

# The European Commission's science and knowledge service

## Joint Research Centre



# JRC Statistical Audit of the European Skills Index

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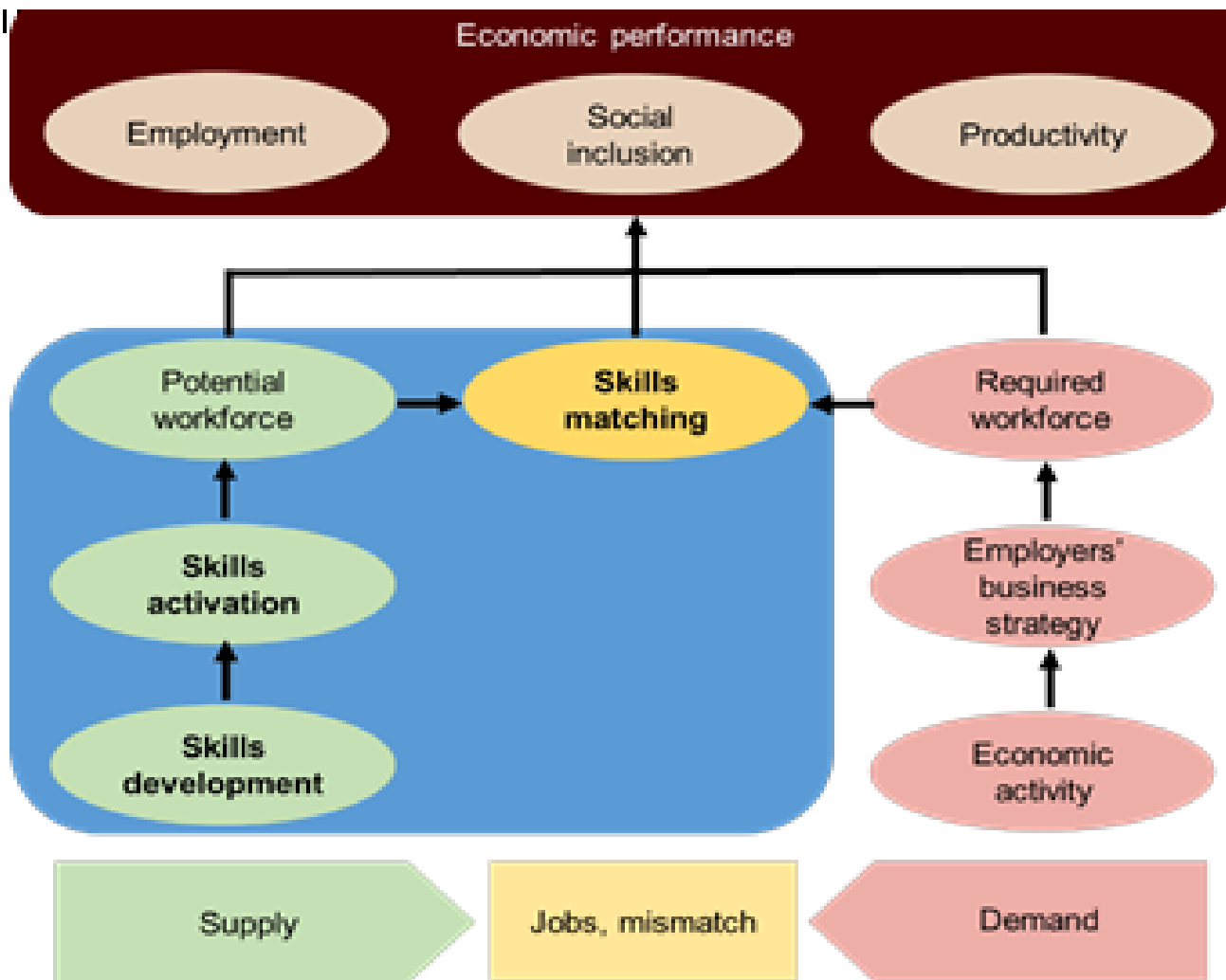
Competence Centre on Composite Indicators and Scoreboards  
27/09/2018, Brussels

# Statistical audit of the European Skills Index

1. **Conceptual framework** based on **existing literature**
2. **Data quality checks**
3. **Statistical coherence**
4. **Impact of modeling assumptions** on the results
5. **Qualitative confrontation with experts** in order to get feedback on choices made during the index development



# The Skills system concept



□ Supply side: Skills activation and skills development

□ Intersection between supply and demand: Skills matching

# The European Skills Index Framework

Pre-primary pupil-to-teacher ratio (students per teacher)	1
Share of pop (aged 15-64) with at least upper secondary education (%)	2
Reading, maths & science scores (aged 15) (PISA)	3
Recent training (%)	4
VET students (%)	5
High computer skills (%)	6
Early leavers from training (%)	7
Recent graduates in employment (%)	8
Activity rate (aged 25-54) (%)	9
Activity rate (aged 20-24) (%)	10
Long-term unemployment (%)	11
Underemployed part-time workers (%)	12
Higher education mismatch (%)	13
ISCED 5-8 proportion of low wage earners (%)	14
Qualification mismatch (%)	15

Indicator	Indicator Weights	Weighted Arithmetic Average	Sub-pillar	Sub-pillar Weights	Weighted Arithmetic Average	Pillar	Pillar Weights	Weighted Geometric Average	Index	Index Weights	
Ind 01	0,4		Compulsory training	0,5		Skills Development	0,3		European Skills Index	0,06	
Ind 02	0,3	→									0,05
Ind 03	0,3										0,05
Ind 04	0,3		Training and tertiary education	0,5	→					0,05	
Ind 05	0,35	→								0,05	
Ind 06	0,35									0,05	
Ind 07	0,7	→	Transition to work	0,5		Skills Activation	0,3	→		0,11	
Ind 08	0,3	→								0,05	
Ind 09	0,5	→	Activity rates	0,5	→					0,08	
Ind 10	0,5	→					0,08				
Ind 11	0,4	→	Unemployment	0,4		Skills Matching	0,4			0,06	
Ind 12	0,6	→								0,10	
Ind 13	0,4	→	Skills mismatch	0,6	→					0,10	
Ind 14	0,1	→					0,02				
Ind 15	0,5	→					0,12				

# Statistical coherence – indicator level

Indicator	SP1: Compulsory education	SP2: Training and tertiary education	SP3: Transition to work	SP4: Activity rates	SP5: Unemployment	SP6: Skills mismatch	P1: Skills Development	P2: Skills Activation	P3: Skills Matching	Index
ind.1	0,71	0,22	0,30	0,17	0,39	0,22	0,51	0,26	0,32	0,43
ind.2	0,70	0,19	0,43	0,27	0,41	0,18	0,50	0,39	0,30	0,52
ind.3	0,64	0,62	0,38	0,55	0,08	0,01	0,73	0,51	0,04	0,52
ind.4	0,41	0,81	0,36	0,66	-0,03	0,07	0,72	0,56	0,03	0,49
ind.5	0,20	0,61	0,08	-0,03	0,19	0,46	0,48	0,03	0,37	0,38
ind.6	0,48	0,75	0,41	0,67	-0,09	-0,02	0,72	0,60	-0,06	0,48
ind.7	0,53	0,36	<b>0,96</b>	0,53	0,13	0,16	0,51	0,83	0,16	0,65
ind.8	0,36	0,23	0,66	0,60	0,52	0,48	0,34	0,70	0,53	0,72
ind.9	0,40	0,51	0,45	0,81	-0,02	0,06	0,53	0,69	0,03	0,54
ind.10	0,37	0,37	0,56	0,81	-0,01	-0,06	0,43	0,76	-0,04	0,46
ind.11	0,47	0,32	0,51	0,45	0,72	0,49	0,45	0,54	0,63	0,72
ind.12	0,28	-0,11	0,05	-0,29	0,91	0,68	0,08	-0,13	0,84	0,42
ind.13	0,26	0,46	0,39	0,25	0,64	0,78	0,42	0,36	0,78	0,74
ind.14	-0,23	0,32	-0,15	-0,16	0,05	0,50	0,06	-0,17	0,34	0,12
ind.15	0,23	0,13	0,11	-0,12	0,63	0,84	0,21	0,00	0,81	0,48

## Cross-correlations (Pearson corr. coef.)

- Expectations:
  - Indicators should be more correlated to their own ESI sub-pillar than to any other
  - Correlations greater than 0.7 within a component
- Results: Indicators have been allocated to the most relevant ESI sub-pillar and none of the 15 indicators is lost in the aggregation (at least at the first two levels).



# Statistical coherence – sub-pillar level

ESI sub-pillars and pillars	P1: Skills Development	P2: Skills Activation	P3: Skills Matching	Index
SP1: Compulsory education	0.84	0.57	0.29	0.70
SP2: Training and tertiary education	0.88	0.50	0.20	0.62
SP3: Transition to work	0.53	0.90	0.29	0.76
SP4: Activity rates	0.59	0.89	-0.01	0.61
SP5: Unemployment	0.26	0.14	0.90	0.64
SP6: Skills mismatch	0.26	0.16	<b>0.95</b>	0.68
P1: Skills Development	1.00			0.77
P2: Skills Activation	0.62	1.00		0.76
P3: Skills Matching	0.28	0.16	1.00	0.71

## Cross-correlations (Pearson corr. coef.)

- Expectations:
  - Sub-pillars should be more correlated to their own ESI pillar than to any other
  - Correlations greater than 0.7 within a component
- Results: Sub-pillars have been allocated to the most relevant ESI pillar and none of the 6 sub-pillars is lost in the aggregation.



# Impact of modelling assumptions (1/2)

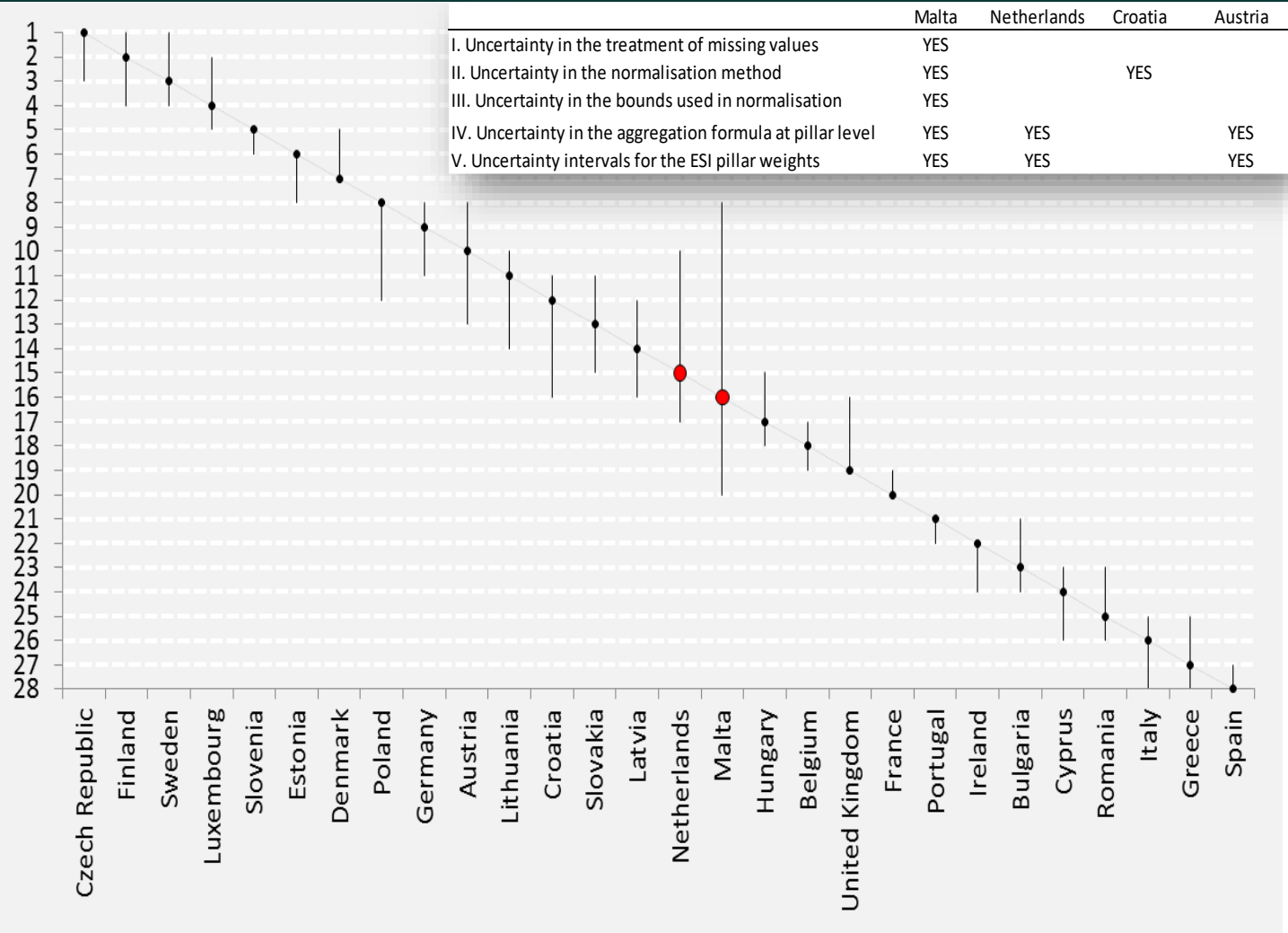
**Uncertainty/robustness analysis** (simultaneous and joint impact of modeling choices on the ranking; 12 000 simulations)

- **Expectations:** Country classification based on the European Skills Index should depend mainly on the indicators used and not on the methodological judgments made.

	<i>Reference</i>	<i>Alternative</i>
I. Uncertainty in the treatment of missing values	No estimation of missing data	Expectation Maximization (EM)
II. Uncertainty in the normalisation method	Min-Max	z-scores
III. Uncertainty in the bounds used in normalisation	Fixed bounds (goalposts)	Observed minimum and maximum values
IV. Uncertainty in the aggregation formula at pillar level	Geometric average	Arithmetic average
V. Uncertainty intervals for the ESI pillar weights	Reference value for the weight	Distribution assigned for robustness analysis
1. Skills Development	0.3	U[0.225, 0.375]
2. Skills Activation	0.3	U[0.225, 0.375]
3. Skills Matching	0.4	U[0.300, 0.500]

# Impact of modelling assumptions (2/2)

European Skills Index 2018:  
ranks and intervals of simulated ranks  
Lower performance ---> Higher performance



## Results



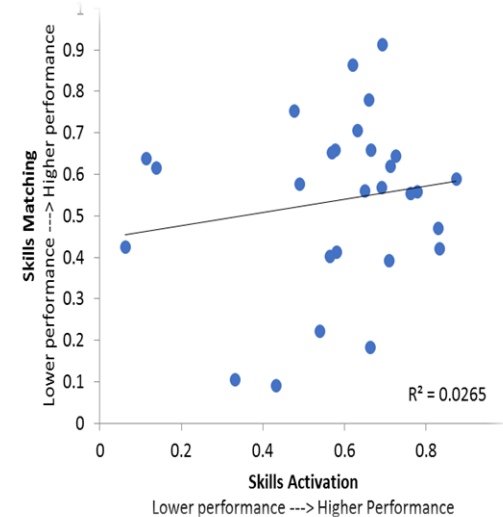
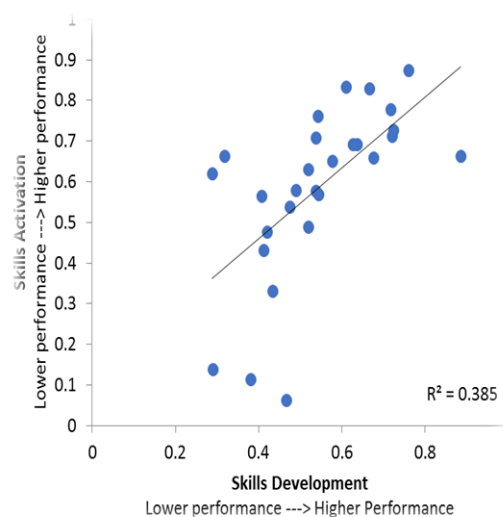
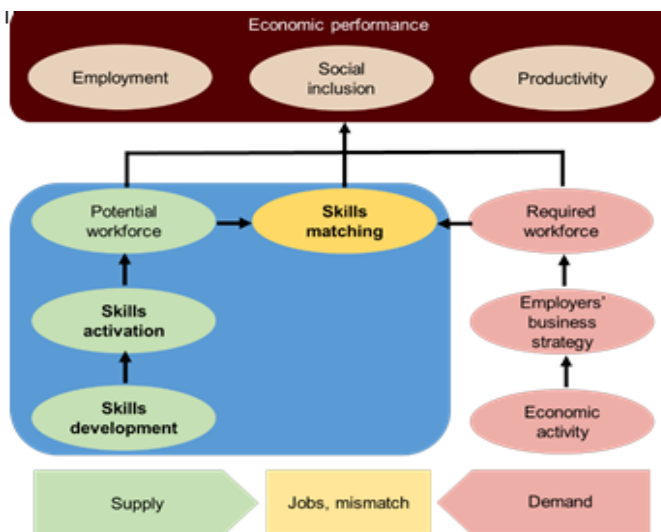
- In most cases (24/28 countries) simulated ranks are  $\pm 3$  positions  $\rightarrow$  narrow enough to allow for meaningful inferences
- Only 2 countries have relatively wide intervals: Malta [8, 20] and the Netherlands [10, 17].

Note: Intervals (90% confidence intervals) are calculated over 12,000 simulated scenarios. Malta and the Netherlands are the two countries with most sensitive ESI ranks (in red); Austria and Croatia follow.

# Five performance groups in the EU according to the European Skills Index

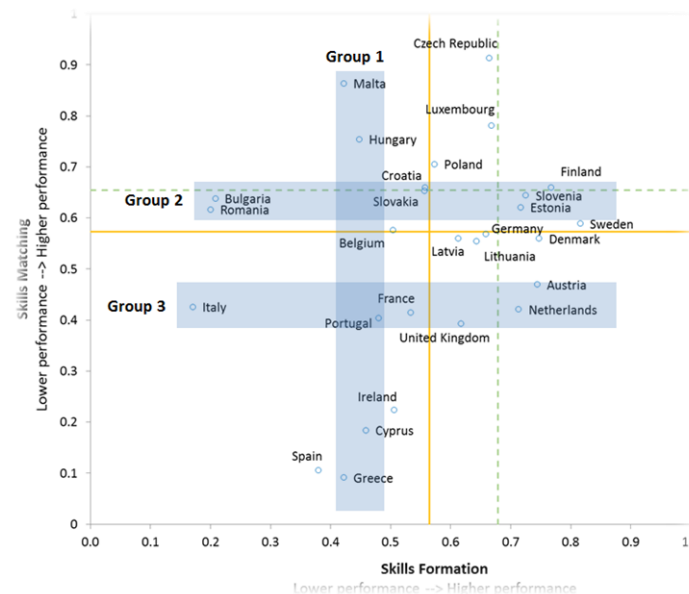
	Original score	Original rank	Original interval of the 5 scenarios in the ESI report	90% Interval over the 12 000 JRC scenarios	Performance group
Czech Republic	0.75	1	[1,3]	[1,3]	Higher
Finland	0.72	2	[2,2]	[1,4]	
Sweden	0.72	3	[1,4]	[1,4]	
Luxembourg	0.71	4	[3,5]	[2,5]	
Slovenia	0.69	5	[5,6]	[5,6]	
Estonia	0.68	6	[6,8]	[6,8]	
Denmark	0.67	7	[4,7]	[5,7]	
Poland	0.62	8	[8,12]	[8,12]	Upper middle
Germany	0.62	9	[9,11]	[8,11]	
Austria	0.62	10	[7,10]	[8,13]	
Lithuania	0.61	11	[10,15]	[10,14]	Middle
Croatia	0.60	12	[12,18]	[11,16]	
Slovakia	0.59	13	[11,15]	[11,15]	
Latvia	0.59	14	[13,16]	[12,16]	
Netherlands	0.58	15	[10,17]	[10,17]	
Malta	0.56	16	[9,19]	[8,20]	
Hungary	0.55	17	[16,17]	[15,18]	
Belgium	0.53	18	[18,19]	[17,19]	
United Kingdom	0.52	19	[15,19]	[16,19]	
France	0.48	20	[20,20]	[19,20]	
Portugal	0.45	21	[21,21]	[21,22]	
Ireland	0.36	22	[22,24]	[22,24]	Lower middle
Bulgaria	0.33	23	[22,24]	[21,24]	
Cyprus	0.32	24	[23,26]	[23,26]	
Romania	0.31	25	[23,25]	[23,26]	
Italy	0.25	26	[25,28]	[25,28]	Lower
Greece	0.23	27	[27,28]	[25,28]	
Spain	0.23	28	[26,28]	[27,28]	

# Three Skills pillars ... one number?



	Index
P1: Skills Development	0.77
P2: Skills Activation	0.76
P3: Skills Matching	0.71

Note: Pearson correlation coefficients (n=28)

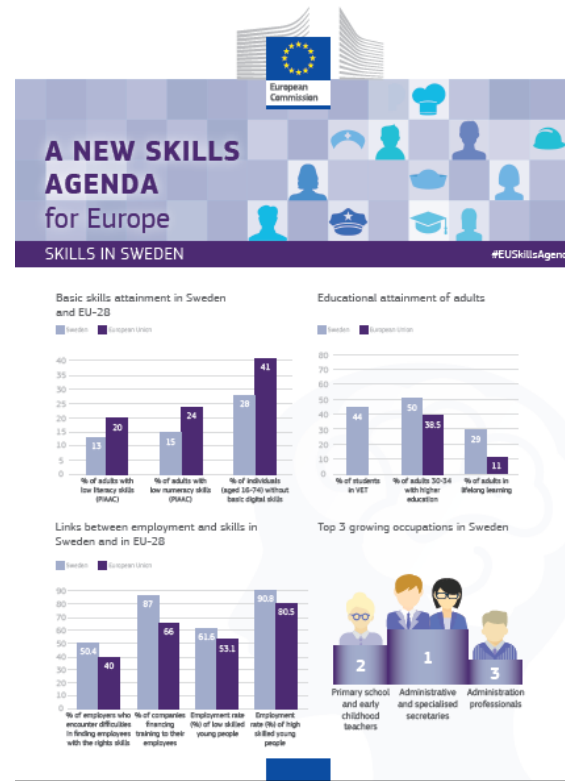


# Focus discussions on the three skills pillars

Could feed into next year's...

## European Skills Index

- Skills Development
- Skills Activation
- Skills Matching



**European Semester**

Country Specific Recommendations



# THANK YOU

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