

CES Youth Labor Market Index

Technical Report

Report

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Table of Contents

Table of Contents	3
List of Tables	4
Executive Summary	5
1 Introduction	6
2 Detailed description of the CES Youth Labor Market Index	7
2.1 Summary of Dimensions and Indicators	7
2.2 Summary of data sources	10
2.2.1 Data update to improve indicator <i>vulnerable employment rate</i>	11
2.2.2 Countries and country groups with data for the CES YLMI	11
2.2.3 Number countries and groups with data	12
2.3 Calculation of the index	12
2.3.1 Scores	13
2.3.2 Setting upper and lower bounds of raw data for indicators	14
2.3.3 Rankings	14
2.3.4 The CES Youth Labor Market Index	14
3 New features of the CES YLMI	16
3.1 Updating of data through APIs	16
3.2 New Web Tool for the CES Youth Labor Market Index	16
4 Conclusion and limitations	19
5 References	20
6 Appendix	21
Author Information	28

List of Tables

- Table 1: Summary of dimensions and indicators of the CES YLMI 8
- Table 2: Data availability by indicator 10
- Table 3: Description of country groups and availability of data for index 11
- Table 4: Number countries with data 12
- Table 5: Weights by category and indicator 15
- Table 6: Detailed Information on Data Sources by Indicator 21
- Table 7: Number of countries and country names by group 24
- Table 8: Number countries by group and indicator with non-missing data in 2019 27

Executive Summary

This technical report introduces the new features of the CES Youth Labor Market Index (CES YLMI) (formerly KOF YLMI). The CES YLMI is a composite index that attempts to quantify the labor market situation of young people aged 15-24 worldwide in a multidimensional manner, based on twelve indicators grouped into four dimensions. Vis-à-vis its former version, the CES YLMI offers a larger database, better technology to update data, and a more flexible web tool for visualizing, analyzing, and downloading data. In this report, we summarize the different dimensions and indicators of the index, share details on data sources, and explain how the index is calculated. In addition, we highlight the two main innovations of the CES YLMI: the updating of data through APIs and a new web tool to access data.

1 Introduction

Youth are one of the most vulnerable groups in the labor market. From 2009-2019, youth unemployment globally was about 14-15 percent compared to 6-7 percent for the entire working age population (World Bank, 2021). During the current COVID-19 pandemic, youth employment fell globally by 8.7 percent from 2019 to 2020 compared to 3.7 percent for adults (ILO, 2021).

However, unemployment and employment rates often do not adequately describe the labor market situation of youth (e.g. Dewan and Peek, 2007), especially not in developing countries, where factors like underemployment and quality of employment—especially in the informal sector—play a much larger role (e.g. Sylla, 2013)¹. For example, during the current COVID-19 pandemic, much of the decrease in youth employment translated into an increased inactivity rate rather than increased unemployment (ILO, 2021).

In recent years, more and more organizations have provided either indicator sets or composite indices monitoring the youth labor market situation in a multidimensional way—based on several indicators across countries and time². Examples of tools based on indicator sets include a project by the International Labour Organization (ILO) providing a set of eight indicators (Puerto et al., 2011). Another is the Scoreboard for Youth Aged 15 to 24 from the OECD (2010), which comprises ten indicators. Both provide data for their indicators in scoreboards, allowing users to make comparisons across countries and time.

In contrast to tools based on indicator sets, composite indices facilitate comparison by summarizing several indicators into a single measure. Examples of composite indices include the KOF Youth Labor Market Index (KOF YLMI) (Renold et al., 2014) and the Labor Market Index for Lower-Income Countries (YLILI) (Kudrzycki et al., 2020)³. While the KOF YLMI is based on 12 youth labor market indicators and data is mostly available for developed countries, the YLILI is based on 10 indicators chosen specifically to measure youth labor market conditions in developing countries, especially informal labor markets.

The composite index described in this report is the CES Youth Labor Market Index (CES YLMI; formerly KOF Youth Labor Market Index) (Renold et al, 2014). The CES YLMI is hosted by the CES Chair of Education Systems, which is dedicated to the improvement of education and training systems worldwide. Apart from its re-branding, the CES YLMI adds several new features. First, the raw data for calculating the CES YLMI is taken directly from the statistical offices' servers via application programming interfaces (APIs). This makes updating of raw data faster and less time consuming. Second, a new web tool for visualization and data access allows users to interact with the CES YLMI in multiple ways and to download the data in various file formats.

This technical report has two main purposes. First, it describes the CES YLMI in detail in the second chapter. This includes a brief summary of its dimensions and indicators, a summary of data sources for this first release, and a section about index calculation. Second, the report presents the main two new features of the CES YLMI in the third chapter.

¹ Underemployment refers to persons working but not at their full capability.

² Also a growing body of the literature try to characterize the youth situation based on multiple indicators. Examples include Ryan (2001) and Biavaschi et al. (2012) who report a set of indicators specific for the youth labor market, while Dewan & Peek (2007) focus on various aspects not previously considered, mostly related to economic conditions.

³ Find the web tool for the YLILI under: <https://nadel.shinyapps.io/yliili/>.

2 Detailed description of the CES Youth Labor Market Index

The CES Youth Labor Market Index (CES YLMI) quantifies the labor market situation of youth aged 15-24 worldwide. The CES YLMI attempts to assess the labor market situation of young people in a multi-dimensional manner, based on twelve indicators grouped into four dimensions. The age interval from 15 to 24 years was chosen for almost all twelve indicators as it is most often used by the international organizations providing the raw data (like ILO, OECD and Eurostat).⁴ This age range may not be optimal because some people might still be in education after age 24, but the advantages of a broader dataset predominate. In the following, we summarize the dimensions and indicators of the CES YLMI briefly. Table 1 provides a compact overview of this summary.

2.1 Summary of dimensions and indicators

The first dimension of the CES YLMI, **Activity State**, does not follow the oft-used standard definition of the International Labor Organization (ILO) to describe the employment situation of youth (ILO, 1982). According to this definition, youth are either employed, meaning in paid employment or self-employment, unemployed, defined as being without work but currently available and seeking for work, or economically inactive, implying neither employed nor unemployed (i.e. out of the labor force). Instead, the CES YLMI uses three different indicators. First, the youth unemployment rate for people aged 15 to 24. Second, the relaxed unemployment rate, which relates the number of unemployed and discouraged youth to the youth labor force (i.e. employed and unemployed). Discouraged workers are classified as inactive as they do not have a job, are available but are not actively seeking for work, perhaps due to bad experiences in previous job searches. By dividing the sum of unemployed and discouraged youth by the total youth in the labor force, the relaxed unemployment rate provides a better picture of the actual rate of youth having no job but wanting one. Third, the rate of youth not in education, employment or training (NEET rate) is the sum of unemployed and inactive youth (e.g. not employed or actively seeking for work) who are not in education or training. Hence, the NEET rate is a more precise measure of the number potential youth labor market entrants than something like the unemployment rate as it just considers those currently available for work.

The second dimension, **Working Conditions**, focuses on the quality of working situations among employed youth. It comprises five indicators. First, the temporary worker rate, which relates the number of youth with a temporary contract (duration <18 months) to the total number of employed youth. This indicator shows the share of youth having to face unstable job relations. Second, the involuntary part-time workers rate, which sets the amount of youth working part-time and wanting to work more but not being able to do so in relation to all employed youth. It quantifies the share of underemployed youth, who may face tight income situations. Third, the atypical working hours rate quantifies the average share of youth working during atypical times, such as at night, in shifts, or on Sundays. It provides insight into how many youth work under such conditions. Fourth, the in work at risk of poverty rate quantifies how many youth earn less than 60% of the national median equalized disposable income, or those that lack

⁴With the exception of indicator number 10, the skills mismatch rate, which refers to youth ages 15-29 and indicator number 12, the relative unemployment ratio, which relates the unemployment rate of youth aged 15-24 to those of adults aged 25 and above.

a job that ensures a decent living. Fifth, the vulnerable employment rate sets the number of youth who are self-employed or contributing family workers in relation to all employed youth. It quantifies the share of youth working in less protected jobs in terms of labor rights, social protection, and health insurance.

The third dimension, **Education**, characterizes the education situation of youth based on two indicators. First, the formal education and training rate relates the amount of youth enrolled in education and training provided by formal institutions like schools, colleges, and universities to the total youth population. Acquiring formal education and training may improve the labor market situation of youth. Second, the skills mismatch rate quantifies discrepancies between the supply and demand of skills in the labor market. It does so by relating the share of unemployed youth with a given education level to the share of employed youth with the same education level. This indicator is calculated for youth aged 15-29.

The last dimension, **Transition Smoothness**, characterizes the transition from education into the labor market and associated difficulties youth face based on two indicators. First, the relative unemployment ratio relates the unemployment rate of youth (aged 15-24) to that of adults (aged 25+). Second, the incidence of long-term unemployment rate relates the number of youth that are unemployed for more than one year to the total number of unemployed youth.

Table 1: Summary of dimensions and indicators of the CES YLMI

No	Indicator	Formula
Activity State: Describes the employment situation of youth.		
1	Youth Unemployment Rate: youth (aged 15-24) being without work, but currently available and seeking for work.	$\text{Unemployment Rate} = \frac{\text{Unemployed}}{\text{Labour Force}} * 100$
2	Relaxed Unemployment Rate: relates the number of unemployed and discouraged youth (aged 15-24) to the labor force (i.e. employed and unemployed). Discouraged workers are classified as inactive as they do not have a job, are available but are not actively seeking for work, e.g. due to bad experiences in previous job searches. It provides a better picture of the actual amount of youth having no job but wanting one.	$\text{Relaxed Unemployment Rate} = \frac{\text{Unemployed} + \text{Discouraged Workers}}{\text{Labour Force}} * 100$
3	NEET Rate (neither in employment nor in education): sum of unemployed and inactive youth (e.g. not employed or actively seeking for work; aged 15-24) who are not in education or training. A more precise measure of the number of potential youth labor market entrants than e.g. the unemployment rate, as it just considers those currently available for work.	$\text{NEET Rate} = \frac{\text{Youth n. Employment n. Education and Training}}{\text{Young Population}} * 100$
Working Conditions: Focuses on the quality of working relations of employed youth.		
4	Temporary Contract Worker Rate: relates the number of youth (aged 15-24) with a temporary contract (with a duration < 18 months) to the total number of employed youth. This indicator shows the share of youth having to face unstable job relations.	$\text{Temporary Contract Workers Rate} = \frac{\text{Workers with a contract <18 m}}{\text{Total number of employees}} * 100$

5	<p>Involuntary Part-Time Worker Rate: sets the amount of youth working part-time and wanting to work more but not being able to do so in relation to all employed youth. It quantifies the share of underemployed youth, who often have to face tight income situations</p>	<p>Involuntary Part – Time Workers Rate $= \frac{\text{Involuntary part – time employment}}{\text{Total employment}} * 100$</p>
6	<p>Atypical Working Hours Rate: quantifies the average share of youth (aged 15-24) working during atypical times, such as at night, in shifts, or on Sundays. It provides insights on how many youth work under such atypical conditions</p>	<p>A. W. H. Rate = $\left(\frac{\text{Working on Sunday}}{\text{Tot. employees}} + \frac{\text{Working at night}}{\text{Tot. employees}} + \frac{\text{Working Shift}}{\text{Tot. employees}} \right) * \frac{1}{3} * 100$</p>
7	<p>In Work at Risk of Poverty Rate: quantifying how many youth (aged 15-24) earn less than 60% of the national median equalized disposable income, i.e. do not have a job that ensures earning enough for a decent living.</p>	<p>In work at Risk of Poverty Rate $= \left(\frac{\text{In work at risk of poverty employees}}{\text{Total number of employees}} \right) * 100$</p>
8	<p>Vulnerable Employment Rate: sets the number of youth (aged 15-24) working as own-account (self-employed) or contributing family workers in relation to all employed youth. It quantifies the share of youth working in less protected jobs in terms of labor rights, social protection and health insurance.</p>	<p>Vulnerable Employment Rate $= \frac{\text{Own account workers} + \text{Unpaid family workers}}{\text{Total Employment}} * 100$</p>
<p>Education: characterizes the education situation of youth.</p>		
9	<p>Formal Education and Training Rate: relates the amount of youth (aged 15-24) enrolled in education and training provided by formal institutions, such as schools, colleges and universities to the total youth population. Acquiring formal education and training may improve the labor market situation of youth.</p>	<p>Formal Education and Training Rate $= \frac{\text{Youth in formal education \& training}}{\text{Young Population}} * 100$</p>
10	<p>Skills Mismatch Rate: quantifies discrepancies between supply and demand of skills in the labor market. It does so by relating the share of unemployed youth (aged 15-29) with a given education level to the share of employed youth with the same education level.</p>	<p>Skills Missm. Rate = $\frac{1}{2}$ $* \sum_{k=1}^3 \left \left(\frac{\text{Employed with edu. } k}{\text{Total employment}} - \frac{\text{Unemployed with edu. } k}{\text{Total unemployed}} \right) \right$</p>
<p>Transition Smoothness: characterizes the transition from education into the labor market and associated difficulties youth face.</p>		
11	<p>Relative Unemployment Ratio: relates the unemployment rate of youth (aged 15-24) to that of adults (aged 25+).</p>	<p>Relative Unemployment Rate $= \frac{\text{Young unemployment rate (15 – 24)}}{\text{Adult unemployment rate (25 +)}}$</p>
12	<p>Long-Term Unemployment Rate: relates the number of youth (aged 15-24) that are unemployed for more than one year to the total number of unemployed youth.</p>	<p>Incidence of Long – Term Unemployment $= \frac{\text{Unemployed longer than one year}}{\text{Total unemployed}} * 100$</p>

2.2 Summary of data sources

The international organizations and statistical offices providing the raw data for the CES YLMI remain the same as in previous releases of the KOF YLMI. As summarized by Table 2, data sources for the first release of the CES YLMI are the ILO, Eurostat, OECD, and Swiss Federal Statistical Office (SFSO).

The data series used to calculate the CES YLMI are restricted to people aged 15-24, with the exception of the indicator *relative unemployment ratio*, for which we set the unemployment rate for youth (aged 15-24) in relation to that of adults (aged 25 and above) and the indicator *skills mismatch rate*, for which we use data for youth aged 15-29.

Table 2: Data availability by indicator

Indicator	Sources	Countries covered in at least one year*	Years covered
1. Unemployment Rate	ILO	181	1991-most recent
2. Relaxed Unemployment Rate	Eurostat	35	2005-most recent
3. NEET Rate	ILO & Eurostat	181	2000-most recent
4. Temporary Worker Rate	Eurostat	35	1992-most recent
5. Involuntary Part-Time Workers Rate	OECD & Swiss Federal Statistical Office (SFSO)	42	1991-most recent
6. Atypical Working Hours Rate	Eurostat	35	1992-most recent
7. In-Work at-Risk-of-Poverty Rate	Eurostat	36	2003-most recent
8. Vulnerable Employment Rate	ILO	181	1991-most recent
9. Formal Education and Training Rate	Eurostat & Swiss Federal Statistical Office (SFSO)	35	1996-most recent
10. Skills Mismatch Rate	Eurostat	60	1992-most recent
11. Relative Unemployment Ratio	ILO	181	1991-most recent
12. Incidence of Long-Term Unemployment Rate	ILO	148	1991-most recent

*as of January 2022

Depending on the data source, the number of countries with available data as of January 2022 ranges from 35 to 181 countries. Due to data availability issues for earlier years, we chose 1991 as earliest year, if available. The latest year for which data is available under the current release of the CES YLMI (as of January 2022) is either the year 2019 or 2020, differing by country and data source (see Table 6

for more details). If data for some of the past years is not available (any more) by the respective statistical office, we use vintages of the data of former releases of the CES YLMI (or KOF YLMI) to update otherwise missing data points.

2.2.1 Data update to improve indicator *vulnerable employment rate*

In the past, the indicator *vulnerable employment rate* could only be calculated for the entire working age population. Due to newly available data, the CES YLMI can now be calculated for the working population aged 15-24 as the ILO now provides the related raw data. Namely, data on the number of self-employed and contributing family workers aged 14-25. Beforehand, no data differentiated by age was available for both series, which implied that this indicator underestimated the vulnerability of youth in the labor market.

2.2.2 Countries and country groups with data for the CES YLMI

The CES YLMI includes all 193 countries that are accredited by the United Nations (UN)⁵. Unfortunately, only 181 of these countries currently report data needed to calculate the CES YLMI. If data becomes available in the future, we will include these countries in our data set.

As the composition of some country groups changes from year to year (e.g. grouping of countries by income level), we only report average data and data for country groups that do not change their composition over time (e.g. Europe, Africa) or where group affiliation does not change very frequently (EU27, OECD). Table 3 shows the country groups for which the CES YLMI is available, the number of members and the maximum number of indicators with non-missing data in at least one year by country group.

The total number of countries in groups affiliated by continent, overall 193, corresponds to the number of UN members. As mentioned in section 2.2.1, we only have non-missing data for 181 of the 193 UN member countries. Hence, the number of group members in the second column of Table 3 does not reflect data availability. Table 7 in the Appendix shows the number of countries and country names by group.

Table 3: Description of country groups and availability of data for index

Group	Number of members	Max. number of indicators with non-missing data in at least one year, form 1991-2020	Source for classification
Africa	54	6/12	Worldometer ⁶
Americas	35	7/12	Worldometer
Asia	44	12/12	Worldometer
Europe	46	12/12	Worldometer
Oceania	14	6/12	Worldometer
OECD	38	12/12	OECD
EU27	27	12/12	EU
G8	8	12/12	G8
EU14	14	12/12	EU

⁵ See UN website: <https://www.un.org/en/about-us>.

⁶ See website: <https://www.worldometers.info>.

2.2.3 Number countries and groups with data

Table 4 summarizes the number of countries with data for at least one and up to twelve indicators. Renold et al. (2014) argue that the index for countries with data for less than six indicators needs to be interpreted with caution.

Table 4 shows that in the year 2019, most countries have at least four or five indicators, while there are fewer with six, ten or eleven indicators. Only 23 countries have data for 12 indicators. Data situation improved in 2019 relative to 2018 for countries with four, ten or eleven indicators, while there were fewer countries with five, six, or twelve indicators.

Table 8 in the Appendix shows the number countries by group and indicator with non-missing data in 2019.

Table 4: Number countries with data

Year 2018		Year 2019	
# of indicators	# of countries	# of indicators	# of countries
1	1	1	1
2	0	2	0
3	0	3	0
4	90	4	92
5	46	5	45
6	10	6	9
7	0	7	0
8	0	8	0
9	0	9	0
10	1	10	3
11	6	11	9
12	28	12	23

2.3 Calculation of the index

Since the CES YLMI is the follow-up of the KOF YLMI, the text in the following heavily draws in information given by Renold et al (2014). The basic idea for the CES YLMI comes from the World Economic Forum's Global Competitiveness Index (GCI; Schwab and Sala-i-Martin, 2012). That multidimensional index quantifies the competitiveness of countries based on several indicators, enabling comparisons across countries and time. Since the CES YLMI is a multidimensional index based on several indicators, its setup and calculation is very similar to the GCI, even if we extend and adjust the calculation concept slightly (e.g. by adding a flexible weighting process of categories and indicators).

The indicators of the CES YLMI have to satisfy three conditions. First, the indicator must be a labor market outcome variable, not a variable affecting the labor market. Second, it must be possible to rank

the indicator, specifically it must be clear if lower or higher values are more desirable. Third, data for the indicator has to be available (or at least data of a useful proxy).

2.3.1 Scores

The raw data for each of the twelve indicators is standardized into a scale ranging from 1 to 7, like the GCI (Schwab and Sala-i-Martin, 2012). A higher score indicates a more favorable labor market situation for youth.

Equations 1 and 2 below show the formulas for this standardization process of raw data, which results in the indicator scores ranging from 1 to 7. Equation 1 (equation 2) is for indicators for which a higher raw value implies a more (less) favorable labor market situation of youth. The only indicator for which equation 1 is applied is the *formal education and training rate* indicator. In both equations, n indicates the indicator number, i the chosen country and t the specified year.

$$score_{nit} = 6 * \left(\frac{indicator_{nit} - fixed\ min}{fixed\ max - fixed\ min} \right) + 1 \quad \text{equation (1)}$$

$$score_{nit} = (-6) * \left(\frac{indicator_{nit} - fixed\ min}{fixed\ max - fixed\ min} \right) + 7 \quad \text{equation (2)}$$

In contrast to the GCI (Schwab and Sala-i-Martin, 2012), which specifies year-specific minimum and maximum indicator values, our minimum and maximum indicator values are constant over time. This makes indicator and index scores comparable over time. Otherwise, the scores would depend on the year-specific sample minimum and maximum for each indicator and therefore change over time. This would not allow us comparing the scores of one country across time. In addition, the set of available countries changes for almost all indicators every year. If we used year-specific minimum and maximum values and the country with the highest/lowest value for a certain one year had no observations in another year, the scores of every other countries would move and complicate comparisons across time.

The scores of the categories (c) Activity State, Working Conditions, Education and Transitions Smoothness for country (i) in year (t) are calculated as the averages of the available indicators in each group (equation 3):

$$score_{cit} = \frac{\sum_{n=1}^{m_c} s_{cnit} * w_{cn}}{\sum_{n=1}^{m_c} w_{cn}} \quad \text{equation (3)}$$

Where (s) is the score of each single indicator, (m_c) is the total number of indicators in a category (c) with score different from zero, indexed by (n). The fact that the number of indicators per category varies is firstly due to the different number of indicators and secondly because indicators without available data are completely excluded from the calculation.

2.3.2 Setting upper and lower bounds of raw data for indicators

Except for the indicator *relative unemployment ratio*, all indicators in the CES YLMI are expressed as a rate, so values can range between 0 and 100%. However, in many cases, real data range within a smaller spectrum (e.g., no country has a temporary worker rate value above 80%). Fixing the upper/lower bounds in the calculation of indicator and index scores based on empirical values from the raw data creates a more dispersed distribution of the scores in the scale between 1 and 7, better tracking of small differences between countries with close values.

While the lower bound for almost all indicators is 0 (the only exception is the *Formal Education and Training Rate* that is set to 30%), we set upper bounds for all indicators at different values—all below 100%. Some countries report extreme outlier values for some indicators in certain years. In such cases, we may censor extreme values for the sake of improving data readability. Countries above the upper bound on a given indicator receive a score of 1. The disadvantage of this methodology is that countries reporting outlier values are no longer comparable to each other (both have a score of 1).

For the KOF YLMI, adjustment of upper bounds was done manually after a graphical check of the data. For the CES YLMI, this will be done automatically. The code to calculate the index will set upper bounds based on the empirical upper and lower bounds in the raw data of a new release. Thereby, extreme outliers will be downscaled to avoid extreme dispersions of indicator and index scores.

2.3.3 Rankings

To facilitate comparisons between countries and years, we also provide country rankings based on indicator and index scores. Rankings are computed within the group of countries that have data for each indicator so countries without values do not distort the rankings.

2.3.4 The CES Youth Labor Market Index

The CES YLMI is a weighted sum of all scores (s) of a country (i) in a year (t). The exact calculation is displayed in the equation below. We modify the methodology of the GCI (Schwab and Sala-i-Martin 2012) by including two weighting factors. One gives different weights (w_c) to the classification category. The other weights the indicators within a category (w_{cn}). Again the (m_c) in the equation indicates that the number of indicators in a category is variable. Similarly, (k) indicates the number of classification category, which have data for at least one indicator; otherwise, the category is excluded entirely from the calculation.

$$CES\ YLMI_{it} = \frac{\sum_{c=1}^k w_c * \frac{\sum_{n=1}^{m_c} s_{cnit} * w_{cn}}{\sum_{n=1}^{m_c} w_{cn}}}{\sum_{c=1}^k w_c} \quad \text{equation (4)}$$

In the standard setting all categories are included with a weight of one ($w_c = 1$ for every c). In addition, the weight of the single indicators (w_{cn}) within each category is set to one by default.

Table 5 summarizes the subdivision of the weights inside the CES YLMI. As previously mentioned, each of the four categories accounts for a quarter of the whole index. The 25% for each category is subdivided equally into each category's corresponding indicators. This subdivision is a normative setting justified by the belief that each of the four categories represents an equally important aspect of the youth situation. Because no theoretical background exists, we give the same importance to every indicator in each

category. In their study, Pusterla and Oswald-Egg (2019) test and prove the robustness of the equal weighting scheme against alternative schemes.

Table 5: Weights by category and indicator

Category	Indicators	Weight of the category	Weight of the indicator
Activity State		25%	
1	Unemployment rate		8.3%
2	Relaxed unemployment rate		8.3%
3	NEET rate		8.3%
Working Conditions		25%	
4	Temporary worker rate		5%
5	Involuntary part-time worker rate		5%
6	Atypical working hours rate		5%
7	In work at risk of poverty rate		5%
8	Vulnerable employment rate		5%
Education		25%	
9	Formal education and training rate		12.5%
10	Skills mismatch rate		12.5%
Transition Smoothness		25%	
11	Relative unemployment ratio		12.5%
12	Incidence of long-term unemployment rate		12.5%

Source: Renold et al (2014).

3 New features of the CES YLMI

In this chapter, we briefly summarize the main innovations of the CES YLMI. First, the choice to update raw data for the index through APIs. Second, the new web tool for visualizing the CES YLMI in a more useful way and making its data accessible to the public.

3.1 Updating of data through APIs

A feature of the CES YLMI in its first release is the partially automated updating of raw data for the calculation of the index. Except for the data for the indicator *Temporary Worker Rate* and data for Switzerland for the indicators *Involuntary Part-Time Workers Rate* and *Formal Education and Training Rate*, all raw data for the CES YLMI can be updated via APIs that provide access to datasets from contributing statistical offices. In contrast to user interfaces for data access provided by international organizations and statistical offices, APIs are a type of software interface that automate access to statistical data, making the process of updating CES YLMI data much more efficient. Many international organizations and statistical offices like the ILO or Eurostat allow access to their databases via API.

Besides summarizing data sources by indicator, Table 6 also depicts the APIs used to download the raw data for the CES YLMI. The associated code, which downloads the raw data and calculates the CES YLMI is written in the statistical software R and can be made available on request.

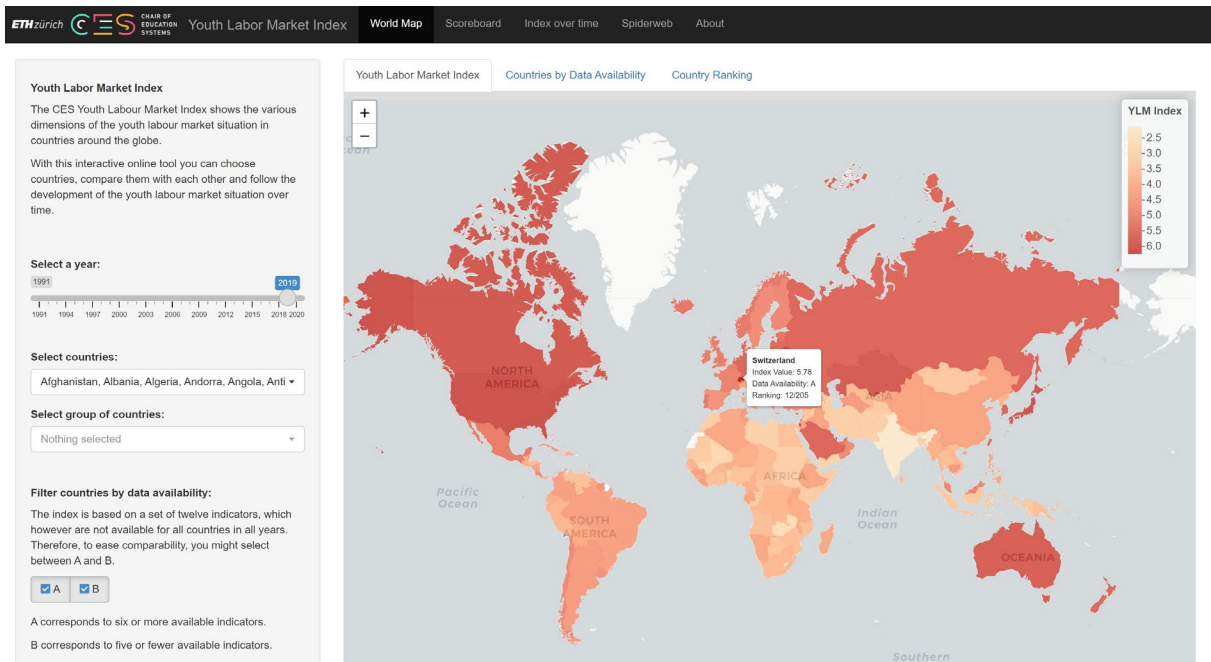
3.2 New web tool for the CES Youth Labor Market Index

A new web tool allows users to visualize and analyze the CES YLMI in multiple ways and to download the data in different file formats. The web tool is written with the R package Shiny⁷. It is available under the following URL: <https://apps.ces.ethz.ch/ylmi/>.

The web tool allows accessing, visualizing, and analyzing CES YLMI data in four main ways.

First, the web tool displays data in a world map. The map displays CES YLMI by score values, data availability classes, or country rankings based on indicator scores. Users can choose to visualize scores, data availability, or rankings for one or multiple countries or country groups at a time and for different years (only one year at a time).

⁷ <https://shiny.rstudio.com/>.



Second, the web tool displays data in a scoreboard. Users can display score values or rankings by dimension, indicator, and for the aggregate index in one or multiple countries, country group averages, or country groups at a time and for different years. In addition, the scoreboard offers users the option to modify the weighting factors of categories and/or of the indicators. For instance, the weight of a single indicator can be changed to double or triple the importance of this indicator in its category. Setting the weight to zero excludes a category or an indicator from the CES YLMI. We leave this decision to the users so that they can adapt the CES YLMI if they have a particular view on the meaningfulness of the chosen categories/indicators or they would like to compare two countries based only on their common indicators. Data can be downloaded as .csv or .xlsx files.

Youth Labor Market Index

Select Time Period: Year Range One Year

Select a year: 1991 2019

Select countries: Nothing selected

Select country group averages: Nothing selected

Select group of countries: Europe

Filter countries by data availability: A B

A corresponds to six or more available indicators.
B corresponds to five or fewer available indicators.
Index value for B category countries should be interpreted with caution!

Download data as: .xlsx

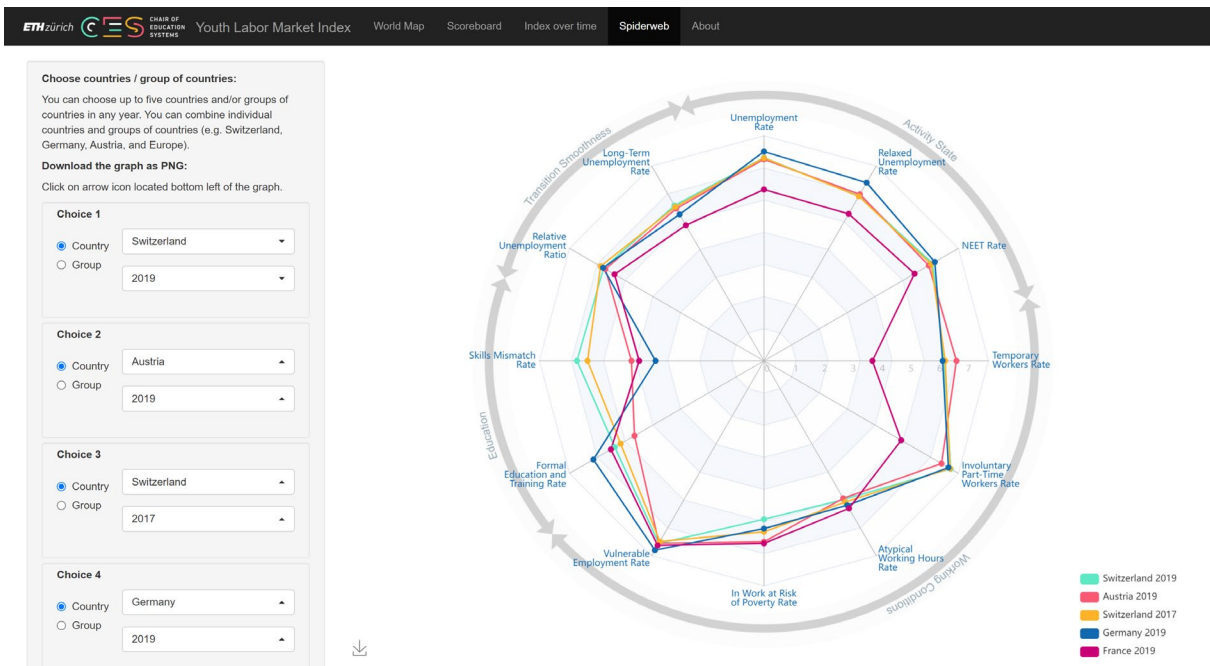
Download the data

Selection			Aggregate Index	Aggregate Index by Dimension				Dimension: Activity State			Dimension: Working Conditions					
Country	Year	Classes		Index	Activity State	Working Conditions	Education	Transition Smoothness	Unemployment Rate	Relaxed Unemployment Rate	NEET Rate	Temporary Workers Rate	Involuntary Part Time Workers Rate	Atypical Working Hours Rate	In Work at Risk of Poverty Rate	Vulnerable Employ Rate
					Weight	Weight	Weight	Weight	Weight	Weight	Weight	Weight	Weight	Weight	Weight	Weight
Albania	2019	A	3.62	3.91	2.73	4.23	4.68	3.13						4.46	1.00	
Armenia	2019	B	3.86	3.48	2.95	5.14	4.22	2.74							2.95	
Austria	2019	A	5.49	6.05	5.90	4.39	5.59	6.27	5.98	5.93	6.00	6.39	4.94	5.63	6.05	
Azerbaijan	2019	B	3.09	5.18	1.00	3.09	5.93	4.42							1.00	
Belarus	2019	B	6.15	5.83	6.81	5.82	6.13	5.53							6.81	
Belgium	2019	A	5.21	5.61	5.26	4.85	5.10	5.78	5.45	5.61	2.84	6.40	5.17	5.61	6.30	
Bosnia and Herzegovina	2019	B	4.46	3.98	5.17	4.23	4.14	3.82							5.17	
Bulgaria	2019	A	5.03	5.59	5.52	4.61	4.40	6.24	5.58	4.94		6.61	4.20	5.05	6.24	
Croatia	2019	A	5.24	5.24	5.09	5.59	5.06	5.57	4.93	5.23	2.85	6.81	3.32	6.07	6.38	
Cyprus	2019	A	5.31	5.40	5.37	4.94	5.53	5.63	5.62	4.95	5.67	5.54	3.67	5.65	6.30	
Czech Republic	2019	A	5.35	6.39	5.58	4.37	5.06	6.52	6.50	6.15	5.01	6.82	3.48	6.61	6.03	
Denmark	2019	A	5.61	5.94	5.04	5.41	6.04	6.14	5.84	5.84	5.50	5.71	4.77	2.49	6.74	
Estonia	2019	A	5.31	5.84	5.33	4.77	5.29	6.05	5.52	5.96	5.80	6.84	3.26	4.19	6.55	
Finland	2019	A	4.98	5.45	4.80	4.56	5.06	5.54	5.13	5.78	3.29	5.16	3.28	5.82	6.46	
France	2019	A	5.09	5.34	5.19	4.70	5.13	5.33	5.28	5.42	3.38	4.94	5.30	5.68	6.63	
Georgia	2019	B	3.62	3.75	1.46	5.63	4.43	4.43	3.10						1.46	
Germany	2019	A	5.63	6.35	5.88	4.76	5.52	6.51	6.40	6.15	5.57	6.64	5.19	5.22	6.80	

Third, the web tool displays data over time. Users can display score values for the aggregate index for one country or country group averages over a specified time range. Thereby, the number of available indicators by country (group) and year are displayed at the bottom of the graph to communicate the reliability of data over time. Data can be downloaded as .csv or .xlsx files, and the graph as a .png file.



Fourth, the web tool displays data in a spiderweb. Users can select up to five countries or country group averages and five corresponding years to display scores for all twelve indicators in a spiderweb graph. The spiderweb graph can be downloaded as .png file.



4 Conclusion and limitations

This technical report introduces the new features of the CES YLMI (formerly KOF YLMI). In contrast to the KOF YLMI, the CES YLMI offers a larger database, better technology to update data, and a more flexible web tool for visualizing, analyzing, and downloading data. The second chapter summarizes the different dimensions and indicators of the index, shares details on data sources, and explains how the index is calculated. The third chapter highlights the two main innovations of the CES YLMI: the updating of data through APIs and a new web tool to access data.

Despite the advantage of describing the youth labor market situation in a multidimensional way as opposed to using single indicators, the CES YLMI has three main limitations. First, data availability is an issue. Often, data for all indicators is only available for European countries, a bottleneck driven by using Eurostat as one of the major data sources. Second, indicators might not have the same relevance in all countries, for example developed versus developing countries. To address this issue, we allow web tool users to mute or amplify individual indicators or categories. Third, the CES YLMI ignores individual characteristics like gender, race, migrant background, and others. The main reason for ignoring these additional characteristics is a lack of data for such disaggregation.

Based on user feedback, we will improve the dataset and further develop features of the CES YLMI to provide a useful diagnostic tool for the young generation's situation across countries.

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6 Appendix

Supplementary tables

Table 6: Detailed Information on Data Sources by Indicator

Indicator	Sources			Countries covered in at least one year (current, 1th release)	Countries with data available for most recent year: 2020 (current, 1th release)	Years
	Statistical Office	Descriptive	API ID			
1. Unemployment Rate	ILO	Unemployment rate by sex and age, ILO modelled estimates; frequency: annual; age: 15-24; sex: total; time: 1991-most recent	UNE_2EAP_SEX_AGE_RT_A	181	0	1991-most recent
2. Relaxed Unemployment Rate	Eurostat	1. Number of discouraged workers; Supplementary indicators to unemployment by sex and age, indicator: Persons available to work but not seeking (NSEE_AV); age: 15-24; frequency: annual; geo: all; sex: total; time: 1991-most recent; unit: thousands of persons	lfsa_sup_age	35	34	2005-most recent
		2. Number of unemployed; Unemployment by sex, age and citizenship (1 000); age: 15-24; citizen: total; frequency: annual; geo: all; sex: total; time: 1991-most recent; unit: thousands of persons	lfsa_uGAN	35	34	2005-most recent
		3. Number of people in labor force; Population by sex, age, citizenship and labour status (1 000); age: 15-24; citizen: total; frequency: annual; geo: all; sex: total; time: 1991-most recent; unit: thousands of persons; working status: Persons in the labour force (former name: active persons; ACT)	lfsa_pGANWS	35	34	2005-most recent
3. NEET rate	ILO: update data from ILO	1. Share of youth not in employment, education or training (NEET) by sex -- ILO modelled estimates; age: 15-24; frequency: annual; sex: total; time: 2000-most recent; unit: percentage	EIP_2EET_SEX_RT_A	181	34	2000-most recent

	with data from Eurostat if missing					
	Eurostat	2. Young people neither in employment nor in education and training by sex, age and labour status (NEET rates); age: 15-24; frequency: annual; geo: all; sex: total; time: 2000-most recent; unit: percentage; working status: Not employed persons (NEMP)	edat_lfse_20	181	34	2000-most recent
4. Temporary Worker Rate	Eurostat	1. Temporary employees by sex, age and duration of the work contract (1 000); note: aggregated values (1 to 18 months and >19 months) obtained from Eurostat only through special request; age: 15-24; duration: 1 to 18 months, > 19 months; frequency: annual; geo: all; sex: total; time: 1992-most recent; unit: thousands; working status: employed	NA; special request Eurostat	35	34	1992-most recent
		2. Employment by sex, age and citizenship; age: 15-24; citizen: total; frequency: annual; geo: all; sex: total; time: 1992-most recent	lfsa_egan	35	34	1992-most recent
5. Involuntary Part-Time Workers Rate	OECD	1. Incidence of involuntary part time workers; age: 15-24; frequency: annual; sex: total; time: 1991-most recent; unit: percentage; working status: total employment; series: SHINV_EMP	INVPT_I	41	39	1991-most recent
	Swiss Federal Statistical Office (SFSO)	2. Involuntary parttime workers; note: data obtained from SFSO only through special request. The values for the years 2007-2010 and 2013-2014 have relatively low reliability. Please interpret these with caution; age: 15-24; frequency: annual; sex: total; time: 2004-most recent; unit: percentage; working status: total employment	NA; special request SFSO	1		2004-most recent
6. Atypical Working Hours Rate	Eurostat	1. Employed persons working at nights as a percentage of the total employment, by sex, age and professional status (%); age: 15-24; frequency: annual; geo: all; sex: total; time: 1992-most recent; unit: percentage; working status: employed (EMP)	lfsa_ewpnig	35	34	1992-most recent
		2. Employees working shifts as a percentage of the total of employees, by sex and age (%); age: 15-24; frequency: annual; geo: all; sex: total; time: 1992-most recent; unit: percentage; working status: employed (EMP)	lfsa_ewpshi	35	34	1992-most recent
		3. Employed persons working on Sundays as a percentage of the total employment, by sex, age and professional status (%); age: 15-24; frequency: annual; geo: all; sex: total; time: 1992-most recent; unit: percentage; working status: employed (EMP)	lfsa_ewpsun	35	34	1992-most recent

7. In-Work at-Risk-of-Poverty Rate	Eurostat	In-work at-risk-of-poverty rate by age and sex; age: 16-24; frequency: annual; geo: all; sex: total; time: 2003-most recent; unit: percentage; working status: employed (EMP)	ilc_iw01	36	30	2003-most recent
8. Vulnerable Employment Rate	ILO	1. Employment by age and status in employment -- ILO modelled estimates; series: own-account workers (STE_ICSE93_3); age: 15-24; frequency: annual; sex: total; time: 1991-most recent; unit: thousands	EMP_2EMP_AGE_STE_NB_A	181		1991-most recent
		2. Employment by age and status in employment -- ILO modelled estimates; series: Contributing family workers (STE_ICSE93_5); age: 15-24; frequency: annual; sex: total; time: 1991-most recent; unit: thousands	EMP_2EMP_AGE_STE_NB_A	181		1991-most recent
		3. Employment by age and status in employment -- ILO modelled estimates; series: total employment (STE_ICSE93_TOTAL); age: 15-24; frequency: annual; sex: total; time: 1991-most recent; unit: thousands	EMP_2EMP_AGE_STE_NB_A	181		1991-most recent
9. Formal Education and Training Rate	Eurostat	1. Participation in education and training; age: 15-24; frequency: annual; geo: all; sex: total; time: 2003-most recent; type of training: Formal education and training (FE); unit: percentage	trng_lfs_09	34	34	2003-most recent
	Swiss Federal Statistical Office (SFSO)	2. Participation rate in formal education and training (last 4 weeks); note: data obtained from SFSO only through special request; age: 15-24; frequency: annual; sex: total; time: 1996-2002; unit: percentage	NA; special request SFSO	1		1996-2002
10. Skills Mismatch Rate	Eurostat	1. Active population by sex, age and educational attainment level (1 000); age: 15 to 24 years & 25 to 29 years; isced 11 level 0-2 (ED0-2), level 3-4 (ED3_4) & level 5-8 (ED5-8) sex: total; unit: thousands	lfsa_agaed	60	34	1992-most recent
		2. Employment by sex, age and educational attainment level (1 000); age: 15 to 24 years & 25 to 29 years; isced 11 level 0-2 (ED0-2), level 3-4 (ED3_4) & level 5-8 (ED5-8) sex: total; unit: thousands	lfsa_egaed	60	34	1992-most recent
11. Relative Unemployment Ratio	ILO	Unemployment rate by sex and age -- ILO modelled estimates; age: 15 to 24 years & 25+ years; frequency: annual; sex: total; time: 1991-most recent; unit: thousands	UNE_2EAP_SEX_AGE_RT_A	181	0	1991-most recent
12. Incidence of Long-Term Unemployment Rate	ILO	Unemployment by sex, age and duration; age: 15-24; duration: total (aggregate duration: DUR_DETAILS_TOTAL & DUR_AGGREGATE_TOTAL) & 12 months or more (DUR_AGGREGATE_MGE12); sex: total; time: 1991-most recent; unit: thousands	UNE_TUNE_SEX_AGE_DUR_NB_A	148	65	1991-most recent

Table 7: Number of countries and country names by group

# of members	Africa	Americas	Asia	Europe	Oceania	OECD	EU27	G8	EU14
1	Algeria	Antigua and Barbuda	Afghanistan	Albania	Australia	Australia	Austria	Canada	Austria
2	Angola	Argentina	Bahrain	Andorra	Fiji	Austria	Belgium	France	Belgium
3	Benin	Bahamas	Bangladesh	Armenia	Kiribati	Belgium	Bulgaria	Germany	Denmark
4	Botswana	Barbados	Bhutan	Austria	Marshall Islands	Canada	Croatia	Italy	Finland
5	Burkina Faso	Belize	Brunei Darussalam	Azerbaijan	Micronesia	Chile	Cyprus	Japan	France
6	Burundi	Bolivia, Plurinational State of	Cambodia	Belarus	Nauru	Colombia	Czech Republic	Russian Federation	Germany
7	Cabo Verde	Brazil	China	Belgium	New Zealand	Costa Rica	Denmark	United Kingdom	Greece
8	Cameroon	Canada	Korea, Democratic People's Republic of	Bosnia and Herzegovina	Palau	Czech Republic	Estonia	United States of America	Ireland
9	Central African Republic	Chile	India	Bulgaria	Papua New Guinea	Denmark	Finland		Italy
10	Chad	Colombia	Indonesia	Croatia	Samoa	Estonia	France		Luxembourg
11	Comoros	Costa Rica	Iran, Islamic Republic of	Cyprus	Solomon Islands	Finland	Germany		Netherlands
12	Congo	Cuba	Iraq	Czech Republic	Tonga	France	Greece		Portugal
13	Congo, Democratic Republic of the	Dominica	Israel	Denmark	Tuvalu	Germany	Hungary		Spain
14	Ivory Coast	Dominican Republic	Japan	Estonia	Vanuatu	Greece	Ireland		Sweden
15	Djibouti	Ecuador	Jordan	Finland		Hungary	Italy		
16	Egypt	El Salvador	Kazakhstan	France		Iceland	Latvia		
17	Equatorial Guinea	Grenada	Kuwait	Georgia		Ireland	Lithuania		
18	Eritrea	Guatemala	Kyrgyzstan	Germany		Israel	Luxembourg		

19	Eswatini	Guyana	Lao People's Democratic Republic	Greece		Italy	Malta		
20	Ethiopia	Haiti	Lebanon	Hungary		Japan	Netherlands		
21	Gabon	Honduras	Malaysia	Iceland		Latvia	Poland		
22	Gambia	Jamaica	Maldives	Ireland		Lithuania	Portugal		
23	Ghana	Mexico	Mongolia	Italy		Luxembourg	Romania		
24	Guinea	Nicaragua	Myanmar	Latvia		Mexico	Slovakia		
25	Guinea-Bissau	Panama	Nepal	Liechtenstein		Netherlands	Slovenia		
26	Kenya	Paraguay	Oman	Lithuania		New Zealand	Spain		
27	Lesotho	Peru	Pakistan	Luxembourg		Norway	Sweden		
28	Liberia	Saint Kitts and Nevis	Philippines	Malta		Poland			
29	Libya	Saint Lucia	Qatar	Monaco		Portugal			
30	Madagascar	Saint Vincent and the Grenadines	Korea, Republic of	Montenegro		Korea, Republic of			
31	Malawi	Suriname	Russian Federation	Netherlands		Slovakia			
32	Mali	Trinidad and Tobago	Saudi Arabia	North Macedonia		Slovenia			
33	Mauritania	United States of America	Singapore	Norway		Spain			
34	Mauritius	Uruguay	Sri Lanka	Poland		Sweden			
35	Morocco	Venezuela, Bolivarian Republic of	Syrian Arab Republic	Portugal		Switzerland			
36	Mozambique		Tajikistan	Moldova, Republic of		Turkey			
37	Namibia		Thailand	Romania		United Kingdom			
38	Niger		Timor-Leste	San Marino		United States of America			
39	Nigeria		Turkey	Serbia					

40	Rwanda		Turkmenistan	Slovakia				
41	Sao Tome and Principe		United Arab Emirates	Slovenia				
42	Senegal		Uzbekistan	Spain				
43	Seychelles		Viet Nam	Sweden				
44	Sierra Leone		Yemen	Switzerland				
45	Somalia			Ukraine				
46	South Africa			United Kingdom				
47	South Sudan							
48	Sudan							
49	Togo							
50	Tunisia							
51	Uganda							
52	Tanzania, United Republic of							
53	Zambia							
54	Zimbabwe							

Table 8: Number countries by group and indicator with non-missing data in 2019

Number countries by indicator in 2019	1. Un-employment Rate	2. Relaxed Un-employment Rate	3. NEET rate	4. Temporary Worker Rate	5. Involuntary Part-Time Workers Rate	6. Atypical Working Hours Rate	7. In-Work at-Risk-of-Poverty Rate	8. Vulnerable Employment Rate	9. Formal Education and Training Rate	10. Skills Mismatch Rate	11. Relative Un-employment Ratio	12. Incidence of Long-Term Un-employment Rate
Africa	53		53					53			53	12
Americas	31		31		4			31			31	16
Asia	44	1	44	1	4	1	1	44	1	1	44	18
Oceania	8		8		1			8			8	1
Europe	42	34	42	31	31	34	33	42	34	34	42	34
OECD	38	27	38	26	33	27	25	38	27	27	38	29
EU27	27	27	27	25	26	27	27	27	27	27	27	22
EU14	14	14	14	13	14	14	14	14	14	14	14	12
G8	8	4	8	4	8	4	3	8	4	4	8	8

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