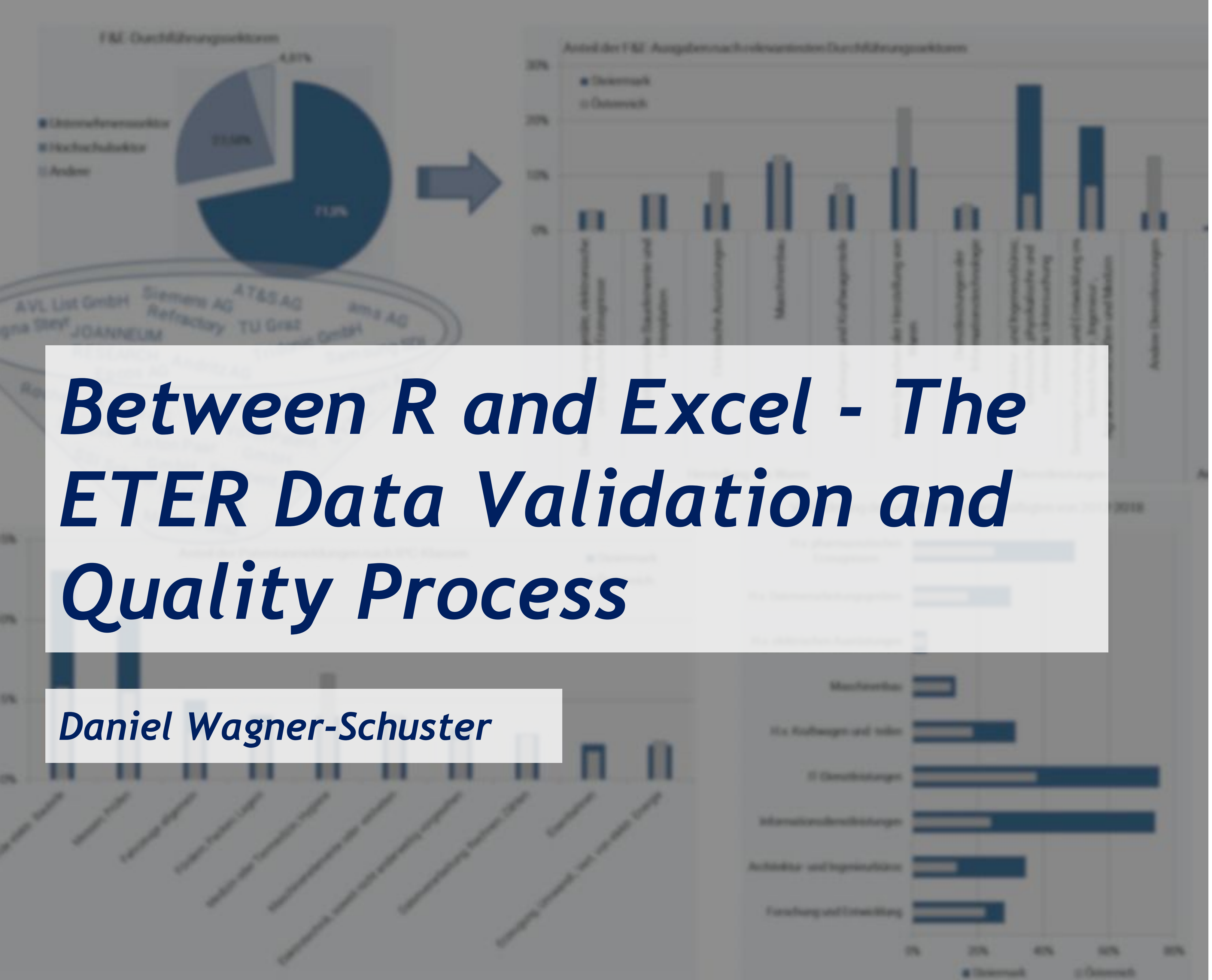


Between R and Excel - The ETER Data Validation and Quality Process

Daniel Wagner-Schuster

JOANNEUM RESEARCH
POLICIES

European Tertiary Education Register

ETER
EUROPEAN TERTIARY EDUCATION REGISTER

- Collects and provides data on higher education institutions in Europe
  - at the institutional level
  - 2013-2019
    - Tender for another 3 years
  - 37 countries
    - ~ 3,000 institutions per year
  - currently data for 6 academic years
    - 17,285 observations for 618 variables
  - eter-project.com

Some challenges

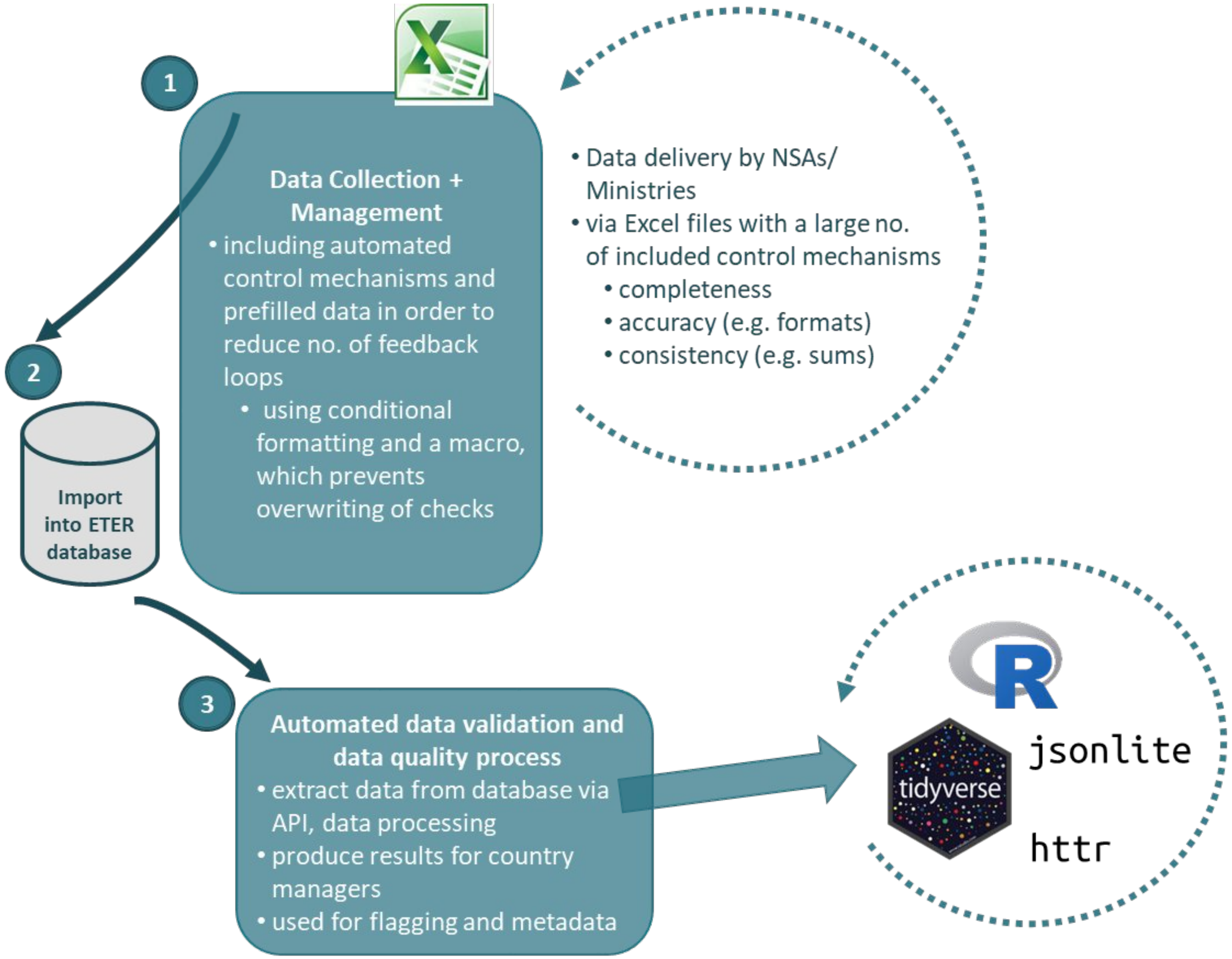
- Collect data from 37+ different sources (countries)

- Ensure tidy data (data validation)
  - Find missing variables, inconsistencies, wrong formats

- Ensure high data quality
  - Multiannual checks
  - Outlier detection
  - Consistency with external data sources (e.g. Eurostat national aggregates)

- Constant interaction between data deliverer, country managers and data collection managers

Challenge #1: Data Collection



1

Data Collection + Management

- including automated control mechanisms and prefilled data in order to reduce no. of feedback loops
    - using conditional formatting and a macro, which prevents overwriting of checks

- Data delivery by NSAs/ Ministries
- via Excel files with a large no. of included control mechanisms
    - completeness
    - accuracy (e.g. formats)
    - consistency (e.g. sums)

2

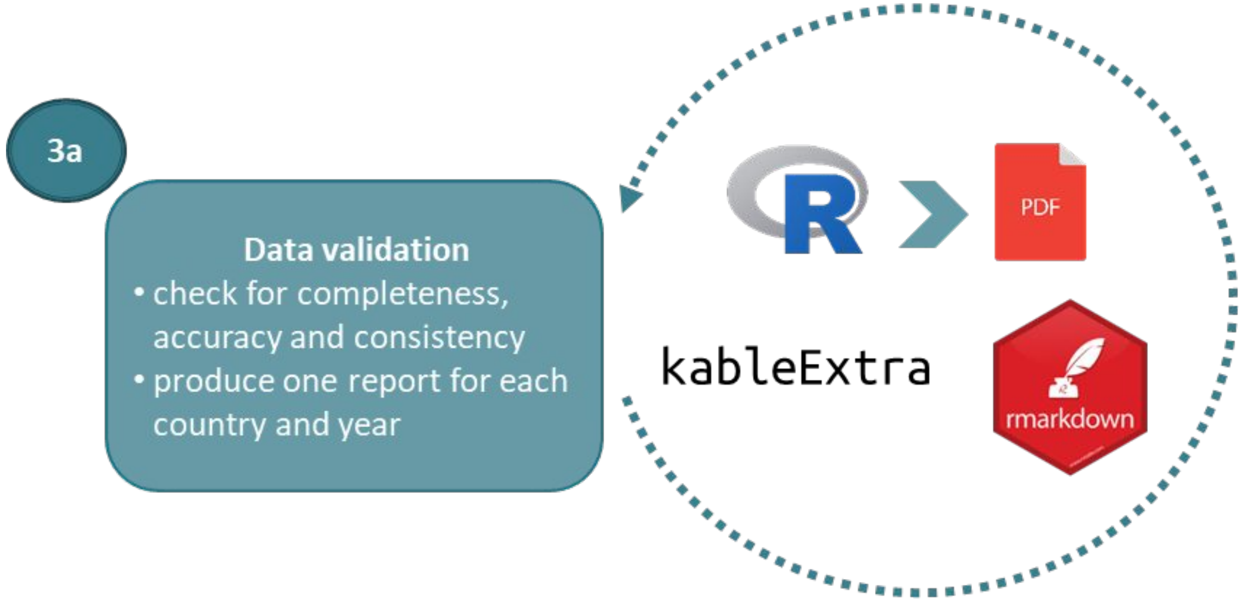
Import into ETER database

3

Automated data validation and data quality process

- extract data from database via API, data processing
- produce results for country managers
- used for flagging and metadata

Challenge #2: Tidy data

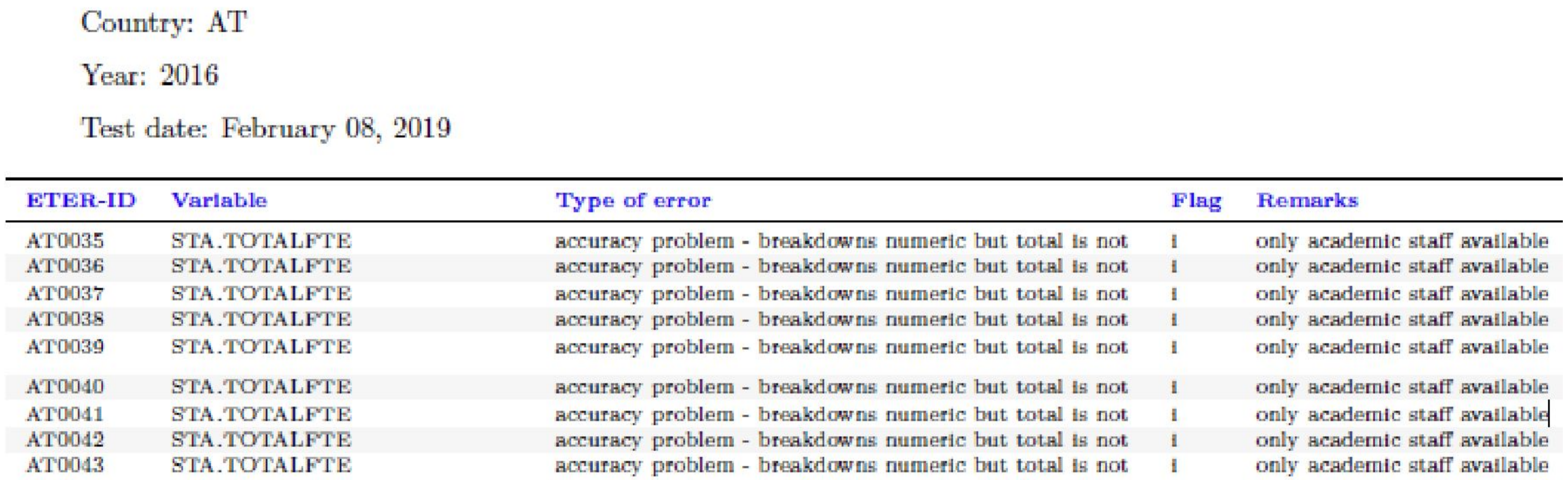


3a

Data validation

- check for completeness, accuracy and consistency
- produce one report for each country and year

Snippet of the Austria data validation report for 2016



Country: AT

Year: 2016

Test date: February 08, 2019

ETER-ID	Variable	Type of error	Flag	Remarks
AT0035	STA.TOTALFTE	accuracy problem - breakdowns numeric but total is not	i	only academic staff available
AT0036	STA.TOTALFTE	accuracy problem - breakdowns numeric but total is not	i	only academic staff available
AT0037	STA.TOTALFTE	accuracy problem - breakdowns numeric but total is not	i	only academic staff available
AT0038	STA.TOTALFTE	accuracy problem - breakdowns numeric but total is not	i	only academic staff available
AT0039	STA.TOTALFTE	accuracy problem - breakdowns numeric but total is not	i	only academic staff available
AT0040	STA.TOTALFTE	accuracy problem - breakdowns numeric but total is not	i	only academic staff available
AT0041	STA.TOTALFTE	accuracy problem - breakdowns numeric but total is not	i	only academic staff available
AT0042	STA.TOTALFTE	accuracy problem - breakdowns numeric but total is not	i	only academic staff available
AT0043	STA.TOTALFTE	accuracy problem - breakdowns numeric but total is not	i	only academic staff available

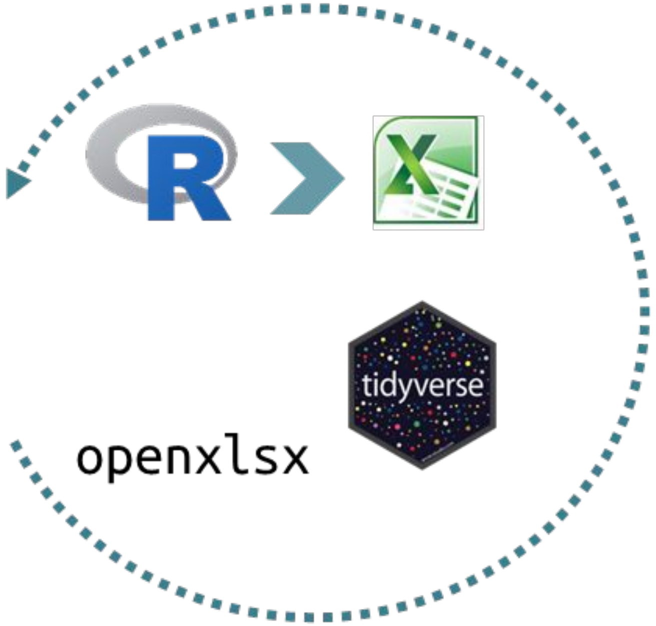
Challenge #3: Data quality

3b

Data quality

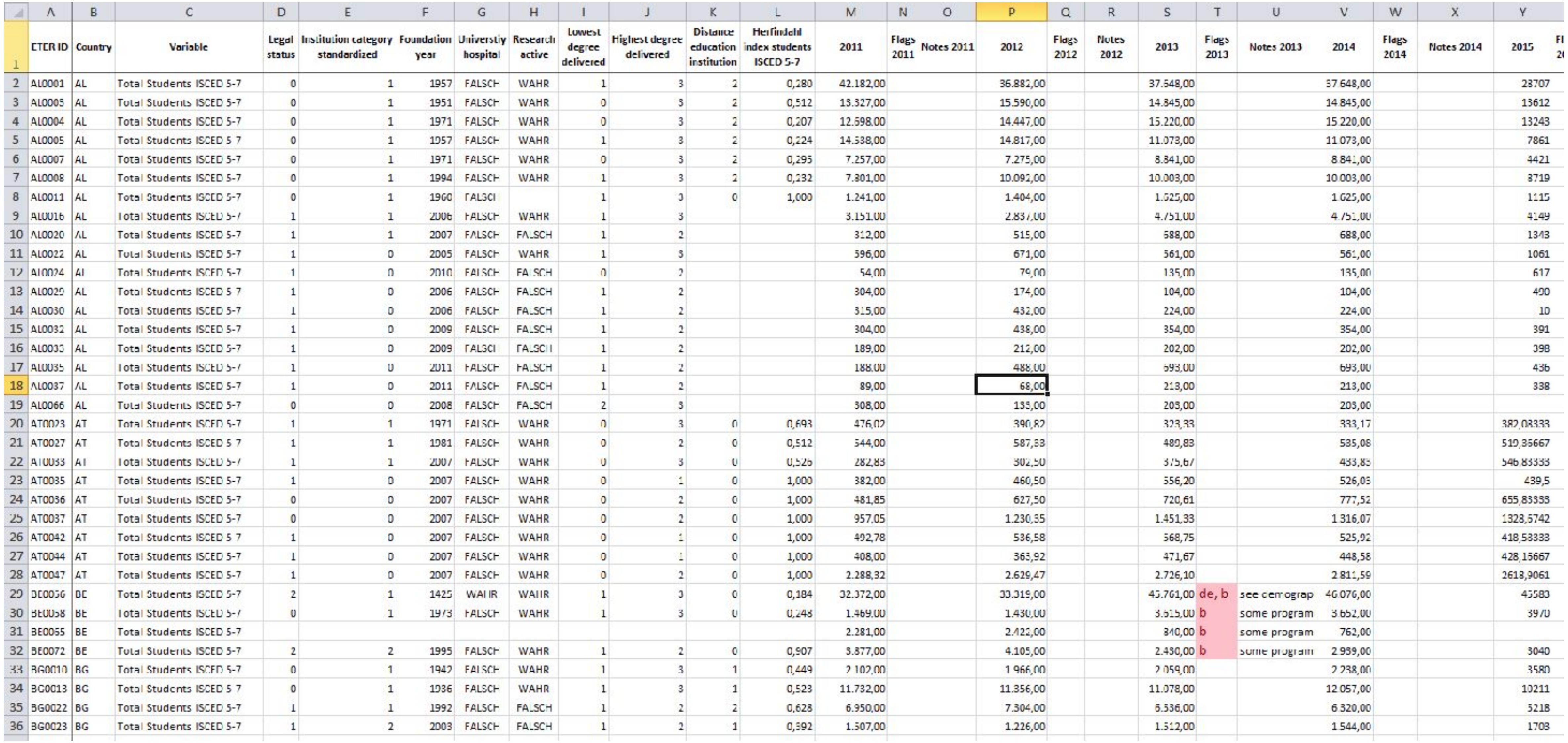
- Internal data quality
  - Multiannual checks
  - Outlier detection
    - determine thresholds
    - calculate test values
    - generate MS-Excel file for country managers
      - use function **conditionalFormatting** of package openxlsx for highlighting already flagged cases

- External data quality
  - e.g. comparison with Eurostat national aggregates



Challenge #3: Data quality (output)

Snippet of the sheet containing positive multiannual test cases



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	
1	ETER ID	Country	Variable	Legal status	Institution category standardized	Foundation year	Universtiy hospital	Research active	Lowest degree delivered	Highest degree delivered	Distance education institution	Herfindahl index students ISCED 5-7	2011	Flags 2011	Notes 2011	2012	Flags 2012	Notes 2012	2013	Flags 2013	Notes 2013	2014	Flags 2014	Notes 2014	2015	Fl 20
2	AL0001	AL	Total Students ISCED 5-7	0	1	1957	FALSCH	WAHR	1	3	2	0,280	42.182,00			36.882,00			37.648,00			37 648,00			23707	
3	AL0003	AL	Total Students ISCED 5-7	0	1	1951	FALSCH	WAHR	0	3	2	0,512	13.327,00			15.590,00			14.845,00			14 845,00			13612	
4	AL0004	AL	Total Students ISCED 5-7	0	1	1971	FALSCH	WAHR	0	3	2	0,207	12.598,00			14.447,00			15.220,00			15 220,00			13243	
5	AL0005	AL	Total Students ISCED 5-7	0	1	1957	FALSCH	WAHR	1	3	2	0,224	14.538,00			14.817,00			11.073,00			11 073,00			7861	
6	AL0007	AL	Total Students ISCED 5-7	0	1	1971	FALSCH	WAHR	0	3	2	0,295	7.257,00			7.275,00			8.841,00			8 841,00			4421	
7	AL0008	AL	Total Students ISCED 5-7	0	1	1994	FALSCH	WAHR	1	3	2	0,232	7.301,00			10.092,00			10.003,00			10 003,00			8719	
8	AL0011	AL	Total Students ISCED 5-7	0	1	1960	FALSCH		1	3	0	1,000	1.241,00			1.404,00			1.625,00			1 625,00			1115	
9	AL0016	AL	Total Students ISCED 5-7	1	1	2006	FALSCH	WAHR	1	3			3.151,00			2.837,00			4.751,00			4 751,00			4149	
10	AL0020	AL	Total Students ISCED 5-7	1	1	2007	FALSCH	FALSCH	1	2			312,00			515,00			588,00			688,00			1343	
11	AL0022	AL	Total Students ISCED 5-7	1	0	2005	FALSCH	WAHR	1	3			596,00			671,00			561,00			561,00			1061	
12	AL0024	AL	Total Students ISCED 5-7	1	0	2010	FALSCH	FALSCH	0	2			54,00			79,00			135,00			135,00			617	
13	AL0029	AL	Total Students ISCED 5-7	1	0	2006	FALSCH	FALSCH	1	2			304,00			174,00			104,00			104,00			400	
14	AL0030	AL	Total Students ISCED 5-7	1	0	2006	FALSCH	FALSCH	1	2			315,00			432,00			224,00			224,00			10	
15	AL0032	AL	Total Students ISCED 5-7	1	0	2009	FALSCH	FALSCH	1	2			304,00			438,00			354,00			354,00			391	
16	AL0033	AL	Total Students ISCED 5-7	1	0	2009	FALSCH	FALSCH	1	2			189,00			212,00			202,00			202,00			398	
17	AL0035	AL	Total Students ISCED 5-7	1	0	2011	FALSCH	FALSCH	1	2			188,00			488,00			693,00			693,00			436	
18	AL0037	AL	Total Students ISCED 5-7	1	0	2011	FALSCH	FALSCH	1	2			89,00			68,00			213,00			213,00			338	
19	AL0066	AL	Total Students ISCED 5-7	0	0	2008	FALSCH	FALSCH	2	3			308,00			135,00			203,00			203,00				
20	AT0023	AT	Total Students ISCED 5-7	1	1	1971	FALSCH	WAHR	0	3	0	0,693	476,02			390,82			323,33			333,17			382,08333	
21	AT0027	AT	Total Students ISCED 5-7	1	1	1981	FALSCH	WAHR	0	2	0	0,512	544,00			587,33			489,83			535,08			519,35667	
22	AT0033	AT	Total Students ISCED 5-7	1	1	2007	FALSCH	WAHR	0	3	0	0,525	282,83			302,50			375,67			433,83			546,83333	
23	AT0035	AT	Total Students ISCED 5-7	1	0	2007	FALSCH	WAHR	0	1	0	1,000	382,00			460,50			556,20			526,03			439,5	
24	AT0036	AT	Total Students ISCED 5-7	0	0	2007	FALSCH	WAHR	0	2	0	1,000	481,85			627,50			720,61			777,52			655,83333	
25	AT0037	AT	Total Students ISCED 5-7	0	0	2007	FALSCH	WAHR	0	2	0	1,000	957,05			1.230,35			1.451,33			1 316,07			1328,6742	
26	AT0042	AT	Total Students ISCED 5-7	1	0	2007	FALSCH	WAHR	0	1	0	1,000	492,78			536,58			568,75			525,92			418,53333	
27	AT0044	AT	Total Students ISCED 5-7	1	0	2007	FALSCH	WAHR	0	1	0	1,000	408,00			363,92			471,67			448,58			428,15667	
28	AT0047	AT	Total Students ISCED 5-7	1	0	2007	FALSCH	WAHR	0	2	0	1,000	2.288,32			2.629,47			2.726,10			2 811,59			2613,9061	
29	BE0056	BE	Total Students ISCED 5-7	2	1	1425	WAHR	WAHR	1	3	0	0,184	32.372,00			33.319,00			45.761,00	de, b	see cerrograp	46 076,00			43583	
30	BE0058	BE	Total Students ISCED 5-7	0	1	1973	FALSCH	WAHR	1	3	0	0,248	1.469,00			1.430,00			3.615,00	b	some program	3 652,00			3970	
31	BE0065	BE	Total Students ISCED 5-7										2.281,00			2.422,00			840,00	b	some program	762,00				
32	BE0072	BE	Total Students ISCED 5-7	2	2	1995	FALSCH	WAHR	1	2	0	0,907	3.877,00			4.105,00			2.430,00	b	some program	2 939,00			3040	
33	BG0010	BG	Total Students ISCED 5-7	0	1	1942	FALSCH	WAHR	1	3	1	0,449	2.102,00			1 966,00			2 059,00			2 238,00			3580	
34	BG0013	BG	Total Students ISCED 5-7	0	1	1936	FALSCH	WAHR	1	3	1	0,523	11.732,00			11.356,00			11.078,00			12 057,00			10211	
35	BG0022	BG	Total Students ISCED 5-7	1	1	1992	FALSCH	FALSCH	1	2	2	0,628	6.950,00			7.304,00			6.536,00			6 320,00			5218	
36	BG0023	BG	Total Students ISCED 5-7	1	2	2003	FALSCH	FALSCH	1	2	1	0,392	1.507,00			1.226,00			1.512,00			1 544,00			1708	

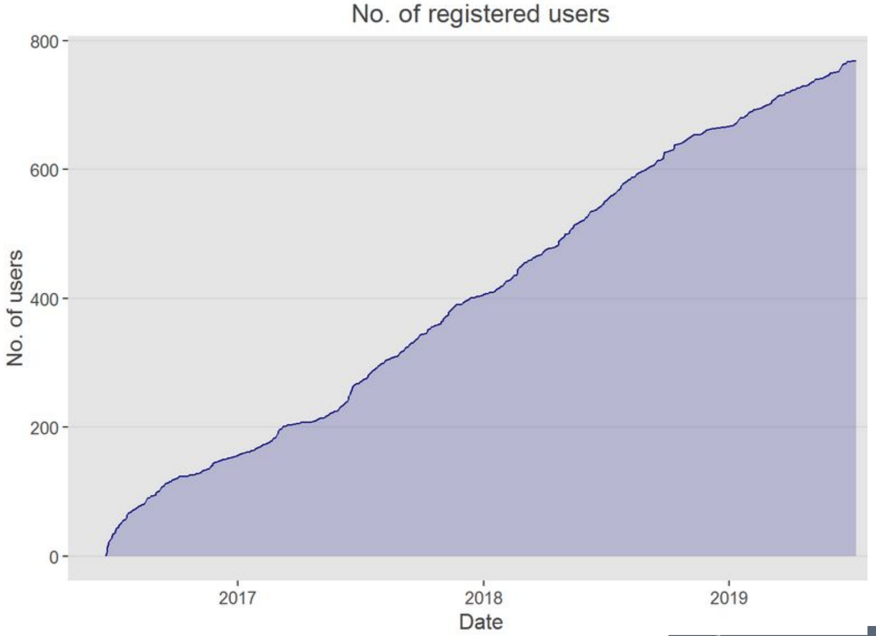
Paper

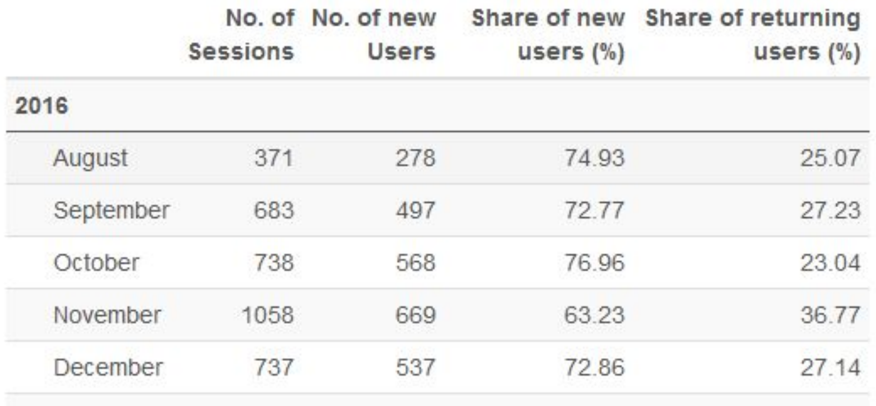
A Tailor-made Data Quality Approach for Higher Educational Data

ETER

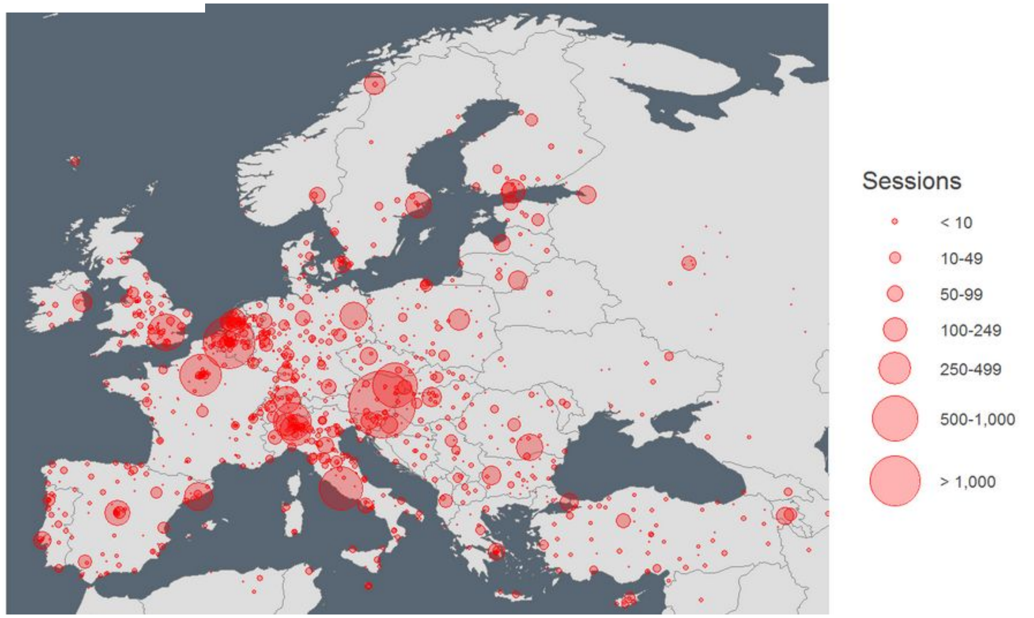
EUROPEAN TERTIARY EDUCATION REGISTER

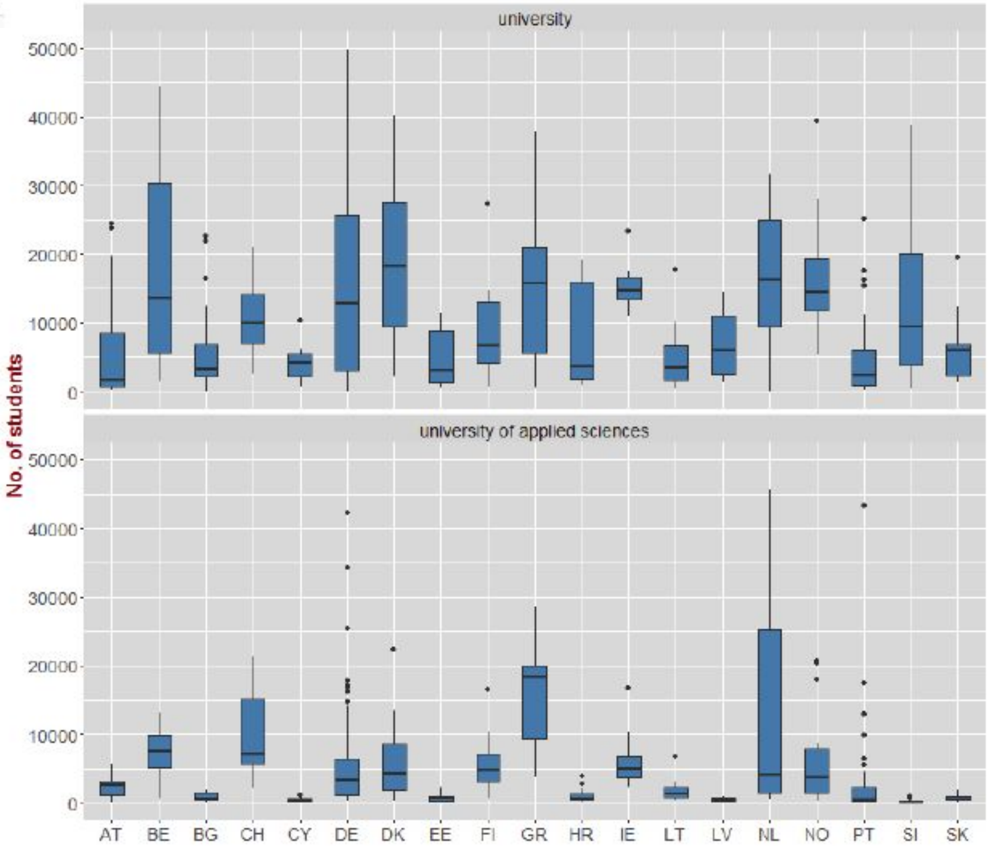
Other R usage in ETER





	No. of Sessions	No. of new Users	Share of new users (%)	Share of returning users (%)
2016				
August	371	278	74.93	25.07
September	683	497	72.77	27.23
October	738	568	76.96	23.04
November	1058	669	63.23	36.77
December	737	537	72.86	27.14





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