Tests Before Factor Analysis

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Data Preparation for Factor Analysis

This section will present the different statistics and test before constructing the composite index. It includes the following:

- ▶ **Correlation of Variables:** Understanding correlations between variables is foundational in factor analysis. This assessment helps identify whether groups of variables share common patterns or underlying factors, which justifies their reduction into fewer dimensions.

- ▶ **Internal Consistency and Cronbach's Alpha:**

Internal Consistency refers to the reliability of items within a scale or test to consistently measure the same underlying construct. It is a crucial aspect of scale reliability and validity. Cronbach's Alpha is a specific statistic used to measure this internal consistency. It quantifies how well a set of items measure an underlying (unobserved) construct.

- ▶ Thresholds for Cronbach's Alpha:
  - ▶ $\alpha \geq 0.90$: Excellent
  - ▶ $0.80 \leq \alpha < 0.90$: Good
  - ▶ $0.70 \leq \alpha < 0.80$: Acceptable

A high Cronbach's Alpha indicates that the items are highly correlated and thus reliably measure the same construct. This helps to ensure that the dimensions extracted from factor analysis are reliable.

Data Preparation for Factor Analysis II

- **Bartlett's Test of Sphericity:** This test checks whether the correlation matrix is an identity matrix, which would indicate that the variables are unrelated and unsuitable for structure detection. A significant result from Bartlett's test supports the factorability of the correlation matrix.

  - **Null Hypothesis (H0)**: The correlation matrix is an identity matrix, indicating that the variables are unrelated and unsuitable for structure detection.
  - **Alternative Hypothesis (H1)**: The correlation matrix is not an identity matrix, indicating significant correlations among the variables, making them suitable for structure detection.

Interpretation of the p-value:

- **p** < 0.05: Reject the null hypothesis. There are significant correlations among the variables, suggesting that the correlation matrix is factorable. This means that the data is suitable for factor analysis.
- **p** ≥ 0.05: Fail to reject the null hypothesis. There is not enough evidence to suggest that the correlation matrix is different from an identity matrix, indicating that the variables may not be suitable for structure detection.

1. 2014 - Access - Correlation, Cronbach, and Bartlett's Ttests

1.1. Correlations
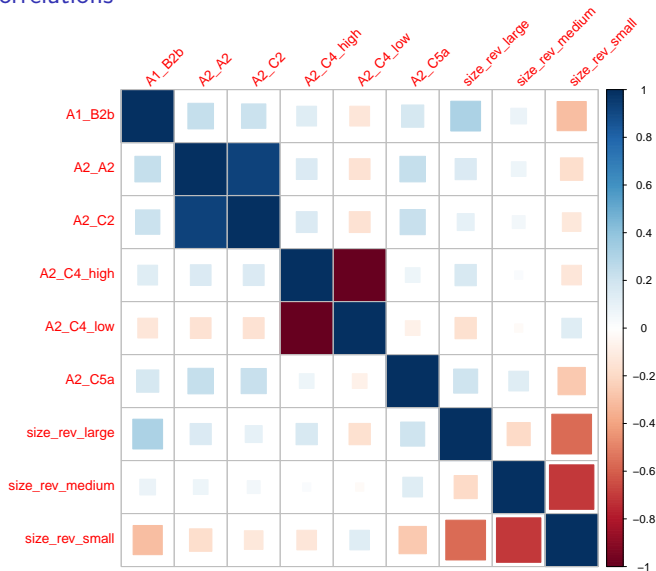
1.2. Cronbach's Alpha Access 2014

▶ For continuous varibles

raw_alpha	std.alpha	G6(smc)	average_r	S/N
0.9628538	0.962927	0.9285045	0.9285045	25.97377

▶ For binary varibles

raw_alpha	std.alpha	G6(smc)	average_r	S/N
0.6673214	-1.751375	-1.422199	-0.1000314	-0.6365453

▶ Combining continuous and binary variables

raw_alpha	std.alpha	G6(smc)	average_r	S/N
0.7099288	-0.0450952	0.1920318	-0.0048175	-0.0431493

1.3. Bartlett's Test of Sphericity Access 2014

Statistic	Degrees_of_Freedom	p_Value
1245763	36	0

2. 2014 - Skills - Correlation, Cronbach, and Bartlett's Ttests

2.1. Correlations
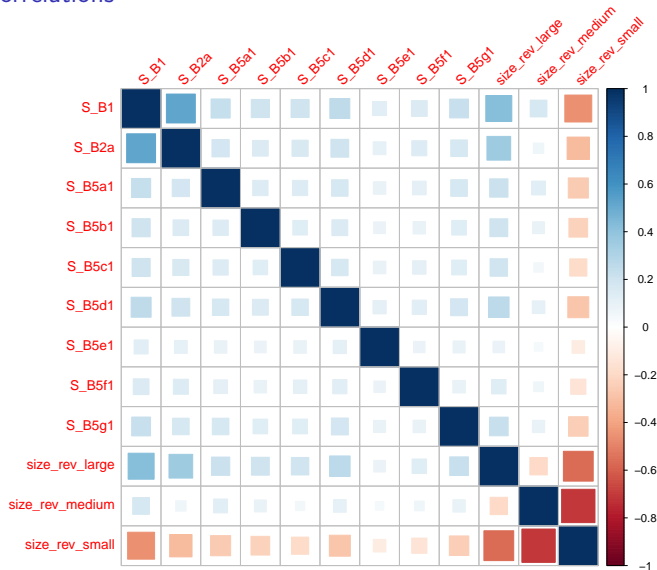
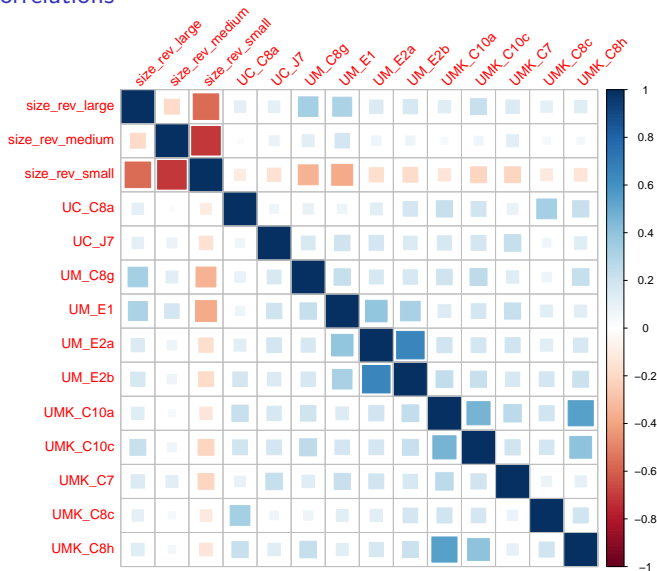## 2.2. Cronbach's Alpha Skills 2014

▶ For binary varibles

raw_alpha	std.alpha	G6(smc)	average_r	S/N
0.7263091	0.4959274	0.5152401	0.0757743	0.9838411

2.3. Bartlett's Test of Sphericity Skills 2014

Statistic	Degrees_of_Freedom	p_Value
558135.9	66	0

3. 2014 - Usage - Correlation, Cronbach, and Bartlett's Ttests

3.1. Correlations

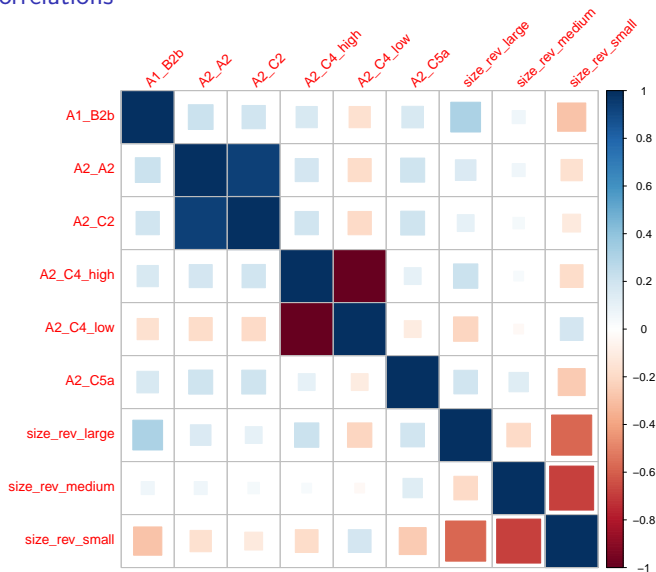### 3.2. Cronbach's Alpha Usage 2014

▶ For binary varibles

raw_alpha	std.alpha	G6(smc)	average_r	S/N
0.7668949	0.6481703	0.6880681	0.1162891	1.842284

3.3. Bartlett's Test of Sphericity Usage 2014

Statistic	Degrees_of_Freedom	p_Value
580456.4	91	0

1. 2015 - Access - Correlation, Cronbach, and Bartlett's Ttests

1.1. Correlations

1.2. Cronbach's Alpha Access 2015

▶ For continuous varibles

raw_alpha	std.alpha	G6(smc)	average_r	S/N
0.966592	0.9666152	0.9353874	0.9353874	28.95372

▶ For binary varibles

raw_alpha	std.alpha	G6(smc)	average_r	S/N
0.6830248	-1.811399	-1.476293	-0.1013745	-0.6443052

▶ Combining continuous and binary variables

raw_alpha	std.alpha	G6(smc)	average_r	S/N
0.7194492	-0.0772024	0.1701028	-0.0080272	-0.0716693

1.3. Bartlett's Test of Sphericity Access 2015

Statistic	Degrees_of_Freedom	p_Value
1308803	36	0

2. 2015 - Skills - Correlation, Cronbach, and Bartlett's Ttests

2.1. Correlations
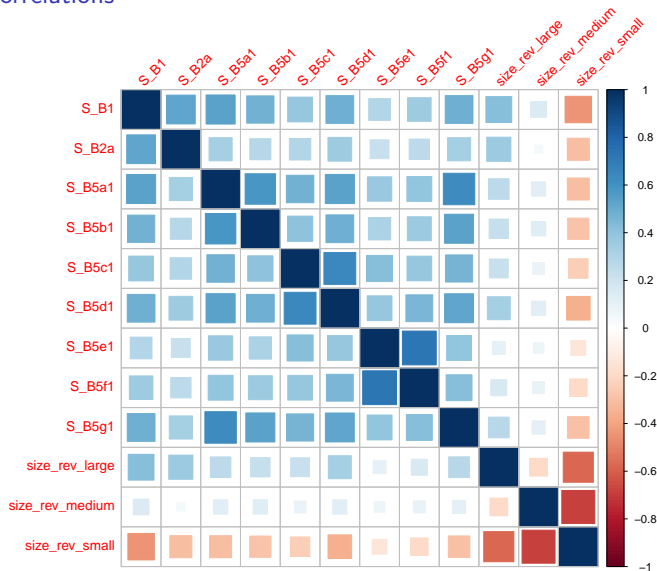
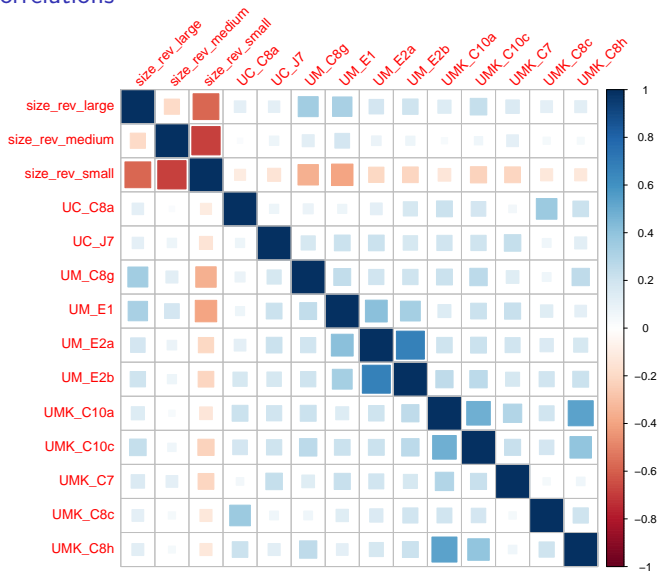## 2.2. Cronbach's Alpha Skills 2015

▶ For binary varibles

raw_alpha	std.alpha	G6(smc)	average_r	S/N
0.8644353	0.7775615	0.8189146	0.2255878	3.495624

2.3. Bartlett's Test of Sphericity Skills 2015

Statistic	Degrees_of_Freedom	p_Value
634071.9	66	0

3. 2015 - Usage - Correlation, Cronbach, and Bartlett's Ttests

3.1. Correlations

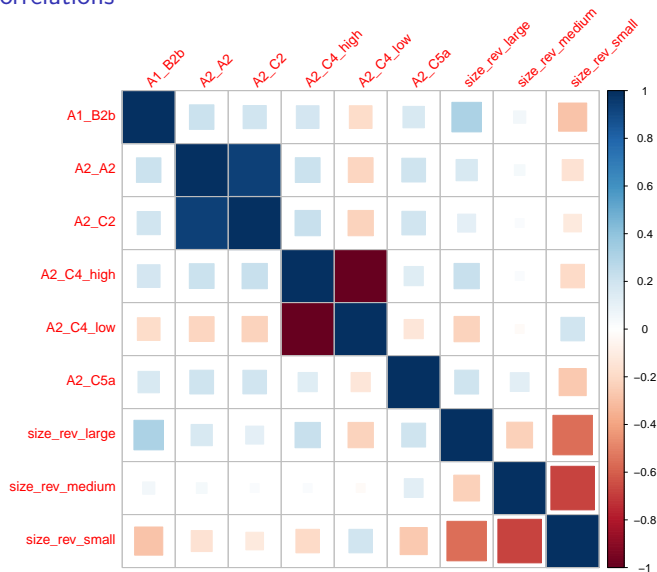### 3.2. Cronbach's Alpha Usage 2015

▶ For binary varibles

raw_alpha	std.alpha	G6(smc)	average_r	S/N
0.7742574	0.6558194	0.6995897	0.1197986	1.905451

3.3. Bartlett's Test of Sphericity Usage 2015

Statistic	Degrees_of_Freedom	p_Value
600664.8	91	0

1. 2016 - Access - Correlation, Cronbach, and Bartlett's Ttests

1.1. Correlations

1.2. Cronbach's Alpha Access 2016

▶ For continuous varibles

raw_alpha	std.alpha	G6(smc)	average_r	S/N
0.9654554	0.9654639	0.9332336	0.9332336	27.95519

▶ For binary varibles

raw_alpha	std.alpha	G6(smc)	average_r	S/N
0.6895462	-1.871075	-1.52412	-0.1026571	-0.6516984

▶ Combining continuous and binary variables

raw_alpha	std.alpha	G6(smc)	average_r	S/N
0.7246086	-0.0923606	0.1585757	-0.0094837	-0.0845513

1.3. Bartlett's Test of Sphericity Access 2016

Statistic	Degrees_of_Freedom	p_Value
1309465	36	0

2. 2016 - Skills - Correlation, Cronbach, and Bartlett's Ttests

2.1. Correlations
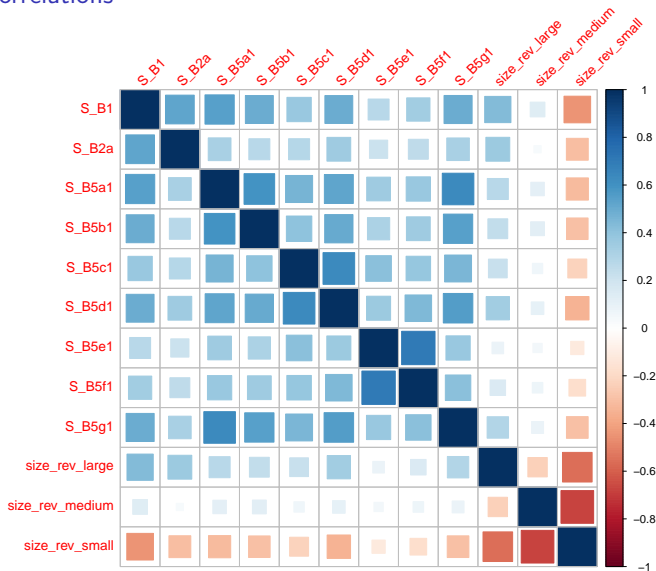
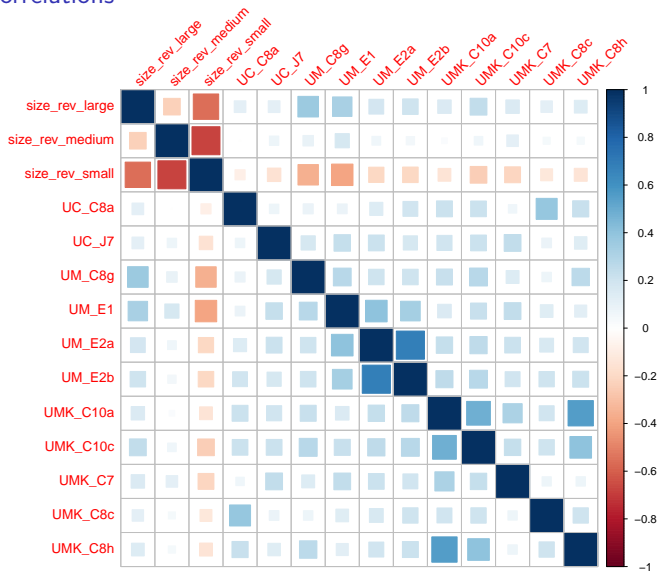## 2.2. Cronbach's Alpha Skills 2016

▶ For binary varibles

raw_alpha	std.alpha	G6(smc)	average_r	S/N
0.8606735	0.7735811	0.8161382	0.2216179	3.416593

2.3. Bartlett's Test of Sphericity Skills 2016

Statistic	Degrees_of_Freedom	p_Value
649206.1	66	0

3. 2016 - Usage - Correlation, Cronbach, and Bartlett's Ttests

3.1. Correlations

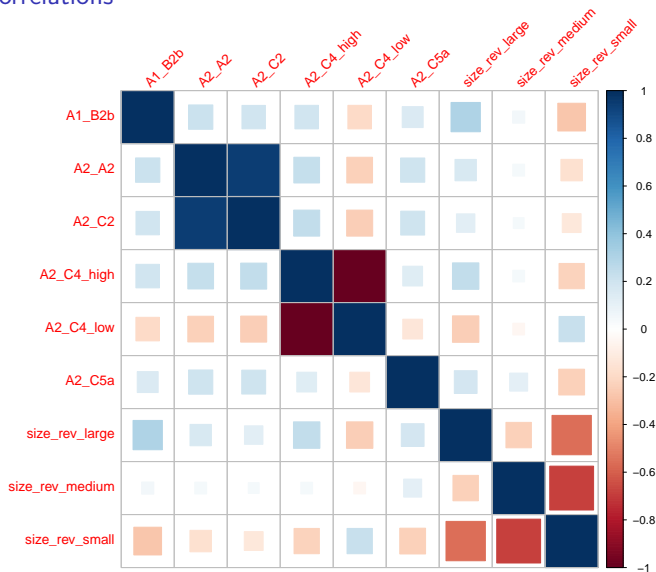### 3.2. Cronbach's Alpha Usage 2016

▶ For binary varibles

raw_alpha	std.alpha	G6(smc)	average_r	S/N
0.7812859	0.6678692	0.7113806	0.1255936	2.010862

3.3. Bartlett's Test of Sphericity Usage 2016

Statistic	Degrees_of_Freedom	p_Value
619288.9	91	0

1. 2017 - Access - Correlation, Cronbach, and Bartlett's Ttests

1.1. Correlations

1.2. Cronbach's Alpha Access 2017

▶ For continuous varibles

raw_alpha	std.alpha	G6(smc)	average_r	S/N
0.9694792	0.9694812	0.94077	0.94077	31.7667

▶ For binary varibles

raw_alpha	std.alpha	G6(smc)	average_r	S/N
0.7007189	-1.888351	-1.543957	-0.1030191	-0.6537817

▶ Combining continuous and binary variables

raw_alpha	std.alpha	G6(smc)	average_r	S/N
0.7354846	-0.0861889	0.1641511	-0.0088951	-0.0793498

1.3. Bartlett's Test of Sphericity Access 2017

Statistic	Degrees_of_Freedom	p_Value
Inf	36	0

2. 2017 - Skills - Correlation, Cronbach, and Bartlett's Ttests

2.1. Correlations
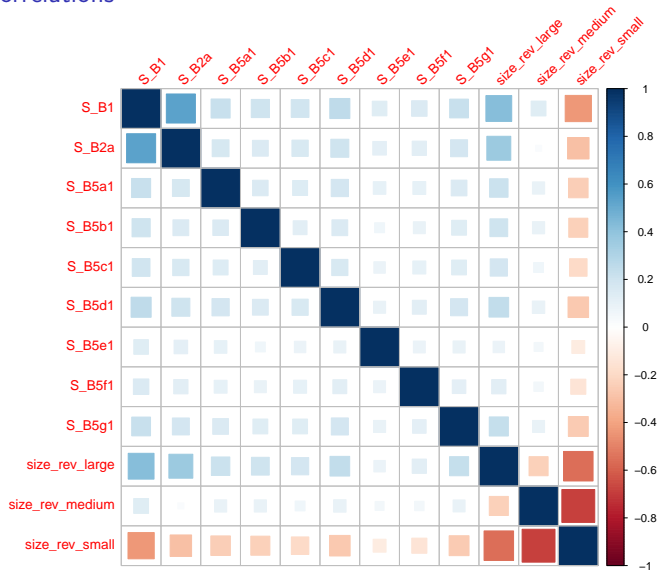
2.2. Cronbach's Alpha Skills 2017
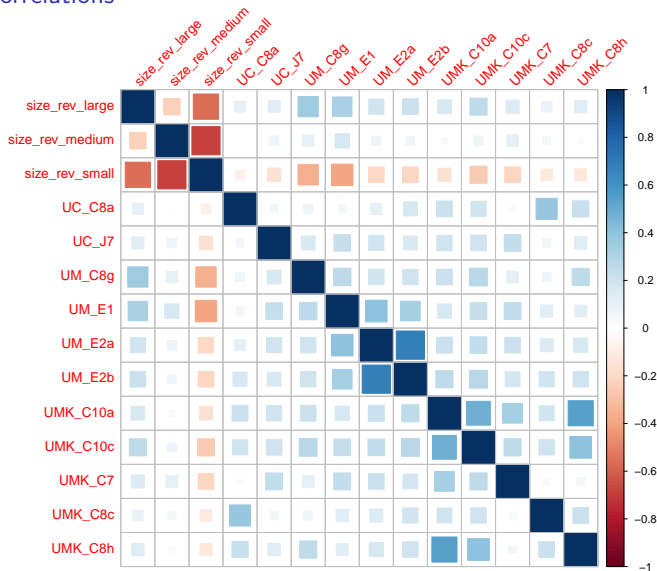
▶ For binary varibles

raw_alpha	std.alpha	G6(smc)	average_r	S/N
0.7224824	0.4873174	0.5079796	0.0733966	0.9505245

2.3. Bartlett's Test of Sphericity Skills 2017

Statistic	Degrees_of_Freedom	p_Value
641579	66	0

3. 2017 - Usage - Correlation, Cronbach, and Bartlett's Ttests

3.1. Correlations

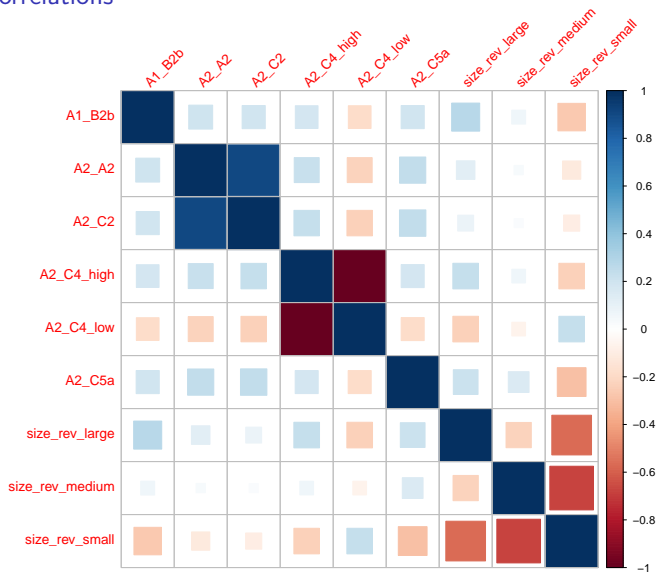### 3.2. Cronbach's Alpha Usage 2017

▶ For binary varibles

raw_alpha	std.alpha	G6(smc)	average_r	S/N
0.7765604	0.6591832	0.706429	0.1213827	1.934127

3.3. Bartlett's Test of Sphericity Usage 2017

Statistic	Degrees_of_Freedom	p_Value
674139	91	0

1. 2018 - Access - Correlation, Cronbach, and Bartlett's Ttests

1.1. Correlations

1.2. Cronbach's Alpha Access 2018

▶ For continuous varibles

raw_alpha	std.alpha	G6(smc)	average_r	S/N
0.9509248	0.9509287	0.9064482	0.9064482	19.37853

▶ For binary varibles

raw_alpha	std.alpha	G6(smc)	average_r	S/N
0.7130943	-1.794827	-1.455185	-0.1010091	-0.6421961

▶ Combining continuous and binary variables

raw_alpha	std.alpha	G6(smc)	average_r	S/N
0.7381329	-0.0709085	0.1649595	-0.0074116	-0.0662134

1.3. Bartlett's Test of Sphericity Access 2018

Statistic	Degrees_of_Freedom	p_Value
1449356	36	0

2. 2018 - Skills - Correlation, Cronbach, and Bartlett's Ttests

2.1. Correlations
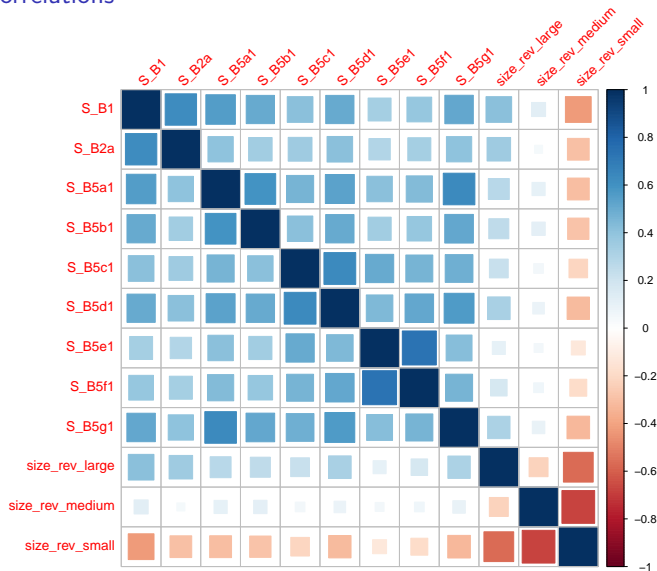
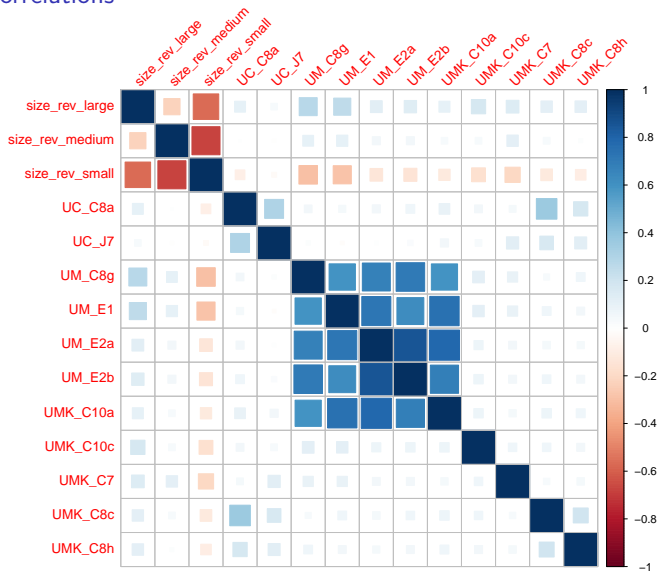## 2.2. Cronbach's Alpha Skills 2018

▶ For binary varibles

raw_alpha	std.alpha	G6(smc)	average_r	S/N
0.8705868	0.7949196	0.8348444	0.2441486	3.876136

2.3. Bartlett's Test of Sphericity Skills 2018

Statistic	Degrees_of_Freedom	p_Value
718070.5	66	0

3.1. Correlations

3.2. Cronbach's Alpha Usage 2018

▶ For binary varibles

raw_alpha	std.alpha	G6(smc)	average_r	S/N
0.7527269	0.6235321	0.7045998	0.1057895	1.656269

3.3. Bartlett's Test of Sphericity Usage 2018

Statistic	Degrees_of_Freedom	p_Value
716629.6	91	0

1. 2019 - Access - Correlation, Cronbach, and Bartlett's Ttests

1.1. Correlations
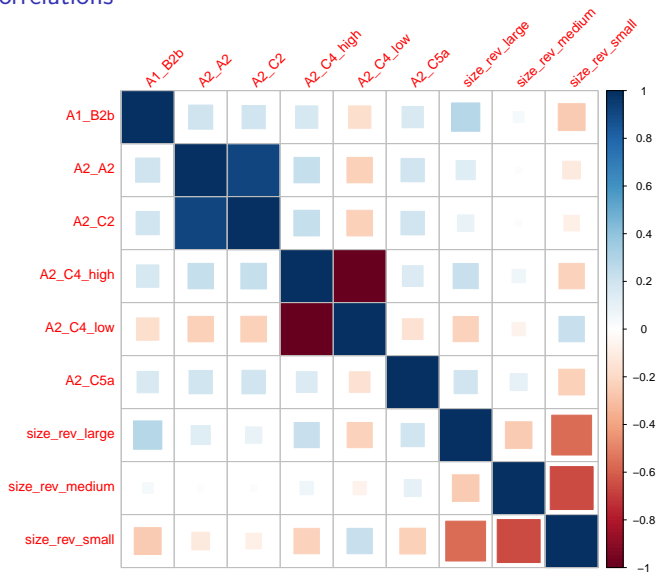
1.2. Cronbach's Alpha Access 2019

▶ For continuous varibles

raw_alpha	std.alpha	G6(smc)	average_r	S/N
0.9572764	0.9572806	0.9180616	0.9180616	22.40857

▶ For binary varibles

raw_alpha	std.alpha	G6(smc)	average_r	S/N
0.6965247	-1.93966	-1.590836	-0.1040704	-0.6598246

▶ Combining continuous and binary variables

raw_alpha	std.alpha	G6(smc)	average_r	S/N
0.7249646	-0.1168043	0.1315451	-0.0117575	-0.1045879

1.3. Bartlett's Test of Sphericity Access 2019

Statistic	Degrees_of_Freedom	p_Value
558278.5	28	0

2. 2019 - Skills - Correlation, Cronbach, and Bartlett's Ttests

2.1. Correlations
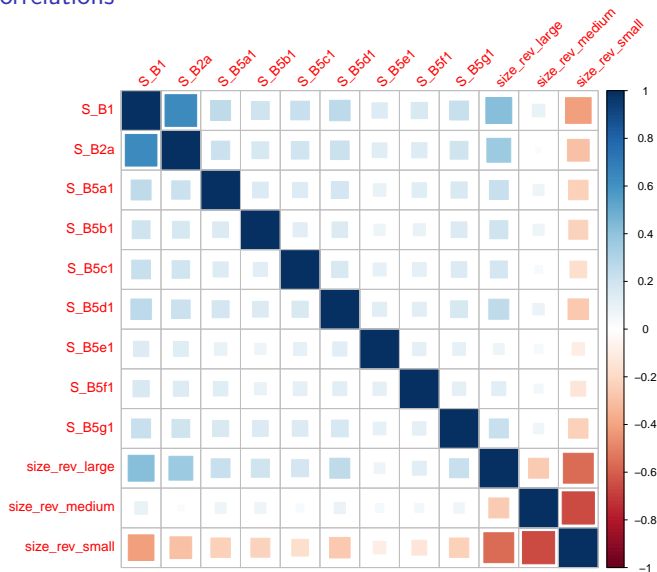
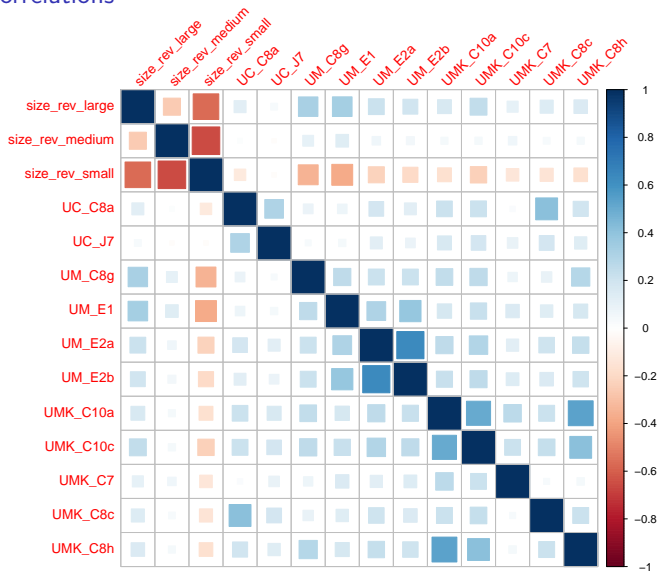## 2.2. Cronbach's Alpha Skills 2019

► For binary varibles

raw_alpha	std.alpha	G6(smc)	average_r	S/N
0.7295966	0.5095596	0.5360509	0.0796829	1.038984

2.3. Bartlett's Test of Sphericity Skills 2019

Statistic	Degrees_of_Freedom	p_Value
542837.8	66	0

3. 2019 - Usage - Correlation, Cronbach, and Bartlett's Ttests

3.1. Correlations

3.2. Cronbach's Alpha Usage 2019

▶ For binary varibles

raw_alpha	std.alpha	G6(smc)	average_r	S/N
0.7738189	0.6481937	0.6926948	0.1162996	1.842474

3.3. Bartlett's Test of Sphericity Usage 2019

Statistic	Degrees_of_Freedom	p_Value
564007.8	91	0