Friedrich-Alexander-Universität
Technische Fakultät

AMSE Project Report

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Research Question

Research Question

„Can a correlation be found between the share of electric vehicles (EVs) among all newly registered cars in a german federal state and its gross domestic product per capita? “

Dataset #1: Vehicle Registrations

Source: Kraftfahrtbundesamt

Dataset #1: Vehicle Registrations

Sample

- Data Format: XLSX
- Update Interval: Once per Month

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Fahrzeugzulassungen (FZ)
Neuzulassungen von Kraftfahrzeugen und Kraftfahrzeuganhängern
FZ 8.6 Neuzulassungen von Personenkraftwagen im Mai 2023 nach Kraftstoffarten, Emissionsgruppen und Bundesländern

Bundesland	Benzin insgesamt	Darunter Euro 6	Darunter		Diesel insgesamt	Darunter Euro 6	Darunter		Flüssiggas (LPG) (einschl. bivalent)	Erdgas (CNG) (einschl. bivalent)	Elektro (BEV)	Hybrid		Sonstige	Insgesamt
			Euro 6d	Euro 6d-temp			Euro 6d	Euro 6d-temp				insgesamt	darunter Plug-in		
Baden-Württemberg	10.238	10.158	10.141	1	5.925	5.891	5.644	2	144	4	6.878	11.071	2.436	3	34.263
Bayern	19.470	19.203	19.203	-	8.821	8.705	8.465	2	170	10	8.026	17.405	2.386	8	53.910
Berlin	2.935	2.927	2.927	-	681	676	661	-	42	1	1.435	2.246	313	-	7.340
Brandenburg	1.397	1.387	1.387	-	621	617	571	-	29	5	679	1.086	226	-	3.817
Bremen	391	387	387	-	293	290	286	-	7	-	231	449	107	-	1.371
Hamburg	2.969	2.964	2.964	-	1.558	1.558	1.544	-	15	42	1.107	2.764	302	3	8.458
Hessen	10.572	10.547	10.546	-	6.275	6.252	6.113	-	76	28	5.173	9.252	2.673	2	31.378
Mecklenburg-Vorpommern	828	826	825	-	432	429	405	-	10	-	305	592	68	-	2.167
Niedersachsen	9.902	9.790	9.788	-	4.654	4.625	4.460	-	98	12	4.052	4.363	827	4	23.085
Nordrhein-Westfalen	17.053	16.956	16.955	-	8.478	8.428	8.134	-	320	10	9.411	13.906	2.849	2	49.180
Rheinland-Pfalz	3.095	3.063	3.062	1	1.524	1.516	1.417	-	70	2	1.931	2.501	543	-	9.123
Saarland	859	847	845	1	296	296	285	-	22	1	360	664	154	1	2.203
Sachsen	2.976	2.962	2.962	-	1.540	1.530	1.472	-	84	4	921	1.978	316	16	7.519
Sachsen-Anhalt	1.186	1.181	1.176	-	644	641	607	1	16	8	446	957	135	-	3.257
Schleswig-Holstein	2.068	2.057	2.057	-	1.067	1.063	993	-	38	3	1.297	1.355	289	-	5.828
Thüringen	1.723	1.710	1.709	-	687	687	670	-	25	-	509	1.011	159	1	3.956
Sonstige	38	38	38	-	9	9	9	-	-	-	19	45	20	-	111
Deutschland	**87.700**	**87.003**	**86.972**	**3**	**43.505**	**43.213**	**41.736**	**5**	**1.166**	**130**	**42.780**	**71.645**	**13.803**	**40**	**246.966**

Dataset #1: Vehicle Registration

Data Transformation

- Iterate over all monthly datasets
- Using pandas *read_excel* method, select the sheet, rows and columns of interest

```
vr_df = pd.read_excel(os.path.join(vr_download_location, vr_file),
                      sheet_name='FZ 8.6',
                      usecols='B:Q',
                      skiprows=7,
                      nrows=17,
                      index_col=0)
```

- Group the monthly data by federal state and aggregate it
- Generate a new feature by calculating the share of Evs

```
aggregated_df = vr_joined_df.groupby('federal_state').aggregate({'electric_total': 'sum', 'total': 'sum',
            'hybrid_total': 'sum'})

aggregated_df['share_electric'] = (aggregated_df['electric_total'] + aggregated_df['hybrid_total']) /
            aggregated_df['total']
```

Dataset #2: Gross Domestic Product

Source: Kraftfahrtbundesamt

Dataset #1: Vehicle Registrations

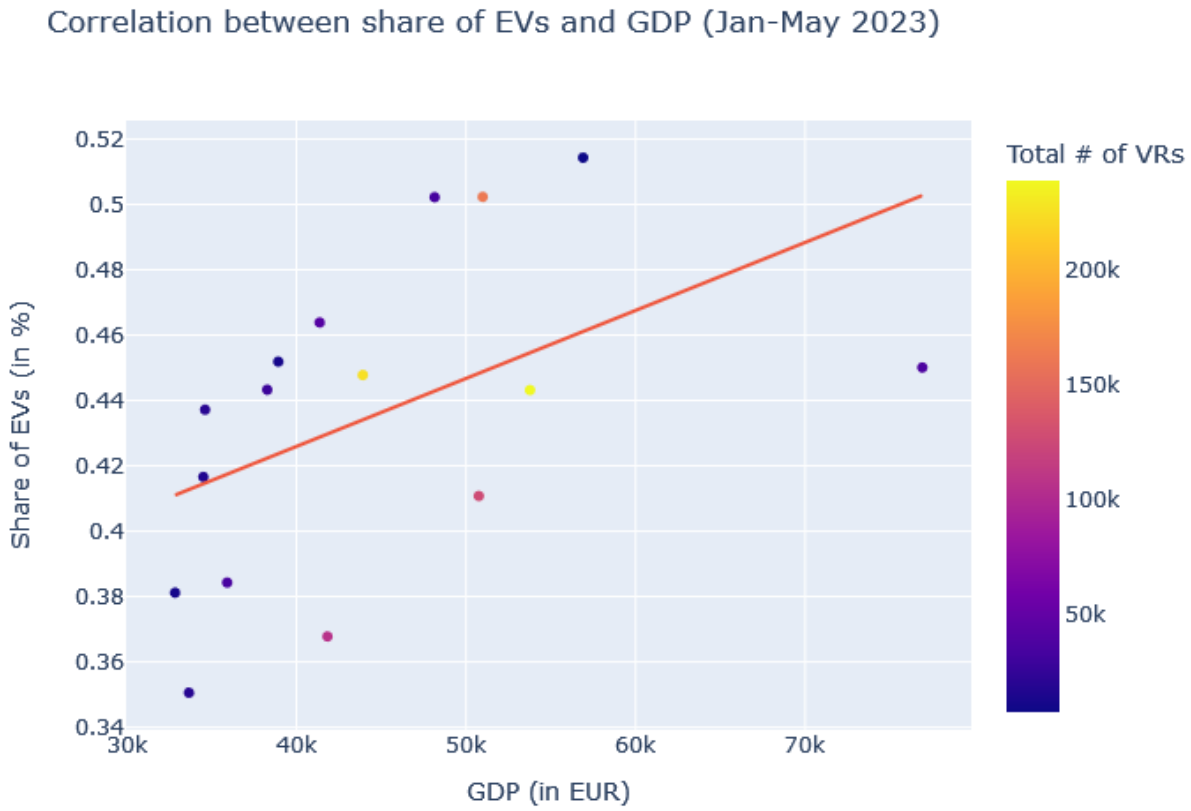
Sample

- Data Format: XLSX
- Update Interval: Once per Year

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	3.3 Bruttoinlandsprodukt in jeweiligen Preisen je Einwohnerin bzw. Einwohner										Zum Inhaltsverzeichnis						
2																	
3	Jahr	Baden-Württemberg	Bayern	Berlin	Branden-burg	Bremen	Hamburg	Hessen	Mecklenburg-Vorpommern	Nieder-sachsen	Nordrhein-Westfalen	Rheinland-Pfalz	Saarland	Sachsen	Sachsen-Anhalt	Schleswig-Holstein	Thüringen
5						in Euro									in Euro		
6	1991	24 524	22 861	19 815	7 690	27 626	36 858	25 924	7 504	19 442	21 808	20 133	19 950	7 759	7 200	19 335	6 573
7	1992	25 458	24 263	21 848	9 667	28 401	38 063	27 050	9 397	20 383	22 793	20 788	20 626	9 785	9 124	20 256	8 896
8	1993	25 001	24 418	23 400	11 776	28 332	39 125	27 226	11 405	20 562	22 811	20 488	20 262	11 958	11 311	20 485	10 997
9	1994	25 761	25 152	24 208	13 615	29 385	40 205	27 820	13 341	21 233	23 402	21 066	21 187	13 967	13 108	21 041	12 913
10	1995	26 582	25 745	24 970	14 973	30 088	41 218	28 509	14 667	21 313	24 142	21 722	22 067	15 442	14 030	21 703	13 722
11	1996	26 976	26 082	24 864	15 661	30 224	42 211	29 125	15 268	21 331	24 153	21 617	21 543	16 107	14 726	21 926	14 321
12	1997	27 437	26 657	24 729	15 906	31 343	43 927	29 686	15 593	21 665	24 690	22 174	22 036	16 190	15 192	22 296	14 860
13	1998	28 269	27 780	25 145	16 221	31 995	45 316	30 333	15 772	22 357	25 364	22 358	22 577	16 563	15 549	22 512	15 363
14	1999	29 130	28 573	25 558	16 859	32 343	45 727	31 515	16 297	22 786	25 574	22 850	23 052	17 037	15 909	22 661	15 967
15	2000	29 811	29 545	25 929	17 310	33 914	46 539	32 195	16 527	23 423	26 051	23 242	23 860	17 176	16 247	23 055	16 323
16	2001	31 041	30 499	26 250	17 777	35 221	48 924	33 343	16 926	23 797	26 613	23 250	24 459	17 900	16 722	23 644	16 898
17	2002	31 110	31 025	26 200	18 051	36 086	49 416	33 409	17 205	23 611	27 003	23 650	24 473	18 687	17 506	23 228	17 273
18	2003	31 360	30 742	26 042	18 266	36 954	49 638	34 330	17 468	23 749	27 007	23 780	24 791	19 231	17 818	23 411	17 769
19	2004	31 705	31 702	26 157	18 816	37 211	50 837	34 838	17 826	24 351	27 766	24 501	25 994	19 901	18 379	23 880	18 324
20	2005	31 917	32 124	26 741	19 140	37 841	51 832	35 068	17 984	25 010	28 090	24 567	27 397	19 980	18 580	23 985	18 485
21	2006	33 965	33 462	27 781	20 145	39 716	52 365	36 301	18 727	26 269	29 119	25 558	28 777	21 135	19 661	24 722	19 467
22	2007	35 860	35 040	29 001	21 074	41 139	53 925	37 731	19 863	27 478	30 891	26 709	30 323	22 243	20 807	25 314	20 529
23	2008	36 350	35 287	30 305	21 920	41 753	55 560	38 306	20 556	28 323	31 739	27 172	30 883	22 640	21 402	26 128	20 952
24	2009	33 692	34 615	30 339	21 542	38 111	53 644	36 729	20 574	27 201	30 634	26 464	28 181	22 139	20 701	25 444	20 299
25	2010	36 534	36 542	31 474	22 613	40 414	55 029	37 978	21 391	28 992	31 550	28 127	29 906	23 252	22 141	26 051	21 703
26	2011	38 646	38 948	32 739	23 387	41 798	55 296	39 609	22 448	30 827	32 894	29 389	31 794	24 482	22 729	27 106	23 133
27	2012	39 334	39 780	32 762	24 029	43 638	56 197	39 625	22 712	31 481	33 204	30 197	32 144	25 006	23 862	28 087	23 604
28	2013	40 128	40 754	33 215	24 715	43 934	58 119	40 368	23 540	31 842	33 841	30 813	31 955	25 724	24 445	28 460	24 658
29	2014	41 473	42 226	34 395	25 980	45 173	58 950	41 809	24 663	33 176	35 074	31 858	33 594	26 989	25 141	29 350	26 031
30	2015	42 910	43 445	35 741	26 442	45 739	60 935	42 422	24 954	33 186	35 899	32 966	34 302	27 908	25 617	29 809	26 563
31	2016	43 507	44 829	37 551	27 092	46 450	61 449	43 773	25 497	35 359	36 547	33 576	34 397	28 711	26 325	30 488	27 263
32	2017	45 260	46 726	39 320	28 265	47 638	64 042	44 972	27 428	36 195	37 929	34 428	35 510	29 852	27 317	32 094	28 394
33	2018	46 772	47 578	41 164	28 990	48 282	64 798	45 747	27 529	37 327	39 228	35 070	36 148	30 684	28 000	32 838	28 987
34	2019	47 393	49 156	42 965	30 205	48 641	67 701	47 121	29 567	38 901	39 987	35 943	36 265	31 988	29 385	34 344	29 839
35	2020	45 878	48 013	42 752	29 985	47 257	64 838	45 803	29 167	37 969	39 427	35 291	35 140	31 660	29 345	34 291	29 735
36	2021	48 493	50 643	45 074	31 787	51 822	70 620	48 190	30 957	39 390	41 440	39 530	36 730	33 330	31 381	35 903	31 413
37	2022	50 982	53 768	48 147	34 610	56 901	76 910	50 751	32 837	41 826	43 910	41 366	38 925	35 909	34 505	38 274	33 656

Final Report

GitHub Pages: https://luccalb.github.io/2023-amse-template/



Answer to Research Question:

Yes, a correlation can be found!

Pipeline Overview

Pipeline Overview

Steps

- Install python dependencies from requirements.txt file
- Run the integration tests
- Create a HTML Version of the report using *jupyter nbconvert* command
- Commit the updated report from GitHub Actions to the repository
- Build and deploy GitHub Pages

Pipeline Overview

Steps

```
[...]
- name: Set up Python 3.11
  uses: actions/setup-python@v4
  with:
    python-version: 3.11

- name: Install python deps
  uses: py-actions/py-dependency-install@v4
  with:
    path: "./main/requirements.txt"

- name: Run Integration- and Unit-Tests
  run: |
    ./main/project/tests.sh

- name: Creating report
  run: |
    jupyter nbconvert --execute --to html ./main/project/report_notebook.ipynb --output index --output-dir
./main

- name: Commit updated report
  uses: stefanzweifel/git-auto-commit-action@v4
  with:
    file_pattern: 'index.html'
    repository: ./main
```

Thank you for your attention!