Disentangling Skills Mismatch: Fifth Release of the KOF Youth Labour Market Index

ETH zürich

KOF Swiss Economic Institute

Disentangling Skills Mismatch

Fifth Release of the KOF Youth Labour Market Index

Filippo Pusterla, Maria Esther Oswald-Egg, Thomas Bolli and Ursula Renold

KOF Studies, No. 123 December 2018

KOF

Imprint

Editor

KOF Swiss Economic Institute, ETH Zurich

Authors

Filippo Pusterla
Maria Esther Oswald-Egg
Thomas Bolli
Ursula Renold

KOF

ETH Zurich
KOF Swiss Economic Institute
LEE G 116
Leonhardstrasse 21
8092 Zurich, Switzerland

Phone +41 44 632 42 39
Fax +41 44 632 12 18
www.kof.ethz.ch
kof@kof.ethz.ch

Disentangling Skills Mismatch

Fifth Release of the KOF Youth Labour Market Index[†]

December 4, 2018

Filippo Pusterla, Maria Esther Oswald-Egg, Thomas Bolli & Ursula Renold[‡]

† A project of the research division Education Systems at the KOF Swiss Economic Institute, ETH Zurich

‡ KOF Swiss Economic Institute, ETH Zurich, Leonhardstrasse 21, 8092 Zurich, Switzerland. E-mails: egg@kof.ethz.ch and pusterla@kof.ethz.ch

Acknowledgements:
The research division Education Systems thank the International Labour Organisation, OECD Statistics, Eurostat and the Swiss Federal Statistics Office for providing the data and for the technical support.

Contents

List of Figures

List of Tables

1 Introduction and Summary

This report describes the fifth release of the KOF Youth Labour Market Index (KOF YLMI). The KOF YLMI is a multidimensional index, which compares the situation for young people on the labour market in different countries over a long period starting from 1991. 12 indicators measuring the dimensions Activity State, Working Conditions, Education and Transitions Smoothness, are combined into one index, which can be used for overall comparisons.

In this release, we use the same data sources as in previous releases – ILO, OECD, and Eurostat – to expand the data series to the year 2016 (Renold et al., 2014; Pusterla, 2015; Pusterla, 2016; Pusterla, 2017). We match these three data sources in order to increase the number of covered countries in many indicators. Specifically, the number of countries with available data increases by 26 for the Incidence of Long-term Unemployment Rate, by 16 for the Vulnerable Worker Rate, by eight for the NEET Rate, and by one each for the Temporary Worker Rate, the Involuntary Part-time Workers Rate, the Atypical Working Hours, the Formal Education and Training Rate and the Skills Mismatch Rate. Combined, our dataset contains 15% more observations than the previous release.

Regarding the results of the KOF YLMI, there are minor changes in the upper part of the ranking. The top ten rank in 2016 includes the same countries as in 2015. The sequence of the top three stays the same: first Denmark, followed by Switzerland and Lithuania. Overall, the largest improvers are Belgium with five ranks, as well as Ireland and Malta with four ranks. The largest descenders are France, dropping down six ranks, and Turkey, dropping down four ranks. The index values of the top ten countries have mostly decreased, whereas the values of the other countries have mostly increased. Thus, the leaders have a worsening youth labour market situation whereas the other countries are catching up, resulting in 19 out of 33 countries having an index value above five in 2016, compared to 13 in 2015. Specifically, the deterioration of the well-performing countries stems from a worsening in the Transition Smoothness dimension, while the amelioration of the other countries derives from improving Activity State and Transition Smoothness dimensions.

Besides keeping track of changes in data availability, this report focuses on the indicator Skills Mismatch Rate, which is part of the Education dimension. Our interest stems from the observation of different patterns in the components of the Skills Mismatch Rate. We disentangle the components and derive a taxonomy to group countries with similar patterns. We discover that the origins of skills mismatch are very heterogeneous, so that similar patterns are common at different levels of the Skills Mismatch Rate.

This study continues as follows. Next, we present the results of the KOF YLMI in 2016 in more detail. Then, we recap its definition and disentangle the indicator Skills Mismatch Rate. We identify similar patterns across countries and build a taxonomy. Lastly, we summarize our findings and gives a short outlook for the next release.

2 The Youth Labour Market Situation in 2016

The KOF YLMI unites 12 labour market indicators in four dimensions for the situation of youth on the labour market providing suitable ground for analyses. Table 1 reports the evolution of the index and its four dimensions – Activity State, Working Conditions, Education and Transition Smoothness – between 2015 and 2016 for all countries having sufficient data available (at least 9 indicators).

We see that in the Activity State dimension there are only positive changes (six) in the lower part of the ranking. In the Working Conditions and Education dimensions there are fewer changes (four and three respectively), though both positive and negative ones. Most changes occur in the Transition Smoothness dimension. The pattern shows that the changes in the first 16 countries of the ranking are negative, whereas the evolution in the remaining countries is positive (except for Romania). Therefore, the deterioration of the top ten countries comes mainly from the worsening of the Transition Smoothness dimension (Relative Unemployment Ratio and Incidence of Long-term Unemployment Rate), whereas the amelioration of the remaining countries stems from the Activity State dimension (Unemployment Rate, Relaxed Unemployment Rate, NEET Rate) and the Transition Smoothness dimension (Relative Unemployment Ratio and Incidence of Long-term Unemployment Rate).

Not surprisingly, the general youth labour market situation for most countries in 2016 did not changed much relative to 2015. According to the ranking of the KOF YLMI index value, the same three countries occupy the top three positions: Denmark is first, followed by Switzerland and Lithuania[1]. In the top ten countries, there has been some changes within the ranking but not in the range of the countries. Newly ranked fourth is the Netherlands, which managed to surpass two countries. The Netherlands is followed by Germany, which still ranks fifth. Austria ranks six in 2016, dropping two ranks from the previous year, whereas Estonia has managed to climb from rank ten to rank seven. Norway, Latvia, and Luxembourg have each dropped one position, and ranks now eight, ninth, and tenth, respectively. Among the remaining countries, the biggest improvers are Belgium (five positions), Ireland and Malta (both four positions), while the biggest descenders are France (six positions) and Turkey (four positions).

Focusing on the change of the KOF YLMI value from 2015 to 2016, we see that the top ten countries have decreasing values, which indicates a worsening labour market situation for the youth. The only exceptions are the Netherlands, with an equal index value, and Estonia with a higher index value. In contrast, the majority of the remaining 23 countries have an increasing index value. Here the exceptions are Iceland, Slovenia, Turkey, France, Romania, and Macedonia, which show a decrease in the aggregate index value. However, except for these countries, the labour market situation for young people has improved overall and we observe the least performing countries catching up. 19 out of 33 countries have a value higher than five in 2016, compared to only 13 out of 33 in 2015.

[1] In the fourth release the top three countries were Denmark, Switzerland and Austria. The inconsistency comes from the data revision of the statistical offices. Specifically, Eurostat conducted a substantial revision on the time series of the Formal Education and Training Rate. Consistent with the strategy adopted in the previous release, we use the most current data available.

Table 1: Evolution of the KOF YLMI between 2015 and 2016

Country	Activity State			Working Conditions			Education			Transition Smoothness			KOF YLM Index			
	2015	2016	Direction*	2015	2016	Direction*	2015	2016	Direction*	2015	2016	Direction*	2015	2016	Rank	Change
Denmark	6.01	5.85	→	5.42	5.07	↘	5.88	6.00	→	6.05	5.94	→	5.84	5.72	1	= 0
Switzerland	6.01	6.02	→	5.73	5.77	→	5.47	5.36	→	5.59	5.52	→	5.70	5.67	2	= 0
Lithuania	5.62	5.68	→	5.91	5.96	→	5.03	4.79	→	5.73	5.73	→	5.57††	5.54††	3	= 0
Netherlands	6.00	6.02	→	5.16	5.12	→	5.07	5.10	→	5.68	5.68	→	5.48	5.48	4	▲ 2
Germany	6.25	6.24	→	5.56	5.50	→	4.66	4.57	→	5.55	5.52	→	5.51	5.46	5	= 0
Austria	5.92	5.89	→	5.65	5.61	→	4.77	4.43	↘	5.69	5.58	→	5.51	5.38	6	▼ 2
Estonia	5.61	5.68	→	5.58	5.54	→	4.60	4.80	→	5.60	5.45	→	5.35	5.37	7	▲ 3
Norway	6.00	5.91	→	5.24	5.13	→	4.78	4.92	→	5.72	5.44	↘	5.44	5.35	8	▼ 1
Latvia	5.48	5.38	→	5.62	5.62	→	5.04	4.95	→	5.33	5.20	→	5.37	5.29	9	▼ 1
Luxembourg	5.17	5.28	→	4.94	4.96	→	5.61	5.43	→	5.75	5.37	↘	5.37	5.26	10	▼ 1
Iceland	6.10	6.32	→	4.57	4.70	→	4.50	4.67	→	5.96	5.28	↓	5.28	5.24†	11	= 0
Czech Republic	5.93	6.06	→	5.14	5.21	→	4.54	4.57	→	4.87	5.06	→	5.12	5.23	12	▲ 1
Slovenia	5.45	5.63	→	4.07	4.19	→	6.50	6.32	→	4.88	4.48	↘	5.22	5.15	13	▼ 1
Hungary	5.37	5.62	→	5.26	5.62	↗	4.31	4.32	→	4.99	4.94	→	4.98	5.13	14	▲ 1
Belgium	5.14	5.35	→	5.29	5.28	→	4.61	4.97	↗	4.56	4.78	→	4.90	5.09	15	▲ 5
Finland	5.02	5.14	→	4.48	4.45	→	4.78	4.81	→	5.78	5.85	→	5.02	5.06	16	▼ 2
United Kingdom	5.59	5.69	→	5.12	5.23	→	4.01	4.07	→	4.91	5.17	↗	4.91	5.04	17	▲ 2
Ireland	5.15	5.41	→	4.94	5.09	→	4.49	4.70	→	4.70	4.89	→	4.82	5.02	18	▲ 4
Poland	5.22	5.42	→	4.50	4.54	→	5.27	5.20	→	4.77	4.92	→	4.94	5.02	19	▼ 3
Turkey	4.61	4.55	→	4.65	4.76	→	4.73	4.65	→	5.74	5.72	→	4.93	4.92†	20	▼ 3
Malta	5.87	5.89	→	5.56	5.63	→	2.65	3.08	↑	4.85	5.09	→	4.73	4.92†	21	▲ 3
Portugal	4.41	4.69	↗	4.31	4.28	→	5.84	5.70	→	4.80	4.88	→	4.84	4.89	22	▼ 1
Cyprus	4.32	4.53	→	4.30	4.34	→	5.29	5.22	→	5.19	5.46	↗	4.78	4.89	23	= 0
France	5.00	5.00	→	4.88	4.79	→	4.89	4.65	→	4.96	4.93	→	4.93	4.85	24	▼ 6
Bulgaria	4.46	4.77	↗	5.50	5.39	→	4.77	4.65	→	4.04	4.27	↗	4.69	4.77	25	= 0
Slovakia	4.82	5.10	↗	4.63	4.84	→	4.88	4.82	→	3.88	4.19	↗	4.55	4.74	26	▲ 1
Sweden	5.36	5.47	→	3.76	4.11	↗	3.67	3.58	→	5.65	5.73	→	4.61	4.72	27	▼ 1
Croatia	3.40	3.96	↑	4.75	4.52	→	5.42	5.17	→	4.02	4.41	↗	4.40	4.51	28	▲ 1
Romania	4.67	4.76	→	3.77	3.90	→	5.29	5.31	→	4.24	3.91	↘	4.49	4.47	29	▼ 1
Spain	3.42	3.70	↗	3.52	3.73	↗	4.86	5.04	→	4.78	5.02	→	4.14	4.37	30	▲ 1
Greece	3.38	3.54	→	3.62	3.54	→	6.22	6.27	→	3.95	4.08	→	4.29	4.36	31	▼ 1
Macedonia	3.12	3.13	→	4.36	4.54	→	5.58	5.53	→	3.53	3.42	→	4.14†	4.16†	32	= 0
Italy	3.02	3.31	↗	3.77	3.77	→	5.36	5.37	→	3.49	3.69	↗	3.91	4.03	33	= 0
EU 28	5.03	5.16	→	4.81	4.84	→	4.94	4.92	→	4.95	5.01	→	4.93	4.98		

* The directions describe the changes in the dimensions' score in 2016 relative to 2015. The key of lecture is the following: ↑ score changes > +10%; ↗ score changes by > +5% to +10%; → score remains stable between +5% and −5%; ↘ score changes by > −5% to −10%; ↓ score changes > −10%

† Only 11 indicators out of 12 available.

†† Only 10 indicators out of 12 available.

Notes: The table shows countries ranked according to their KOF YLM index value in 2016. The index value is an unweighted average of the scores in the four dimensions activity state, working conditions, education and transition smoothness. The scores in turn are standardized country values on a scale from one to seven, where a higher score indicates a more desirable outcome. For more information on the construction of the index and the scores please consult (Renold et al., 2014). The second to fifth column display the KOF YLM index value of 2015 as reference and the actual value of 2016 followed by the rank in 2016 and the change from 2015 to 2016. Then, the following columns show respectively the score value in 2015, the score value in 2016 and the direction of the change for the four dimensions activity state, working conditions, education and transition smoothness. The data used for the table are the newest available. Therefore, the data from 2015 in this release might differ from the data of 2015 in the previous release.

3 Disentangling the Skills Mismatch Rate

This release puts a special focus on the indicator Skills Mismatch Rate. The complexity of its definition and the existence of different patterns among countries urged us to have a closer look. In the following, we discuss the definition and disentangle the Skills Mismatch Rate into its components, namely the mismatch at three education levels – primary, secondary and tertiary. Thereafter, we present a possible taxonomy of skills mismatch patterns distinguishing three groups.

3.1 Definition and Description of Skills Mismatch

Skills Mismatch is a highly discussed topic among policy makers (e.g. Cedefop, 2018). Eurostat (2018) reports that in 2016 about every sixth young employee (aged 15-34) had a job that did not correspond to his or her education level. However, so far there is no common statistical methodology to capture skills mismatch (ILO, 2013a; Sparreboom & Tarvid, 2017). Worth noting is the work of Sparreboom & Tarvid (2017), which give an extensive overview on the

recently used methodologies and approaches in the literature of skills mismatch.

In the KOF YLMI, we use the methodology from the ILO, as this data is available and enables a comparison of a wide range of countries over a long period. That measure of skills mismatch compares the disequilibrium in the skills provided by workers with the skills demanded by companies at a certain education level. The education levels used are primary (ISCED 1-2), secondary (ISCED 3-4) and tertiary (ISCED 5-8; ILO, 2013b). The exact calculation is as follows:

$$\textbf{Skills Mismatch Rate} = \frac{1}{2} * \sum_{k=1}^{3} ABS \left(\frac{Emp.\ with\ education\ k}{Total\ emp.} - \frac{Unemp.\ with\ education\ k}{Total\ unemp.} \right)$$

In the equation, ABS is the absolute difference and (k) the level of education. The share of people employed with a certain education level is compared with the share of people unemployed having the same education level. The absolute values of the difference at the three education levels are then summed up to a single value. The resulting Skills Mismatch Rate is thus an index of dissimilarities.

This method has two advantages. First, the required data is easily available. Second, it presents one indicator to compare countries with each other. However, this method has also two disadvantages. The main disadvantage is that summing up the absolute values together generates loss of information concerning whether the skills mismatch arises due to overdemand or oversupply. On the one hand, there is overdemand when the share of employed with a certain education level is higher than the share of unemployed with the same education level. On the other hand there is oversupply when the share of employed at a certain education level is lower than the share of unemployed at the same level. The second disadvantage is that the indicator only covers vertical skills mismatch and neglects completely horizontal skills mismatch. Vertical skills mismatch identifies whether there is a discrepancy between the educational level attained and the current occupation, whereas horizontal skills mismatch focuses on the occupation being in the same field as the highest attained education.

The ILO (2013a) further differentiates between various types of mismatch. Besides the two already mentioned types – vertical mismatch and horizontal mismatch – the ILO also mention overeducation or undereducation, skill shortage or surplus, skill gap, overqualification or underqualification and skills obsolescence. Unfortunately, none of these types has an indisputable methodology and all of them measure just a part of skills mismatch. Furthermore, there is no large data collection available for those indicators.

Noteworthy is the current work conducted by Eurostat on skills mismatch. Eurostat is currently working on two experimental indicators to foster the policy debate on the issue of skills mismatch[2]. The first focuses on vertical skills mismatch and has data for the period 2008-2016. It is calculated by looking at tertiary education graduates not working in an occupation requiring tertiary education. The second indicator is for horizontal skills mismatch and covers the period

[2]More information is available under `https://ec.europa.eu/eurostat/web/skills/background/experimental-statistics`

2014-2016. It is calculated by matching ISCED-1999 fields of education and training with ISCO-2008 occupations. These measures might become valid alternatives in the future development of the KOF YLMI. Nevertheless, our main argument for preferring the ILO methodology still holds: the sample of countries and time coverage is the largest.

3.2 Skills Mismatch Patterns

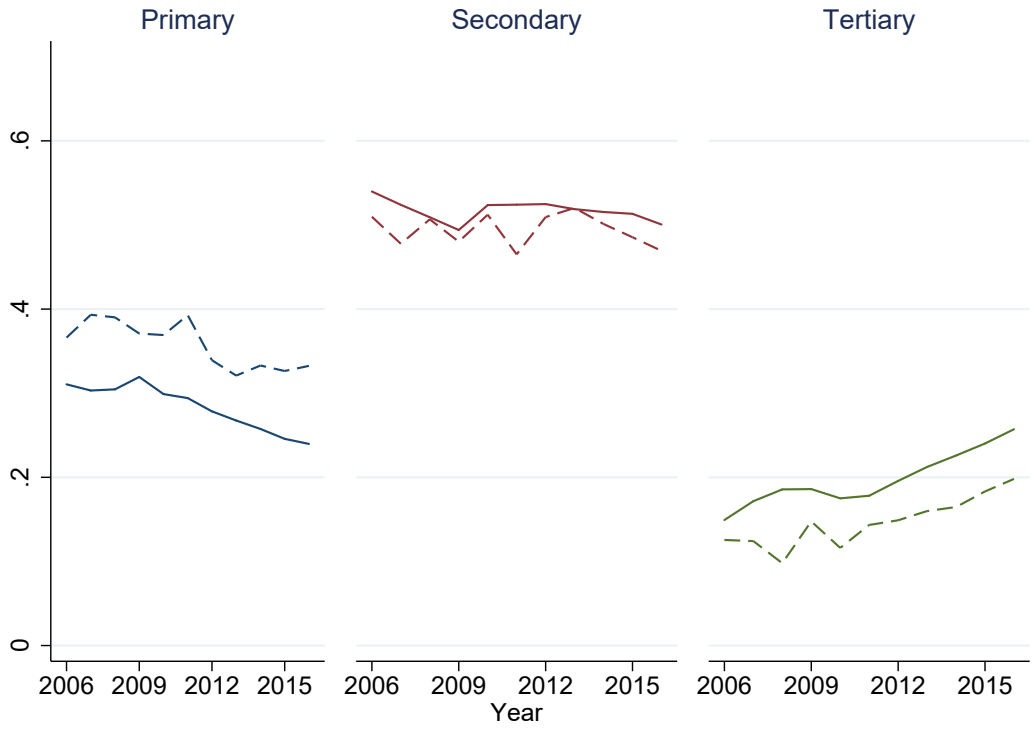
After having reviewed the definition of skills mismatch, we now focus on the patterns of this indicator across countries. We start by presenting in Figure 1 an example of the Skills Mismatch Rate decomposition in two countries, namely Switzerland and Germany. These two countries, which in many dimensions are very similar, present different patterns with respect to the Skills Mismatch Rate. The solid lines in the figure report the shares of employed youth by education level, while the dashed lines indicate the shares of unemployed by education level. The sum of the distances between the solid and the dashed lines determine the index of dissimilarity. In Figure 1, we observe an oversupply of primary educated workers in both countries – i.e. the share of youth within unemployment with primary education is larger than the corresponding share within employment. In Germany, the gap is clearly larger than in Switzerland, suggesting that in Germany the oversupply of primary educated workers is more of an issue than in Switzerland. This imbalance is reflected at the secondary level. Here, Switzerland presents an almost matched situation, in which the proportion of secondary educated youth within employment and unemployment is almost equal. On the contrary, in Germany, we observe an overdemand of secondary educated workers – i.e. the share of unemployed youth with secondary education is smaller than the corresponding share of employed youth. Finally, the sub-graphs reporting the evolution of employment and unemployment share with tertiary educated youth suggest a similar situation in Switzerland and Germany. In both countries, we observe an overdemand of tertiary educated youth.

Having exemplified how the three components of skills mismatch emerge in Switzerland and Germany, we now turn our focus on a broader set of countries. Figure 2 reports the components of skills mismatch – i.e. the difference between the share of employment and unemployment over three education levels – for all countries having data available in the KOF YLMI between 2006 and 2016. Countries are sorted on the vertical axis according to their average value in the index of dissimilarity. This figure offers us multiple insights on the skills mismatch patterns. First, the vast majority of countries present an oversupply of workers with primary education. The only exceptions in this regard are Turkey and Greece. For these two countries, the labour market demand of workers with primary education (ISCED 1-2) is larger than the supply.

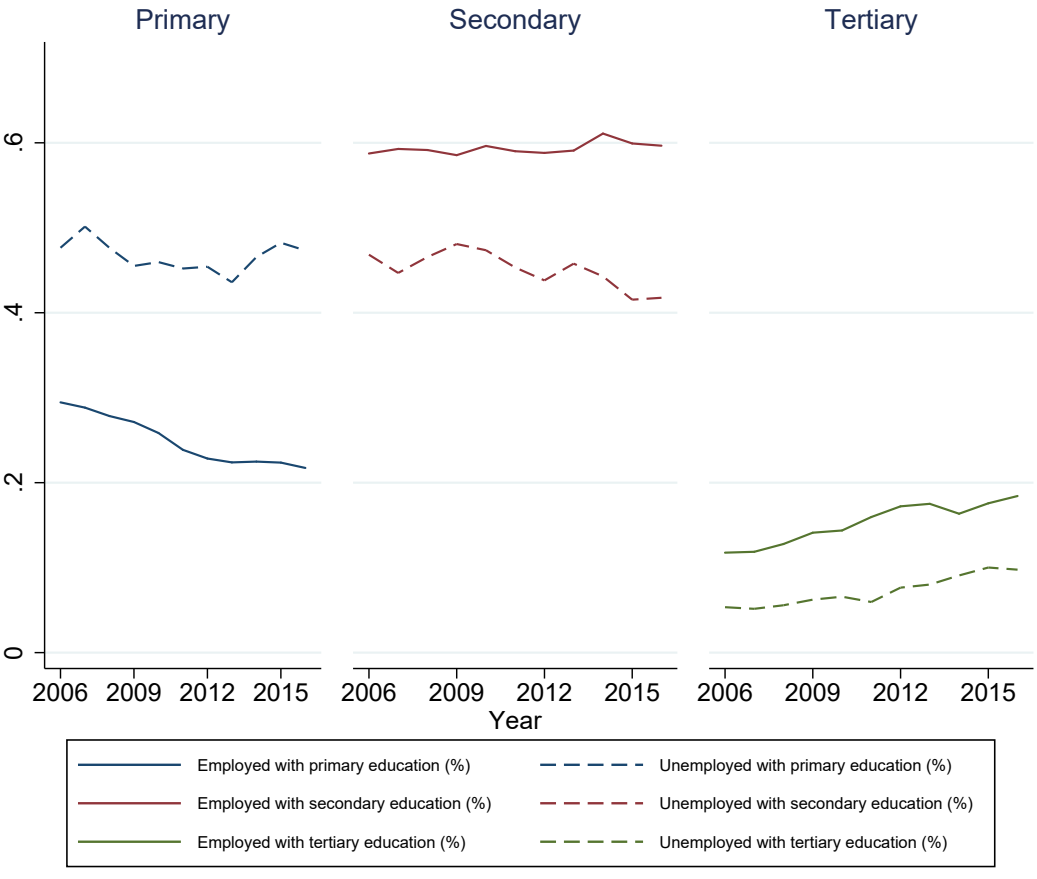
Furthermore, Figure 2 indicates that the countries presenting large Skills Mismatch Rates – Malta, Sweden, Norway, Netherlands, Germany, and Finland – have an overdemand of both secondary (ISCED 3-4) and tertiary educated workers (ISCED 5-8). Looking further down the list of countries, one can note that for Belgium, Ireland, the United Kingdom and France, the oversupply of primary educated workers is counterbalanced only by overdemand of tertiary educated workers. For these countries, the demand and supply of secondary educated workers are

Figure 1: Share of employed and unemployed by education level

(a) Switzerland



(b) Germany



well matched. The central part of Figure 2 suggests that countries with average Skills Mismatch present an overdemand of tertiary educated workers generally larger than the overdemand of secondary educated workers. Finally, the bottom part of Figure 2 reports the situation in the countries showing the lowest level of skills mismatch. The imbalances between demand and supply in these countries are very heterogeneous, although rather low.

Figure 2 suggests that the driving forces behind the Skills Mismatch Rate are quite different across countries. In particular, the patterns of mismatch – i.e. which level of education drives the mismatch – are independent on the level of Skills Mismatch Rate. For instance, we observe countries with oversupply of primary educated workers, overdemand of tertiary educated workers, and matched secondary education in both the upper and lower part of the distribution. Similarly, countries presenting almost equal levels of overdemand of secondary and tertiary educated workers can be found at almost all levels of the Skills Mismatch Rate.

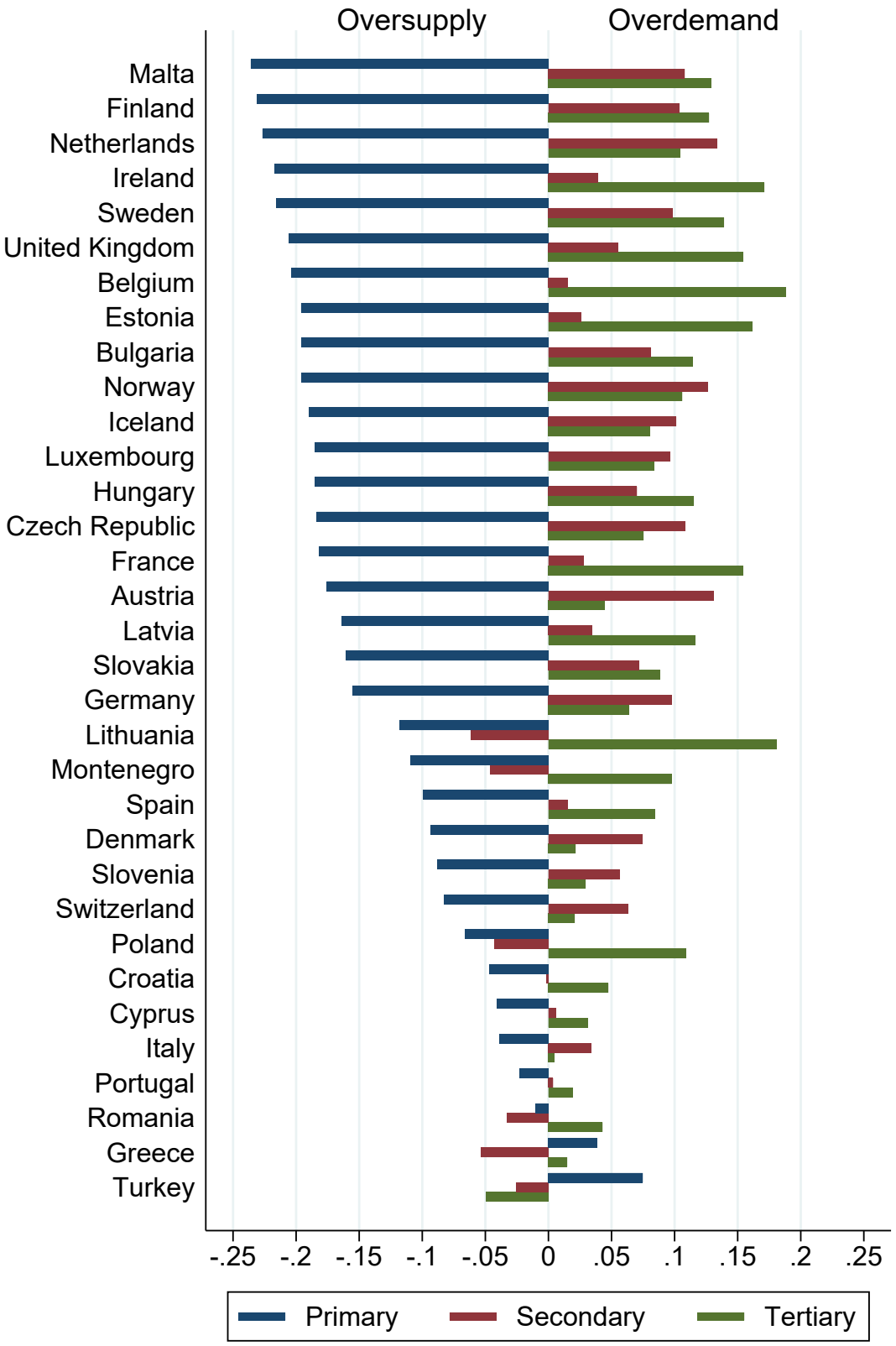
In order to better visualize the different patterns, Figure 3 presents a possible taxonomy of skills mismatch. Figure 2 shows that almost all countries have an oversupply of primary educated workers. Hence, this second figure focuses on the pattern of overdemand and oversupply at secondary and tertiary level. The x-axis reports the value of the aggregate Skills Mismatch Rate, which can range between 0 and 100. The y-axis indicates whether the overdemand of tertiary educated workers is larger than the overdemand of secondary educated ($y>0$) or vice versa ($y<0$). The y-axis reports the difference between the green and the red bars of Figure 2.

Starting by looking at the graph from the left to the right side, we observe a first group of countries showing relatively low values of skills mismatch. Countries in this group presents very small differences between the overdemand of secondary educated and tertiary educated workers. In Greece, Cyprus, Romania, Croatia and Switzerland the overdemand of tertiary educated workers is larger than that of secondary educated workers, while in Slovenia, Italy and Turkey the opposite occurs. Finally, in Portugal the overdemand of secondary educated and tertiary educated workers is almost identical. We define this group of countries as "matched".

Focusing now on the countries with a higher skills mismatch, we observe a first group of countries spread around the horizontal line showing close values of overdemand at secondary and tertiary level. We call countries in this groups "unmatched both at secondary and tertiary level". Among this large group of countries, five of them – Denmark, Austria, Czech Republic, Iceland and Germany – present an overdemand of secondary educated workers that is larger than the overdemand of tertiary educated. The remaining nine – Slovakia, Hungary, Luxembourg, Bulgaria, Finland, the Netherlands, Norway, Sweden and Malta – show an overdemand of secondary educated workers that is smaller than the overdemand of tertiary educated workers. The higher the skills mismatch value, the higher are the overdemand of secondary and tertiary educated workers. For example, Sweden and Malta both have very high overdemand of secondary and tertiary educated workers, which are compensated by an extremely high oversupply of primary educated workers (see Figure 2).

The third group of countries that emerges from Figure 3 is composed of all countries in which the overdemand of tertiary educated workers dominates the overdemand of secondary educated workers. This means that the Skills Mismatch Rate in these countries is mainly driven by a very

Figure 2: Skills mismatch components across countries (average 2006-2016)

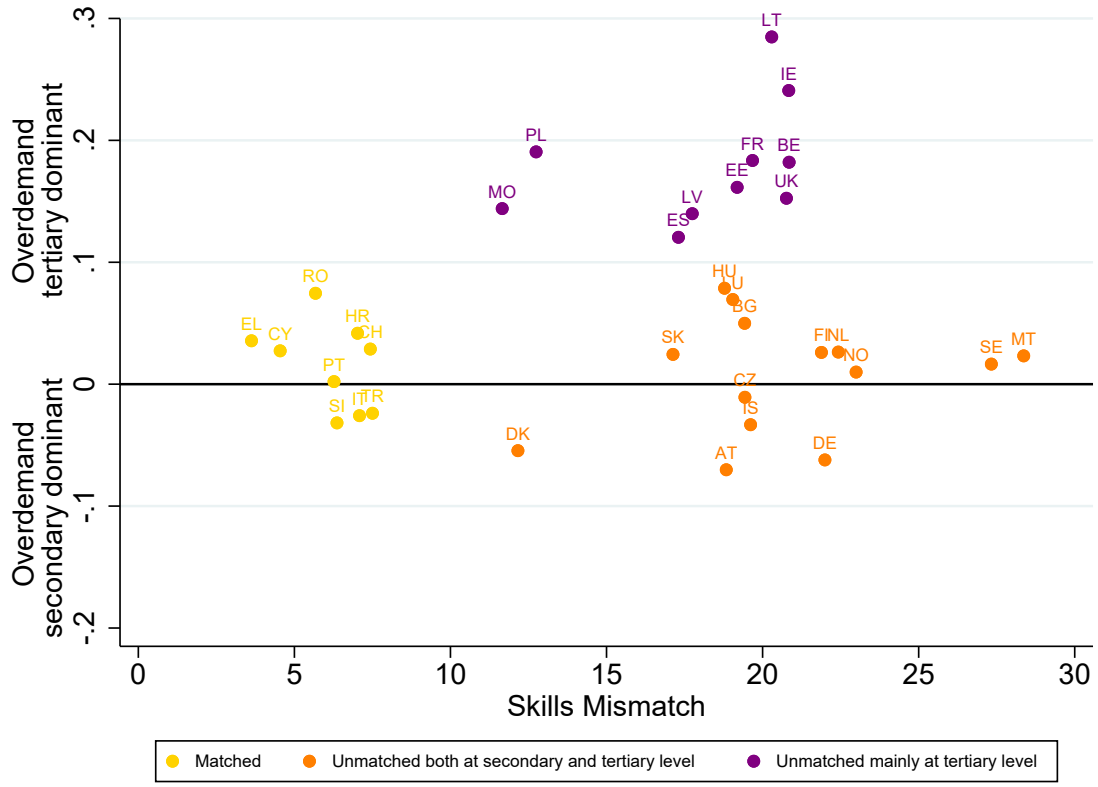


Notes: overdemand occurs when the share of employment with education k is larger than the share in unemployment with the same education k. On the contrary, oversupply occurs when the share of employment with education k is smaller than the share in unemployment with the same education k. Primary education correspond to ISCED levels 1-2, secondary education correspond to ISCED 3-4, while tertiary to ISCED 5-8.

large overdemand of tertiary educated workers. Among this group, we observe three different sub-groups. First, in Montenegro and Poland, the overdemand of tertiary educated workers dominates that of secondary educated workers, but we observe a generally low level of Skills Mismatch Rate. Second, a large set of countries – composing of Spain, Latvia, Estonia, France, Belgium and the United Kingdom – shows a similarly dominant overdemand of tertiary educated workers, but at a higher level of Skills Mismatch Rate (i.e. are more on the right of Figure 3). Finally, it is worth noting the source of Skills Mismatch Rate in Ireland and Lithuania. In these two countries, the difference between the overdemand of tertiary educated workers and that of secondary educated workers is the largest among the considered countries.

In summary, the heterogeneity in the pattern of skills mismatch presented in this section highlights the importance of not just considering mismatch on an aggregate level, but also in considering the source of the imbalances. Policies aiming to reduce the Skills Mismatch Rate should therefore focus on the structure of the labour force and target measures adequate to the extent of overdemand and oversupply of skills.

Figure 3: Taxonomy of skills mismatch



Notes: this graph reports on the x-axis the countries' average Skills Mismatch Rate over the period 2006-2016. The y-axis indicates whether the overdemand of tertiary educated workers is larger than the overdemand of secondary educated (y>0) or vice versa the overdemand of secondary educated workers dominates the ones of tertiary educated workers (y<0). Overdemand occurs when the share of employment with education k is larger than the share in unemployment with the same education k. Secondary education corresponds to ISCED 3-4, while tertiary to ISCED 5-8. An example of interpretation of the graph is the flowing: Iceland and Estonia shows an almost identical level of Skills Mismatch Rate. However, while in Iceland the mismatch is equally driven by an overdemand of secondary and tertiary educated worker, in the case of Estonia the mismatch is mainly driven by an overdemand of tertiary educated workers, which dominates the overdemand of secondary educated workers.

4 Summary and Outlook

With the fifth release of the KOF YLMI we extend the time series to the year 2016. The updated values are available in the interactive web tool[3], which allows comparisons between countries and over time. Users can select their country of interest and get access to graphs and scoreboards. From the methodological point of view, the fifth release of the index does not imply any change in indicators' definitions or index aggregation procedure. With regard to data sources, principal repositories did not change with respect to the previous release. Similarly to the previous release, we follow a strategy aimed to increase time and geographical coverage, while still ensuring perfect comparability among sources. Altogether, the number of observations in this fifth release increases by more than 15% relative to the previous release.

Our assessment of the evolution of the index between 2015 and 2016 confirms the leading positions of Denmark and Switzerland. Lithuania ranks at the third place, and is followed by the Netherlands, Germany and Austria. In the bottom of the ranking, Southern European countries continue on their path of amelioration, while top countries show decreasing values, which indicates a worsening labour market situation for the youth. In particular, looking at the different dimensions composing the KOF YLMI, we observe that in the Activity State there were some positive changes in the lower part of the rankings. On the contrary, in the Transition Smoothness dimension we observe deterioration for the countries at the top of the rank.

As in the previous releases, the update of the KOF YLMI allows the Education Systems research division the possibility to shed light on a particular aspect of the youth labour market. With this report, we focus on the Skills Mismatch Rate. Specifically, in the main section of this study, after reviewing the definition of the Skills Mismatch Rate, we disentangle this indicator into its components. Thereafter, we present the skills mismatch patterns across a large set of European countries. Finally, we create a taxonomy of skills mismatch patterns. Interestingly, our analysis suggests that the patterns of skills mismatch are highly heterogeneous. Specifically, we observe overdemand of tertiary educated workers among highly unmatched countries but also among countries with a more balanced situation. Similarly, there is a set of countries with very different levels of Skills Mismatch Rate, but with the same source of mismatch. This study stresses the importance of considering the sources of skills mismatch between countries showing a similar aggregate level of mismatch.

The areas of development of the KOF YLMI include the periodic update of indicator values and the continuous check of the methodological aspects of the index definition. Furthermore, we plan to conduct deeper analyses on the evolution of single indicators as well as comparisons across countries or regions based on the entire set of indicators.

[3] Access at `https://www.kof.ethz.ch/en/forecasts-and-indicators/indicators/kof-youth-labour-market-index.html`

Bibliography

Cedefop (2018). Insights into skill shortages and skill mismatch. learning from cedefopś european skills and jobs survey. Technical report, CEDEFOP - European Centre for the Development of Vocational Training.

Eurostat (2018). Young people on the labour market - statistics. `https://ec.europa.eu/eurostat/statistics-explained/index.php/Young_people_on_the_labour_market_-_statistics`. Accessed: 2018-11-01.

ILO (2013a). Global Employment Trends for Youth 2013. A generation at risk. Technical report, International Labour Office Geneva.

ILO (2013b). *Key Indicators of the Labour Market, Eighth Edition (pre-print)*. International Labour Office Geneva. `http://www.ilo.org/empelm/what/WCMS_114240/lang--en/index.htm` [accessed 16.01.2014].

Pusterla, F. (2015). How did the Youth Labour Market Situation Evolve between 2012 and 2013? Second Release of the KOF Youth Labour Market Index. *KOF Studies*, (67).

Pusterla, F. (2016). The Great Recession and the Working Conditions of Youth: A Descriptive Analysis of the European Labour Market. *KOF Studies*, (83).

Pusterla, F. (2017). How Active are Youth? The Interplay between Education, Youth Unemployment and Inactivity. Fourth Release of the KOF Youth Labour Market Index. *KOF Studies*, (97).

Renold, U., Bolli, T., Egg, M. E., & Pusterla, F. (2014). On the Multiple Dimensions of Youth Labour Markets. *KOF Study*, (51).

Sparreboom, T. & Tarvid, A. (2017). Skills mismatch of natives and immigrants in europe. *International Labour Office, Conditions of Work and Equality Department, ILO. Switzerland: Geneva.*

A Methodological Notes on the Fifth Release

This section reports the data sources of the indicators composing the KOF YLMI. From the methodological perspective, no changes with respect to indicators definition or calculation procedure has occurred for this release. Readers interested in methodological aspects such as the indicators definition, standardization scale or index aggregation should please refer to the technical manuals of the previous releases.

With respect to data sources, principal repositories have remained the same since the previous release. As Table 2 reports, the main data sources for this fifth release of the KOF YLMI are the ILO, the OECD, and Eurostat[4]. Similar to the previous releases, we match data sets from these three institutions to increase geographical coverage. For all indicators, we validate comparability by checking definitions and consistency of values across data sets. Thanks to this strategy, our data set increases. Specifically, the number of countries reporting values for the NEET Rate increases from 133 to 141. The country coverage increases by one unit in the case of the Temporary Worker Rate, the Involuntary Part-time Workers Rate, the Atypical Working Hours Rate, the Formal Education and Training Rate, and the Skills Mismatch Rate. For the Vulnerable Worker Rate, the number of covered countries rose from 159 in the previous release to 175 in this fifth release. Finally, the Incidence of Long-term Unemployment Rate presents values for up to 125 countries – previously only 99. Appendix B reports extensive information on data sources, time, and geographical coverage for every indicator.

Altogether, the number of observations in the KOF YLMI fifth release increases by more than 15% relative to the previous release. We welcome this increase in data coverage as our aim is to provide the most complete overview of the youth labour market in an international context.

Table 2: Summary of data availability

Indicator	Source	Time coverage	No. of countries
Activity State			
Unemployment Rate	ILO KILM & ILOSTAT	1991 - 2016	up to 178
Relaxed Unemployment Rate	Eurostat	2005 - 2016	up to 33
NEET Rate	Eurostat, ILO KILM & ILOSTAT	1998 - 2016	up to 141
Working Conditions			
Temporary Worker Rate	Eurostat	1992 - 2016	up to 34
Involuntary Part-Time Workers Rate	OECD & SFSO	1991 - 2016	up to 42
Atypical Working Hours Rate	Eurostat	1992 - 2016	up to 34
In Work at Risk of Poverty Rate	Eurostat	2003 - 2016	up tp 34
Vulnerable Employment Rate	ILO KILM & ILOSTAT	1991 - 2016	up to 175
Education			
Formal Education and Training Rate	Eurostat & SFSO	1996 - 2016	up to 34
Skills Mismatch Rate	Eurostat, ILO KILM & ILOSTAT	1992 - 2016	up to 60
Transition Smoothness			
Relative Unemployment Ratio	ILO KILM & ILOSTAT	1991 - 2016	up to 178
Incidence of Long-Term Unemployment Rate	Eurostat, ILO KILM, ILOSTAT & OECD	1991 - 2016	up to 125

[4]In a few cases, the data sources are completed by data from national institutions such as the Swiss Federal Statistical Office (SFSO).

B Detailed Information on Data Availability

Table 3: Detailed information on data sources, extraction methods, number of covered countries and time coverage

Indicator	**Sources**	**Countries covered in at least one year**	**Countries covered in 2015 (4th release)**	**Countries covered in 2016 (5th release)**	**Years**
Unemployment Rate		178	175	175	1991 - 2016
	ILO - *ILOSTAT, Key Indicators of the Labour Market (KILM): Unemployment rate - ILO modeled estimates, May 2017 [Source: ILO estimate; Age: 15-24; Time: 2000-2016]* Last update 19.12.2017	175	175	175	2000 - 2016
	ILO - *KILM 9th Edition Table 10a: Youth unemployment (ILO estimates) [Youth unemployment rate; Countries: Select all, exclude Samoa; Income group: Select all; Year: 1991-2014; Sex: MF; Type of statistic: Select all]* Extracted on 08.03.2016	178	-	-	1991 - 2014
Relaxed Unemployment Rate	**Eurostat** - *Unemployment [lfsa_ugan; Age: 15-24; Citizen: Total; Geo: Select all; Sex: Total; Time: 1995-2016; Unit: Thousand] Last update 19.12.2017; Supplementary indicators to unemployment [lfsi_sup_a; Age: 15-24; Geo: Select all; INDIC_EM: NSEE_AV; Sex: Total; Time: 2005-2016; Unit: Thousand] Last update 11.10.2017; Population [lfsa_pganws; Age: 15-24; Citizen: Total; Geo: Select all; Sex: T; Time: 1995-2016; Unit: Thousand; WStatus: ACT]* Last update 19.12.2017	33	31	31	2005 - 2016

NEET Rate		141	68	83	1998 - 2016
	ILO - *ILOSTAT, Key Indicators of the Labour Market (KILM): Youth NEET rate - ILO modeled estimates, Nov. 2016 [Share of youth not in employment, education or training (NEET) (%); Source: all; Time: 2000-2016]* Last update 19.12.2017	135	68	83	2000 - 2016
	ILO - *KILM 9th Edition Table 10c: NEET Rates [Share of youth not in education, employment, or training; Countries: Select all, exclude Samoa; Income group: Select all; Year: 1998-2014; Age: 15-24; Repository: Select all; Type of source: Select all; Coverage: Select all; Geographical coverage: Select all]* Extracted on 24.11.2015	106	-	-	1998 - 2014
	Eurostat - *Young people neither in employment nor in education and training by sex and age (NEET rates) [NEET rate; Sex: Total; Age: 15-24; Year: 2000-2014; Unit: Percentage; WStatus: NEMP]* Last update 08.10.2015	33	-	-	2000 - 2014
Temporary Worker Rate	**Eurostat** - *Temporary employees by sex, age and duration of the work contract [lfsa_etgadc; Age: 15-24; Duration: Less than 1 month, From 1 to 3 months, From 4 to 6 months, From 7 to 12 months, From 13 to 18 months; Geo: Select all; Sex: T; Time: 1992-2016]* Aggregated values (1 to 18 months) obtained from Eurostat on 17.05.2018 after direct request; *Employment by sex, age and citizenship [lfsa_egan; Age: 15-24; Citizen: Total; Geo: Select all; Sex: T; Time: 1995-2016]*	34	33	34	1992 - 2016

Involuntary Part-Time Workers Rate		42	40	42	1991 - 2016
	OECD - *Incidence of involuntary part time workers [Country: Select all; Time: 1991-2016; Sex: All persons; Age: 15-24; Employment status: Total Employment; Series: Share of involuntary part-timers in total employment]* Extracted on 05.01.2018	41	39	41	1991 - 2016
	Swiss Federal Statistical Office - *Involuntary part-time workers [Involuntary part-time workers are part-timers (working less than 30-usual hours per week) because they could not find a full-time job]*; Data obtained from the SFSO on 08.01.2018 after direct request. Note that the values for the years 2007-2010 and 2013-2014 have relatively low reliability. Please interpret those values with caution.	1	1	1	2004 - 2016
Atypical Working Hours Rate	**Eurostat** - *Employees working shifts as a percentage of the total of employees [lfsa_ewpshi; Age: 15-24; Geo: Select all; Sex: T; Time: 1992-2016] Last update 19.12.2017, Employed persons working at nights as a percentage of the total employment [lfsa_ewpnig; Age: 15-24; Frequenc: Usually; Geo: Select all; Sex: T; Time: 1992-2016; WStatus: EMP] Last update 19.12.2017, Employed persons working on Sundays as a percentage of the total employment [lfsa_ewpsun; Age: 15-24; Frequenc: Usually; Geo: Select all; Sex: T; Time: 1992-2016; WStatus: EMP]*, Last update 19.12.2017	34	32	32	1992 - 2016

In Work at Risk of Poverty Rate	**Eurostat** - *In-work at-risk-of-poverty rate by age and sex [ilc_iw01; Age: 15-24; Geo: Select all; Sex: T; Time: 2003-2016; WStatus: EMP]* Last update 17.05.2018	34	33	33	2003 - 2016
Vulnerable Employment Rate		175	74	175	1991 - 2016
	ILO - *ILOSTAT, Key Indicators of the Labour Market (KILM): Status in employment - ILO modeled estimates, May 2017 [Own-account workers, Contributing family workers, Total employment; Sex: Tot; Time: 1991-2016]* Extracted on 08.01.2018	175	75	175	2000 - 2016
	ILO - *KILM 9th Edition Table 3: Status in Employment [Share of vulnerable employment in total employment; Countries: Select all, exclude American Samoa, Anguilla, Antigua and Barbuda, Aruba, British Virgin Islands, Cayman Islands, Cook Islands, Djibouti, Dominica, French Guiana, French Polynesia, Germany (Federal Republic of), Grenada, Guam, Isle of Man, Kosovo, Marshall Islands, Montserrat, Netherlands Antilles, New Caledonia, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Samoa, San Marino, Sao Tome and Principe, Tonga, Turks and Caicos Islands, Tuvalu, Vanuatu; Income group: Select all; Year: 1998-2014; Age: Select all; Repository: Select all; Type of source: Select all; Coverage: Select all; Geographical coverage: Select all]* Extracted on 01.12.2015	157	-	-	1991 - 2014

Formal Education and Training Rate		34	33	34	1996 - 2016
	Eurostat - *Participation in education and training [trng_lfs_09; Age: 15-24; Geo: Select all; Sex: T; Time: 2004-2016; TYPTRAI: Formal education and training; Unit: PC]* Last update 21.12.2017. Values for year 2003 obtained from Eurostat on 10.09.2015 after direct request.	34	33	34	2003 - 2016
	Swiss Federal Statistics Office - *Participation rate in formal education and training (last 4 weeks) [by sex and age (15-24), frequencies in percent*] Data available from the SFSO upon request	1	-	-	1996 - 2002
Skills Mismatch Rate		60	33	34	1992 - 2016
	Eurostat - *Active population by sex, age and educational attainment level (1 000) [lfsa_agaed; Sex: Total; Age: From 15 to 24 years & from 25 to 29 years; Unit: Thousand; Time: 1992-2016] Last update: 17.01.2018 - Employment by sex, age and educational attainment level (1 000) [lfsa_egaed; Sex: Total; Age: From 15 to 24 years & from 25 to 29 years; Unit: Thousand; Time: 1992-2016]* Last update: 17.01.2018	34	33	34	1992 - 1999 2013 - 2016
	ILO - *KILM 8th Edition Table 15a: Skills mismatch between labour supply and demand by educational attainment [Skills mismatch; Sex: MF; Year: 2000-2013; exclude: Samoa]* Extracted on 02.02.2015	59	-	-	2000 - 2013

Relative Unemployment Ratio		178	175	175	1991 - 2016
	ILO - *ILOSTAT, Key Indicators of the Labour Market (KILM): Unemployment rate - ILO modeled estimates, May 2016 [Source: ILO estimate; Age: 15-24 & 25+ ; Time: 2000-2016]* Last update 06.01.2018	175	174	175	2000 - 2016
	ILO - *KILM 9th Edition Table 10a: Youth unemployment (ILO estimates) [Ratio of youth unemployment rate to adult unemployment rate; Countries: Select all, exclude Samoa; Income group: Select all; Year: 1991-2014; Sex: MF; Type of statistic: Select all]* Extracted on 01.22.2015	178	-	-	1991 - 2014
Incidence of Long-Term Unemployment Rate		125	69	75	1991 - 2016
	ILO - *ILOSTAT: Unemployment by sex, age and duration [Sex: Total, Age: 15-24 Duration: Total (aggregate duration) & 12 months or more; Source: all; Time: 2000-2016]* Extracted on 08.01.2018	117	69	75	2000 - 2016
	ILO - *KILM 9th Edition Table 11a: Long-term unemployment [Incidence of long-term unemployment; Countries: Select all, exclude French Polynesia; Income group: Select all; Year: 1991-2014; Sex: MF; Age group: Youth; Repository: Select all; Type of source: Select all; Coverage: Select all; Geographical coverage: Select all]* Extracted on 10.03.2016	87	-	-	1991 - 2014

	OECD - *OECD.Stat [Unemployment by duration; Year: 1991-2013; Sex: All Person; Age: 15 to 24; Frequency: Annual; Unit: Persons, thousands]* Extracted on 06.07.2015 - *OECD.Stat [Incidence of unemployment by duration; Year: 1991-2013; Sex: All Person; Age: 15 to 24; Unit: Percentage]* Extracted on 06.07.2015	12	-	-	1997-2013
	Eurostat - *Long-term unemployment (12 months or more) as a percentage of the total unemployment, by sex, age and nationality (%) [lfsa_upgan; Age: From 15 to 24 years; Citizen: Total; Geo: Select all; Sex: Total: Time: 1995-2014; Unit: Percentage]* Last update 24.02.2016	1	-	-	1998-2014

Notes: Data sources might change over releases due to data availability. Values for certain countries/years, which are no longer contained in the last version of the repository, are included from previous release of the KOF YLMI.