When viewing time series describing economic phenomena, we can often see the index series to follow a certain "formula" from one year to the next, as visible in Figure 5A, for example. That is, when drawing annual index series in the same figure, the variations in the series are parallel in identical periods. This annually/quarterly repeated variation is called seasonal variation and there appears similarity in sequences of the length of the basic time unit (month or quarter).

It is customarily thought that a time series is composed of distinct components that cannot be detected separately. From time series describing the development of an economic phenomenon the following four components are commonly distinguished: trend, cyclical, seasonal and residual components.

In addition to the traditional trend, cyclical, seasonal and residual components, calendar variations can be eliminated in economic time series by working day adjustment. In the case of the labour cost index the reason for quarterly changes can be, apart from cost changes, differences in the number of working days, which is particularly influenced by the timing of holidays and placement of weeks in quarters and the effects of public holidays on working days.

In accordance with Eurostat's Regulation, three series must be published on the labour cost index:

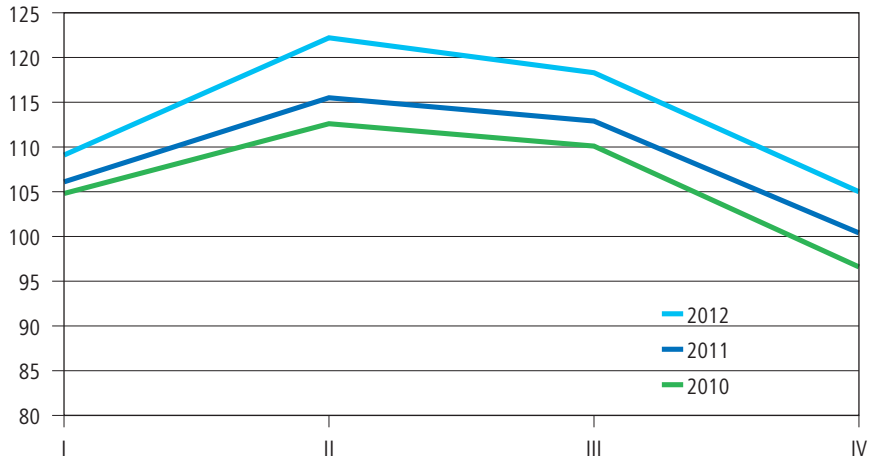
- A raw series, where labour costs are depicted as real,
- A series adjusted for working days, where attention is paid to the variation of working days, and
- A seasonally adjusted series, which takes account of seasonal adjustment, such as the regular effect of the payment time of one-off pay components.

Table 5A.
Number of weekdays and public holidays in 2010–2013

Year	Quarter	Days, No.	Working days, No. [1]	Normal weekday Saturdays, No.	Normal weekday Sundays, No.	Mid-week holidays, No. [2]	Saturday holidays, No.	Sunday holidays, No. [3]
2010	I	90	62	13	13	2	0	0
	II	91	61	11	12	4	2	1
	III	92	66	13	13	0	0	0
	IV	92	64	11	12	2	2	1
2011	I	90	63	12	13	1	1	0
	II	91	61	12	11	4	1	2
	III	92	66	13	13	0	0	0
	IV	92	63	12	12	2	2	1
2012	I	91	64	13	12	1	0	1
	II	91	60	12	12	5	1	1
	III	92	65	13	14	0	0	0
	IV	92	62	12	13	4	1	0
2013	I	90	62	13	11	2	0	2
	II	91	61	12	13	4	1	0
	III	92	66	13	13	0	0	0
	IV	92	62	12	13	4	1	0

[1] Working days are here understood as normal weekdays included in working days from Monday to Friday.
[2] Monday to Friday coinciding with a public holiday. Mid-week holidays are also considered weekdays that are not generally working days, such as Mid summer Eve.
[3] Sundays coinciding with a public holiday, such as Easter Sunday.

Figure 5A.
Labour cost index 2008=100 in the private sector by quarter in 2010–2012



Finland has delivered working day adjusted and seasonally adjusted series of the Labour Cost Index 2008 = 100 to Eurostat since the autumn of 2012 when the time series became long enough to model the variation in the number of working days and seasonal variation. Prior to this, the index was produced only as a so-called raw series. The index series of the municipal sector are not yet seasonally adjusted due to the fact that the series are short and the poor coverage of the sample during the initial years. In the series that are delivered to Eurostat the effect of the local government sector has been estimated based on the index of wage and salary earnings.

The variation in the number of working days can be divided into two parts – the number of actual weekdays and Sundays. Similarly, public holidays may be fixed holidays, whose weekday varies, such as Christmas, or moving holidays, which change the quarter, such as Easter.

As can be seen in Table 5A, the number of ordinary weekdays alone changes from one quarter to the next between 60 and 66. Correspondingly, the number of public holidays varies from zero to seven. These have an effect on labour costs because generally public holidays are also days off, as are Saturdays for most people, when the number of hours worked for monthly-paid

Table 5B.
Labour costs of the example person calculated per quarter, working day and day worked

2012	Working days	Days off	Days worked	Labour cost euro/quarter	euro/working day	euro/day worked
1st quarter	64	0	64	12,000	187.50	187.50
2nd quarter	60	5	55	12,000	200.00	218.18
3rd quarter	65	20	45	14,000	215.38	311.11
4th quarter	62	5	57	12,000	193.55	210.53

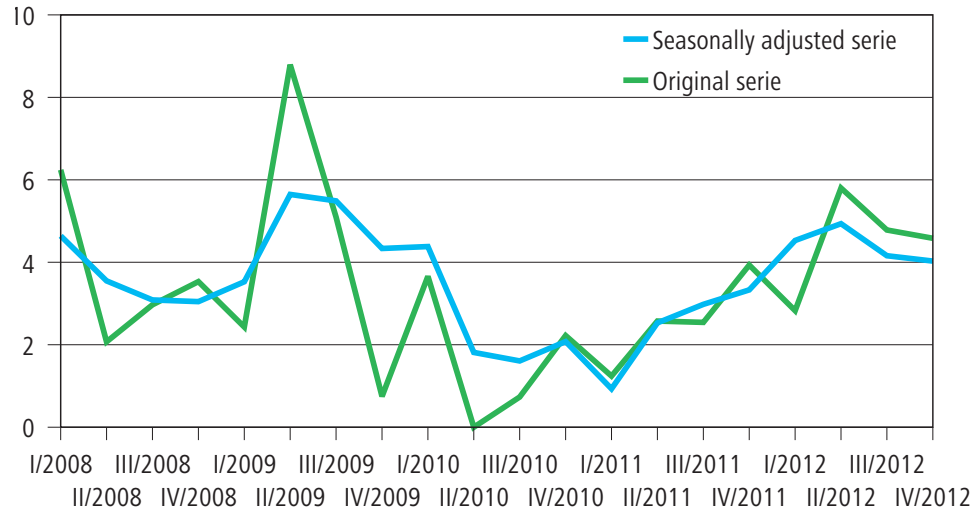
office workers working from Monday to Friday may vary between 435 and 478.5 hours per quarter. Let us assume that the monthly costs of an employee for an enterprise are EUR 4,000, the cost per hour worked then varies from EUR 25.08 to EUR 27.59 if the person has worked 7 hours 15 minutes every day.

Similarly, a large number of public holidays and especially the variation of their number from one quarter to the next and between different quarters of successive years have an effect on labour costs in branches that work in shifts and where shifts are also worked on public holidays. Then the compensations received from public holidays may raise hourly costs. As an example, let us examine the second quarters of 2012 and 2013. In the second quarter of 2012 there were five mid-week holidays and one public holiday on a Saturday and one on a Sunday, while in the second quarter of 2013 there were four mid-week holidays and one public holiday on a Saturday. The number of public holidays alone reduced from seven to five.

At simplest, calendar variations can be explained by the change in the number of weekdays. In the case of the labour cost index differences in the remuneration systems make the situation more complicated, however. For example, the payment practices of compensations during mid-week holidays are different for hourly-paid employees, depending on the collective agreement. According to some agreements the compensation during mid-week holidays is paid in the month on which the holiday falls, in some agreements a uniform compensation is agreed for all months, whether the month has mid-week holidays or not. Then the models must be constructed industry-specifically, as was done for the imputation models for hours worked. For this reason regression models by which a coefficient can be given to each public holiday are generally used.

For the labour cost index seasonal variation is mostly due to the payment periods of holiday bonuses and other one-off pay and bonuses, such as performance-based bonuses, and the timing of holidays. In the second and third quar-

5B.
Year-on-year change in labour costs in the private sector from the respective quarter of previous year %, original and seasonally adjusted series in 2008–2012



ters labour costs are usually higher per hour worked than in the first and fourth quarters, because of the reasons just mentioned above (see Figure 5A).

Let us examine the labour costs of our example person in 2012, the monthly cost for the employer being EUR 4,000. We assume that the person's holiday entitlement is six weeks, of which he/she takes one week in April (2nd quarter), four weeks in July (3rd quarter) and one week in December (4th quarter). In addition, holiday bonus is paid to him/her in July, the cost from which for the employer is assumed to be EUR 2,000. Table 5B shows that the person's labour costs per day worked vary considerably more than the costs calculated per working day.

Variation in the effective date of contractual pay increases and their payment makes it difficult to adjust for seasonal variation in the time series. Taking this into account requires information about the effect of industry-specific pay increases on the wages and salaries sum and their possible payment schedule. Collectively bargained pay increases are not taken into consideration in the seasonal adjustment of the labour cost index.

For removing the effects of seasonal variation use is made of the TRAMO/SEATS method recommended by Eurostat. The method recommended by Eurostat improves the quality of seasonally adjusted data and international comparability.

Figure 5B shows the annual change percentages for both the raw series (original series) and the seasonally adjusted series for 2008 to 2012. For example, the annual change of the raw series in the second quarter of 2009 was high partially due to the fact that there were three fewer working days than in the corresponding period in 2008. The annual change of the seasonally adjusted index is clearly smaller during the same time period.

6 Old indices and other information service

The labour cost index is produced in compliance with the EU's concepts and classifications. The concepts defined in the EU Regulation have been used since 1996. However, the revisions of the statistics production method and of the Standard Industrial Classification from 2007 make it more difficult to compare these statistics with earlier ones.

Eurostat publishes the labour cost index quarterly on its Internet pages. Unlike the national labour cost index, Eurostat publishes data by industry without sector division. Differences between countries in the statistics compilation method may influence the comparability of the indices on different countries.

The labour cost index is published on Statistics Finland's free Internet pages. More detailed results on changes in labour costs are released yearly in the summary publication Wages, salaries and labour costs.

7 Uses and application of the labour cost index

7.1 What is the labour cost index used for

The labour cost index measures the change in labour costs calculated per hour worked within a certain industry. The change in average labour costs is affected by such as:

- Contractual pay increase of earnings and the wage drift,
- Structural change in labour force,
- Changes in use of labour force (e.g. overtime work, holidays, temporary lay-offs, mid-week holidays),
- One-off pay components, e.g. performance-based bonuses,
- Change in social insurance tariffs.

Cost-type specific sub-indices published from the index enhance the possibilities to analyse the reasons for the cost change. Changes in cost factors are also examined in the annual publication of the statistics on wages and salaries and labour costs released every year.

On the level of the national economy the labour cost index can be used when comparing the cost development calculated per hour worked with changes in productivity. As it covers the whole European Union, the index allows comparisons of Finland's cost development with its rival countries. Seasonal adjustment of the index improves international comparability of cost changes.

On the level of enterprises the labour cost index makes it possible to compare one's cost development with enterprises in the same industry both in Finland and in the EU area.

The official index of wage and salary earnings is often better suited for price updates of delivery contracts than the current labour cost index. The seasonally adjusted and working-day adjusted index improves the suitability of the labour cost index for delivery contracts. Due to the shortness of the time series and seasonal adjustment methods, seasonally adjusted time series may become revised quite much due to new observations. This should be considered when using the data.

7.2 Connections to other statistics describing labour costs

The index of wage and salary earnings published by Statistics Finland measures the change in earnings received from regular working hours. It is based on the statistics on wages and salaries concerning mainly the last quarter of the year. The change in the index of wage and salary earnings and the labour cost index may differ, for example, because of the more exhaustive cost concept of the labour cost index, changes in use of working hours, different calculation methods of indices and varying recording practices for extraordinary or one-off cost components.

The labour cost survey and the labour cost index are based on the same concepts and methods. Since the year 2008, the labour cost index and the labour cost survey are coordinated so that the sample of the index forms the majority of the sample for the labour cost survey. However, there are methodological and conceptual differences in the compilation of statistics describing structure and change, with an impact on the results. The labour cost statistics cover enterprises employing at least ten wage and salary earners – the index those with at least 20–30 employees.

Of the cost items of the labour cost statistics shown in Table 3A, the continuous cost monitoring of the index does not cover categories D2 (vocational training costs), D3 (other expenditure paid by the employer, e.g. occupational health care) and D5 (subsidies received by the employer).

The labour cost index measures the change in the wages and salaries sum calculated per hour worked and the change in social costs. For that reason the index of wage costs can be notionally formed by dividing the change in the wages and salaries sum by the change in the number of hours worked. The wage and salary indices describes the change in the wages and salaries sum paid using the administrative periodic tax return data of enterprises as basic data. The wage and salary concept described in the statistics does not cover cash expenses incurred by the employer from incentive stock options – unlike the labour cost index.

8 Calculation examples on the use of the index

8.1 Calculating change in cost per hour worked

Changes in cost per hour worked are usually reported in percentages. If you want to know how much the cost per hour worked has risen from 2007 to 2008, when the labour cost index 2008 = 100 is 96.7 in 2007 and 100.0 in 2008, the percentage change is calculated as follows:

$$\frac{I_{2008} - I_{2007}}{I_{2007}} * 100 \text{ , i.e.}$$

$$\frac{100.0 - 96.7}{96.7} * 100 = 3.4.$$

The cost per hour worked has thus gone up by 3.4 per cent.

8.2 Calculating change in cost per hour worked by indices with two different base years

When the base year of the index is changed, there may be situations where the only tools available for calculating the development of cost per hour worked from the start of a specific period are an index calculated with the old base year and an index calculated from the end-point onwards with the new base year. In this situation it will be necessary to have some fixed time-point for which both the new and old indices are available. For instance, if it is known that for the base year X the labour cost index is $I_Z^{X=100}$ in the year Z and $I_Y^{X=100}$ in the year Y and for the base year Y the corresponding index is $I_W^{Y=100}$ in the year W and $I_Y^{Y=100}$ in the year Y, the change in cost per hour worked from the year Z to W can be calculated as follows:

$$((\frac{I_Y^{X=100}}{I_Z^{X=100}} * \frac{I_W^{Y=100}}{I_Y^{Y=100}}) - 1) * 100.$$

8.3 Changing index base year

If the development of cost per hour worked is examined repeatedly on the basis of a certain agreement, for instance, it may be useful to change the point figure that is based on an old index into a point figure that is based on a new base year. In this instance the index point figures based on the new index can be used as they stand and they do not need to be separately chained to comply with the original index. Using the point figures given in the example above, the new index for the base period may be calculated as follows:

$$I_Z^{Y=100} = \frac{I_Y^{Y=100}}{I_Y^{X=100}} * I_Z^{X=100}.$$

The development of cost per hour worked can now be calculated directly with the point figures based on the new index:

$$\frac{I_W^{Y=100} - I_Z^{Y=100}}{I_Z^{Y=100}} * 100.$$

8.4 Calculating own index

In some cases the services or products offered by an enterprise involve production from two or more industries. Let us assume, for instance, that 75 per cent of the labour input invested in metal construction consists of metal products manufacturing and 25 per cent of house construction. The corresponding indices 2008 = 100 for the year 2007 are 98.6 (metal industry) and 93.6 (construction). In this case these indices can be weighted together as follows:

$w_1 * I_1 + w_2 * I_2$ eli

$0.75 * 98.6 + 0.25 * 93.6 = 97.35$

Corresponding indices can also be constructed by combining the labour cost indices and producer price indices, for instance, allowing changes in labour costs and in the prices of materials used by enterprises to be combined. Then it is important to make sure that the indices have the same base year.

9 Publication of the labour cost index

The data on the labour cost index are published four times a year on Statistics Finland's Internet pages at: http://tilastokeskus.fi/til/tvki/index_en.html. The data are published about 70 days from the end of the quarter. The data of the index are released as preliminary and new indices can be revised, if needed.

In addition to the actual statistical release, the statistics homepage contains database tables and descriptions of the used concepts and classifications relating to labour costs. The joint publication Wages, salaries and labour costs published once a year provides more extensive information on the labour cost index data than the statistical release.

Appendix 1 Series of the labour cost index (different categories)

Basic serie

B	Mining and quarrying (05–09)
C	Manufacturing (10–33)
D	Electricity, gas, steam and air conditioning supply (35)
E	Water supply; sewerage; waste management and remediation activities (36–39)
F	Construction (41–43)
G	Wholesale and retail trade; repair of motor vehicles and motorcycles (45–47)
H	Tranportation and storage (49–53)
I	Accomodation and food service activities (55–56)
J	Information and communication (58–63)
K	Financial and insurance activities (64–66)
L	Real estate activities (68)
M	Professional, scientific and technical activities (69–75)
N	Administrative and support service activities (77–82)
O	Public administration and defense; compulsory social security (84)
P	Education (85)
Q	Human health and social work activities (86–88)
R	Arts, entertainment and recreation (90–93)
S	Other service activities (94–96)

Aggregates of economical activities

B_E	Economical activities B–E
B_F	Economical activities B–F
B_N	Economical activities B–N
B_S	Economical activities B–S / Total, private sector
D_S	Economical activities D-S / Total, local government sector
G_J	Economical activities G–J
G_N	Economical activities G–N
J_R	Economical activities J–R / Total, state sector
K_N	Economical activities K–N
O_S	Economical activities O–S
P_S	Economical activities P–S

Auxiliary series of industry

C1	Manufacture of food, beverages and tobacco products (10–12)
C2	Manufacture of textiles, wearing apparel and leather etc. products (13–15)
C3C4	Forest industry (16,17)
C5	Chemical industry (19–22)
C6C7	Metal industry (24–30)
C8	Manufacture of furniture, other manufacturing, repair and install of machinery and equipments (31–33)

Appendix 2 Imputation models of labour input

The imputation model of paid working time for monthly-paid employees in manufacturing (Model 1)

$$\log(q_{it}^{p}) = a_j + b_1 \log(x_{it1}) + b_2\sqrt{\log(x_{it1})} + b_3 \log(x_{it2}) + b_4 \sqrt{\log(x_{it2})} + b_5 \log(x_{i,t-1,1}) + b_6 \log(x_{i,t-1,2}) + b_7 \log(q_{it-1}^{p}) + e_{ij}$$

where

$\log(q_{it}^{p})$ is *logarithmic paid working time* at present in enterprise *i*,
$\log(x_{it1})$ is *the logarithmic number of full-time employees* at present in enterprise *i*,
$\log(x_{it2})$ is *the logarithmic number of part-time employees* at present in enterprise *i*,
$\log(x_{i,t-1,1})$ is *the number of full-time employees delayed* by one period in enterprise *i*,
$\log(x_{i,t-1,2})$ is *the number of part-time employees delayed* by one period in enterprise *i*,
a_j is the standardised stratum effect and
e_{ij} is the residual term of the model.

The imputation model of worked hours for monthly-paid employees in manufacturing (Model 2)

$$\log(q_{it}^{T}) = a_j + b_1 \log(q_{it}^{p}) + e_{ij} + b_2 \sqrt{\log(q_{it}^{p})} + b_3 \log(q_{i,t-1}^{p}) + e_{it}$$

where

$\log(q_{it}^{T})$ is *logarithmic working time worked* at present in enterprise *i*,
$\log(q_{it}^{p})$ is *logarithmic paid hours imputed with model (1)* at present in enterprise *i*,
a_j is the standardised stratum effect.
e_{ij} and e_{it} are the residual terms of the model.

The imputation model of paid working time for full-time and part-time employees in services (Model 3)

$$\log(q_{it}^{p}) = a_j + b_1 \log(x_{it1}) + b_2\sqrt{\log(x_{it1})} + b_3 \log(x_{it3}) + b_4 \log(x_{it4}) + b_5\sqrt{\log(x_{it4})} + e_{ij}$$

where

$\log(q_{it}^{p})$ is *logarithmic paid working time* at present in enterprise *i*,
$\log(x_{it1})$ is *the logarithmic number of employees* at present in enterprise *i*,
$\log(x_{it3})$ is *the relative share of part-time employees of all employees* in the enterprise *i*,
$\log(x_{it4})$ is *the logarithmic number of employees* in the previous period in enterprise *i*,
a_j is the standardised stratum effect and
e_{ij} is the residual term of the model.

The imputation model of worked hours for full-time and part-time employees in services (Model 4)

$$\log(q_{it}^{T}) = a_j + b_1 \log(x_{it1}) + b_2 \sqrt{\log(x_{it1})} + b_3 \log(x_{it2}) + b_4 \sqrt{\log(x_{it2})} + b_5 \log(x_{it3}) + b_6 \sqrt{\log(x_{it3})} + e_{ij}$$

where

$\log(q_{it}^{T})$ is *logarithmic working time* worked in enterprise *i*,
$\log(x_{it1}) = \log(q_{it}^{p})$ is *logarithmic paid hours imputed with model (3)*,
$\log(x_{it2})$ is *the logarithmic number of employees* at present in enterprise *i*,
$\log(x_{it3})$ is *the relative share of part-time employees of all employees* in the enterprise *i*,
a_j is the standardised stratum effect and
e_{ij} is the residual term of the model.

The imputation model of paid working time for hourly-paid employees in manufacturing (Model 5)

$$\log(q_{it}^{p}) = a_j + b_1 \log(x_{it1}) + b_2 \sqrt{\log(x_{it1})} + b_3 \log(x_{it2}) + b_4 \sqrt{\log(x_{it2})} + b_5 \log(x_{it3}) + b_6 \sqrt{\log(x_{it3})} + b_7 (x_{it2}/x_{it1}) + b_8 \log(ett\_ansio) + b_9 \sqrt{ett\_ansio} + e_{ij}$$

where

$\log(q_{it}^{P})$ is *logarithmic paid working time* at present in enterprise *i*,
$\log(x_{it1})$ is *the interpolated logarithmic number of full-time and part-time employees* between two successive quarters in enterprise *i*,
$\log(x_{it2})$ is *the interpolated logarithmic number of part-time employees* between two successive quarters in enterprise *i*,

$\log(x_{it3})$ is *the logarithmic overtime pay premium* in enterprise *i*,
x_{it2}/x_{it1} is the relative share of part-time employees of all employees (interpolated numbers between two successive quarters) in enterprise *i* and
$\log(ett\_ansio)$ is logarithmic earnings for hours not worked,
a_j is the standardised stratum effect and
e_{ij} is the residual term of the model.

The imputation model of working time worked for hourly-paid employees in manufacturing (Model 6)

$$\log(q_{it}^T) = a_j + b_1 \log(q_{it}^p) + e_{ij} + b_2 \sqrt{\log(q_{it}^p)} + b_3 \left(x_{it2} / x_{it1} \right) + b_4 \log(x_{it3}) + b_5 \sqrt{\log(x_{it3})} + e_{it}$$

where
$\log(q_{it}^T)$ is *logarithmic working time worked* at present in enterprise *i*,
$\log(q_{it}^p)$ is *logarithmic paid hours imputed with model 5* at present in enterprise *i*,
x_{it2}/x_{it1} is *the relative share of part-time employees of all employees* (interpolated numbers between two successive quarters) in enterprise *i*,
$\log(x_{it3})$ is *the logarithmic overtime pay premium* in enterprise *i* ,
a_j is the standardised stratum effect and
e_{ij} and e_{it} are the residual terms of the model.

Appendix 3 Inquiry forms in manufacturing, services, education and public sector

Statistics Finland

LABOUR COST INDEX IN THE PRIVATE SECTOR
MANUFACTURING

	Payment periods ending during the quarter			
	Hourly-paid		Monthly-paid	
Statistical period (ddmmyyyy)	start date	end date	start date	end date

1. Paid employment relationships at end of period		
1a. Full-time employees		
1b. Part-time employees		
2. Working hours (in full hours)		
2a. Definition of working hours Tick the definition basis used for the monthly-paid		☐ Worked ☐ Paid
2b. Number of hours		
3. Wages and salaries (in euros)		
3a. Wages and salaries subject to preliminary withholding tax in total, of which		
3b. Monetary pay for hours worked, of which		
3c. Pay premiums for overtime and Sunday work		
3d. Wages and salaries paid for hours not worked		
3e. Pay for extra and overtime work		
3f. Performance-based bonuses		
3g. Other extraordinary or one-off pay (e.g. holiday bonus)		
4. Tariff of social insurance contributions of wages and salaries sum, %, with two decimals		

Notes:

Statistics Finland

LABOUR COST INDEX IN THE PRIVATE SECTOR SERVICES

	Payment periods ending during the quarter	
Statistical period (ddmmyyyy)	start date	end date
	In total	, of which part-time employees
1. Paid employment relationships at end of period		
2. Working hours (in full hours)		
2a. Definition of working hours Tick the definition basis used for the monthly-paid	☐ Worked ☐ Paid	☐ Worked ☐ Paid
2b. Number of hours		
3. Wages and salaries (in euros)		
3a. Wages and salaries subject to preliminary withholding tax in total, of which		
3b. Pay for extra and overtime work		
3c. Performance-based bonuses		
3d. Other extraordinary or one-off pay (e.g. holiday bonus)		
4. Tariff of social insurance contributions of wages and salaries sum, %, with two decimals		

Notes

Appendix 3 Continued

Statistics Finland

LABOUR COST INDEX
EDUCATION

	Payment periods ending during the quarter		
Statistical period (ddmmyyyy)	start date	end date	
	Personnel following compulsory teaching time Full-time	Part-time	Other personnel (e.g. headmasters study-advisers)
1. Number of wage and salary earners at end of statistical period			
2. Working hours			
2a. Teaching hours held on which remuneration is based, total			
2b. of which club and remedial instruction hours			
2c. Other than teaching hours (incl. hours during planning and training according to collective bargaining agreement)			
2d. Paid sickness leaves (incl. those on partial wages)			
2e. Hours worked			
3. Wages and salaries (in euros)			
3a. Wages and salaries subject to preliminary withholding tax in total, of which			
3b. Ordinary wages and salaries			
3c. One-off hourly fees			
3d. Performance-based bonuses			
3e. Other extraordinary or one-off pay			
4. Tariff of social insurance contributions of wages and salaries sum, %, with two decimals			

Notes

Appendix 3 Continued

Statistics Finland

LABOUR COST INDEX IN THE PUBLIC SECTOR

Payment periods ending during the quarter

Statistical period (ddmmyyyy)

Start date | End date

	Full-time monthly-paid employees	Part-time monthly-paid employees	Hourly-paid employees
1. Number of paid employment relationships at the end of statistical period			
2. Number of hours (in full hours)			
2a. Total number of hours paid, from which			
2b. extra and overtime hours			
2c. paid absences			
2d.from which hours of sickness leave and family leave			
2e. Worked hours			
3. Wages and salaries (in euros)			
3a. Wages and salaries subject to preliminary withholding tax in total, of which			
3b. Ordinary wages and salaries			
3c. Pay for extra and overtime work			
3d. Performance-based bonuses			
3e. Other extraordinary or one-off pay (e.g. holiday bonus)			
4. Tariff of social insurance contributions of wages and salaries sum, %, with two decimals			

Notes

Appendix 4 Realised sample in 2007–2012

		2007	2008	2009	2010	2011	2012
B	Mining and quarrying	17	24	25	29	32	31
C	Manufacturing	440	579	640	678	690	735
D	Electricity, gas, steam and air conditioning supply	27	27	27	33	36	36
E	Water supply; severage; waste management and remediation activities	20	20	33	42	44	44
F	Construction	298	300	355	378	387	383
G	Wholesale and retail trade; repair of motor vehicles and motorcycles	224	235	247	252	256	256
H	Transportation and storage	178	190	212	219	236	234
I	Accommodation and food service activities	36	45	48	49	57	57
J	Information and communication	112	135	145	150	158	156
K	Financial and insurance activities	142	142	161	180	200	186
L	Real estate activities	45	55	65	69	73	72
M	Professional, scientific and technical activities	110	124	138	146	160	167
N	Administrative and support service activities	151	168	185	201	219	227
O	Public administration and defense; compulsory social security	18	19	22	22	24	24
P	Education	66	68	87	80	87	86
Q	Human health and social work activities	55	67	67	67	80	78
R	Arts, entertainment and recreation	49	49	53	53	63	63
S	Other service activities	59	65	70	70	77	73

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