

BFSe estimates: R Package to Estimate Confidence Intervals of BFS Surveys

AMT FÜR DATEN UND STATISTIK
KOMPETENZTEAM DATENMANAGEMENT

0'633	222'607	68'026	23,4	83'645	69'981	1'039	135'968	157'221	119'247	37'974	24,2	37'160	38'941	613	80'507	10'436	7'737	2'699	25,9	2'018	1'443	25	4'950	21'174	15'297	51														
24	4'927	212	11'811	9'171	7'347	1'824	19,9	2'327	2'486	27	4'331	3'510	2'967	543	15,5	1'302	813	9	1'386	15'870	11'483	4'387	27,6	3'648	4'248	40														
2'321	22	6'111	6'818	4'983	1'039	26,9	1'704	1'450	33	3'631	5'137	4'376	991	18,5	1'260	1'825	15	2'267	12'165	8'933	3'182	26,2	2'789	2'697	29	6'650	17'971	14'126	3'845											
13	37	8'478	11'272	8'611	2'661	23,6	2'607	2'628	38	5'999	2'378	2'014	364	15,3	584	807	7	980	19'249	14'673	4'576	23,8	4'276	5'092	53	9'828	1'411	1'232	179	12,7	389									
43	8'198	1'745	17,6	2'557	2'812	51	4'523	20'120	16'218	3'902	19,4	2'797	9'399	113	1'813	701	630	71	10,1	101	382	2	216	1'665	1'476	189	11,4	220	919	2	524	278	246							
3	126	710	597	143	159	76	418	3	213	1'551	1'248	303	19,5	307	488	4	752	1'71	4'352	5,6	27,5	313	565	8	987	5'661	4'205	1'456	25,7	693	2'759	65	2'144	1'107	960					
682	1'370	457	397	60	13,1	79	214	-	164	280	246	34	12,	38	119	1	122	1'931	111	183	9,6	246	1'135	8	512	1'466	1'286	180	12,6	226	306	9	425	2'470	1'852	618	2			
258	81'089	43'211	17'878	29,3	19'218	13'052	189	28'630	1'662	1'468	194	11,7	778	500	2	1050	803	247	23,5	304	229	1	516	4'415	3'719	696	15,8	2'069	777	11	1'558									
17	32,6	1'897	1'536	18	3'033	4'602	3'217	1'385	30,1	1'344	1'034	13	2'211	1'051	815	2	307	227	6	511	331	290	41	12,4	169	58	1	113	5'327	3'805	1'522	28,6	1	7						
68	14'410	10'414	3'996	27,7	4'557	3'205	48	6'600	1'451	1'291	160	11	639	260	4	543	1'224	9'771	6'964	41,6	3'593	3'644	59	9'439	708	627	81	11,4	297	112	2	297	1'129							
6705	239	4	346	1'569	1'424	145	9,2	881	222	2	464	36'069	30'484	5'585	15	16'742	92	13'101	553	518	35	6,3	313	62	4	174	824	728	96	11,7	394	137	4	289	6					
9	350	98	0	246	1'081	979	102	9,4	582	136	7	156	781	672	109	14	349	148	5	279	6'126	5'132	1'154	18,4	2'816	1'106	8	2'356	245	215	30	12,2	148	23	1	73	239	232		
1	80	2'161	1'726	435	20,1	797	434	4	926	534	4'11	53	9,	282	59	1	192	43	122	1'126	114	15	2	32	1'291	1'132	159	12,3	562	243	2	484	934	791	14,3	15,3	453	13		
1	31	11,8	100	37,	1	124	499	464	35	7	298	44	1	156	1'273	2'006	267	41,7	1'240	3'65	1'674	585	530	55	9,4	313	109	2	161	765	696	69	9	439	100	1	235	435	3,4	101
2	198	748	685	63,	8,4	408	108	2	230	6'698	5'510	1	138	17	2'872	1'279	19	2'528	844	399	245	29	273	130	1	440	918	825	93	10,1	504	101	0	313	1'364	1'067	297	21,8		
710	656	54	7,6	415	57	2	236	608	545	63	10,4	305	80	9	213	439	416	23	5,2	297	25	0	117	493	459	34	6,9	325	37	0	131	2'622	2'097	525	20	1'100	484	2	1'036	16
16,7	7'527	2'656	34	5'917	564	543	41	7	345	45	0	194	670	625	45	6,7	402	76	1	191	778	704	49	6,5	389	104	1	259	1'629	170	10,4	844	238	7	540	542	478	6		
1	177	2'572	2'089	483	18,8	1'084	441	5	1'042	511	472	39	7,6	297	83	0	131	969	785	184	19	218	152	6	433	318	293	25	7,9	186	20	-	112	156	151	5	3,2	100	23	-0
0	25,8	710	430	1	723	2'439	1'922	517	21,2	1'047	518	6	868	1'588	1'398	190	12	840	189	5	554	420	373	47	11,2	226	36	0	158	1'119	771	348	31,1	390	226	1	502	290		
026	23,4	83'645	69'981	1'039	135'968	157'221	119'247	37'974	24,2	37'160	38'941	613	80'507	10'436	7'737	2'699	25,9	2'018	3'443	25	4'950	21'174	15'293	5'881	27,8	4'224	4													
811	9'171	7'347	1'824	19,9	2'327	2'486	27	4'331	3'510	2'967	543	15,5	1'302	813	9	1'386	15'870	11'483	4'387	27,6	3'648	3'248	46	8'928	10'486	7'224	3'262	31,1	2'032	2'										
18	4'983	1'835	26,9	1'704	1'450	33	3'631	5'367	4'376	991	18,5	1'260	1'825	15	2'267	12'165	8'983	3'182	26,2	2'789	2'697	29	6'650	17'971	14'126	3'845	21,4	5'443	4'013											
272	8'611	2'661	23,6	2'607	2'628	38	5'999	2'378	2'014	364	15,3	584	807	7	980	19'249	14'673	4'576	23,8	4'276	5'092	53	9'828	1'411	1'232	179	12,7	389	379	9	634	9'94								
6	2'557	2'812	51	4'923	20'120	16'218	3'902	19,4	2'797	9'399	111	7'813	701	630	71	10,1	101	382	2	216	1'665	1'476	189	11,4	220	919	2	524	278	246	32	11,5	64	85	3					
3	15,9	76	418	3	213	1'551	1'248	303	19,5	307	488	4	752	1'873	1'357	516	27,5	313	565	8	987	5'661	4'205	1'456	25,7	693	2'759	65	2'144	1'107	960	147	13,3	134	602					
7	60	13,1	79	214	-	164	280	246	34	12,1	38	119	1	122	1'901	1'718	183	9,6	246	1'135	8	512	1'466	1'286	180	12,3	226	806	9	425	2'470	1'852	618	25	300	907	5	1'258		
211	17'878	29,3	19'218	13'052	189	28'630	1'662	1'468	194	11,7	728	300	3	631	1'050	803	247	23,5	304	229	1	516	4'415	3'719	696	15,8	2'069	777	11	1'558	6'484	4'367								
197	1'536	18	3'033	4'602	3'217	1'385	30,1	1'344	13	2'211	1'051	819	232	22,1	307	227	6	511	331	290	41	12,4	169	48	1	113	5'327	3'805	1'522	28,6	1	728	1'218	1						

Contents

- BFS Census
- Motivation
- **BFSe**stimates Usage

BFS Census

BFS Census

1850–2000 Paper questionnaire every 10 years

2010– Yearly ➡ The new census

Register survey

Structural survey

Thematic surveys

Omnibus

BFS Census

1850–2000 Paper questionnaire every 10 years

2010– Yearly ➡ The new census

Structural survey

Thematic surveys

Structural survey (SE/RS)

Structural survey

- Household type and size
- Economic activity
- Languages
- Religious practices
- Nationality and migration
- Rental prices
- Education level etc.

Thematic surveys

Thematic surveys

Different theme every year in five-year cycle:

2020: Mobility and transport microcensus
(MZMV/MRMT)

2021: Education

2022: Health

2023: Families

2024: Languages and religion

Confidence Intervals

Confidence Intervals

$$\text{CI}_{SE} = \sqrt{\sum_h \frac{m_h}{m_h - 1} \left(1 - \frac{m_h}{N_h}\right) \sum_{i \in r_h} \left(w_i I_c - \frac{\hat{N}_{hc}}{m_h}\right)^2} \times \text{qnorm}\left(1 - \frac{\alpha}{2}\right)$$

$$\text{CI}_{MZMV} = 1.14 \times \sqrt{\frac{\sum_{i \in r} w_i (y_i - \bar{y})^2}{n \left(\sum_{i \in r} w_i\right) - 1}} \times \text{qnorm}\left(1 - \frac{\alpha}{2}\right)$$

Confidence Intervals

Out of the box

BFS

SAS

Majority cantons/offices

SAS, SPSS, survey, srvyr

Closed-form formula

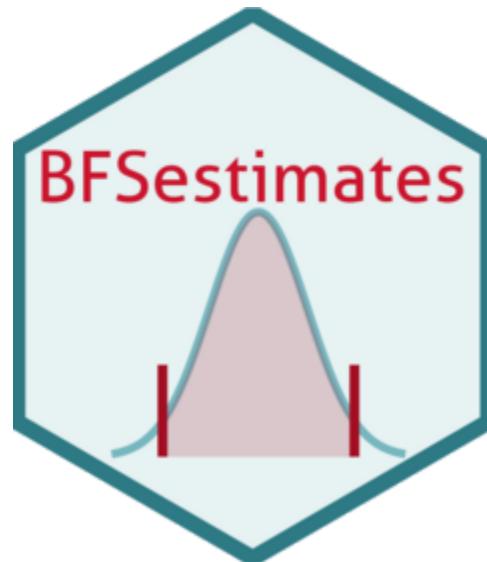
TI, AG, FR

vhatbfs for SE

BL

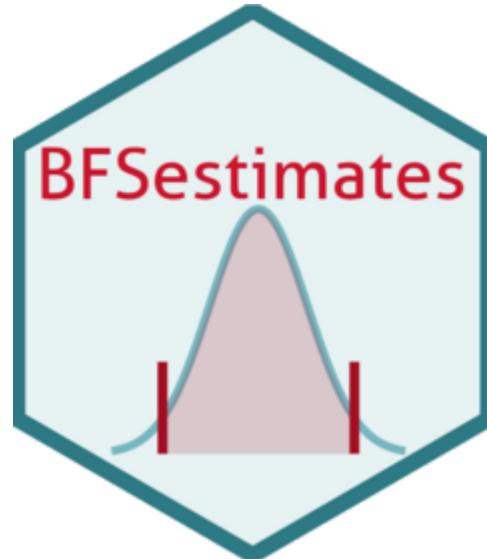
BFSestimates for SE and MZMV

BFSe estimates



- CI: structural survey and mobility and transport microcensus
- tidyverse

BFSe estimates



```
1 devtools:::install_github("afds-bl/BFSe estimates")
```

```
1 library(BFSe estimates)
2
3 # Structural survey
4 ?se_estimate_total
5 ?se_estimate_mean
6
7 # Mobility and transport microcensus
8 ?mzmv_estimate_mean
9 ?mzmv_estimate_mean_map
```

Structural Survey

Strukturerhebung / Relevé structurel

Population per Canton

▼ Code

```

1 df_canton <- se_estimate_total(
2   data = df_se_zpers,
3   weight = "weight_2015_2019",
4   condition = "canton"
5 )

```

Canton	Total	CI	CI (%)
1 ZH Zürich	1,247,994	647	0.1
2 BE Bern	862,507	455	0.1
3 LU Luzern	336,843	222	0.1
4 UR Uri	30,166	92	0.3
5 SZ Schwyz	131,868	206	0.2
6 OW Obwalden	31,338	92	0.3
7 NW Nidwalden	36,393	103	0.3
8 GL Glarus	33,822	124	0.4
9 ZG Zug	104,026	126	0.1
10 FR Fribourg	256,565	267	0.1

Migration by Canton, Gender and Nationality

▼ Code

```

1 df_canton <- se_estimate_total(
2   data = df_se_zpers,
3   weight = "weight_2015_2019",
4   condition = c("canton", "sex", "nationalityagg_text", "migrationstatus_binary")
5 )

```

Col 1	Col 2	Col 3	Col 4	Col 5	Col 6	Col 7	Col 8
1 ZH Zürich	Male	Schweiz	Ohne Migrationshintergrund	343,282	2,319	0.7	
1 ZH Zürich	Male	Schweiz	Mit Migrationshintergrund	96,162	1,389	1.4	
1 ZH Zürich	Male	Schweiz	Migrationshintergrund unbekannt	2,962	255	8.6	
1 ZH Zürich	Male	Europäischer Staat	Mit Migrationshintergrund	151,722	1,822	1.2	
1 ZH Zürich	Male	Europäischer Staat	Migrationshintergrund unbekannt	159	65	40.9	
1 ZH Zürich	Male	Aussereuropäischer Staat	Mit Migrationshintergrund	23,526	794	3.4	
1 ZH Zürich	Male	Aussereuropäischer Staat	Migrationshintergrund unbekannt	175	68	39.0	
1 ZH Zürich	Male	Nationalität unbekannt	Mit Migrationshintergrund	164	69	42.2	
1 ZH Zürich	Male	Nationalität unbekannt	Migrationshintergrund unbekannt	-	-	-	
1 ZH Zürich	Female	Schweiz	Ohne Migrationshintergrund	347,522	2,277	0.7	

Average Rental Prices

▼ Code

```

1 df_rentnet <- se_estimate_mean(
2   data = df_se_zpers_hh,
3   weight = "hh_weight_2015_2019",
4   variable = "rentnet",
5   var_type = "num",
6   condition = "canton"
7 )

```

Canton	Average	CI
1 ZH Zürich	1,559	4
2 BE Bern	1,191	3
3 LU Luzern	1,333	4
4 UR Uri	1,176	19
5 SZ Schwyz	1,554	14
6 OW Obwalden	1,285	22
7 NW Nidwalden	1,453	21
8 GL Glarus	1,117	18

Source: Structural survey, Federal Statistics Office

Average Rental Prices

▼ Code

```

1 df_rentnet <- se_estimate_mean(
2   data = df_se_zpers_hh,
3   weight = "hh_weight_2015_2019",
4   variable = "rentnet",
5   var_type = "num",
6   condition = c("canton", "numberofrooms_agg")
7 )

```

	1		2		3		4		5		6+	
Canton	Average	CI										
1 ZH Zürich	911	8	1,297	6	1,495	5	1,789	6	2,211	15	2,851	46
2 BE Bern	681	8	953	6	1,144	4	1,377	5	1,640	12	2,025	43
3 LU Luzern	732	12	1,039	7	1,272	5	1,465	5	1,796	13	2,116	42
4 UR Uri	569	50	889	42	1,108	25	1,271	26	1,531	55	1,794	145
5 SZ Schwyz	737	32	1,129	23	1,428	18	1,752	18	2,118	44	2,644	122
6 OW Obwalden	598	34	941	33	1,218	30	1,487	29	1,694	71	1,836	142

Canton	1	2	3	4	5	6+	BASEL LANDSCHAFT					
	Average	CI	Average	CI	Average	CI	Average					
7 NW Nidwalden	653	40	1,028	32	1,388	29	1,627	25	1,985	61	2,195	154
8 GL Glarus	580	55	866	31	1,058	24	1,246	27	1,404	53	1,657	126
9 ZG Zug	866	20	1,360	15	1,705	13	2,038	11	2,499	25	3,181	79
10 FR Fribourg	663	13	959	10	1,172	8	1,399	10	1,709	25	1,939	59
11 SO Solothurn	653	21	917	13	1,078	8	1,321	10	1,554	25	1,889	67
12 BS Basel- Stadt	732	14	1,044	10	1,276	9	1,661	17	2,149	47	2,842	114
13 BL Basel- Landschaft	699	22	1,079	14	1,293	9	1,600	12	1,968	38	2,485	125
14 SH Schaffhausen	591	38	928	22	1,069	16	1,290	18	1,657	47	2,032	126
15 AR Appenzell Ausserrhoden	609	52	885	31	1,080	24	1,288	27	1,497	54	1,735	90
16 AI Appenzell Innerrhoden	654	61	841	59	1,117	46	1,389	55	1,605	102	1,514	105
17 SG St. Gallen	649	13	940	8	1,156	7	1,342	7	1,580	15	1,871	43

Source: Structural survey, Federal Statistics Office

Canton	1	2		3		4		5		6+	BASEL LANDSCHAFT 
	Average	CI									
18 GR Graubünden	644	19	1,013	16	1,231	13	1,418	13	1,585	31	AMT FÜR DATEN UND STATISTIK KOMPETENZTEAM DATENMANAGEMENT
19 AG Aargau	726	14	1,056	9	1,274	6	1,519	7	1,805	17	2,125
20 TG Thurgau	650	16	940	11	1,152	8	1,338	8	1,587	16	1,812
21 TI Ticino	704	9	953	6	1,144	5	1,381	6	1,678	19	2,141
22 VD Vaud	760	6	1,047	4	1,312	4	1,649	5	2,062	14	2,749
23 VS Valais	636	11	900	10	1,114	10	1,312	10	1,535	25	1,808
24 NE Neuchâtel	576	11	758	7	908	5	1,169	6	1,468	16	1,839
25 GE Genève	872	10	1,102	8	1,351	7	1,594	8	1,930	15	2,866
26 JU Jura	529	35	692	22	842	13	1,042	17	1,218	36	1,342

Source: Structural survey, Federal Statistics Office

Mobility and Transport Microcensus

Mikrozensus für Mobilität und Verkehr /

Microrecensement mobilité et transports

Number of Vehicles per Household in BL

▼ Code

```

1 df_mzmv2021_vehicles <- mzmv_estimate_mean(
2   data = df_fahrzeug,
3   weight = "wm",
4   variable = c("Autos", "Motorräder", "Kleinmotorräder", "Mofas", "Velos", "Ebikes")
5 )

```

Variable	Absolute	CI
Autos	1.11	0.04
Motorräder	0.15	0.02
Kleinmotorräder	0.01	0.01
Mofas	0.10	0.09
Velos	1.52	0.10
Ebikes	0.32	0.04

Number of Vehicles per Household in BL

▼ Code

```

1 df_mzmv2021_vehicles <- mzmv_estimate_mean_map(
2   data = df_fahrzeug,
3   weight = "wm",
4   variable = c("Autos", "Motorräder", "Kleinmotorräder", "Mofas", "Velos", "Ebikes"),
5   condition = "hhincome"
6 )

```

Condition	Value	Autos		Motorräder		Kleinmotorräder		Mofas		Velos		Ebikes	
		Absolute	CI	Absolute	CI	Absolute	CI	Absolute	CI	Absolute	CI	Absolute	CI
hhincome	≤ 4,000 CHF	0.62	0.10	0.05	0.04	0.01	0.02	0.01	0.02	0.53	0.13	0.13	0.07
hhincome	4,001 - 8,000 CHF	1.00	0.07	0.14	0.04	0.02	0.01	0.02	0.01	1.10	0.12	0.27	0.06
hhincome	8,001 - 12,000 CHF	1.36	0.10	0.19	0.06	0.01	0.01	0.02	0.03	1.78	0.19	0.38	0.08
hhincome	> 12,000 CHF	1.58	0.10	0.29	0.08	0.00	0.01	0.03	0.03	2.19	0.24	0.52	0.10
hhincome	Do not know	1.12	0.07	0.14	0.03	0.02	0.01	0.33	0.31	2.07	0.24	0.35	0.09

Number of Vehicles by Household in BL

▼ Code

```

1 df_mzmv2021_vehicles <- mzmv_estimate_mean_map(
2   data = df_fahrzeug,
3   weight = "wm",
4   variable = c("Autos", "Motorräder", "Kleinmotorräder", "Mofas", "Velos", "Ebikes"),
5   condition = c("hhincome", "urbanisierungsgrad", "hhszie"),
6 )

```

	Autos		Motorräder		Kleinmotorräder		Mofas		Velos		Ebikes	
	Absolute	CI	Absolute	CI	Absolute	CI	Absolute	CI	Absolute	CI	Absolute	CI
Household income												
≤ 4,000 CHF	0.62	0.10	0.05	0.04	0.01	0.02	0.01	0.02	0.53	0.13	0.13	0.07
4,001 - 8,000 CHF	1.00	0.07	0.14	0.04	0.02	0.01	0.02	0.01	1.10	0.12	0.27	0.06
8,001 - 12,000 CHF	1.36	0.10	0.19	0.06	0.01	0.01	0.02	0.03	1.78	0.19	0.38	0.08
> 12,000 CHF	1.58	0.10	0.29	0.08	0.00	0.01	0.03	0.03	2.19	0.24	0.52	0.10
Do not know	1.12	0.07	0.14	0.03	0.02	0.01	0.33	0.31	2.07	0.24	0.35	0.09
Urbanisation level												
Urban	0.82	0.08	0.15	0.04	0.01	0.02	0.01	0.02	0.85	0.15	0.30	0.07
Rural	0.55	0.07	0.09	0.03	0.01	0.01	0.01	0.01	0.55	0.12	0.20	0.05

What's Next?

 (internal)



Get in touch!

Thank you



