

# Assignment 1:

## Regional GDP Inequality in 4 Selected European Economies

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### 1 Data Acquisition

In this assignment we will use data for four selected countries from Eurostat and process it to analyse the sub-national GDP (gross domestic product) and population data from the years 2000-2023. Eurostat serves as the statistical office of the European Union, and their work is to collect and provide statistics on EU countries, through reliable, impartial and comparable data. The countries we have analysed are Germany, Switzerland, Croatia and Ireland. In these datasets we encountered missing values which we decided to keep. These NA, or missing data was caused by different reasons for each country.

- Germany which has the most observations, lacks data for GDP for year 2023 in a lot of its regions. This can be because of late reporting of its data to Eurostat. There are also some missing data on population during 2000-2010 and a few other regions during 2000-2023 which may be caused by the emergence of new regions or changes in districts such that updates are required.
- Ireland lacks data from the early 2000 to 2011 in population due to changes in NUTS 3 level in their regions. When it comes to the GDP, Ireland only misses data from 2015-2017 in Mid-West and South-West. This was due to confidentiality concerns ('Recent Trends in Regional GDP', n.d.).
- Croatia only have NA values on population but its spread out on different regions. The same occurs for Germany, here the lack of data can be explained by the changes in regions and districts, which may be the cause of the spread in NA values. It has also been shown that the NUTS2 regions have changed from 2007 to 2021, and the data has been reported using several different NUTS-definitions ('The NUTS Classification in Croatia', n.d.).
- Switzerland is a non-EU, but EFTA country, and did not have a data-sharing agreement with Eurostat for NUTS3 GDP from 2000-2007. In 2008 the NUTS classification was updated and it was standardized across all regions (*Information on Data - National Accounts - Eurostat*, n.d.). Switzerland also lacks the data from 2022-2023 which may be that they are waiting to finalize the data before releasing it.

We will below calculate the GDP per capita and explore regional inequality through a EDA (exploratory data analysis)

## 1.1 GDP per Region

In `?@lst-import`, we use the `read_excel` function from the package `readxl` to read the downloaded GDP data from Eurostat into R. We store it in memory as a tibble called `gdp_wide`.

Table 1: GNP in million € for 15 German NUTS3 regions in year 2000.

NUTS3	NUTS3name	year	GDP (mill. €)
DE111	Stuttgart, Stadtkreis	2000	35 273.9
DE112	Böblingen	2000	13 867.9
DE113	Esslingen	2000	14 404.6
DE114	Göppingen	2000	6 000.4
DE115	Ludwigsburg	2000	14 657.5
DE116	Rems-Murr-Kreis	2000	10 367.5
DE117	Heilbronn, Stadtkreis	2000	5 273.6
DE118	Heilbronn, Landkreis	2000	8 453.8
DE119	Hohenlohekreis	2000	3 083.0
DE11A	Schwäbisch Hall	2000	4 503.8
DE11B	Main-Tauber-Kreis	2000	3 470.6
DE11C	Heidenheim	2000	3 677.4
DE11D	Ostalbkreis	2000	7 456.2
DE121	Baden-Baden, Stadtkreis	2000	1 894.7
DE122	Karlsruhe, Stadtkreis	2000	12 988.6

[1] 72 4

## 1.2 Demographic Data

Similarly as before, we do the same for the downloaded demographic dataset from Eurostat, again using the “`read_excel`”-function. This time we input the data into a function we have called “`raw_demo`”, before we make it tidy and input that into “`tidy_demo`”.

Table 2: Population for 15 German NUTS3 regions in year 2000.

NUTS3	NUTS3name	year	Population
DE111	Stuttgart, Stadtkreis	2000	582 443
DE112	Böblingen	2000	362 048
DE113	Esslingen	2000	497 826
DE114	Göppingen	2000	256 136
DE115	Ludwigsburg	2000	495 443
DE116	Rems-Murr-Kreis	2000	407 213
DE117	Heilbronn, Stadtkreis	2000	119 526
DE118	Heilbronn, Landkreis	2000	317 578
DE119	Hohenlohekreis	2000	106 930
DE11A	Schwäbisch Hall	2000	184 819
DE11B	Main-Tauber-Kreis	2000	137 135
DE11C	Heidenheim	2000	136 890
DE11D	Ostalbkreis	2000	313 318
DE121	Baden-Baden, Stadtkreis	2000	52 627
DE122	Karlsruhe, Stadtkreis	2000	277 204

NUTS3	NUTS3name	Time	pop
Length:11424	Length:11424	Length:11424	Min. : 14946
Class :character	Class :character	Class :character	1st Qu.: 105932
Mode :character	Mode :character	Mode :character	Median : 150867
			Mean : 212629
			3rd Qu.: 247409
			Max. : 3677472
			NA's : 778

[1] 0 4

## 2 GDP Per capita:

To calculate GDP per capita we have used the NUTS-3 codes from the “Geo\_Codes” column as a primary key to join the tidied demographic and economic tables together. The code chunk below joins the two datasets and adds a new column called “GDP\_Capita”, calculated by multiplying the “GDP Million EUR”-column by a million and dividing it by the reported population in the same year. We also add two more columns called “Country” and “NUTS2” by Extracting the first letters (which indicate country and NUTS2-region) from the NUTS3-column.

### 3 Descriptive analysis of the “GDP per capita”-table

#### 3.1 Switzerland

Table 3: Descriptive statistics for Switzerland.

CH			
Statistic	GDP	pop	GDP per capita
n	364	624	364
mean	21 507.00	305 461.88	65 662.47
sd	25 817.17	319 131.49	26 094.69
median	14 450.17	214 911.50	59 181.38
trimmed	16 282.75	242 215.72	61 016.74
mad	16 671.43	215 700.51	13 876.25
min	526.26	14 946.00	30 506.73
max	140 799.63	1 579 967.00	187 233.69
range	140 273.37	1 565 021.00	156 726.96
skew	2.56	1.88	2.24

#### 3.2 Germany

Table 4: Descriptive statistics for Germany.

DE			
Statistic	GDP	pop	GDP per capita
n	9 202	9 163	8 765
mean	7 022.39	205 311.43	32 287.57
sd	11 430.89	237 276.72	15 350.99
median	4 243.68	149 491.00	28 584.35
trimmed	4 979.97	168 596.74	29 874.51
mad	2 878.05	81 501.49	10 166.43
min	806.67	33 264.00	10 984.41
max	197 516.68	3 677 472.00	199 296.18
range	196 710.01	3 644 208.00	188 311.77

DE

Statistic	GDP	pop	GDP per capita
skew	7.35	8.31	2.58

### 3.3 Croatia

Table 5: Descriptive statistics for Croatia.

HR

Statistic	GDP	pop	GDP per capita
n	504	315	315
mean	2 166.74	194 105.67	10 596.37
sd	3 226.54	151 293.65	4 177.19
median	1 146.18	143 380.00	9 365.78
trimmed	1 459.15	165 969.36	10 035.89
mad	727.21	61 731.02	2 752.18
min	237.32	42 469.00	4 141.43
max	25 658.09	790 038.00	33 381.85
range	25 420.77	747 569.00	29 240.42
skew	4.08	2.23	1.75

### 3.4 Ireland

Table 6: Descriptive statistics for Ireland.

IE

Statistic	GDP	pop	GDP per capita
n	185	96	89
mean	30 186.15	607 720.80	51 718.66
sd	42 352.46	318 232.23	41 164.89
median	13 769.34	472 295.50	35 327.62
trimmed	19 981.87	552 867.55	43 961.75
mad	9 581.30	169 040.12	16 962.68
min	3 765.33	286 326.00	16 456.08

IE			
Statistic	GDP	pop	GDP per capita
max	248 326.34	1 499 179.00	193 838.09
range	244 561.01	1 212 853.00	177 382.01
skew	2.83	1.55	1.73

Using the following code, we see that we have a total of 3838 NA-values in our dataset. Most due to different ways of reporting demographic and economic data, making the datasets hard to pair and leading to even more NA-values in the GDP\_Capita-column.

```
[1] 2774
```

Country	NUTS3	NUTS3name	NUTS2
Length:10920	Length:10920	Length:10920	Length:10920
Class :character	Class :character	Class :character	Class :character
Mode :character	Mode :character	Mode :character	Mode :character

NUTS1	Time	GDP	pop
Length:10920	Length:10920	Min. : 237.3	Min. : 14946
Class :character	Class :character	1st Qu.: 2544.7	1st Qu.: 106034
Mode :character	Mode :character	Median : 4220.9	Median : 155074
		Mean : 7715.8	Mean : 214882
		3rd Qu.: 7596.0	3rd Qu.: 250128
		Max. :248326.3	Max. :3677472
		NA's :665	NA's :722

```
GDP_Capita
Min. : 4141
1st Qu.: 22243
Median : 28681
Mean : 33027
3rd Qu.: 38111
Max. :199296
NA's :1387
```

All ("CH", "DE", "HR", "IE")

Statistic	GDP	pop	GDP per capita
n	10 255	10 198	9 533
mean	7 715.75	214 881.48	33 026.60
sd	13 832.81	245 981.80	17 885.20

All ("CH", "DE", "HR", "IE")			
Statistic	GDP	pop	GDP per capita
median	4 220.93	155 074.00	28 681.36
trimmed	5 125.64	173 660.24	30 334.35
mad	3 076.10	89 245.11	11 027.70
min	237.32	14 946.00	4 141.43
max	248 326.34	3 677 472.00	199 296.18
range	248 089.02	3 662 526.00	195 154.75
skew	6.98	7.13	2.65

## 4 Using light levels as a predictor of economic development

In this assignment we use reported GDP and demographic data from Eurostat to determine regional inequality in a selection of countries, but what can you do when regional income data isn't readily available? The paper "Regional inequality, convergence, and its determinants – A view from outer space" by Christian Lessmann and André Seidel Lessmann & Seidel (2017) aimed to find a new way of finding regional inequalities in areas without economic data – estimating regional income using satellite images of nighttime light intensity.

Their method involved using luminosity data taken from meteorological satellites from the U.S air force, and existing income data to estimate a relationship between the two variables. They then used this estimate to predict regional income for other regions where economic data was not available, and to calculate inequality indicators such as the Gini coefficient. The main takeaway from the study would be that yes – it is possible to use light as an indicator of GDP. Findings also showed that for about 70% of countries, regional gaps got smaller, while other countries saw inequality grow. They also discovered an "n-shaped" link between development and regional inequality: in early stages of growth inequality is low, for mid-income regions it rises, before it falls again in rich economies.

## 5 Regional GDP inequality - Calculating the Gini coefficient

To calculate the Gini coefficient for our selected countries (weighted for population) we first insert our data including GDP per capita Table ?? into a new function we have called "ginigdp" Table ?. To be able to calculate the Gini coefficient, we then have to remove NA-values from our dataset. This can be done by using the "na.omit"-function. The output is then grouped by year

(variable “Time”) and region (NUTS2), and sent to a summarise-function which includes our Gini calculation (done by the “gini.wtd”-function). We have also included a count-column that shows the amount of NUTS3-regions in each of the NUTS2-regions. This is to provide clarity in case we get “strange” Gini-values like 0, which we would represent ultimate equality. We will get this in all cases where there is only one NUTS3-region per NUTS2-region. The code chunk below does all this and prints the first 10 results.

Table 8: Change i gini-coefficients for the NUTS2 regions in Switzerland. The numbers after n3 are the number of NUTS3 regions in the different NUTS2 regions.

Time	CH01 N3: 3	CH02 N3: 5	CH03 N3: 3	CH04 N3: 1	CH05 N3: 7	CH06 N3: 6	CH07 N3: 1
2008	0.1390	0.0445	0.1668	0	0.0592	0.1624	0
2009	0.1304	0.0454	0.1713	0	0.0585	0.1600	0
2010	0.1307	0.0464	0.1728	0	0.0601	0.1739	0
2011	0.1296	0.0529	0.1790	0	0.0581	0.1721	0
2012	0.1279	0.0569	0.1781	0	0.0534	0.1720	0
2013	0.1343	0.0546	0.1757	0	0.0537	0.1764	0
2014	0.1317	0.0549	0.1797	0	0.0520	0.1667	0
2015	0.1268	0.0575	0.1879	0	0.0522	0.1729	0
2016	0.1205	0.0563	0.2018	0	0.0526	0.1717	0
2017	0.1275	0.0573	0.2103	0	0.0536	0.1617	0
2018	0.1262	0.0599	0.2136	0	0.0542	0.1631	0
2019	0.1253	0.0625	0.2116	0	0.0544	0.1641	0
2020	0.1228	0.0615	0.2106	0	0.0506	0.1641	0
2021	0.1242	0.0669	0.2230	0	0.0554	0.1713	0

Table 9: Change i gini-coefficients for the NUTS2 regions in the NUTS1 region “DE2” (Bavaria) in Germany. (N3 number of NUTS3 regions.)

Time	DE21 N3: 23	DE22 N3: 12	DE23 N3: 10	DE24 N3: 13	DE25 N3: 12	DE26 N3: 12	DE27 N3: 14
2000	0.2821	0.1517	0.2432	0.2003	0.2186	0.1959	0.1406
2001	0.2847	0.1674	0.2361	0.2070	0.2012	0.1987	0.1434
2002	0.2809	0.1634	0.2265	0.2084	0.2076	0.1973	0.1408
2003	0.2781	0.1722	0.2340	0.2034	0.2076	0.1969	0.1407



Time	DE21 N3: 23	DE22 N3: 12	DE23 N3: 10	DE24 N3: 13	DE25 N3: 12	DE26 N3: 12	DE27 N3: 14
2004	0.2767	0.1758	0.2372	0.2125	0.2226	0.1985	0.1443
2005	0.2795	0.1814	0.2383	0.2140	0.2090	0.2060	0.1415
2006	0.2796	0.1780	0.2400	0.2203	0.2119	0.2046	0.1439
2007	0.2780	0.1856	0.2486	0.2270	0.2146	0.2008	0.1511
2008	0.2636	0.1726	0.2469	0.2248	0.2182	0.1927	0.1501
2009	0.2648	0.1745	0.2488	0.2259	0.2204	0.1863	0.1434
2010	0.2582	0.1814	0.2580	0.2222	0.2067	0.2007	0.1370
2011	0.2642	0.1857	0.2515	0.2171	0.2162	0.2098	0.1268
2012	0.2671	0.1720	0.2397	0.2203	0.2187	0.2129	0.1348
2013	0.2695	0.1695	0.2338	0.2173	0.2135	0.2076	0.1306
2014	0.2634	0.1797	0.2327	0.2113	0.2127	0.2067	0.1278
2015	0.2644	0.1705	0.2322	0.2096	0.2157	0.2105	0.1328
2016	0.2634	0.1694	0.2254	0.2195	0.2125	0.2135	0.1247
2017	0.2620	0.1737	0.2336	0.2200	0.2117	0.2124	0.1203
2018	0.2624	0.1516	0.2221	0.2135	0.2170	0.2095	0.1141
2019	0.2666	0.1538	0.2215	0.2048	0.2191	0.2084	0.1153
2020	0.2559	0.1440	0.2132	0.2032	0.2188	0.2022	0.1083
2021	0.2622	0.1519	0.2167	0.2130	0.2189	0.2055	0.1045
2022	0.2602	0.1453	0.2109	0.2014	0.2102	0.1968	0.1045

Table 10: Change i gini-coefficients for the NUTS2 regions in Croatia. (N3 number of NUTS3 regions.)

Time	HR02 N3: 8	HR03 N3: 7	HR05 N3: 1	HR06 N3: 5
2001		0.1278		
2002		0.1226		
2003		0.1224		
2004		0.1106		
2005		0.1115		
2006		0.1115		
2007		0.0990		

Time	HR02 N3: 8	HR03 N3: 7	HR05 N3: 1	HR06 N3: 5
2008		0.1039		
2009		0.1172		
2010		0.1144		
2011		0.1198		
2012		0.1275		
2013	0.0766	0.1195	0	0.0597
2014	0.0817	0.1214	0	0.0408
2015	0.0817	0.1159	0	0.0392
2016	0.0798	0.1169	0	0.0406
2017	0.0724	0.1146	0	0.0420
2018	0.0571	0.1107	0	0.0532
2019	0.0530	0.0943	0	0.0503
2020	0.0575	0.0828	0	0.0561
2021	0.0605	0.0877	0	0.0512
2022	0.0644	0.0992	0	0.0497
2023	0.0619	0.0958	0	0.0475

Table 11: Change i gini-coefficients for the NUTS2 regions in Ireland. (N3 number of NUTS3 regions.)

Time	IE04 N3: 2	IE05 N3: 3	IE05 N3: 1	IE06 N3: 3	IE06 N3: 2
2012	0.1228	0.1001		0.2356	
2013	0.1289	0.0989		0.2588	
2014	0.1300	0.1032		0.2701	
2015	0.1312		0	0.2586	
2016	0.1165		0	0.2385	
2017	0.1042		0	0.2308	
2018	0.1126	0.2885			0.1367
2019	0.1000	0.2441		0.2539	
2020	0.1419	0.2517		0.2602	
2021	0.1561	0.2869		0.2649	

Time	IE04 N3: 2	IE05 N3: 3	IE05 N3: 1	IE06 N3: 3	IE06 N3: 2
2022	0.1598	0.3122		0.2602	
2023	0.1513	0.2785		0.2784	

If we need to reference the tables we can do it like this [Table 8](#), [Table 9](#), [Table 10](#) and [Table 11](#).

## 6 Visualizing the Gini coefficient

In the sections below, we will use the newly created “ginigdp”-function where all our gini-coefficients have been stored. To do this, we first filter down to the specific country, before we send the data to ggplot, group it by NUTS2-region and visualize using `geom_point` and `geom_line` graphs.

### 6.1 Switzerland

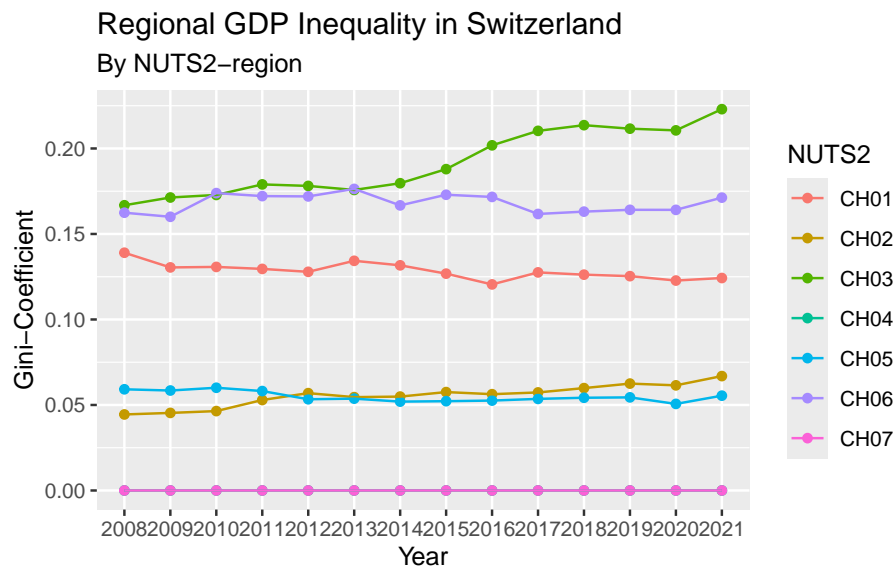


Figure 1: Regional GDP Inequality in Switzerland by NUTS2-regions.

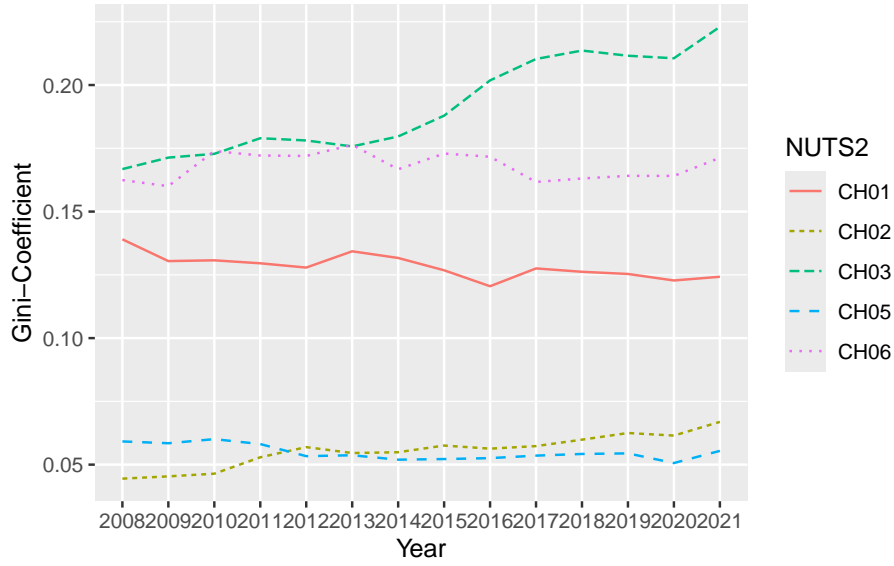


Figure 2: Regional GDP Inequality in Switzerland by NUTS2-regions. Both regions CH04 and CH07 includes only one NUTS3 region and are excluded.

Figure 1 shows low Gini-coefficients for each region, with a tendency to stay below 0.20. There is seemingly a divide into two groups one of which has a higher gini-coefficient than the other. While the overall inequality seems to remain low and consistent, we do see a divergence from the rest by CH03 who has seen growing regional inequality the last 10+ years. This seems to be because CH031 Basel-Stadt has a much higher GDP per capita growth than the surrounding areas. CH07 stays at 0 for the whole period due to only having one region.

## 6.2 Ireland

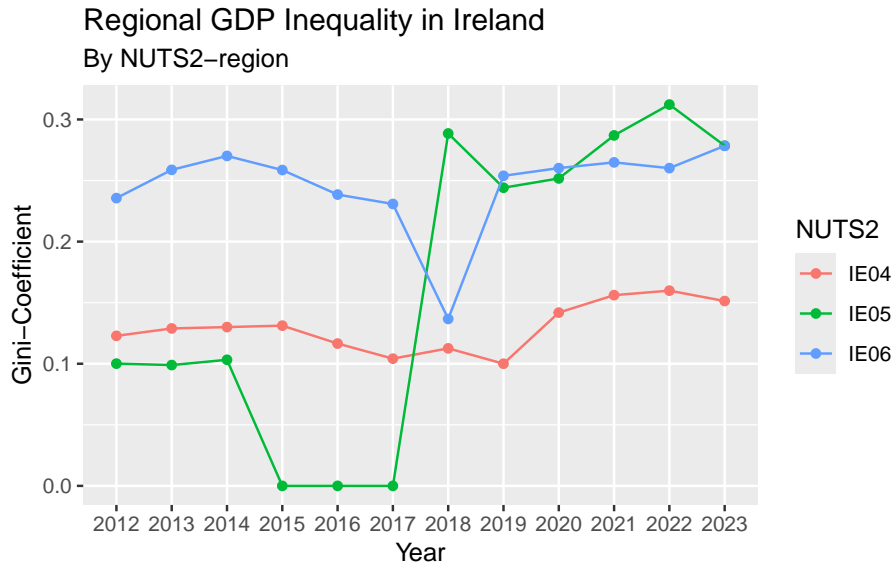


Figure 3: Regional GDP Inequality in Ireland

The Irish graph seen in Figure 3 shows a bigger spread and more “movement” than the Swiss graph. We only have population data from 2012 onwards, hence our starting point. As we can see in the graph, IE05 and IE04 start out with similarly low Gini coefficients, both lying around 0.1, whereas IE06, containing the capital Dublin, has a much less even distribution of GDP per capita. If we take a look at Table ??, we can see that for the period 2015-2017 no GDP data was reported for the Mid-West and South-West NUTS3-regions, leaving only one NUTS3-region remaining in the IE05 group, giving us a Gini coefficient of 0,0 for those years. When GDP data returned in 2018, IE053 (South-West) had grown in GDP per capita in a big way, pulling away from the rest of the group and increasing the Gini coefficient. The graph seems to show a trend towards slowly growing regional inequality of development in Ireland.

### 6.3 Germany

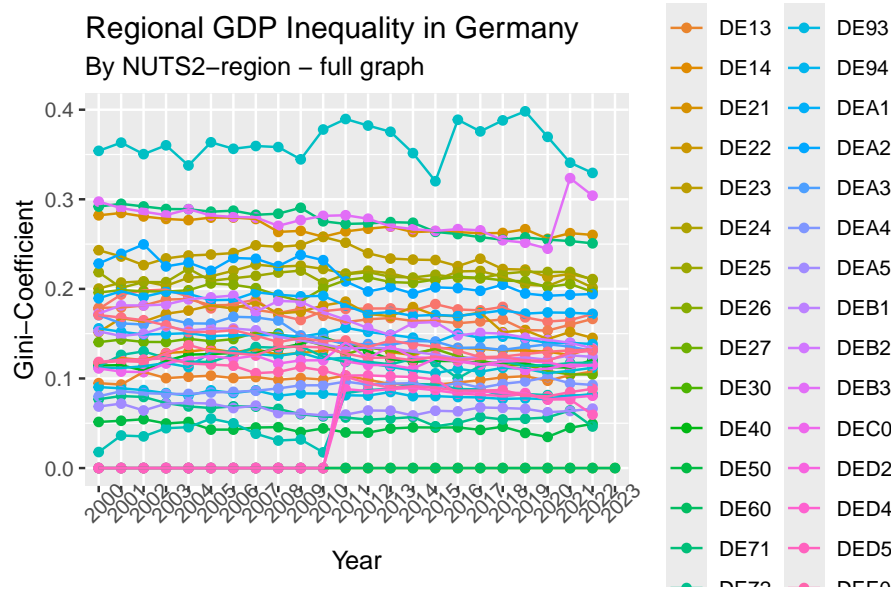


Figure 4: Regional GDP Inequality in Germany - Full graph

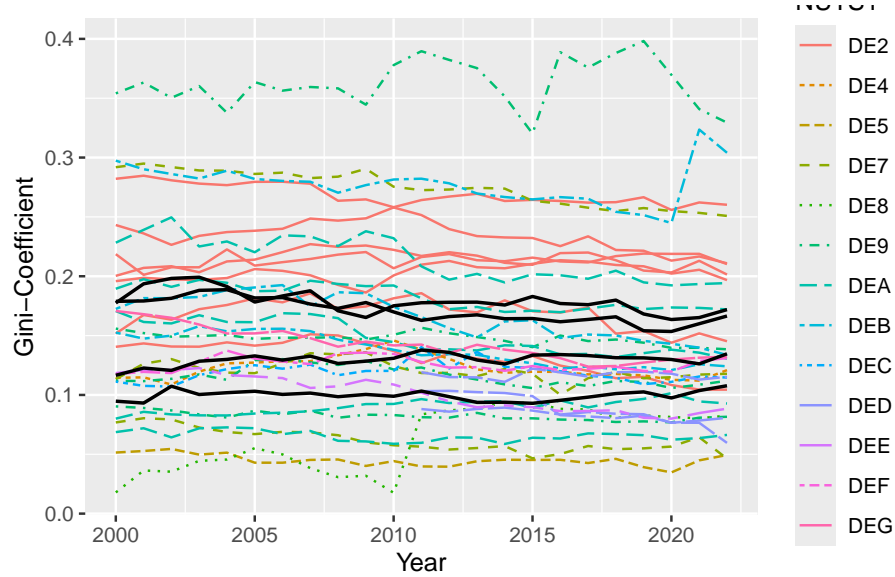


Figure 5: Regional GDP Inequality in Germany - Full graph. The zones in DE1 are depicted with black solid somewhat thicker lines.

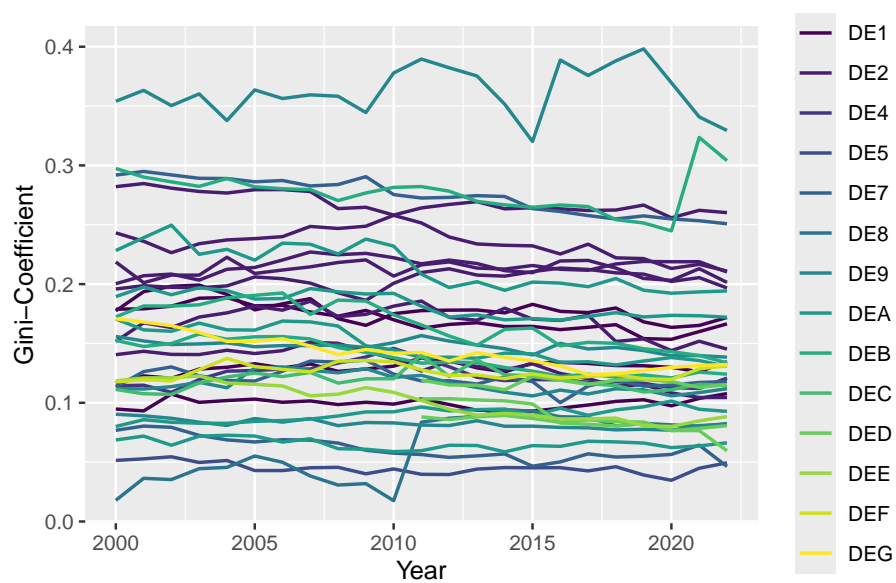


Figure 6: Regional GDP Inequality in Germany - Full graph.

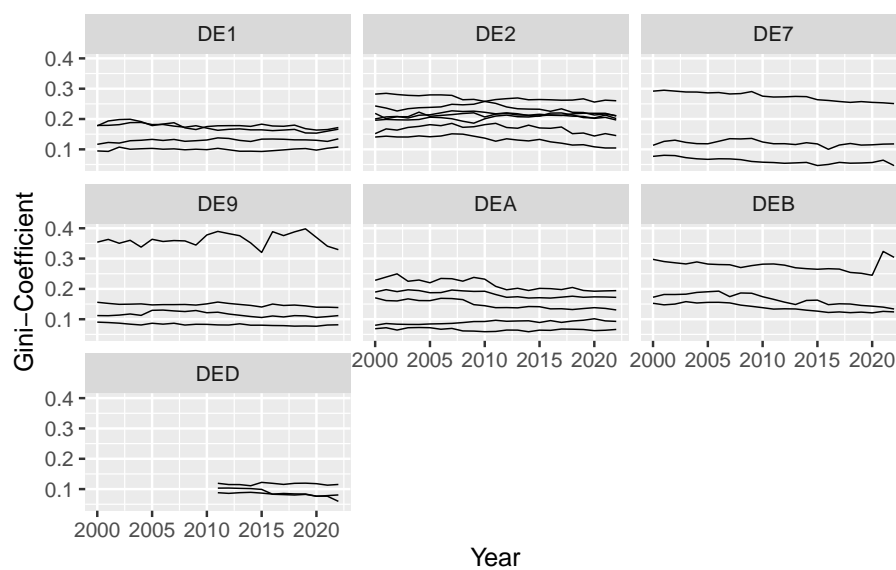


Figure 7: Regional GDP Inequality in Germany - NUTS1 regions with multiple NUTS2 regions.

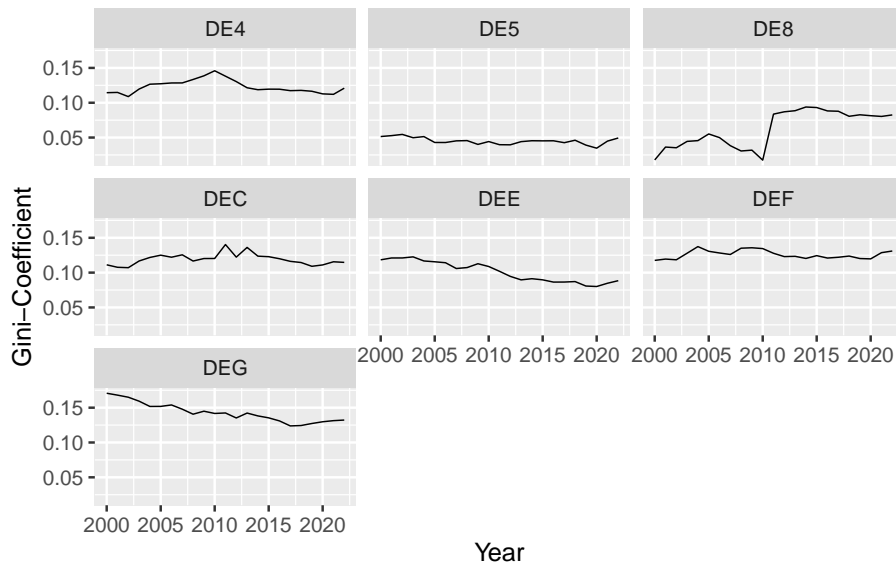


Figure 8: Regional GDP Inequality in Germany - NUTS1 regions with a single NUTS2 region.

Germany has been very consistent at reporting data and we have data for the full period, but as Figure 4 shows, we have a little bit of an information overload on our hands. Germany consists of up to 38 NUTS2 regions which is crowding the graph, making it very hard to read. Our dataset gives a spread from 0 to 0.4 in gini-coefficient. To combat the information overload we have chosen to extract 10 random regions to get a better picture of Germany's regional inequalities.

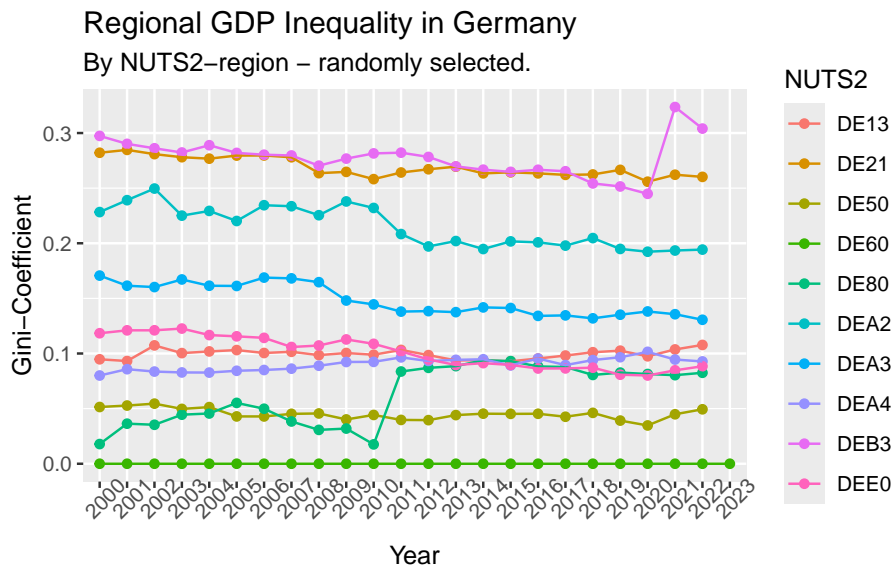


Figure 9: Regional GDP Inequality in Germany - Random selection



Figure 9 takes 10 randomly selected NUTS2 regions and shows the same spread as the one with all regions. The graph Figure 4 containing all regions from Germany showed one region with a Gini of 0,4 while most other regions lie between 0,1 and 0,2. The pattern seems to be the Gini coefficient remains stable over time, but we do have two significant “jumps”. DEB3 shows a significant jump from 0,24 in 2020 to 0,32 in 2021. This seems to be because DEB35 Mainz doubles in reported GDP, with their population remaining stable leading to a boost in productivity. The other regions in the group do not see a similar jump, hence inequality grows. The other jump can be seen in DE80, where we have a jump from 0,017 (extremely low) in 2010 to 0,083 in 2011. If we refer to the tidyjoined-table Table ?? , we see that population data was only reported for two of the NUTS3-regions in DE80 until 2011, giving us artificially low values for the preceeding period. The Gini coefficient for DE80 is therefore not comparable between the periods before 2010 and after 2011. DE60 only contains one NUTS3-region (Hamburg) and is therefore stable at 0.

## 6.4 Croatia

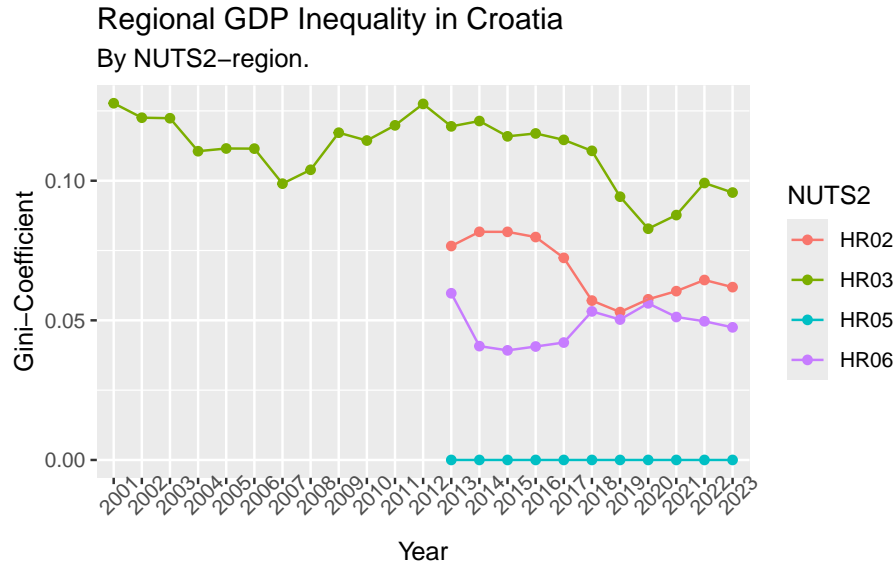


Figure 10: Regional GDP Inequality in Croatia

The graph of Croatia Figure 10 shows us a bit of a different picture from the other countries. Demographic data seems to be missing in the “ginigdp”-table for all regions but HR03 before 2013, hence the early start for HR03. Croatia has had its NUTS regions change several times between 2000 to 2023, and the data available from Eurostat contains both the old and new definitions, making it hard to pair the two datasets. For instance, the capital Zagreb appears as both HR041 and HR050 using different NUTS-definitions. Because we joined the two Eurostat-datasets by NUTS3-code, we end up getting a graph that looks

incomplete, but this appears to be the best way to pair the available datasets with each other while still limiting room for error.

If we take a look at the calculated Gini coefficients in Table ?? , we see that we get very low values for all available croatian regions. This could usually mean that we have very few NUTS3-regions per group, but if we take a look at the data, we see that this is not the case. HR06 for instance, has 5 NUTS3-regions inside of it, all with similar GDP per capita. The fact that all of Croatia's regions have such a low Gini coefficient could indicate that economic development is evenly spread inside the NUTS2-regions. HR05 only contains the capital Zagreb, and is therefore shown as 0.

## 7 Implications of our findings

In this assignment we have calculated Gini coefficients inside each available NUTS2-region using Eurostat data for Ireland, Germany, Croatia and Switzerland. The calculated variations in the Gini coefficient tell us something about the variations of gdp per capita inside each NUTS2-region. A high Gini could indicate that we have a case of a highly productive city-region inside a greater region containing a lot of less productive land.

Overall, the the calculated Gini coefficients seem to be stable over time, except for a few outliers as commented on previously. This could mean that economic development in our selected countries is mostly stable “across the board”, and not especially concentrated in a handful of highly productive cities inside larger regions.

Our findings do however not entirely dismiss the idea that growth and economic development is mostly centered around cities. If we take a look at the data for Croatia in Table ??, we can see that Zagreb has been designated as its' own region, with a GDP per capita much higher than the other regions in Croatia. Had Zagreb instead been a part of any of the other regions, the calculated Gini coefficient would have been much higher than what Figure 10 showed. The same is the case for Berlin, Hamburg and many other highly productive cities, but because they are designated to their own NUTS2-regions, they end up as “blind spots” for this specific assignment and end up with a Gini of 0 (due to only consisting of one NUTS3-region). To further examine this theory, it would be interesting to look at the calculated Gini coefficients based on variations of GDP per capita per NUTS2 region, which would show variations in GDP per capita inside the whole country, which might be able to pick up these disparities.

## 8 AI Disclaimer

In this assignments we have used AI to confirm through controlling questions and constructive judging the text and the codes used, to provide a constructive feedback. The AI was used as a sparring partner to help with the wording of the writing and testing of the codes to provide an explanation of how each function in the code works. The software of AI we used was ChatGPT 3.5, which is the

free version available for all users. It was only used to function test our codes and recommend correct grammar and code syntax.

R version 4.5.1 (2025-06-13 ucrt)  
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Running under: Windows 11 x64 (build 26100)

Matrix products: default  
LAPACK version 3.12.1

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time zone: Europe/Oslo  
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attached base packages:  
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other attached packages:  
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[5] PxWebApiData\_1.1.0 lubridate\_1.9.4 forcats\_1.0.0 stringr\_1.5.1  
[9] dplyr\_1.1.4 purrr\_1.1.0 readr\_2.1.5 tidyr\_1.3.1  
[13] tibble\_3.3.0 ggplot2\_3.5.2 tidyverse\_2.0.0

loaded via a namespace (and not attached):  
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R Core Team (2025). *R: A Language and Environment for Statistical Computing*. R Foundation for Statistical Computing, Vienna, Austria. <<https://www.R-project.org/>>.

A BibTeX entry for LaTeX users is

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@Manual{,
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We have invested a lot of time and effort in creating R, please cite it when using it for data analysis. See also 'citation("pkgname")' for citing R packages.

*Information on data - national accounts - eurostat.* (n.d.). <https://ec.europa.eu/eurostat/web/national-accounts/information-data>

Lessmann, C., & Seidel, A. (2017). Regional inequality, convergence, and its determinants – a view from outer space. *European Economic Review*, 92, 110–132. <https://doi.org/10.1016/j.euroecorev.2016.11.009>

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