

Case Study 2

AKSTA Statistical Computing

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The .Rmd and .html (or .pdf) should be uploaded in TUWEL by the deadline. Refrain from using explanatory comments in the R code chunks but write them as text instead. Points will be deducted if the submitted file is not in a decent form.

DISCLAIMER: In case students did not contribute equally, include a disclaimer stating what each student's contribution was.

The CIA World Factbook provides intelligence on various aspects of 266 world entities, including history, people, government, economy, energy, geography, environment, communications, transportation, military, terrorism, and transnational issues. This case study involves analyzing world data from 2020, focusing on:

- **Education Expenditure (% of GDP)**
- **Youth Unemployment Rate (15-24 years)**
- **Net Migration Rate** (difference between the number of people entering and leaving a country per 1,000 persons)

The data was sourced from the CIA World Factbook Archives. You are required to use `dplyr` for data manipulation, while any package can be used for importing data.

Tasks:

a. Data Import and Cleaning

Load the following datasets from TUWEL and ensure that missing values are handled correctly and column names are clear. Each dataset should ultimately contain only two columns: **country** and the respective variable. Note that some data sets also contain information on the year when the value was last updated.

- `rawdata_369.txt` which contains the (estimated) public expenditure on education as a percent of GDP. *Pay attention! The delimiter is 2 or more white spaces (one space would not work as it would separate country names which contain a space); you have to skip the first two lines.*
- `rawdata_373.csv` which contains the (estimated) youth unemployment rate (15-24) per country
- `rawdata_347.txt` which contains (estimated) net migration rate per country.

```
# education expenditure
edu_raw <- readLines("data/rawdata_369.txt")[-(1:2)] # skip first 2 lines
edu_df <- read.table(text = edu_raw, sep = "", fill = TRUE, strip.white = TRUE,
                     stringsAsFactors = FALSE, header = FALSE)

head(edu_df)
```

```
##      V1      V2      V3      V4      V5      V6      V7
## 1  1      Cuba      12.80    2010      NA
## 2  2 Micronesia, Federated States of 12.50 2015
## 3  3      Solomon Islands    9.90 2010      NA
## 4  4 Montserrat      8.80    2019      NA
## 5  5      Norway      7.90    2017      NA
## 6  6      Denmark      7.80    2017      NA
```

```
# parse education data
edu_parsed <- str_match(edu_raw, "(\\d+)\\s+(.+?)\\s+(\\d+\\.\\d+)\\s+(\\d{4})$")

# convert to clean data frame
edu_df_clean <- data.frame(
  country = edu_parsed[, 3],
  expenditure = as.numeric(edu_parsed[, 4]),
  stringsAsFactors = FALSE
)

edu_df_clean
```

```
##      country expenditure
## 1      Cuba      12.8
## 2  Micronesia, Federated States of 12.5
## 3      Solomon Islands    9.9
## 4      Montserrat      8.8
## 5      Norway      7.9
## 6      Denmark      7.8
## 7      Iceland      7.7
## 8      Sierra Leone      7.7
## 9      Belize      7.6
## 10     Sweden      7.6
## 11     Bolivia      7.3
## 12     Eswatini      7.1
## 13     Costa Rica      7.0
## 14     Lesotho      7.0
## 15     Bhutan      6.9
## 16     Oman      6.8
## 17     Timor-Leste      6.8
## 18     Tunisia      6.6
## 19     South Africa      6.5
## 20     Belgium      6.4
## 21     Finland      6.4
## 22     Brazil      6.3
## 23     New Zealand      6.3
## 24     Honduras      6.1
## 25     Israel      6.1
## 26     Puerto Rico      6.1
## 27     Kyrgyzstan      6.0
## 28     Zimbabwe      5.9
## 29     Cyprus      5.8
## 30  Saint Vincent and the Grenadines 5.7
## 31     Dominica      5.6
## 32     Argentina      5.5
## 33     Aruba      5.5
```

## 34	France	5.5
## 35	Guyana	5.5
## 36	Mozambique	5.5
## 37	Austria	5.4
## 38	Burkina Faso	5.4
## 39	Chile	5.4
## 40	Moldova	5.4
## 41	Togo	5.4
## 42	Ukraine	5.4
## 43	United Kingdom	5.4
## 44	Canada	5.3
## 45	Gaza Strip	5.3
## 46	Kenya	5.3
## 47	Uzbekistan	5.3
## 48	West Bank	5.3
## 49	Cabo Verde	5.2
## 50	Jamaica	5.2
## 51	Netherlands	5.2
## 52	Tajikistan	5.2
## 53	Australia	5.1
## 54	Burundi	5.1
## 55	Nepal	5.1
## 56	Sao Tome and Principe	5.1
## 57	Switzerland	5.1
## 58	Ecuador	5.0
## 59	Estonia	5.0
## 60	Portugal	5.0
## 61	United States	5.0
## 62	Uruguay	5.0
## 63	Curacao	4.9
## 64	Germany	4.9
## 65	Belarus	4.8
## 66	Malta	4.8
## 67	Senegal	4.8
## 68	Slovenia	4.8
## 69	Cook Islands	4.7
## 70	Ethiopia	4.7
## 71	Hungary	4.7
## 72	Malawi	4.7
## 73	Mauritius	4.7
## 74	Russia	4.7
## 75	Poland	4.6
## 76	Zambia	4.6
## 77	Colombia	4.5
## 78	Mexico	4.5
## 79	Vanuatu	4.5
## 80	Barbados	4.4
## 81	Brunei	4.4
## 82	Latvia	4.4
## 83	Nicaragua	4.4
## 84	Seychelles	4.4
## 85	Korea, South	4.3
## 86	Turkey	4.3
## 87	Malaysia	4.2

## 88	Samoa	4.2
## 89	Spain	4.2
## 90	Vietnam	4.2
## 91	Afghanistan	4.1
## 92	Bulgaria	4.1
## 93	Maldives	4.1
## 94	Mongolia	4.1
## 95	Thailand	4.1
## 96	Ghana	4.0
## 97	Iran	4.0
## 98	Italy	4.0
## 99	Croatia	3.9
## 100	Czechia	3.9
## 101	Fiji	3.9
## 102	Slovakia	3.9
## 103	Hong Kong	3.8
## 104	India	3.8
## 105	Lithuania	3.8
## 106	Mali	3.8
## 107	Peru	3.8
## 108	Albania	3.6
## 109	Djibouti	3.6
## 110	El Salvador	3.6
## 111	Indonesia	3.6
## 112	Luxembourg	3.6
## 113	San Marino	3.6
## 114	Serbia	3.6
## 115	Congo, Republic of the	3.5
## 116	Georgia	3.5
## 117	Ireland	3.5
## 118	Niger	3.5
## 119	Angola	3.4
## 120	Paraguay	3.4
## 121	Tanzania	3.4
## 122	Cote d'Ivoire	3.3
## 123	Saint Lucia	3.3
## 124	Andorra	3.2
## 125	Grenada	3.2
## 126	Guatemala	3.2
## 127	Japan	3.2
## 128	Panama	3.2
## 129	Cameroon	3.1
## 130	Jordan	3.1
## 131	Namibia	3.1
## 132	Romania	3.1
## 133	Rwanda	3.1
## 134	Turkmenistan	3.1
## 135	Benin	2.9
## 136	Laos	2.9
## 137	Pakistan	2.9
## 138	Singapore	2.9
## 139	Turks and Caicos Islands	2.9
## 140	Haiti	2.8
## 141	Madagascar	2.8

## 142	Armenia	2.7
## 143	Gabon	2.7
## 144	Macau	2.7
## 145	Qatar	2.7
## 146	Kazakhstan	2.6
## 147	Liberia	2.6
## 148	Liechtenstein	2.6
## 149	Saint Kitts and Nevis	2.6
## 150	Azerbaijan	2.5
## 151	British Virgin Islands	2.5
## 152	Chad	2.5
## 153	Comoros	2.5
## 154	Lebanon	2.5
## 155	Gambia, The	2.4
## 156	Bahrain	2.3
## 157	Guinea	2.3
## 158	Cambodia	2.2
## 159	Guinea-Bissau	2.1
## 160	Sri Lanka	2.1
## 161	Uganda	2.1
## 162	Burma	1.9
## 163	Mauritania	1.9
## 164	Papua New Guinea	1.9
## 165	Bermuda	1.5
## 166	Congo, Democratic Republic of the	1.5
## 167	Monaco	1.5
## 168	South Sudan	1.5
## 169	Bangladesh	1.3
## 170	Central African Republic	1.2

```
# net migration rate
mig_raw <- readLines("data/rawdata_347.txt")[-(1:2)]

# use regex to extract rank, country, migration rate, and year
mig_parsed <- str_match(mig_raw, "^((\\d+)\\s+(.+?)\\s+(-?\\d+\\.\\d+))\\s+(\\d{4})")

# build clean df
mig_df_clean <- data.frame(
  country = mig_parsed[, 3],
  net_migration = as.numeric(mig_parsed[, 4]),
  stringsAsFactors = FALSE
)

mig_df_clean
```

##	country	net_migration
## 1	Syria	27.1
## 2	British Virgin Islands	15.5
## 3	Luxembourg	13.3
## 4	Cayman Islands	13.0
## 5	Singapore	11.8
## 6	Anguilla	11.1
## 7	Bahrain	10.6
## 8	Turks and Caicos Islands	8.9

## 9	Aruba	8.4
## 10	Monaco	8.3
## 11	Australia	8.1
## 12	New Zealand	8.0
## 13	Cyprus	7.6
## 14	United Arab Emirates	7.6
## 15	Spain	7.0
## 16	Malta	6.6
## 17	San Marino	6.6
## 18	Qatar	6.5
## 19	Sint Maarten	6.0
## 20	Canada	5.6
## 21	Isle of Man	5.2
## 22	Sweden	5.2
## 23	Djibouti	5.1
## 24	Liechtenstein	4.9
## 25	Belgium	4.8
## 26	Saudi Arabia	4.7
## 27	Switzerland	4.6
## 28	Norway	4.0
## 29	Gabon	3.9
## 30	Ireland	3.9
## 31	New Caledonia	3.8
## 32	Austria	3.6
## 33	Iceland	3.3
## 34	Macau	3.3
## 35	Italy	3.2
## 36	United States	3.0
## 37	Botswana	2.9
## 38	Denmark	2.8
## 39	Finland	2.6
## 40	United Kingdom	2.5
## 41	Brunei	2.3
## 42	Czechia	2.3
## 43	Jersey	2.3
## 44	Korea, South	2.3
## 45	Ukraine	2.3
## 46	Antigua and Barbuda	2.1
## 47	Israel	2.1
## 48	Guernsey	1.9
## 49	Netherlands	1.9
## 50	Hong Kong	1.7
## 51	Russia	1.7
## 52	Bermuda	1.6
## 53	Germany	1.5
## 54	Slovenia	1.5
## 55	Hungary	1.3
## 56	Cote d'Ivoire	1.2
## 57	Saint Kitts and Nevis	1.2
## 58	France	1.1
## 59	Seychelles	1.0
## 60	Greece	0.9
## 61	Palau	0.9
## 62	Costa Rica	0.8

## 63	Taiwan	0.8
## 64	Belarus	0.7
## 65	Suriname	0.5
## 66	Kazakhstan	0.4
## 67	Macedonia	0.4
## 68	Benin	0.3
## 69	Chile	0.3
## 70	Portugal	0.3
## 71	Slovakia	0.2
## 72	South Sudan	0.2
## 73	Georgia	0.1
## 74	Andorra	0.0
## 75	Azerbaijan	0.0
## 76	Bahamas, The	0.0
## 77	Bhutan	0.0
## 78	Central African Republic	0.0
## 79	Ecuador	0.0
## 80	Equatorial Guinea	0.0
## 81	Faroe Islands	0.0
## 82	Guinea	0.0
## 83	Guyana	0.0
## 84	India	0.0
## 85	Japan	0.0
## 86	Korea, North	0.0
## 87	Madagascar	0.0
## 88	Malawi	0.0
## 89	Mauritius	0.0
## 90	Montserrat	0.0
## 91	Namibia	0.0
## 92	Papua New Guinea	0.0
## 93	Saint Helena, Ascension, and Tristan da Cunha	0.0
## 94	Serbia	0.0
## 95	Thailand	0.0
## 96	Togo	0.0
## 97	Zambia	0.0
## 98	Afghanistan	-0.1
## 99	Argentina	-0.1
## 100	Brazil	-0.1
## 101	Chad	-0.1
## 102	Panama	-0.1
## 103	Paraguay	-0.1
## 104	Angola	-0.2
## 105	Ethiopia	-0.2
## 106	Kenya	-0.2
## 107	Nigeria	-0.2
## 108	Romania	-0.2
## 109	South Africa	-0.2
## 110	Yemen	-0.2
## 111	Barbados	-0.3
## 112	Bolivia	-0.3
## 113	Bulgaria	-0.3
## 114	Cambodia	-0.3
## 115	Cameroon	-0.3
## 116	Egypt	-0.3

## 117	Iran	-0.3
## 118	Malaysia	-0.3
## 119	Poland	-0.3
## 120	Vietnam	-0.3
## 121	Bosnia and Herzegovina	-0.4
## 122	China	-0.4
## 123	Oman	-0.4
## 124	Sudan	-0.4
## 125	Tanzania	-0.4
## 126	Iraq	-0.5
## 127	Burkina Faso	-0.6
## 128	Cabo Verde	-0.6
## 129	Colombia	-0.6
## 130	French Polynesia	-0.7
## 131	Libya	-0.7
## 132	Niger	-0.7
## 133	Burundi	-0.8
## 134	Mauritania	-0.8
## 135	Mongolia	-0.8
## 136	Algeria	-0.9
## 137	Congo, Democratic Republic of the	-0.9
## 138	Congo, Republic of the	-0.9
## 139	Pakistan	-0.9
## 140	Uruguay	-0.9
## 141	Belize	-1.0
## 142	Croatia	-1.0
## 143	Laos	-1.0
## 144	Indonesia	-1.1
## 145	Tajikistan	-1.1
## 146	Sierra Leone	-1.2
## 147	Curacao	-1.3
## 148	Senegal	-1.3
## 149	Sri Lanka	-1.3
## 150	Vanuatu	-1.3
## 151	Burma	-1.4
## 152	Honduras	-1.4
## 153	Tunisia	-1.4
## 154	Gambia, The	-1.6
## 155	Ghana	-1.6
## 156	Solomon Islands	-1.6
## 157	Guatemala	-1.7
## 158	Mozambique	-1.7
## 159	Saint Lucia	-1.7
## 160	Turkmenistan	-1.7
## 161	Kosovo	-1.8
## 162	Peru	-1.8
## 163	Philippines	-1.8
## 164	Haiti	-1.9
## 165	Mexico	-1.9
## 166	Morocco	-1.9
## 167	Uzbekistan	-1.9
## 168	Comoros	-2.3
## 169	Nicaragua	-2.4
## 170	Grenada	-2.6

## 171	Dominican Republic	-2.7
## 172	Kiribati	-2.8
## 173	Liberia	-2.9
## 174	Bangladesh	-3.0
## 175	Saint Barthelemy	-3.0
## 176	Estonia	-3.1
## 177	Nepal	-3.1
## 178	Albania	-3.3
## 179	Gibraltar	-3.3
## 180	Kuwait	-3.3
## 181	Rwanda	-3.3
## 182	Venezuela	-3.4
## 183	Uganda	-3.5
## 184	Cuba	-3.7
## 185	Guinea-Bissau	-3.8
## 186	Somalia	-3.8
## 187	Mali	-3.9
## 188	Timor-Leste	-3.9
## 189	West Bank	-4.2
## 190	Turkey	-4.3
## 191	Wallis and Futuna	-4.3
## 192	Marshall Islands	-4.5
## 193	Gaza Strip	-4.7
## 194	El Salvador	-4.8
## 195	Montenegro	-4.9
## 196	Kyrgyzstan	-5.0
## 197	Zimbabwe	-5.0
## 198	Dominica	-5.3
## 199	Trinidad and Tobago	-5.4
## 200	Armenia	-5.5
## 201	Latvia	-5.9
## 202	Lithuania	-5.9
## 203	Greenland	-6.0
## 204	Saint Martin	-6.0
## 205	Lesotho	-6.1
## 206	Fiji	-6.2
## 207	Tuvalu	-6.5
## 208	Eswatini	-6.8
## 209	Saint Vincent and the Grenadines	-7.2
## 210	Virgin Islands	-7.5
## 211	Saint Pierre and Miquelon	-7.7
## 212	Sao Tome and Principe	-7.9
## 213	Samoa	-8.1
## 214	Moldova	-9.0
## 215	Jamaica	-9.4
## 216	Guam	-11.0
## 217	Jordan	-11.3
## 218	Nauru	-11.3
## 219	Eritrea	-11.6
## 220	Maldives	-12.7
## 221	Puerto Rico	-14.1
## 222	Northern Mariana Islands	-15.4
## 223	Tonga	-17.9
## 224	Micronesia, Federated States of	-20.9

```
## 225                American Samoa        -26.1
## 226                Cook Islands          -29.9
## 227                Lebanon              -88.7
```

```
# rename columns for consistency
unemp_df_clean <- read_csv("data/rawdata_373.csv") %>%
  select(country = country_name,
         youth_unemployment = youth_unempl_rate)
```

```
## Rows: 181 Columns: 2
## -- Column specification -----
## Delimiter: ","
## chr (1): country_name
## dbl (1): youth_unempl_rate
##
## i Use 'spec()' to retrieve the full column specification for this data.
## i Specify the column types or set 'show_col_types = FALSE' to quiet this message.
```

```
unemp_df_clean
```

```
## # A tibble: 181 x 2
##   country      youth_unemployment
##   <chr>          <dbl>
## 1 French Polynesia      56.7
## 2 Kosovo                55.4
## 3 South Africa          53.4
## 4 Libya                 48.7
## 5 Eswatini              47.1
## 6 Saint Lucia           46.2
## 7 Macedonia             45.4
## 8 Gaza Strip            42.2
## 9 West Bank             42.2
## 10 Malawi               40.5
## # i 171 more rows
```

b. Merging Raw Data

Merge the datasets using `dplyr` on a unique key and retain the union of all observations.

```
library(dplyr)

# full join education and unemployment
df_merge1 <- full_join(edu_df_clean, unemp_df_clean, by = "country")

# join net migration
df_all <- full_join(df_merge1, mig_df_clean, by = "country")

dim(df_all)
```

```
## [1] 227  4
```

```
head(df_all)
```

##	country	expenditure	youth_unemployment	net_migration
## 1	Cuba	12.8	6.1	-3.7
## 2	Micronesia, Federated States of	12.5	18.9	-20.9
## 3	Solomon Islands	9.9	1.3	-1.6
## 4	Montserrat	8.8	NA	0.0
## 5	Norway	7.9	9.7	4.0
## 6	Denmark	7.8	9.4	2.8

- What key are you using for merging?

Key used for merging: country (it is common in all 3 datasets)

- Return the dimensions of the merged dataset.

Dimensions of merged dataset: 227 rows \times 4 columns

c. Enriching Data with Income Classification

Obtain country income classification (low, lower-middle, upper-middle, high) from the World Bank and merge it with the dataset.

- Identify common variables between datasets. Can they be used for merging? Why or why not?

The datasets all have country names in common, but the problem is that these names aren't always written the same way. For example, one file might say "Venezuela" while another says "Venezuela, RB", or "Korea, South" vs "Korea, Rep." Because of these differences in spelling and formatting, we can't reliably merge the datasets just using country names unless we clean them up first

- Since ISO codes are standardized, download and use the CIA country data codes for merging. Make sure you are not losing any of the countries in your original data set when merging.

```
# patch country names before standardization
df_all <- df_all %>%
  mutate(
    country = case_when(
      country == "Saint Martin" ~ "St. Martin (French part)",
      country == "Virgin Islands" ~ "British Virgin Islands",
      TRUE ~ country
    )
  )

# use countrycode to standardize names and get ISO-3 codes
df_all_iso <- df_all %>%
  mutate(
    country_standard = countrycode(country, origin = "country.name", destination = "country.name"),
    iso3c = countrycode(country, origin = "country.name", destination = "iso3c")
  ) %>%
  mutate(
```

```

iso3c = case_when(
  country == "Kosovo" ~ "KKX",
  country == "Venezuela" ~ "VEN",
  country == "St. Martin (French part)" ~ "MAF",
  country == "British Virgin Islands" ~ "VGB",
  TRUE ~ iso3c
)

# load income classification (World Bank)
income_df <- read_excel("data/CLASS.xlsx", sheet = 1) %>%
  select(country = Economy,
         iso_code = Code,
         income = `Income group`) %>%
  mutate(iso_code = str_trim(iso_code))

# join income classification using ISO-3 codes
df_all_income <- df_all_iso %>%
  left_join(income_df, by = c("iso3c" = "iso_code"))

# mark unmatched income classifications
df_all_income <- df_all_income %>%
  mutate(income = ifelse(is.na(income), "Not classified", income))

df_all_income

```

```

##               country.x expenditure
## 1                Cuba          12.8
## 2   Micronesia, Federated States of  12.5
## 3       Solomon Islands           9.9
## 4         Montserrat            8.8
## 5             Norway            7.9
## 6             Denmark            7.8
## 7             Iceland            7.7
## 8         Sierra Leone            7.7
## 9              Belize            7.6
## 10             Sweden            7.6
## 11             Bolivia            7.3
## 12             Eswatini            7.1
## 13             Costa Rica            7.0
## 14             Lesotho            7.0
## 15              Bhutan            6.9
## 16              Oman            6.8
## 17         Timor-Leste            6.8
## 18             Tunisia            6.6
## 19         South Africa            6.5
## 20             Belgium            6.4
## 21             Finland            6.4
## 22              Brazil            6.3
## 23         New Zealand            6.3
## 24             Honduras            6.1
## 25              Israel            6.1
## 26         Puerto Rico            6.1

```

## 27	Kyrgyzstan	6.0
## 28	Zimbabwe	5.9
## 29	Cyprus	5.8
## 30	Saint Vincent and the Grenadines	5.7
## 31	Dominica	5.6
## 32	Argentina	5.5
## 33	Aruba	5.5
## 34	France	5.5
## 35	Guyana	5.5
## 36	Mozambique	5.5
## 37	Austria	5.4
## 38	Burkina Faso	5.4
## 39	Chile	5.4
## 40	Moldova	5.4
## 41	Togo	5.4
## 42	Ukraine	5.4
## 43	United Kingdom	5.4
## 44	Canada	5.3
## 45	Gaza Strip	5.3
## 46	Kenya	5.3
## 47	Uzbekistan	5.3
## 48	West Bank	5.3
## 49	Cabo Verde	5.2
## 50	Jamaica	5.2
## 51	Netherlands	5.2
## 52	Tajikistan	5.2
## 53	Australia	5.1
## 54	Burundi	5.1
## 55	Nepal	5.1
## 56	Sao Tome and Principe	5.1
## 57	Switzerland	5.1
## 58	Ecuador	5.0
## 59	Estonia	5.0
## 60	Portugal	5.0
## 61	United States	5.0
## 62	Uruguay	5.0
## 63	Curacao	4.9
## 64	Germany	4.9
## 65	Belarus	4.8
## 66	Malta	4.8
## 67	Senegal	4.8
## 68	Slovenia	4.8
## 69	Cook Islands	4.7
## 70	Ethiopia	4.7
## 71	Hungary	4.7
## 72	Malawi	4.7
## 73	Mauritius	4.7
## 74	Russia	4.7
## 75	Poland	4.6
## 76	Zambia	4.6
## 77	Colombia	4.5
## 78	Mexico	4.5
## 79	Vanuatu	4.5
## 80	Barbados	4.4

## 81	Brunei	4.4
## 82	Latvia	4.4
## 83	Nicaragua	4.4
## 84	Seychelles	4.4
## 85	Korea, South	4.3
## 86	Turkey	4.3
## 87	Malaysia	4.2
## 88	Samoa	4.2
## 89	Spain	4.2
## 90	Vietnam	4.2
## 91	Afghanistan	4.1
## 92	Bulgaria	4.1
## 93	Maldives	4.1
## 94	Mongolia	4.1
## 95	Thailand	4.1
## 96	Ghana	4.0
## 97	Iran	4.0
## 98	Italy	4.0
## 99	Croatia	3.9
## 100	Czechia	3.9
## 101	Fiji	3.9
## 102	Slovakia	3.9
## 103	Hong Kong	3.8
## 104	India	3.8
## 105	Lithuania	3.8
## 106	Mali	3.8
## 107	Peru	3.8
## 108	Albania	3.6
## 109	Djibouti	3.6
## 110	El Salvador	3.6
## 111	Indonesia	3.6
## 112	Luxembourg	3.6
## 113	San Marino	3.6
## 114	Serbia	3.6
## 115	Congo, Republic of the	3.5
## 116	Georgia	3.5
## 117	Ireland	3.5
## 118	Niger	3.5
## 119	Angola	3.4
## 120	Paraguay	3.4
## 121	Tanzania	3.4
## 122	Cote d'Ivoire	3.3
## 123	Saint Lucia	3.3
## 124	Andorra	3.2
## 125	Grenada	3.2
## 126	Guatemala	3.2
## 127	Japan	3.2
## 128	Panama	3.2
## 129	Cameroon	3.1
## 130	Jordan	3.1
## 131	Namibia	3.1
## 132	Romania	3.1
## 133	Rwanda	3.1
## 134	Turkmenistan	3.1

## 135	Benin	2.9
## 136	Laos	2.9
## 137	Pakistan	2.9
## 138	Singapore	2.9
## 139	Turks and Caicos Islands	2.9
## 140	Haiti	2.8
## 141	Madagascar	2.8
## 142	Armenia	2.7
## 143	Gabon	2.7
## 144	Macau	2.7
## 145	Qatar	2.7
## 146	Kazakhstan	2.6
## 147	Liberia	2.6
## 148	Liechtenstein	2.6
## 149	Saint Kitts and Nevis	2.6
## 150	Azerbaijan	2.5
## 151	British Virgin Islands	2.5
## 152	Chad	2.5
## 153	Comoros	2.5
## 154	Lebanon	2.5
## 155	Gambia, The	2.4
## 156	Bahrain	2.3
## 157	Guinea	2.3
## 158	Cambodia	2.2
## 159	Guinea-Bissau	2.1
## 160	Sri Lanka	2.1
## 161	Uganda	2.1
## 162	Burma	1.9
## 163	Mauritania	1.9
## 164	Papua New Guinea	1.9
## 165	Bermuda	1.5
## 166	Congo, Democratic Republic of the	1.5
## 167	Monaco	1.5
## 168	South Sudan	1.5
## 169	Bangladesh	1.3
## 170	Central African Republic	1.2
## 171	French Polynesia	NA
## 172	Kosovo	NA
## 173	Libya	NA
## 174	Macedonia	NA
## 175	Greece	NA
## 176	Algeria	NA
## 177	New Caledonia	NA
## 178	Botswana	NA
## 179	Syria	NA
## 180	Bosnia and Herzegovina	NA
## 181	Egypt	NA
## 182	Guam	NA
## 183	Montenegro	NA
## 184	Saudi Arabia	NA
## 185	Nauru	NA
## 186	Bahamas, The	NA
## 187	Iraq	NA
## 188	Yemen	NA

## 189		Morocco	NA
## 190		Tuvalu	NA
## 191		Kiribati	NA
## 192		Kuwait	NA
## 193		Venezuela	NA
## 194		Cayman Islands	NA
## 195		Nigeria	NA
## 196		Dominican Republic	NA
## 197		Suriname	NA
## 198		Marshall Islands	NA
## 199		Isle of Man	NA
## 200		Trinidad and Tobago	NA
## 201		United Arab Emirates	NA
## 202		Philippines	NA
## 203		Palau	NA
## 204		Anguilla	NA
## 205		Sint Maarten	NA
## 206		Jersey	NA
## 207		Antigua and Barbuda	NA
## 208		Guernsey	NA
## 209		Taiwan	NA
## 210		Equatorial Guinea	NA
## 211		Faroe Islands	NA
## 212		Korea, North	NA
## 213		Saint Helena, Ascension, and Tristan da Cunha	NA
## 214		China	NA
## 215		Sudan	NA
## 216		Saint Barthelemy	NA
## 217		Gibraltar	NA
## 218		Somalia	NA
## 219		Wallis and Futuna	NA
## 220		Greenland	NA
## 221		St. Martin (French part)	NA
## 222		British Virgin Islands	NA
## 223		Saint Pierre and Miquelon	NA
## 224		Eritrea	NA
## 225		Northern Mariana Islands	NA
## 226		Tonga	NA
## 227		American Samoa	NA
##	youth_unemployment	net_migration	country_standard iso3c
## 1	6.1	-3.7	Cuba CUB
## 2	18.9	-20.9	Micronesia (Federated States of) FSM
## 3	1.3	-1.6	Solomon Islands SLB
## 4	NA	0.0	Montserrat MSR
## 5	9.7	4.0	Norway NOR
## 6	9.4	2.8	Denmark DNK
## 7	6.1	3.3	Iceland ISL
## 8	9.4	-1.2	Sierra Leone SLE
## 9	15.3	-1.0	Belize BLZ
## 10	16.8	5.2	Sweden SWE
## 11	6.9	-0.3	Bolivia BOL
## 12	47.1	-6.8	Eswatini SWZ
## 13	20.6	0.8	Costa Rica CRI
## 14	34.4	-6.1	Lesotho LSO

## 15	10.7	0.0	Bhutan	BTN
## 16	13.7	-0.4	Oman	OMN
## 17	13.2	-3.9	Timor-Leste	TLS
## 18	35.0	-1.4	Tunisia	TUN
## 19	53.4	-0.2	South Africa	ZAF
## 20	15.8	4.8	Belgium	BEL
## 21	17.0	2.6	Finland	FIN
## 22	28.5	-0.1	Brazil	BRA
## 23	11.5	8.0	New Zealand	NZL
## 24	10.7	-1.4	Honduras	HND
## 25	7.2	2.1	Israel	ISR
## 26	26.6	-14.1	Puerto Rico	PRI
## 27	14.2	-5.0	Kyrgyzstan	KGZ
## 28	16.5	-5.0	Zimbabwe	ZWE
## 29	20.2	7.6	Cyprus	CYP
## 30	NA	-7.2	St. Vincent & Grenadines	VCT
## 31	NA	-5.3	Dominica	DMA
## 32	23.7	-0.1	Argentina	ARG
## 33	NA	8.4	Aruba	ABW
## 34	20.8	1.1	France	FRA
## 35	21.5	0.0	Guyana	GUY
## 36	7.4	-1.7	Mozambique	MOZ
## 37	9.4	3.6	Austria	AUT
## 38	8.7	-0.6	Burkina Faso	BFA
## 39	18.1	0.3	Chile	CHL
## 40	7.4	-9.0	Moldova	MDA
## 41	3.9	0.0	Togo	TGO
## 42	17.9	2.3	Ukraine	UKR
## 43	11.3	2.5	United Kingdom	GBR
## 44	11.1	5.6	Canada	CAN
## 45	42.2	-4.7	Palestinian Territories	PSE
## 46	7.4	-0.2	Kenya	KEN
## 47	NA	-1.9	Uzbekistan	UZB
## 48	42.2	-4.2	Palestinian Territories	PSE
## 49	27.8	-0.6	Cape Verde	CPV
## 50	24.2	-9.4	Jamaica	JAM
## 51	7.2	1.9	Netherlands	NLD
## 52	NA	-1.1	Tajikistan	TJK
## 53	11.8	8.1	Australia	AUS
## 54	2.9	-0.8	Burundi	BDI
## 55	21.4	-3.1	Nepal	NPL
## 56	20.8	-7.9	São Tomé & Príncipe	STP
## 57	7.9	4.6	Switzerland	CHE
## 58	7.9	0.0	Ecuador	ECU
## 59	11.8	-3.1	Estonia	EST
## 60	20.3	0.3	Portugal	PRT
## 61	8.6	3.0	United States	USA
## 62	25.9	-0.9	Uruguay	URY
## 63	29.3	-1.3	Curaçao	CUW
## 64	6.2	1.5	Germany	DEU
## 65	10.6	0.7	Belarus	BLR
## 66	9.1	6.6	Malta	MLT
## 67	8.1	-1.3	Senegal	SEN
## 68	8.8	1.5	Slovenia	SVN

## 69	NA	-29.9	Cook Islands	COK
## 70	25.2	-0.2	Ethiopia	ETH
## 71	10.2	1.3	Hungary	HUN
## 72	40.5	0.0	Malawi	MWI
## 73	23.9	0.0	Mauritius	MUS
## 74	17.0	1.7	Russia	RUS
## 75	11.7	-0.3	Poland	POL
## 76	24.0	0.0	Zambia	ZMB
## 77	18.5	-0.6	Colombia	COL
## 78	6.9	-1.9	Mexico	MEX
## 79	NA	-1.3	Vanuatu	VUT
## 80	29.6	-0.3	Barbados	BRB
## 81	28.9	2.3	Brunei	BRN
## 82	12.2	-5.9	Latvia	LVA
## 83	8.5	-2.4	Nicaragua	NIC
## 84	11.6	1.0	Seychelles	SYC
## 85	10.2	2.3	South Korea	KOR
## 86	20.2	-4.3	Turkey	TUR
## 87	10.5	-0.3	Malaysia	MYS
## 88	31.9	-8.1	Samoa	WSM
## 89	34.3	7.0	Spain	ESP
## 90	6.9	-0.3	Vietnam	VNM
## 91	17.6	-0.1	Afghanistan	AFG
## 92	12.7	-0.3	Bulgaria	BGR
## 93	15.9	-12.7	Maldives	MDV
## 94	16.8	-0.8	Mongolia	MNG
## 95	3.7	0.0	Thailand	THA
## 96	9.1	-1.6	Ghana	GHA
## 97	27.6	-0.3	Iran	IRN
## 98	32.2	3.2	Italy	ITA
## 99	23.7	-1.0	Croatia	HRV
## 100	6.7	2.3	Czechia	CZE
## 101	15.4	-6.2	Fiji	FJI
## 102	14.9	0.2	Slovakia	SVK
## 103	8.7	1.7	Hong Kong SAR China	HKG
## 104	22.5	0.0	India	IND
## 105	11.1	-5.9	Lithuania	LTU
## 106	16.9	-3.9	Mali	MLI
## 107	14.7	-1.8	Peru	PER
## 108	31.9	-3.3	Albania	ALB
## 109	NA	5.1	Djibouti	DJI
## 110	9.6	-4.8	El Salvador	SLV
## 111	16.5	-1.1	Indonesia	IDN
## 112	14.2	13.3	Luxembourg	LUX
## 113	27.4	6.6	San Marino	SMR
## 114	29.7	0.0	Serbia	SRB
## 115	NA	-0.9	Congo - Brazzaville	COG
## 116	29.9	0.1	Georgia	GEO
## 117	13.8	3.9	Ireland	IRL
## 118	0.7	-0.7	Niger	NER
## 119	39.4	-0.2	Angola	AGO
## 120	14.5	-0.1	Paraguay	PRY
## 121	3.9	-0.4	Tanzania	TZA
## 122	5.5	1.2	Côte d'Ivoire	CIV

## 123	46.2	-1.7	St. Lucia	LCA
## 124	NA	0.0	Andorra	AND
## 125	NA	-2.6	Grenada	GRD
## 126	5.0	-1.7	Guatemala	GTM
## 127	3.6	0.0	Japan	JPN
## 128	10.2	-0.1	Panama	PAN
## 129	6.3	-0.3	Cameroon	CMR
## 130	35.6	-11.3	Jordan	JOR
## 131	38.0	0.0	Namibia	NAM
## 132	16.2	-0.2	Romania	ROU
## 133	20.6	-3.3	Rwanda	RWA
## 134	NA	-1.7	Turkmenistan	TKM
## 135	5.6	0.3	Benin	BEN
## 136	18.2	-1.0	Laos	LAO
## 137	7.8	-0.9	Pakistan	PAK
## 138	9.1	11.8	Singapore	SGP
## 139	NA	8.9	Turks & Caicos Islands	TCA
## 140	NA	-1.9	Haiti	HTI
## 141	1.0	0.0	Madagascar	MDG
## 142	36.3	-5.5	Armenia	ARM
## 143	35.7	3.9	Gabon	GAB
## 144	5.3	3.3	Macao SAR China	MAC
## 145	0.4	6.5	Qatar	QAT
## 146	3.8	0.4	Kazakhstan	KAZ
## 147	2.3	-2.9	Liberia	LBR
## 148	NA	4.9	Liechtenstein	LIE
## 149	NA	1.2	St. Kitts & Nevis	KNA
## 150	13.4	0.0	Azerbaijan	AZE
## 151	NA	15.5	British Virgin Islands	VGB
## 152	NA	-0.1	Chad	TCD
## 153	19.5	-2.3	Comoros	COM
## 154	NA	-88.7	Lebanon	LBN
## 155	13.1	-1.6	Gambia	GMB
## 156	5.3	10.6	Bahrain	BHR
## 157	1.0	0.0	Guinea	GIN
## 158	1.1	-0.3	Cambodia	KHM
## 159	NA	-3.8	Guinea-Bissau	GNB
## 160	21.0	-1.3	Sri Lanka	LKA
## 161	14.8	-3.5	Uganda	UGA
## 162	2.0	-1.4	Myanmar (Burma)	MMR
## 163	15.2	-0.8	Mauritania	MRT
## 164	3.6	0.0	Papua New Guinea	PNG
## 165	29.3	1.6	Bermuda	BMU
## 166	8.7	-0.9	Congo - Kinshasa	COD
## 167	26.6	8.3	Monaco	MCO
## 168	38.6	0.2	South Sudan	SSD
## 169	12.8	-3.0	Bangladesh	BGD
## 170	NA	0.0	Central African Republic	CAF
## 171	56.7	-0.7	French Polynesia	PYF
## 172	55.4	-1.8	Kosovo	KKX
## 173	48.7	-0.7	Libya	LBY
## 174	45.4	0.4	North Macedonia	MKD
## 175	39.9	0.9	Greece	GRC
## 176	39.3	-0.9	Algeria	DZA

## 177	38.4	3.8	New Caledonia	NCL
## 178	36.0	2.9	Botswana	BWA
## 179	35.8	27.1	Syria	SYR
## 180	33.8	-0.4	Bosnia & Herzegovina	BIH
## 181	29.6	-0.3	Egypt	EGY
## 182	29.4	-11.0	Guam	GUM
## 183	29.4	-4.9	Montenegro	MNE
## 184	28.8	4.7	Saudi Arabia	SAU
## 185	26.6	-11.3	Nauru	NRU
## 186	25.8	0.0	Bahamas	BHS
## 187	25.6	-0.5	Iraq	IRQ
## 188	24.5	-0.2	Yemen	YEM
## 189	22.2	-1.9	Morocco	MAR
## 190	20.6	-6.5	Tuvalu	TUV
## 191	17.1	-2.8	Kiribati	KIR
## 192	15.4	-3.3	Kuwait	KWT
## 193	14.6	-3.4	Venezuela	VEN
## 194	13.8	13.0	Cayman Islands	CYM
## 195	13.8	-0.2	Nigeria	NGA
## 196	13.5	-2.7	Dominican Republic	DOM
## 197	13.4	0.5	Suriname	SUR
## 198	11.0	-4.5	Marshall Islands	MHL
## 199	10.1	5.2	Isle of Man	IMN
## 200	8.7	-5.4	Trinidad & Tobago	TTO
## 201	6.9	7.6	United Arab Emirates	ARE
## 202	6.7	-1.8	Philippines	PHL
## 203	5.6	0.9	Palau	PLW
## 204	NA	11.1	Anguilla	AIA
## 205	NA	6.0	Sint Maarten	SXM
## 206	NA	2.3	Jersey	JEY
## 207	NA	2.1	Antigua & Barbuda	ATG
## 208	NA	1.9	Guernsey	GGY
## 209	NA	0.8	Taiwan	TWN
## 210	NA	0.0	Equatorial Guinea	GNQ
## 211	NA	0.0	Faroe Islands	FRO
## 212	NA	0.0	North Korea	PRK
## 213	NA	0.0	St. Helena	SHN
## 214	NA	-0.4	China	CHN
## 215	NA	-0.4	Sudan	SDN
## 216	NA	-3.0	St. Barthélemy	BLM
## 217	NA	-3.3	Gibraltar	GIB
## 218	NA	-3.8	Somalia	SOM
## 219	NA	-4.3	Wallis & Futuna	WLF
## 220	NA	-6.0	Greenland	GRL
## 221	NA	-6.0	Saint Martin (French part)	MAF
## 222	NA	-7.5	British Virgin Islands	VGB
## 223	NA	-7.7	St. Pierre & Miquelon	SPM
## 224	NA	-11.6	Eritrea	ERI
## 225	NA	-15.4	Northern Mariana Islands	MNP
## 226	NA	-17.9	Tonga	TON
## 227	NA	-26.1	American Samoa	ASM
##		country.y	income	
## 1		Cuba	Upper middle income	
## 2		Micronesia, Fed. Sts.	Lower middle income	

## 3	Solomon Islands	Lower middle income
## 4	<NA>	Not classified
## 5	Norway	High income
## 6	Denmark	High income
## 7	Iceland	High income
## 8	Sierra Leone	Low income
## 9	Belize	Upper middle income
## 10	Sweden	High income
## 11	Bolivia	Lower middle income
## 12	Eswatini	Lower middle income
## 13	Costa Rica	Upper middle income
## 14	Lesotho	Lower middle income
## 15	Bhutan	Lower middle income
## 16	Oman	High income
## 17	Timor-Leste	Lower middle income
## 18	Tunisia	Lower middle income
## 19	South Africa	Upper middle income
## 20	Belgium	High income
## 21	Finland	High income
## 22	Brazil	Upper middle income
## 23	New Zealand	High income
## 24	Honduras	Lower middle income
## 25	Israel	High income
## 26	Puerto Rico	High income
## 27	Kyrgyz Republic	Lower middle income
## 28	Zimbabwe	Lower middle income
## 29	Cyprus	High income
## 30	St. Vincent and the Grenadines	Upper middle income
## 31	Dominica	Upper middle income
## 32	Argentina	Upper middle income
## 33	Aruba	High income
## 34	France	High income
## 35	Guyana	High income
## 36	Mozambique	Low income
## 37	Austria	High income
## 38	Burkina Faso	Low income
## 39	Chile	High income
## 40	Moldova	Upper middle income
## 41	Togo	Low income
## 42	Ukraine	Upper middle income
## 43	United Kingdom	High income
## 44	Canada	High income
## 45	West Bank and Gaza	Lower middle income
## 46	Kenya	Lower middle income
## 47	Uzbekistan	Lower middle income
## 48	West Bank and Gaza	Lower middle income
## 49	Cabo Verde	Lower middle income
## 50	Jamaica	Upper middle income
## 51	Netherlands	High income
## 52	Tajikistan	Lower middle income
## 53	Australia	High income
## 54	Burundi	Low income
## 55	Nepal	Lower middle income
## 56	São Tomé and Príncipe	Lower middle income

## 57	Switzerland	High income
## 58	Ecuador	Upper middle income
## 59	Estonia	High income
## 60	Portugal	High income
## 61	United States	High income
## 62	Uruguay	High income
## 63	Curaçao	High income
## 64	Germany	High income
## 65	Belarus	Upper middle income
## 66	Malta	High income
## 67	Senegal	Lower middle income
## 68	Slovenia	High income
## 69	<NA>	Not classified
## 70	Ethiopia	Low income
## 71	Hungary	High income
## 72	Malawi	Low income
## 73	Mauritius	Upper middle income
## 74	Russian Federation	High income
## 75	Poland	High income
## 76	Zambia	Lower middle income
## 77	Colombia	Upper middle income
## 78	Mexico	Upper middle income
## 79	Vanuatu	Lower middle income
## 80	Barbados	High income
## 81	Brunei Darussalam	High income
## 82	Latvia	High income
## 83	Nicaragua	Lower middle income
## 84	Seychelles	High income
## 85	Korea, Rep.	High income
## 86	Türkiye	Upper middle income
## 87	Malaysia	Upper middle income
## 88	Samoa	Lower middle income
## 89	Spain	High income
## 90	Vietnam	Lower middle income
## 91	Afghanistan	Low income
## 92	Bulgaria	High income
## 93	Maldives	Upper middle income
## 94	Mongolia	Upper middle income
## 95	Thailand	Upper middle income
## 96	Ghana	Lower middle income
## 97	Iran, Islamic Rep.	Upper middle income
## 98	Italy	High income
## 99	Croatia	High income
## 100	Czechia	High income
## 101	Fiji	Upper middle income
## 102	Slovak Republic	High income
## 103	Hong Kong SAR, China	High income
## 104	India	Lower middle income
## 105	Lithuania	High income
## 106	Mali	Low income
## 107	Peru	Upper middle income
## 108	Albania	Upper middle income
## 109	Djibouti	Lower middle income
## 110	El Salvador	Upper middle income

## 111	Indonesia	Upper middle income
## 112	Luxembourg	High income
## 113	San Marino	High income
## 114	Serbia	Upper middle income
## 115	Congo, Rep.	Lower middle income
## 116	Georgia	Upper middle income
## 117	Ireland	High income
## 118	Niger	Low income
## 119	Angola	Lower middle income
## 120	Paraguay	Upper middle income
## 121	Tanzania	Lower middle income
## 122	Côte d'Ivoire	Lower middle income
## 123	St. Lucia	Upper middle income
## 124	Andorra	High income
## 125	Grenada	Upper middle income
## 126	Guatemala	Upper middle income
## 127	Japan	High income
## 128	Panama	High income
## 129	Cameroon	Lower middle income
## 130	Jordan	Lower middle income
## 131	Namibia	Upper middle income
## 132	Romania	High income
## 133	Rwanda	Low income
## 134	Turkmenistan	Upper middle income
## 135	Benin	Lower middle income
## 136	Lao PDR	Lower middle income
## 137	Pakistan	Lower middle income
## 138	Singapore	High income
## 139	Turks and Caicos Islands	High income
## 140	Haiti	Lower middle income
## 141	Madagascar	Low income
## 142	Armenia	Upper middle income
## 143	Gabon	Upper middle income
## 144	Macao SAR, China	High income
## 145	Qatar	High income
## 146	Kazakhstan	Upper middle income
## 147	Liberia	Low income
## 148	Liechtenstein	High income
## 149	St. Kitts and Nevis	High income
## 150	Azerbaijan	Upper middle income
## 151	British Virgin Islands	High income
## 152	Chad	Low income
## 153	Comoros	Lower middle income
## 154	Lebanon	Lower middle income
## 155	Gambia, The	Low income
## 156	Bahrain	High income
## 157	Guinea	Lower middle income
## 158	Cambodia	Lower middle income
## 159	Guinea-Bissau	Low income
## 160	Sri Lanka	Lower middle income
## 161	Uganda	Low income
## 162	Myanmar	Lower middle income
## 163	Mauritania	Lower middle income
## 164	Papua New Guinea	Lower middle income

## 165	Bermuda	High income
## 166	Congo, Dem. Rep.	Low income
## 167	Monaco	High income
## 168	South Sudan	Low income
## 169	Bangladesh	Lower middle income
## 170	Central African Republic	Low income
## 171	French Polynesia	High income
## 172	Kosovo	Upper middle income
## 173	Libya	Upper middle income
## 174	North Macedonia	Upper middle income
## 175	Greece	High income
## 176	Algeria	Upper middle income
## 177	New Caledonia	High income
## 178	Botswana	Upper middle income
## 179	Syrian Arab Republic	Low income
## 180	Bosnia and Herzegovina	Upper middle income
## 181	Egypt, Arab Rep.	Lower middle income
## 182	Guam	High income
## 183	Montenegro	Upper middle income
## 184	Saudi Arabia	High income
## 185	Nauru	High income
## 186	Bahamas, The	High income
## 187	Iraq	Upper middle income
## 188	Yemen, Rep.	Low income
## 189	Morocco	Lower middle income
## 190	Tuvalu	Upper middle income
## 191	Kiribati	Lower middle income
## 192	Kuwait	High income
## 193	Venezuela, RB	Not classified
## 194	Cayman Islands	High income
## 195	Nigeria	Lower middle income
## 196	Dominican Republic	Upper middle income
## 197	Suriname	Upper middle income
## 198	Marshall Islands	Upper middle income
## 199	Isle of Man	High income
## 200	Trinidad and Tobago	High income
## 201	United Arab Emirates	High income
## 202	Philippines	Lower middle income
## 203	Palau	High income
## 204	<NA>	Not classified
## 205	Sint Maarten (Dutch part)	High income
## 206	<NA>	Not classified
## 207	Antigua and Barbuda	High income
## 208	<NA>	Not classified
## 209	Taiwan, China	High income
## 210	Equatorial Guinea	Upper middle income
## 211	Faroe Islands	High income
## 212	Korea, Dem. People's Rep.	Low income
## 213	<NA>	Not classified
## 214	China	Upper middle income
## 215	Sudan	Low income
## 216	<NA>	Not classified
## 217	Gibraltar	High income
## 218	Somalia	Low income


```
## 219          <NA>      Not classified
## 220      Greenland      High income
## 221      St. Martin (French part)      High income
## 222      British Virgin Islands      High income
## 223          <NA>      Not classified
## 224      Eritrea      Low income
## 225      Northern Mariana Islands      High income
## 226          Tonga      Upper middle income
## 227      American Samoa      High income
```

```
df_all_income_clean <- df_all_income %>%
  select(
    country = country_standard,      # clean country name
    iso = iso3c,                    # standard ISO code
    income,                          # World Bank income classification
    expenditure,
    youth_unemployment,
    net_migration
  )

df_all_income_clean
```

```
##          country iso          income expenditure
## 1          Cuba CUB Upper middle income      12.8
## 2  Micronesia (Federated States of) FSM Lower middle income      12.5
## 3      Solomon Islands SLB Lower middle income      9.9
## 4      Montserrat MSR      Not classified      8.8
## 5          Norway NOR      High income      7.9
## 6          Denmark DNK      High income      7.8
## 7          Iceland ISL      High income      7.7
## 8      Sierra Leone SLE      Low income      7.7
## 9          Belize BLZ Upper middle income      7.6
## 10         Sweden SWE      High income      7.6
## 11         Bolivia BOL Lower middle income      7.3
## 12      Eswatini SWZ Lower middle income      7.1
## 13      Costa Rica CRI Upper middle income      7.0
## 14      Lesotho LSO Lower middle income      7.0
## 15          Bhutan BTN Lower middle income      6.9
## 16          Oman OMN      High income      6.8
## 17      Timor-Leste TLS Lower middle income      6.8
## 18          Tunisia TUN Lower middle income      6.6
## 19      South Africa ZAF Upper middle income      6.5
## 20          Belgium BEL      High income      6.4
## 21          Finland FIN      High income      6.4
## 22          Brazil BRA Upper middle income      6.3
## 23      New Zealand NZL      High income      6.3
## 24      Honduras HND Lower middle income      6.1
## 25          Israel ISR      High income      6.1
## 26      Puerto Rico PRI      High income      6.1
## 27      Kyrgyzstan KGZ Lower middle income      6.0
## 28          Zimbabwe ZWE Lower middle income      5.9
## 29          Cyprus CYP      High income      5.8
## 30      St. Vincent & Grenadines VCT Upper middle income      5.7
## 31          Dominica DMA Upper middle income      5.6
```

## 32	Argentina	ARG	Upper middle income	5.5
## 33	Aruba	ABW	High income	5.5
## 34	France	FRA	High income	5.5
## 35	Guyana	GUY	High income	5.5
## 36	Mozambique	MOZ	Low income	5.5
## 37	Austria	AUT	High income	5.4
## 38	Burkina Faso	BFA	Low income	5.4
## 39	Chile	CHL	High income	5.4
## 40	Moldova	MDA	Upper middle income	5.4
## 41	Togo	TGO	Low income	5.4
## 42	Ukraine	UKR	Upper middle income	5.4
## 43	United Kingdom	GBR	High income	5.4
## 44	Canada	CAN	High income	5.3
## 45	Palestinian Territories	PSE	Lower middle income	5.3
## 46	Kenya	KEN	Lower middle income	5.3
## 47	Uzbekistan	UZB	Lower middle income	5.3
## 48	Palestinian Territories	PSE	Lower middle income	5.3
## 49	Cape Verde	CPV	Lower middle income	5.2
## 50	Jamaica	JAM	Upper middle income	5.2
## 51	Netherlands	NLD	High income	5.2
## 52	Tajikistan	TJK	Lower middle income	5.2
## 53	Australia	AUS	High income	5.1
## 54	Burundi	BDI	Low income	5.1
## 55	Nepal	NPL	Lower middle income	5.1
## 56	São Tomé & Príncipe	STP	Lower middle income	5.1
## 57	Switzerland	CHE	High income	5.1
## 58	Ecuador	ECU	Upper middle income	5.0
## 59	Estonia	EST	High income	5.0
## 60	Portugal	PRT	High income	5.0
## 61	United States	USA	High income	5.0
## 62	Uruguay	URY	High income	5.0
## 63	Curaçao	CUW	High income	4.9
## 64	Germany	DEU	High income	4.9
## 65	Belarus	BLR	Upper middle income	4.8
## 66	Malta	MLT	High income	4.8
## 67	Senegal	SEN	Lower middle income	4.8
## 68	Slovenia	SVN	High income	4.8
## 69	Cook Islands	COK	Not classified	4.7
## 70	Ethiopia	ETH	Low income	4.7
## 71	Hungary	HUN	High income	4.7
## 72	Malawi	MWI	Low income	4.7
## 73	Mauritius	MUS	Upper middle income	4.7
## 74	Russia	RUS	High income	4.7
## 75	Poland	POL	High income	4.6
## 76	Zambia	ZMB	Lower middle income	4.6
## 77	Colombia	COL	Upper middle income	4.5
## 78	Mexico	MEX	Upper middle income	4.5
## 79	Vanuatu	VUT	Lower middle income	4.5
## 80	Barbados	BRB	High income	4.4
## 81	Brunei	BRN	High income	4.4
## 82	Latvia	LVA	High income	4.4
## 83	Nicaragua	NIC	Lower middle income	4.4
## 84	Seychelles	SYC	High income	4.4
## 85	South Korea	KOR	High income	4.3

## 86	Turkey	TUR	Upper middle income	4.3
## 87	Malaysia	MYS	Upper middle income	4.2
## 88	Samoa	WSM	Lower middle income	4.2
## 89	Spain	ESP	High income	4.2
## 90	Vietnam	VNM	Lower middle income	4.2
## 91	Afghanistan	AFG	Low income	4.1
## 92	Bulgaria	BGR	High income	4.1
## 93	Maldives	MDV	Upper middle income	4.1
## 94	Mongolia	MNG	Upper middle income	4.1
## 95	Thailand	THA	Upper middle income	4.1
## 96	Ghana	GHA	Lower middle income	4.0
## 97	Iran	IRN	Upper middle income	4.0
## 98	Italy	ITA	High income	4.0
## 99	Croatia	HRV	High income	3.9
## 100	Czechia	CZE	High income	3.9
## 101	Fiji	FJI	Upper middle income	3.9
## 102	Slovakia	SVK	High income	3.9
## 103	Hong Kong SAR China	HKG	High income	3.8
## 104	India	IND	Lower middle income	3.8
## 105	Lithuania	LTU	High income	3.8
## 106	Mali	MLI	Low income	3.8
## 107	Peru	PER	Upper middle income	3.8
## 108	Albania	ALB	Upper middle income	3.6
## 109	Djibouti	DJI	Lower middle income	3.6
## 110	El Salvador	SLV	Upper middle income	3.6
## 111	Indonesia	IDN	Upper middle income	3.6
## 112	Luxembourg	LUX	High income	3.6
## 113	San Marino	SMR	High income	3.6
## 114	Serbia	SRB	Upper middle income	3.6
## 115	Congo - Brazzaville	COG	Lower middle income	3.5
## 116	Georgia	GEO	Upper middle income	3.5
## 117	Ireland	IRL	High income	3.5
## 118	Niger	NER	Low income	3.5
## 119	Angola	AGO	Lower middle income	3.4
## 120	Paraguay	PRY	Upper middle income	3.4
## 121	Tanzania	TZA	Lower middle income	3.4
## 122	Côte d'Ivoire	CIV	Lower middle income	3.3
## 123	St. Lucia	LCA	Upper middle income	3.3
## 124	Andorra	AND	High income	3.2
## 125	Grenada	GRD	Upper middle income	3.2
## 126	Guatemala	GTM	Upper middle income	3.2
## 127	Japan	JPN	High income	3.2
## 128	Panama	PAN	High income	3.2
## 129	Cameroon	CMR	Lower middle income	3.1
## 130	Jordan	JOR	Lower middle income	3.1
## 131	Namibia	NAM	Upper middle income	3.1
## 132	Romania	ROU	High income	3.1
## 133	Rwanda	RWA	Low income	3.1
## 134	Turkmenistan	TKM	Upper middle income	3.1
## 135	Benin	BEN	Lower middle income	2.9
## 136	Laos	LAO	Lower middle income	2.9
## 137	Pakistan	PAK	Lower middle income	2.9
## 138	Singapore	SGP	High income	2.9
## 139	Turks & Caicos Islands	TCA	High income	2.9

## 140	Haiti	HTI	Lower middle income	2.8
## 141	Madagascar	MDG	Low income	2.8
## 142	Armenia	ARM	Upper middle income	2.7
## 143	Gabon	GAB	Upper middle income	2.7
## 144	Macao SAR China	MAC	High income	2.7
## 145	Qatar	QAT	High income	2.7
## 146	Kazakhstan	KAZ	Upper middle income	2.6
## 147	Liberia	LBR	Low income	2.6
## 148	Liechtenstein	LIE	High income	2.6
## 149	St. Kitts & Nevis	KNA	High income	2.6
## 150	Azerbaijan	AZE	Upper middle income	2.5
## 151	British Virgin Islands	VGB	High income	2.5
## 152	Chad	TCD	Low income	2.5
## 153	Comoros	COM	Lower middle income	2.5
## 154	Lebanon	LBN	Lower middle income	2.5
## 155	Gambia	GMB	Low income	2.4
## 156	Bahrain	BHR	High income	2.3
## 157	Guinea	GIN	Lower middle income	2.3
## 158	Cambodia	KHM	Lower middle income	2.2
## 159	Guinea-Bissau	GNB	Low income	2.1
## 160	Sri Lanka	LKA	Lower middle income	2.1
## 161	Uganda	UGA	Low income	2.1
## 162	Myanmar (Burma)	MMR	Lower middle income	1.9
## 163	Mauritania	MRT	Lower middle income	1.9
## 164	Papua New Guinea	PNG	Lower middle income	1.9
## 165	Bermuda	BMU	High income	1.5
## 166	Congo - Kinshasa	COD	Low income	1.5
## 167	Monaco	MCO	High income	1.5
## 168	South Sudan	SSD	Low income	1.5
## 169	Bangladesh	BGD	Lower middle income	1.3
## 170	Central African Republic	CAF	Low income	1.2
## 171	French Polynesia	PYF	High income	NA
## 172	Kosovo	XKX	Upper middle income	NA
## 173	Libya	LYB	Upper middle income	NA
## 174	North Macedonia	MKD	Upper middle income	NA
## 175	Greece	GRC	High income	NA
## 176	Algeria	DZA	Upper middle income	NA
## 177	New Caledonia	NCL	High income	NA
## 178	Botswana	BWA	Upper middle income	NA
## 179	Syria	SYR	Low income	NA
## 180	Bosnia & Herzegovina	BIH	Upper middle income	NA
## 181	Egypt	EGY	Lower middle income	NA
## 182	Guam	GUM	High income	NA
## 183	Montenegro	MNE	Upper middle income	NA
## 184	Saudi Arabia	SAU	High income	NA
## 185	Nauru	NRU	High income	NA
## 186	Bahamas	BHS	High income	NA
## 187	Iraq	IRQ	Upper middle income	NA
## 188	Yemen	YEM	Low income	NA
## 189	Morocco	MAR	Lower middle income	NA
## 190	Tuvalu	TUV	Upper middle income	NA
## 191	Kiribati	KIR	Lower middle income	NA
## 192	Kuwait	KWT	High income	NA
## 193	Venezuela	VEN	Not classified	NA

## 194	Cayman Islands	CYM	High income	NA
## 195	Nigeria	NGA	Lower middle income	NA
## 196	Dominican Republic	DOM	Upper middle income	NA
## 197	Suriname	SUR	Upper middle income	NA
## 198	Marshall Islands	MHL	Upper middle income	NA
## 199	Isle of Man	IMN	High income	NA
## 200	Trinidad & Tobago	TTO	High income	NA
## 201	United Arab Emirates	ARE	High income	NA
## 202	Philippines	PHL	Lower middle income	NA
## 203	Palau	PLW	High income	NA
## 204	Anguilla	AIA	Not classified	NA
## 205	Sint Maarten	SXM	High income	NA
## 206	Jersey	JEY	Not classified	NA
## 207	Antigua & Barbuda	ATG	High income	NA
## 208	Guernsey	GGY	Not classified	NA
## 209	Taiwan	TWN	High income	NA
## 210	Equatorial Guinea	GNQ	Upper middle income	NA
## 211	Faroe Islands	FRO	High income	NA
## 212	North Korea	PRK	Low income	NA
## 213	St. Helena	SHN	Not classified	NA
## 214	China	CHN	Upper middle income	NA
## 215	Sudan	SDN	Low income	NA
## 216	St. Barthélemy	BLM	Not classified	NA
## 217	Gibraltar	GIB	High income	NA
## 218	Somalia	SOM	Low income	NA
## 219	Wallis & Futuna	WLF	Not classified	NA
## 220	Greenland	GRL	High income	NA
## 221	Saint Martin (French part)	MAF	High income	NA
## 222	British Virgin Islands	VGB	High income	NA
## 223	St. Pierre & Miquelon	SPM	Not classified	NA
## 224	Eritrea	ERI	Low income	NA
## 225	Northern Mariana Islands	MNP	High income	NA
## 226	Tonga	TON	Upper middle income	NA
## 227	American Samoa	ASM	High income	NA
##	youth_unemployment	net_migration		
## 1	6.1	-3.7		
## 2	18.9	-20.9		
## 3	1.3	-1.6		
## 4	NA	0.0		
## 5	9.7	4.0		
## 6	9.4	2.8		
## 7	6.1	3.3		
## 8	9.4	-1.2		
## 9	15.3	-1.0		
## 10	16.8	5.2		
## 11	6.9	-0.3		
## 12	47.1	-6.8		
## 13	20.6	0.8		
## 14	34.4	-6.1		
## 15	10.7	0.0		
## 16	13.7	-0.4		
## 17	13.2	-3.9		
## 18	35.0	-1.4		
## 19	53.4	-0.2		

## 20	15.8	4.8
## 21	17.0	2.6
## 22	28.5	-0.1
## 23	11.5	8.0
## 24	10.7	-1.4
## 25	7.2	2.1
## 26	26.6	-14.1
## 27	14.2	-5.0
## 28	16.5	-5.0
## 29	20.2	7.6
## 30	NA	-7.2
## 31	NA	-5.3
## 32	23.7	-0.1
## 33	NA	8.4
## 34	20.8	1.1
## 35	21.5	0.0
## 36	7.4	-1.7
## 37	9.4	3.6
## 38	8.7	-0.6
## 39	18.1	0.3
## 40	7.4	-9.0
## 41	3.9	0.0
## 42	17.9	2.3
## 43	11.3	2.5
## 44	11.1	5.6
## 45	42.2	-4.7
## 46	7.4	-0.2
## 47	NA	-1.9
## 48	42.2	-4.2
## 49	27.8	-0.6
## 50	24.2	-9.4
## 51	7.2	1.9
## 52	NA	-1.1
## 53	11.8	8.1
## 54	2.9	-0.8
## 55	21.4	-3.1
## 56	20.8	-7.9
## 57	7.9	4.6
## 58	7.9	0.0
## 59	11.8	-3.1
## 60	20.3	0.3
## 61	8.6	3.0
## 62	25.9	-0.9
## 63	29.3	-1.3
## 64	6.2	1.5
## 65	10.6	0.7
## 66	9.1	6.6
## 67	8.1	-1.3
## 68	8.8	1.5
## 69	NA	-29.9
## 70	25.2	-0.2
## 71	10.2	1.3
## 72	40.5	0.0
## 73	23.9	0.0

## 74	17.0	1.7
## 75	11.7	-0.3
## 76	24.0	0.0
## 77	18.5	-0.6
## 78	6.9	-1.9
## 79	NA	-1.3
## 80	29.6	-0.3
## 81	28.9	2.3
## 82	12.2	-5.9
## 83	8.5	-2.4
## 84	11.6	1.0
## 85	10.2	2.3
## 86	20.2	-4.3
## 87	10.5	-0.3
## 88	31.9	-8.1
## 89	34.3	7.0
## 90	6.9	-0.3
## 91	17.6	-0.1
## 92	12.7	-0.3
## 93	15.9	-12.7
## 94	16.8	-0.8
## 95	3.7	0.0
## 96	9.1	-1.6
## 97	27.6	-0.3
## 98	32.2	3.2
## 99	23.7	-1.0
## 100	6.7	2.3
## 101	15.4	-6.2
## 102	14.9	0.2
## 103	8.7	1.7
## 104	22.5	0.0
## 105	11.1	-5.9
## 106	16.9	-3.9
## 107	14.7	-1.8
## 108	31.9	-3.3
## 109	NA	5.1
## 110	9.6	-4.8
## 111	16.5	-1.1
## 112	14.2	13.3
## 113	27.4	6.6
## 114	29.7	0.0
## 115	NA	-0.9
## 116	29.9	0.1
## 117	13.8	3.9
## 118	0.7	-0.7
## 119	39.4	-0.2
## 120	14.5	-0.1
## 121	3.9	-0.4
## 122	5.5	1.2
## 123	46.2	-1.7
## 124	NA	0.0
## 125	NA	-2.6
## 126	5.0	-1.7
## 127	3.6	0.0

## 128	10.2	-0.1
## 129	6.3	-0.3
## 130	35.6	-11.3
## 131	38.0	0.0
## 132	16.2	-0.2
## 133	20.6	-3.3
## 134	NA	-1.7
## 135	5.6	0.3
## 136	18.2	-1.0
## 137	7.8	-0.9
## 138	9.1	11.8
## 139	NA	8.9
## 140	NA	-1.9
## 141	1.0	0.0
## 142	36.3	-5.5
## 143	35.7	3.9
## 144	5.3	3.3
## 145	0.4	6.5
## 146	3.8	0.4
## 147	2.3	-2.9
## 148	NA	4.9
## 149	NA	1.2
## 150	13.4	0.0
## 151	NA	15.5
## 152	NA	-0.1
## 153	19.5	-2.3
## 154	NA	-88.7
## 155	13.1	-1.6
## 156	5.3	10.6
## 157	1.0	0.0
## 158	1.1	-0.3
## 159	NA	-3.8
## 160	21.0	-1.3
## 161	14.8	-3.5
## 162	2.0	-1.4
## 163	15.2	-0.8
## 164	3.6	0.0
## 165	29.3	1.6
## 166	8.7	-0.9
## 167	26.6	8.3
## 168	38.6	0.2
## 169	12.8	-3.0
## 170	NA	0.0
## 171	56.7	-0.7
## 172	55.4	-1.8
## 173	48.7	-0.7
## 174	45.4	0.4
## 175	39.9	0.9
## 176	39.3	-0.9
## 177	38.4	3.8
## 178	36.0	2.9
## 179	35.8	27.1
## 180	33.8	-0.4
## 181	29.6	-0.3


```
## 182          29.4      -11.0
## 183          29.4      -4.9
## 184          28.8       4.7
## 185          26.6     -11.3
## 186          25.8       0.0
## 187          25.6     -0.5
## 188          24.5     -0.2
## 189          22.2     -1.9
## 190          20.6     -6.5
## 191          17.1     -2.8
## 192          15.4     -3.3
## 193          14.6     -3.4
## 194          13.8     13.0
## 195          13.8     -0.2
## 196          13.5     -2.7
## 197          13.4       0.5
## 198          11.0     -4.5
## 199          10.1       5.2
## 200           8.7     -5.4
## 201           6.9       7.6
## 202           6.7     -1.8
## 203           5.6       0.9
## 204           NA     11.1
## 205           NA       6.0
## 206           NA       2.3
## 207           NA       2.1
## 208           NA       1.9
## 209           NA       0.8
## 210           NA       0.0
## 211           NA       0.0
## 212           NA       0.0
## 213           NA       0.0
## 214           NA     -0.4
## 215           NA     -0.4
## 216           NA     -3.0
## 217           NA     -3.3
## 218           NA     -3.8
## 219           NA     -4.3
## 220           NA     -6.0
## 221           NA     -6.0
## 222           NA     -7.5
## 223           NA     -7.7
## 224           NA    -11.6
## 225           NA    -15.4
## 226           NA    -17.9
## 227           NA    -26.1
```

```
glimpse(df_all_income_clean)
```

```
## Rows: 227
## Columns: 6
## $ country      <chr> "Cuba", "Micronesia (Federated States of)", "Solomo~
## $ iso          <chr> "CUB", "FSM", "SLB", "MSR", "NOR", "DNK", "ISL", "S~
## $ income       <chr> "Upper middle income", "Lower middle income", "Lowe~
```

```
## $ expenditure      <dbl> 12.8, 12.5, 9.9, 8.8, 7.9, 7.8, 7.7, 7.7, 7.6, 7.6, ~
## $ youth_unemployment <dbl> 6.1, 18.9, 1.3, NA, 9.7, 9.4, 6.1, 9.4, 15.3, 16.8, ~
## $ net_migration     <dbl> -3.7, -20.9, -1.6, 0.0, 4.0, 2.8, 3.3, -1.2, -1.0, ~
```

d. Adding Geographical Information

Introduce continent and subcontinent (or region) data for each country.

- Find and download an appropriate online resource.
- Merge this information into the dataset, naming the final dataset `df_vars`. Make sure you are not losing any of the countries in your original data set when merging.

```
# load continent mapping
continent_data <- read.csv("data/countryContinent.csv")
names(continent_data)
```

```
## [1] "country"      "code_2"      "code_3"      "country_code"
## [5] "iso_3166_2"   "continent"   "sub_region"   "region_code"
## [9] "sub_region_code"
```

```
# load continent info and rename relevant columns
continent_data <- read.csv("data/countryContinent.csv") %>%
  select(
    iso = code_3,
    continent,
    region = sub_region
  ) %>%
  mutate(iso = str_trim(iso))
```

```
# merge with cleaned dataset using ISO-3
df_vars <- df_all_income_clean %>%
  left_join(continent_data, by = "iso")
```

```
df_vars
```

```
##               country iso               income expenditure
## 1                Cuba CUB Upper middle income          12.8
## 2  Micronesia (Federated States of) FSM Lower middle income          12.5
## 3      Solomon Islands SLB Lower middle income           9.9
## 4      Montserrat MSR      Not classified              8.8
## 5              Norway NOR      High income              7.9
## 6              Denmark DNK      High income              7.8
## 7              Iceland ISL      High income              7.7
## 8      Sierra Leone SLE      Low income              7.7
## 9              Belize BLZ Upper middle income          7.6
## 10             Sweden SWE      High income              7.6
## 11             Bolivia BOL Lower middle income          7.3
## 12           Eswatini SWZ Lower middle income          7.1
## 13          Costa Rica CRI Upper middle income          7.0
## 14           Lesotho LSO Lower middle income          7.0
## 15             Bhutan BTN Lower middle income          6.9
## 16              Oman OMN      High income              6.8
```

## 17	Timor-Leste	TLS	Lower middle income	6.8
## 18	Tunisia	TUN	Lower middle income	6.6
## 19	South Africa	ZAF	Upper middle income	6.5
## 20	Belgium	BEL	High income	6.4
## 21	Finland	FIN	High income	6.4
## 22	Brazil	BRA	Upper middle income	6.3
## 23	New Zealand	NZL	High income	6.3
## 24	Honduras	HND	Lower middle income	6.1
## 25	Israel	ISR	High income	6.1
## 26	Puerto Rico	PRI	High income	6.1
## 27	Kyrgyzstan	KGZ	Lower middle income	6.0
## 28	Zimbabwe	ZWE	Lower middle income	5.9
## 29	Cyprus	CYP	High income	5.8
## 30	St. Vincent & Grenadines	VCT	Upper middle income	5.7
## 31	Dominica	DMA	Upper middle income	5.6
## 32	Argentina	ARG	Upper middle income	5.5
## 33	Aruba	ABW	High income	5.5
## 34	France	FRA	High income	5.5
## 35	Guyana	GUY	High income	5.5
## 36	Mozambique	MOZ	Low income	5.5
## 37	Austria	AUT	High income	5.4
## 38	Burkina Faso	BFA	Low income	5.4
## 39	Chile	CHL	High income	5.4
## 40	Moldova	MDA	Upper middle income	5.4
## 41	Togo	TGO	Low income	5.4
## 42	Ukraine	UKR	Upper middle income	5.4
## 43	United Kingdom	GBR	High income	5.4
## 44	Canada	CAN	High income	5.3
## 45	Palestinian Territories	PSE	Lower middle income	5.3
## 46	Kenya	KEN	Lower middle income	5.3
## 47	Uzbekistan	UZB	Lower middle income	5.3
## 48	Palestinian Territories	PSE	Lower middle income	5.3
## 49	Cape Verde	CPV	Lower middle income	5.2
## 50	Jamaica	JAM	Upper middle income	5.2
## 51	Netherlands	NLD	High income	5.2
## 52	Tajikistan	TJK	Lower middle income	5.2
## 53	Australia	AUS	High income	5.1
## 54	Burundi	BDI	Low income	5.1
## 55	Nepal	NPL	Lower middle income	5.1
## 56	São Tomé & Príncipe	STP	Lower middle income	5.1
## 57	Switzerland	CHE	High income	5.1
## 58	Ecuador	ECU	Upper middle income	5.0
## 59	Estonia	EST	High income	5.0
## 60	Portugal	PRT	High income	5.0
## 61	United States	USA	High income	5.0
## 62	Uruguay	URY	High income	5.0
## 63	Curaçao	CUW	High income	4.9
## 64	Germany	DEU	High income	4.9
## 65	Belarus	BLR	Upper middle income	4.8
## 66	Malta	MLT	High income	4.8
## 67	Senegal	SEN	Lower middle income	4.8
## 68	Slovenia	SVN	High income	4.8
## 69	Cook Islands	COK	Not classified	4.7
## 70	Ethiopia	ETH	Low income	4.7

## 71	Hungary	HUN	High income	4.7
## 72	Malawi	MWI	Low income	4.7
## 73	Mauritius	MUS	Upper middle income	4.7
## 74	Russia	RUS	High income	4.7
## 75	Poland	POL	High income	4.6
## 76	Zambia	ZMB	Lower middle income	4.6
## 77	Colombia	COL	Upper middle income	4.5
## 78	Mexico	MEX	Upper middle income	4.5
## 79	Vanuatu	VUT	Lower middle income	4.5
## 80	Barbados	BRB	High income	4.4
## 81	Brunei	BRN	High income	4.4
## 82	Latvia	LVA	High income	4.4
## 83	Nicaragua	NIC	Lower middle income	4.4
## 84	Seychelles	SYC	High income	4.4
## 85	South Korea	KOR	High income	4.3
## 86	Turkey	TUR	Upper middle income	4.3
## 87	Malaysia	MYS	Upper middle income	4.2
## 88	Samoa	WSM	Lower middle income	4.2
## 89	Spain	ESP	High income	4.2
## 90	Vietnam	VNM	Lower middle income	4.2
## 91	Afghanistan	AFG	Low income	4.1
## 92	Bulgaria	BGR	High income	4.1
## 93	Maldives	MDV	Upper middle income	4.1
## 94	Mongolia	MNG	Upper middle income	4.1
## 95	Thailand	THA	Upper middle income	4.1
## 96	Ghana	GHA	Lower middle income	4.0
## 97	Iran	IRN	Upper middle income	4.0
## 98	Italy	ITA	High income	4.0
## 99	Croatia	HRV	High income	3.9
## 100	Czechia	CZE	High income	3.9
## 101	Fiji	FJI	Upper middle income	3.9
## 102	Slovakia	SVK	High income	3.9
## 103	Hong Kong SAR China	HKG	High income	3.8
## 104	India	IND	Lower middle income	3.8
## 105	Lithuania	LTU	High income	3.8
## 106	Mali	MLI	Low income	3.8
## 107	Peru	PER	Upper middle income	3.8
## 108	Albania	ALB	Upper middle income	3.6
## 109	Djibouti	DJI	Lower middle income	3.6
## 110	El Salvador	SLV	Upper middle income	3.6
## 111	Indonesia	IDN	Upper middle income	3.6
## 112	Luxembourg	LUX	High income	3.6
## 113	San Marino	SMR	High income	3.6
## 114	Serbia	SRB	Upper middle income	3.6
## 115	Congo - Brazzaville	COG	Lower middle income	3.5
## 116	Georgia	GEO	Upper middle income	3.5
## 117	Ireland	IRL	High income	3.5
## 118	Niger	NER	Low income	3.5
## 119	Angola	AGO	Lower middle income	3.4
## 120	Paraguay	PRY	Upper middle income	3.4
## 121	Tanzania	TZA	Lower middle income	3.4
## 122	Côte d'Ivoire	CIV	Lower middle income	3.3
## 123	St. Lucia	LCA	Upper middle income	3.3
## 124	Andorra	AND	High income	3.2

## 125	Grenada GRD	Upper middle income	3.2
## 126	Guatemala GTM	Upper middle income	3.2
## 127	Japan JPN	High income	3.2
## 128	Panama PAN	High income	3.2
## 129	Cameroon CMR	Lower middle income	3.1
## 130	Jordan JOR	Lower middle income	3.1
## 131	Namibia NAM	Upper middle income	3.1
## 132	Romania ROU	High income	3.1
## 133	Rwanda RWA	Low income	3.1
## 134	Turkmenistan TKM	Upper middle income	3.1
## 135	Benin BEN	Lower middle income	2.9
## 136	Laos LAO	Lower middle income	2.9
## 137	Pakistan PAK	Lower middle income	2.9
## 138	Singapore SGP	High income	2.9
## 139	Turks & Caicos Islands TCA	High income	2.9
## 140	Haiti HTI	Lower middle income	2.8
## 141	Madagascar MDG	Low income	2.8
## 142	Armenia ARM	Upper middle income	2.7
## 143	Gabon GAB	Upper middle income	2.7
## 144	Macao SAR China MAC	High income	2.7
## 145	Qatar QAT	High income	2.7
## 146	Kazakhstan KAZ	Upper middle income	2.6
## 147	Liberia LBR	Low income	2.6
## 148	Liechtenstein LIE	High income	2.6
## 149	St. Kitts & Nevis KNA	High income	2.6
## 150	Azerbaijan AZE	Upper middle income	2.5
## 151	British Virgin Islands VGB	High income	2.5
## 152	Chad TCD	Low income	2.5
## 153	Comoros COM	Lower middle income	2.5
## 154	Lebanon LBN	Lower middle income	2.5
## 155	Gambia GMB	Low income	2.4
## 156	Bahrain BHR	High income	2.3
## 157	Guinea GIN	Lower middle income	2.3
## 158	Cambodia KHM	Lower middle income	2.2
## 159	Guinea-Bissau GNB	Low income	2.1
## 160	Sri Lanka LKA	Lower middle income	2.1
## 161	Uganda UGA	Low income	2.1
## 162	Myanmar (Burma) MMR	Lower middle income	1.9
## 163	Mauritania MRT	Lower middle income	1.9
## 164	Papua New Guinea PNG	Lower middle income	1.9
## 165	Bermuda BMU	High income	1.5
## 166	Congo - Kinshasa COD	Low income	1.5
## 167	Monaco MCO	High income	1.5
## 168	South Sudan SSD	Low income	1.5
## 169	Bangladesh BGD	Lower middle income	1.3
## 170	Central African Republic CAF	Low income	1.2
## 171	French Polynesia PYF	High income	NA
## 172	Kosovo XKX	Upper middle income	NA
## 173	Libya LBY	Upper middle income	NA
## 174	North Macedonia MKD	Upper middle income	NA
## 175	Greece GRC	High income	NA
## 176	Algeria DZA	Upper middle income	NA
## 177	New Caledonia NCL	High income	NA
## 178	Botswana BWA	Upper middle income	NA

## 179	Syria	SYR	Low income	NA
## 180	Bosnia & Herzegovina	BIH	Upper middle income	NA
## 181	Egypt	EGY	Lower middle income	NA
## 182	Guam	GUM	High income	NA
## 183	Montenegro	MNE	Upper middle income	NA
## 184	Saudi Arabia	SAU	High income	NA
## 185	Nauru	NRU	High income	NA
## 186	Bahamas	BHS	High income	NA
## 187	Iraq	IRQ	Upper middle income	NA
## 188	Yemen	YEM	Low income	NA
## 189	Morocco	MAR	Lower middle income	NA
## 190	Tuvalu	TUV	Upper middle income	NA
## 191	Kiribati	KIR	Lower middle income	NA
## 192	Kuwait	KWT	High income	NA
## 193	Venezuela	VEN	Not classified	NA
## 194	Cayman Islands	CYM	High income	NA
## 195	Nigeria	NGA	Lower middle income	NA
## 196	Dominican Republic	DOM	Upper middle income	NA
## 197	Suriname	SUR	Upper middle income	NA
## 198	Marshall Islands	MHL	Upper middle income	NA
## 199	Isle of Man	IMN	High income	NA
## 200	Trinidad & Tobago	TTO	High income	NA
## 201	United Arab Emirates	ARE	High income	NA
## 202	Philippines	PHL	Lower middle income	NA
## 203	Palau	PLW	High income	NA
## 204	Anguilla	AIA	Not classified	NA
## 205	Sint Maarten	SXM	High income	NA
## 206	Jersey	JEY	Not classified	NA
## 207	Antigua & Barbuda	ATG	High income	NA
## 208	Guernsey	GGY	Not classified	NA
## 209	Taiwan	TWN	High income	NA
## 210	Equatorial Guinea	GNQ	Upper middle income	NA
## 211	Faroe Islands	FRO	High income	NA
## 212	North Korea	PRK	Low income	NA
## 213	St. Helena	SHN	Not classified	NA
## 214	China	CHN	Upper middle income	NA
## 215	Sudan	SDN	Low income	NA
## 216	St. Barthélemy	BLM	Not classified	NA
## 217	Gibraltar	GIB	High income	NA
## 218	Somalia	SOM	Low income	NA
## 219	Wallis & Futuna	WLF	Not classified	NA
## 220	Greenland	GRL	High income	NA
## 221	Saint Martin (French part)	MAF	High income	NA
## 222	British Virgin Islands	VGB	High income	NA
## 223	St. Pierre & Miquelon	SPM	Not classified	NA
## 224	Eritrea	ERI	Low income	NA
## 225	Northern Mariana Islands	MNP	High income	NA
## 226	Tonga	TON	Upper middle income	NA
## 227	American Samoa	ASM	High income	NA
##	youth_unemployment	net_migration	continent	region
## 1	6.1	-3.7	Americas	Caribbean
## 2	18.9	-20.9	Oceania	Micronesia
## 3	1.3	-1.6	Oceania	Melanesia
## 4	NA	0.0	Americas	Caribbean

## 5	9.7	4.0	Europe	Northern Europe
## 6	9.4	2.8	Europe	Northern Europe
## 7	6.1	3.3	Europe	Northern Europe
## 8	9.4	-1.2	Africa	Western Africa
## 9	15.3	-1.0	Americas	Central America
## 10	16.8	5.2	Europe	Northern Europe
## 11	6.9	-0.3	Americas	South America
## 12	47.1	-6.8	Africa	Southern Africa
## 13	20.6	0.8	Americas	Central America
## 14	34.4	-6.1	Africa	Southern Africa
## 15	10.7	0.0	Asia	Southern Asia
## 16	13.7	-0.4	Asia	Western Asia
## 17	13.2	-3.9	Asia	South-Eastern Asia
## 18	35.0	-1.4	Africa	Northern Africa
## 19	53.4	-0.2	Africa	Southern Africa
## 20	15.8	4.8	Europe	Western Europe
## 21	17.0	2.6	Europe	Northern Europe
## 22	28.5	-0.1	Americas	South America
## 23	11.5	8.0	Oceania	Australia and New Zealand
## 24	10.7	-1.4	Americas	Central America
## 25	7.2	2.1	Asia	Western Asia
## 26	26.6	-14.1	Americas	Caribbean
## 27	14.2	-5.0	Asia	Central Asia
## 28	16.5	-5.0	Africa	Eastern Africa
## 29	20.2	7.6	Asia	Western Asia
## 30	NA	-7.2	Americas	Caribbean
## 31	NA	-5.3	Americas	Caribbean
## 32	23.7	-0.1	Americas	South America
## 33	NA	8.4	Americas	Caribbean
## 34	20.8	1.1	Europe	Western Europe
## 35	21.5	0.0	Americas	South America
## 36	7.4	-1.7	Africa	Eastern Africa
## 37	9.4	3.6	Europe	Western Europe
## 38	8.7	-0.6	Africa	Western Africa
## 39	18.1	0.3	Americas	South America
## 40	7.4	-9.0	Europe	Eastern Europe
## 41	3.9	0.0	Africa	Western Africa
## 42	17.9	2.3	Europe	Eastern Europe
## 43	11.3	2.5	Europe	Northern Europe
## 44	11.1	5.6	Americas	Northern America
## 45	42.2	-4.7	Asia	Western Asia
## 46	7.4	-0.2	Africa	Eastern Africa
## 47	NA	-1.9	Asia	Central Asia
## 48	42.2	-4.2	Asia	Western Asia
## 49	27.8	-0.6	Africa	Western Africa
## 50	24.2	-9.4	Americas	Caribbean
## 51	7.2	1.9	Europe	Western Europe
## 52	NA	-1.1	Asia	Central Asia
## 53	11.8	8.1	Oceania	Australia and New Zealand
## 54	2.9	-0.8	Africa	Eastern Africa
## 55	21.4	-3.1	Asia	Southern Asia
## 56	20.8	-7.9	Africa	Middle Africa
## 57	7.9	4.6	Europe	Western Europe
## 58	7.9	0.0	Americas	South America

## 59	11.8	-3.1	Europe	Northern Europe
## 60	20.3	0.3	Europe	Southern Europe
## 61	8.6	3.0	Americas	Northern America
## 62	25.9	-0.9	Americas	South America
## 63	29.3	-1.3	Americas	Caribbean
## 64	6.2	1.5	Europe	Western Europe
## 65	10.6	0.7	Europe	Eastern Europe
## 66	9.1	6.6	Europe	Southern Europe
## 67	8.1	-1.3	Africa	Western Africa
## 68	8.8	1.5	Europe	Southern Europe
## 69	NA	-29.9	Oceania	Polynesia
## 70	25.2	-0.2	Africa	Eastern Africa
## 71	10.2	1.3	Europe	Eastern Europe
## 72	40.5	0.0	Africa	Eastern Africa
## 73	23.9	0.0	Africa	Eastern Africa
## 74	17.0	1.7	Europe	Eastern Europe
## 75	11.7	-0.3	Europe	Eastern Europe
## 76	24.0	0.0	Africa	Eastern Africa
## 77	18.5	-0.6	Americas	South America
## 78	6.9	-1.9	Americas	Central America
## 79	NA	-1.3	Oceania	Melanesia
## 80	29.6	-0.3	Americas	Caribbean
## 81	28.9	2.3	Asia	South-Eastern Asia
## 82	12.2	-5.9	Europe	Northern Europe
## 83	8.5	-2.4	Americas	Central America
## 84	11.6	1.0	Africa	Eastern Africa
## 85	10.2	2.3	Asia	Eastern Asia
## 86	20.2	-4.3	Asia	Western Asia
## 87	10.5	-0.3	Asia	South-Eastern Asia
## 88	31.9	-8.1	Oceania	Polynesia
## 89	34.3	7.0	Europe	Southern Europe
## 90	6.9	-0.3	Asia	South-Eastern Asia
## 91	17.6	-0.1	Asia	Southern Asia
## 92	12.7	-0.3	Europe	Eastern Europe
## 93	15.9	-12.7	Asia	Southern Asia
## 94	16.8	-0.8	Asia	Eastern Asia
## 95	3.7	0.0	Asia	South-Eastern Asia
## 96	9.1	-1.6	Africa	Western Africa
## 97	27.6	-0.3	Asia	Southern Asia
## 98	32.2	3.2	Europe	Southern Europe
## 99	23.7	-1.0	Europe	Southern Europe
## 100	6.7	2.3	Europe	Eastern Europe
## 101	15.4	-6.2	Oceania	Melanesia
## 102	14.9	0.2	Europe	Eastern Europe
## 103	8.7	1.7	Asia	Eastern Asia
## 104	22.5	0.0	Asia	Southern Asia
## 105	11.1	-5.9	Europe	Northern Europe
## 106	16.9	-3.9	Africa	Western Africa
## 107	14.7	-1.8	Americas	South America
## 108	31.9	-3.3	Europe	Southern Europe
## 109	NA	5.1	Africa	Eastern Africa
## 110	9.6	-4.8	Americas	Central America
## 111	16.5	-1.1	Asia	South-Eastern Asia
## 112	14.2	13.3	Europe	Western Europe

## 113	27.4	6.6	Europe	Southern Europe
## 114	29.7	0.0	Europe	Southern Europe
## 115	NA	-0.9	Africa	Middle Africa
## 116	29.9	0.1	Asia	Western Asia
## 117	13.8	3.9	Europe	Northern Europe
## 118	0.7	-0.7	Africa	Western Africa
## 119	39.4	-0.2	Africa	Middle Africa
## 120	14.5	-0.1	Americas	South America
## 121	3.9	-0.4	Africa	Eastern Africa
## 122	5.5	1.2	Africa	Western Africa
## 123	46.2	-1.7	Americas	Caribbean
## 124	NA	0.0	Europe	Southern Europe
## 125	NA	-2.6	Americas	Caribbean
## 126	5.0	-1.7	Americas	Central America
## 127	3.6	0.0	Asia	Eastern Asia
## 128	10.2	-0.1	Americas	Central America
## 129	6.3	-0.3	Africa	Middle Africa
## 130	35.6	-11.3	Asia	Western Asia
## 131	38.0	0.0	Africa	Southern Africa
## 132	16.2	-0.2	Europe	Eastern Europe
## 133	20.6	-3.3	Africa	Eastern Africa
## 134	NA	-1.7	Asia	Central Asia
## 135	5.6	0.3	Africa	Western Africa
## 136	18.2	-1.0	Asia	South-Eastern Asia
## 137	7.8	-0.9	Asia	Southern Asia
## 138	9.1	11.8	Asia	South-Eastern Asia
## 139	NA	8.9	Americas	Caribbean
## 140	NA	-1.9	Americas	Caribbean
## 141	1.0	0.0	Africa	Eastern Africa
## 142	36.3	-5.5	Asia	Western Asia
## 143	35.7	3.9	Africa	Middle Africa
## 144	5.3	3.3	Asia	Eastern Asia
## 145	0.4	6.5	Asia	Western Asia
## 146	3.8	0.4	Asia	Central Asia
## 147	2.3	-2.9	Africa	Western Africa
## 148	NA	4.9	Europe	Western Europe
## 149	NA	1.2	Americas	Caribbean
## 150	13.4	0.0	Asia	Western Asia
## 151	NA	15.5	Americas	Caribbean
## 152	NA	-0.1	Africa	Middle Africa
## 153	19.5	-2.3	Africa	Eastern Africa
## 154	NA	-88.7	Asia	Western Asia
## 155	13.1	-1.6	Africa	Western Africa
## 156	5.3	10.6	Asia	Western Asia
## 157	1.0	0.0	Africa	Western Africa
## 158	1.1	-0.3	Asia	South-Eastern Asia
## 159	NA	-3.8	Africa	Western Africa
## 160	21.0	-1.3	Asia	Southern Asia
## 161	14.8	-3.5	Africa	Eastern Africa
## 162	2.0	-1.4	Asia	South-Eastern Asia
## 163	15.2	-0.8	Africa	Western Africa
## 164	3.6	0.0	Oceania	Melanesia
## 165	29.3	1.6	Americas	Northern America
## 166	8.7	-0.9	Africa	Middle Africa

## 167	26.6	8.3	Europe	Western Europe
## 168	38.6	0.2	Africa	Eastern Africa
## 169	12.8	-3.0	Asia	Southern Asia
## 170	NA	0.0	Africa	Middle Africa
## 171	56.7	-0.7	Oceania	Polynesia
## 172	55.4	-1.8	<NA>	<NA>
## 173	48.7	-0.7	Africa	Northern Africa
## 174	45.4	0.4	Europe	Southern Europe
## 175	39.9	0.9	Europe	Southern Europe
## 176	39.3	-0.9	Africa	Northern Africa
## 177	38.4	3.8	Oceania	Melanesia
## 178	36.0	2.9	Africa	Southern Africa
## 179	35.8	27.1	Asia	Western Asia
## 180	33.8	-0.4	Europe	Southern Europe
## 181	29.6	-0.3	Africa	Northern Africa
## 182	29.4	-11.0	Oceania	Micronesia
## 183	29.4	-4.9	Europe	Southern Europe
## 184	28.8	4.7	Asia	Western Asia
## 185	26.6	-11.3	Oceania	Micronesia
## 186	25.8	0.0	Americas	Caribbean
## 187	25.6	-0.5	Asia	Western Asia
## 188	24.5	-0.2	Asia	Western Asia
## 189	22.2	-1.9	Africa	Northern Africa
## 190	20.6	-6.5	Oceania	Polynesia
## 191	17.1	-2.8	Oceania	Micronesia
## 192	15.4	-3.3	Asia	Western Asia
## 193	14.6	-3.4	Americas	South America
## 194	13.8	13.0	Americas	Caribbean
## 195	13.8	-0.2	Africa	Western Africa
## 196	13.5	-2.7	Americas	Caribbean
## 197	13.4	0.5	Americas	South America
## 198	11.0	-4.5	Oceania	Micronesia
## 199	10.1	5.2	Europe	Northern Europe
## 200	8.7	-5.4	Americas	Caribbean
## 201	6.9	7.6	Asia	Western Asia
## 202	6.7	-1.8	Asia	South-Eastern Asia
## 203	5.6	0.9	Oceania	Micronesia
## 204	NA	11.1	Americas	Caribbean
## 205	NA	6.0	Americas	Caribbean
## 206	NA	2.3	Europe	Northern Europe
## 207	NA	2.1	Americas	Caribbean
## 208	NA	1.9	Europe	Northern Europe
## 209	NA	0.8	Asia	Eastern Asia
## 210	NA	0.0	Africa	Middle Africa
## 211	NA	0.0	Europe	Northern Europe
## 212	NA	0.0	Asia	Eastern Asia
## 213	NA	0.0	Africa	Western Africa
## 214	NA	-0.4	Asia	Eastern Asia
## 215	NA	-0.4	Africa	Northern Africa
## 216	NA	-3.0	Americas	Caribbean
## 217	NA	-3.3	Europe	Southern Europe
## 218	NA	-3.8	Africa	Eastern Africa
## 219	NA	-4.3	Oceania	Polynesia
## 220	NA	-6.0	Americas	Northern America

```
## 221      NA      -6.0 Americas      Caribbean
## 222      NA      -7.5 Americas      Caribbean
## 223      NA      -7.7 Americas      Northern America
## 224      NA     -11.6  Africa        Eastern Africa
## 225      NA     -15.4 Oceania        Micronesia
## 226      NA     -17.9 Oceania        Polynesia
## 227      NA     -26.1 Oceania        Polynesia
```

```
# look for unmatched
df_vars %>%
  filter(is.na(continent)) %>%
  select(country, iso) %>%
  distinct()
```

```
##   country iso
## 1  Kosovo XKX
```

```
# patch Kosovo region and continent
df_vars <- df_vars %>%
  mutate(
    continent = ifelse(iso == "XKX", "Europe", continent),
    region = ifelse(iso == "XKX", "Southern Europe", region)
  )
```

e. Data Tidiness and Summary Statistics

- Evaluate the tidiness of `df_vars` (observational units, variables, fixed vs. measured variables). Make adjustments to tidy the data, if necessary.

```
glimpse(df_vars)
```

```
## Rows: 227
## Columns: 8
## $ country      <chr> "Cuba", "Micronesia (Federated States of)", "Solomo~
## $ iso          <chr> "CUB", "FSM", "SLB", "MSR", "NOR", "DNK", "ISL", "S~
## $ income       <chr> "Upper middle income", "Lower middle income", "Lowe~
## $ expenditure  <dbl> 12.8, 12.5, 9.9, 8.8, 7.9, 7.8, 7.7, 7.7, 7.6, 7.6,~
## $ youth_unemployment <dbl> 6.1, 18.9, 1.3, NA, 9.7, 9.4, 6.1, 9.4, 15.3, 16.8,~
## $ net_migration <dbl> -3.7, -20.9, -1.6, 0.0, 4.0, 2.8, 3.3, -1.2, -1.0, ~
## $ continent    <chr> "Americas", "Oceania", "Oceania", "Americas", "Euro~
## $ region       <chr> "Caribbean", "Micronesia", "Melanesia", "Caribbean"~
```

Each row in `df_vars` represents one country, and each column is a different variable like education expenditure, youth unemployment, net migration, or income classification. So the dataset follows the tidy data rules: one row per observational unit and one column per variable.

But there are some special cases to watch out for:

- Some values are missing (e.g., NA in youth unemployment or income group). The data is still tidy, but we'd need to deal with those if we're doing summaries or modeling.
- A few country names didn't match standard codes automatically (like "Kosovo"), so we manually fixed them using `case_when()`. This was needed to avoid issues with the `countrycode()` function.

- Standardizing country names and adding ISO3 codes wasn't strictly needed for tidiness, but it helps if we want to merge with other datasets later.

So overall, the dataset is already tidy, but we had to take care of some edge cases to keep it consistent and ready for analysis.

- Create a frequency table for the income status variable and briefly interpret the results.

```
# absolute frequency
table(df_vars$income)
```

```
##
##      High income      Low income Lower middle income      Not classified
##           85           26           52           10
## Upper middle income
##           54
```

```
# relative frequency
prop.table(table(df_vars$income))
```

```
##
##      High income      Low income Lower middle income      Not classified
##      0.37444934      0.11453744      0.22907489      0.04405286
## Upper middle income
##      0.23788546
```

The dataset has 84 high income countries, 54 upper middle income, 52 lower middle income, 26 low income, and 10 countries that are not classified. High income countries make up about 37% of the data, followed by upper middle (24%), lower middle (23%), and low income (11%). Only around 4% of countries are not classified. This shows the data is somewhat balanced, but there's a clear tilt toward middle and high income countries.

- Analyze the distribution of income status across continents by computing absolute and relative frequencies. Comment on the findings.

```
# absolute counts
table(df_vars$continent, df_vars$income)
```

```
##
##      High income Low income Lower middle income Not classified
## Africa           1          22                23             1
## Americas         22           0                4             5
## Asia             15           4                19             0
## Europe           38           0                 0             2
## Oceania           9           0                 6             2
##
##      Upper middle income
## Africa              8
## Americas            19
## Asia                14
## Europe              9
## Oceania             4
```

```
# relative frequencies (row-wise proportions)
prop.table(table(df_vars$continent, df_vars$income), margin = 1)
```

```
##
##           High income Low income Lower middle income Not classified
## Africa      0.01818182 0.40000000          0.41818182      0.01818182
## Americas    0.44000000 0.00000000          0.08000000      0.10000000
## Asia        0.28846154 0.07692308          0.36538462      0.00000000
## Europe      0.77551020 0.00000000          0.00000000      0.04081633
## Oceania     0.42857143 0.00000000          0.28571429      0.09523810
##
##           Upper middle income
## Africa          0.14545455
## Americas        0.38000000
## Asia            0.26923077
## Europe          0.18367347
## Oceania         0.19047619
```

In **Africa** (55 countries), 22 are low income (40%) and 23 are lower middle income (42%). This means over 80% of African countries fall into the lower income brackets. Only 1 country is high income (2%). This reflects ongoing economic development challenges across much of the continent.

In the **Americas** (49 countries), 21 are high income (43%) and 19 are upper middle income (39%). 4 are lower middle income (8%) and 5 are not classified (10%). The region is clearly skewed toward wealthier countries, but a few countries still fall into the middle and unclassified groups. This mix reflects strong economies like the US and Canada, alongside developing nations in Central and South America.

Asia (52 countries) is the most economically diverse. It has 15 high income (29%), 14 upper middle (27%), 19 lower middle (37%), and 4 low income countries (8%). The range covers some of the world's richest countries (like Japan and South Korea) and some of the poorest (like Afghanistan and Yemen), showing Asia's economic contrasts.

Europe (49 countries) is heavily dominated by high income countries — 38 of them (78%). The rest are mostly upper middle income (18%), with just 2 not classified. There are no low or lower middle income countries. This confirms Europe's position as one of the wealthiest regions in the world.

Oceania (21 countries) has 9 high income (43%) and 6 lower middle income (29%), with 4 upper middle (19%) and 2 unclassified (10%). The split here shows the contrast between rich countries like Australia and New Zealand, and smaller island nations with lower economic status.

The data reflects global economic inequalities. Wealth is concentrated in Europe and parts of Oceania, while Africa remains largely low income. Asia and the Americas are more balanced, containing both very rich and developing countries. These patterns align with global development trends and regional histories.

- Using the distribution of income status across continents, identify which countries are the only ones in their income group across the continent. Discuss briefly.

```
# find unique income group within each continent
df_vars %>%
  filter(income != "Not classified") %>%
  group_by(continent, income) %>%
  filter(n() == 1) %>%
  select(country, continent, income) %>%
  arrange(continent, income)
```

```
## # A tibble: 1 x 3
## # Groups:   continent, income [1]
##   country    continent income
##   <chr>      <chr>    <chr>
## 1 Seychelles Africa      High income

# find rare income groups within each continent
df_vars %>%
  filter(income != "Not classified") %>%
  group_by(continent, income) %>%
  filter(n() <= 5) %>%
  select(country, continent, income) %>%
  arrange(continent, income)
```

```
## # A tibble: 13 x 3
## # Groups:   continent, income [4]
##   country    continent income
##   <chr>      <chr>    <chr>
## 1 Seychelles Africa      High income
## 2 Bolivia    Americas  Lower middle income
## 3 Honduras   Americas  Lower middle income
## 4 Nicaragua  Americas  Lower middle income
## 5 Haiti       Americas  Lower middle income
## 6 Afghanistan Asia       Low income
## 7 Syria       Asia       Low income
## 8 Yemen       Asia       Low income
## 9 North Korea Asia       Low income
## 10 Fiji       Oceania    Upper middle income
## 11 Tuvalu     Oceania    Upper middle income
## 12 Marshall Islands Oceania    Upper middle income
## 13 Tonga      Oceania    Upper middle income
```

These countries differ from the economic pattern of their continent for several reasons:

- **Seychelles** has a small population and benefits from high-end tourism and stable governance, which helps it achieve high income despite being in Africa where most countries are lower income.
- In the **Americas**, countries like *Bolivia*, *Honduras*, *Nicaragua*, and *Haiti* have weaker infrastructure, lower education levels, and histories of political instability or colonial exploitation. These factors contribute to them lagging behind wealthier neighbors.
- **Asia's** low income countries — *Afghanistan*, *Syria*, *Yemen*, and *North Korea* — are heavily affected by war, sanctions, or authoritarian regimes. These issues limit foreign investment, trade, and development.
- **Fiji**, although a small island nation, has a relatively strong economy for the Pacific thanks to tourism, remittances, and regional political influence. It stands apart from nearby countries that rely more heavily on subsistence agriculture or aid.

In general, these cases show how politics, geography, conflict, and resource access all play major roles in shaping a country's economic status.

f. Further Summary Statistics and Insights

- Create a table of average (mean and median) values for expenditure, youth unemployment rate and net migration rate separated into income status. Make sure that in the output, the ordering of the income classes is proper (i.e., L, LM, UM, H or the other way around). Briefly comment the results and any differences between the mean and median.

df_vars

##		country	iso	income	expenditure
## 1		Cuba	CUB	Upper middle income	12.8
## 2	Micronesia (Federated States of)	FSM	Lower middle income		12.5
## 3		Solomon Islands	SLB	Lower middle income	9.9
## 4		Montserrat	MSR	Not classified	8.8
## 5		Norway	NOR	High income	7.9
## 6		Denmark	DNK	High income	7.8
## 7		Iceland	ISL	High income	7.7
## 8		Sierra Leone	SLE	Low income	7.7
## 9		Belize	BLZ	Upper middle income	7.6
## 10		Sweden	SWE	High income	7.6
## 11		Bolivia	BOL	Lower middle income	7.3
## 12		Eswatini	SWZ	Lower middle income	7.1
## 13		Costa Rica	CRI	Upper middle income	7.0
## 14		Lesotho	LSO	Lower middle income	7.0
## 15		Bhutan	BTN	Lower middle income	6.9
## 16		Oman	OMN	High income	6.8
## 17		Timor-Leste	TLS	Lower middle income	6.8
## 18		Tunisia	TUN	Lower middle income	6.6
## 19		South Africa	ZAF	Upper middle income	6.5
## 20		Belgium	BEL	High income	6.4
## 21		Finland	FIN	High income	6.4
## 22		Brazil	BRA	Upper middle income	6.3
## 23		New Zealand	NZL	High income	6.3
## 24		Honduras	HND	Lower middle income	6.1
## 25		Israel	ISR	High income	6.1
## 26		Puerto Rico	PRI	High income	6.1
## 27		Kyrgyzstan	KGZ	Lower middle income	6.0
## 28		Zimbabwe	ZWE	Lower middle income	5.9
## 29		Cyprus	CYP	High income	5.8
## 30	St. Vincent & Grenadines	VCT	Upper middle income		5.7
## 31		Dominica	DMA	Upper middle income	5.6
## 32		Argentina	ARG	Upper middle income	5.5
## 33		Aruba	ABW	High income	5.5
## 34		France	FRA	High income	5.5
## 35		Guyana	GUY	High income	5.5
## 36		Mozambique	MOZ	Low income	5.5
## 37		Austria	AUT	High income	5.4
## 38		Burkina Faso	BFA	Low income	5.4
## 39		Chile	CHL	High income	5.4
## 40		Moldova	MDA	Upper middle income	5.4
## 41		Togo	TGO	Low income	5.4
## 42		Ukraine	UKR	Upper middle income	5.4
## 43		United Kingdom	GBR	High income	5.4
## 44		Canada	CAN	High income	5.3

## 45	Palestinian Territories	PSE	Lower middle income	5.3
## 46	Kenya	KEN	Lower middle income	5.3
## 47	Uzbekistan	UZB	Lower middle income	5.3
## 48	Palestinian Territories	PSE	Lower middle income	5.3
## 49	Cape Verde	CPV	Lower middle income	5.2
## 50	Jamaica	JAM	Upper middle income	5.2
## 51	Netherlands	NLD	High income	5.2
## 52	Tajikistan	TJK	Lower middle income	5.2
## 53	Australia	AUS	High income	5.1
## 54	Burundi	BDI	Low income	5.1
## 55	Nepal	NPL	Lower middle income	5.1
## 56	São Tomé & Príncipe	STP	Lower middle income	5.1
## 57	Switzerland	CHE	High income	5.1
## 58	Ecuador	ECU	Upper middle income	5.0
## 59	Estonia	EST	High income	5.0
## 60	Portugal	PRT	High income	5.0
## 61	United States	USA	High income	5.0
## 62	Uruguay	URY	High income	5.0
## 63	Curaçao	CUW	High income	4.9
## 64	Germany	DEU	High income	4.9
## 65	Belarus	BLR	Upper middle income	4.8
## 66	Malta	MLT	High income	4.8
## 67	Senegal	SEN	Lower middle income	4.8
## 68	Slovenia	SVN	High income	4.8
## 69	Cook Islands	COK	Not classified	4.7
## 70	Ethiopia	ETH	Low income	4.7
## 71	Hungary	HUN	High income	4.7
## 72	Malawi	MWI	Low income	4.7
## 73	Mauritius	MUS	Upper middle income	4.7
## 74	Russia	RUS	High income	4.7
## 75	Poland	POL	High income	4.6
## 76	Zambia	ZMB	Lower middle income	4.6
## 77	Colombia	COL	Upper middle income	4.5
## 78	Mexico	MEX	Upper middle income	4.5
## 79	Vanuatu	VUT	Lower middle income	4.5
## 80	Barbados	BRB	High income	4.4
## 81	Brunei	BRN	High income	4.4
## 82	Latvia	LVA	High income	4.4
## 83	Nicaragua	NIC	Lower middle income	4.4
## 84	Seychelles	SYC	High income	4.4
## 85	South Korea	KOR	High income	4.3
## 86	Turkey	TUR	Upper middle income	4.3
## 87	Malaysia	MYS	Upper middle income	4.2
## 88	Samoa	WSM	Lower middle income	4.2
## 89	Spain	ESP	High income	4.2
## 90	Vietnam	VNM	Lower middle income	4.2
## 91	Afghanistan	AFG	Low income	4.1
## 92	Bulgaria	BGR	High income	4.1
## 93	Maldives	MDV	Upper middle income	4.1
## 94	Mongolia	MNG	Upper middle income	4.1
## 95	Thailand	THA	Upper middle income	4.1
## 96	Ghana	GHA	Lower middle income	4.0
## 97	Iran	IRN	Upper middle income	4.0
## 98	Italy	ITA	High income	4.0

## 99	Croatia	HRV	High income	3.9
## 100	Czechia	CZE	High income	3.9
## 101	Fiji	FJI	Upper middle income	3.9
## 102	Slovakia	SVK	High income	3.9
## 103	Hong Kong SAR China	HKG	High income	3.8
## 104	India	IND	Lower middle income	3.8
## 105	Lithuania	LTU	High income	3.8
## 106	Mali	MLI	Low income	3.8
## 107	Peru	PER	Upper middle income	3.8
## 108	Albania	ALB	Upper middle income	3.6
## 109	Djibouti	DJI	Lower middle income	3.6
## 110	El Salvador	SLV	Upper middle income	3.6
## 111	Indonesia	IDN	Upper middle income	3.6
## 112	Luxembourg	LUX	High income	3.6
## 113	San Marino	SMR	High income	3.6
## 114	Serbia	SRB	Upper middle income	3.6
## 115	Congo - Brazzaville	COG	Lower middle income	3.5
## 116	Georgia	GEO	Upper middle income	3.5
## 117	Ireland	IRL	High income	3.5
## 118	Niger	NER	Low income	3.5
## 119	Angola	AGO	Lower middle income	3.4
## 120	Paraguay	PRY	Upper middle income	3.4
## 121	Tanzania	TZA	Lower middle income	3.4
## 122	Côte d'Ivoire	CIV	Lower middle income	3.3
## 123	St. Lucia	LCA	Upper middle income	3.3
## 124	Andorra	AND	High income	3.2
## 125	Grenada	GRD	Upper middle income	3.2
## 126	Guatemala	GTM	Upper middle income	3.2
## 127	Japan	JPN	High income	3.2
## 128	Panama	PAN	High income	3.2
## 129	Cameroon	CMR	Lower middle income	3.1
## 130	Jordan	JOR	Lower middle income	3.1
## 131	Namibia	NAM	Upper middle income	3.1
## 132	Romania	ROU	High income	3.1
## 133	Rwanda	RWA	Low income	3.1
## 134	Turkmenistan	TKM	Upper middle income	3.1
## 135	Benin	BEN	Lower middle income	2.9
## 136	Laos	LAO	Lower middle income	2.9
## 137	Pakistan	PAK	Lower middle income	2.9
## 138	Singapore	SGP	High income	2.9
## 139	Turks & Caicos Islands	TCA	High income	2.9
## 140	Haiti	HTI	Lower middle income	2.8
## 141	Madagascar	MDG	Low income	2.8
## 142	Armenia	ARM	Upper middle income	2.7
## 143	Gabon	GAB	Upper middle income	2.7
## 144	Macao SAR China	MAC	High income	2.7
## 145	Qatar	QAT	High income	2.7
## 146	Kazakhstan	KAZ	Upper middle income	2.6
## 147	Liberia	LBR	Low income	2.6
## 148	Liechtenstein	LIE	High income	2.6
## 149	St. Kitts & Nevis	KNA	High income	2.6
## 150	Azerbaijan	AZE	Upper middle income	2.5
## 151	British Virgin Islands	VGB	High income	2.5
## 152	Chad	TCD	Low income	2.5

## 153	Comoros	COM	Lower middle income	2.5
## 154	Lebanon	LBN	Lower middle income	2.5
## 155	Gambia	GMB	Low income	2.4
## 156	Bahrain	BHR	High income	2.3
## 157	Guinea	GIN	Lower middle income	2.3
## 158	Cambodia	KHM	Lower middle income	2.2
## 159	Guinea-Bissau	GNB	Low income	2.1
## 160	Sri Lanka	LKA	Lower middle income	2.1
## 161	Uganda	UGA	Low income	2.1
## 162	Myanmar (Burma)	MMR	Lower middle income	1.9
## 163	Mauritania	MRT	Lower middle income	1.9
## 164	Papua New Guinea	PNG	Lower middle income	1.9
## 165	Bermuda	BMU	High income	1.5
## 166	Congo - Kinshasa	COD	Low income	1.5
## 167	Monaco	MCO	High income	1.5
## 168	South Sudan	SSD	Low income	1.5
## 169	Bangladesh	BGD	Lower middle income	1.3
## 170	Central African Republic	CAF	Low income	1.2
## 171	French Polynesia	PYF	High income	NA
## 172	Kosovo	XKX	Upper middle income	NA
## 173	Libya	LYB	Upper middle income	NA
## 174	North Macedonia	MKD	Upper middle income	NA
## 175	Greece	GRC	High income	NA
## 176	Algeria	DZA	Upper middle income	NA
## 177	New Caledonia	NCL	High income	NA
## 178	Botswana	BWA	Upper middle income	NA
## 179	Syria	SYR	Low income	NA
## 180	Bosnia & Herzegovina	BIH	Upper middle income	NA
## 181	Egypt	EGY	Lower middle income	NA
## 182	Guam	GUM	High income	NA
## 183	Montenegro	MNE	Upper middle income	NA
## 184	Saudi Arabia	SAU	High income	NA
## 185	Nauru	NRU	High income	NA
## 186	Bahamas	BHS	High income	NA
## 187	Iraq	IRQ	Upper middle income	NA
## 188	Yemen	YEM	Low income	NA
## 189	Morocco	MAR	Lower middle income	NA
## 190	Tuvalu	TUV	Upper middle income	NA
## 191	Kiribati	KIR	Lower middle income	NA
## 192	Kuwait	KWT	High income	NA
## 193	Venezuela	VEN	Not classified	NA
## 194	Cayman Islands	CYM	High income	NA
## 195	Nigeria	NGA	Lower middle income	NA
## 196	Dominican Republic	DOM	Upper middle income	NA
## 197	Suriname	SUR	Upper middle income	NA
## 198	Marshall Islands	MHL	Upper middle income	NA
## 199	Isle of Man	IMN	High income	NA
## 200	Trinidad & Tobago	TTO	High income	NA
## 201	United Arab Emirates	ARE	High income	NA
## 202	Philippines	PHL	Lower middle income	NA
## 203	Palau	PLW	High income	NA
## 204	Anguilla	AIA	Not classified	NA
## 205	Sint Maarten	SXM	High income	NA
## 206	Jersey	JEY	Not classified	NA

## 207	Antigua & Barbuda	ATG	High income	NA
## 208	Guernsey	GGY	Not classified	NA
## 209	Taiwan	TWN	High income	NA
## 210	Equatorial Guinea	GNQ	Upper middle income	NA
## 211	Faroe Islands	FRO	High income	NA
## 212	North Korea	PRK	Low income	NA
## 213	St. Helena	SHN	Not classified	NA
## 214	China	CHN	Upper middle income	NA
## 215	Sudan	SDN	Low income	NA
## 216	St. Barthélemy	BLM	Not classified	NA
## 217	Gibraltar	GIB	High income	NA
## 218	Somalia	SOM	Low income	NA
## 219	Wallis & Futuna	WLF	Not classified	NA
## 220	Greenland	GRL	High income	NA
## 221	Saint Martin (French part)	MAF	High income	NA
## 222	British Virgin Islands	VGB	High income	NA
## 223	St. Pierre & Miquelon	SPM	Not classified	NA
## 224	Eritrea	ERI	Low income	NA
## 225	Northern Mariana Islands	MNP	High income	NA
## 226	Tonga	TON	Upper middle income	NA
## 227	American Samoa	ASM	High income	NA
##	youth_unemployment	net_migration	continent	region
## 1	6.1	-3.7	Americas	Caribbean
## 2	18.9	-20.9	Oceania	Micronesia
## 3	1.3	-1.6	Oceania	Melanesia
## 4	NA	0.0	Americas	Caribbean
## 5	9.7	4.0	Europe	Northern Europe
## 6	9.4	2.8	Europe	Northern Europe
## 7	6.1	3.3	Europe	Northern Europe
## 8	9.4	-1.2	Africa	Western Africa
## 9	15.3	-1.0	Americas	Central America
## 10	16.8	5.2	Europe	Northern Europe
## 11	6.9	-0.3	Americas	South America
## 12	47.1	-6.8	Africa	Southern Africa
## 13	20.6	0.8	Americas	Central America
## 14	34.4	-6.1	Africa	Southern Africa
## 15	10.7	0.0	Asia	Southern Asia
## 16	13.7	-0.4	Asia	Western Asia
## 17	13.2	-3.9	Asia	South-Eastern Asia
## 18	35.0	-1.4	Africa	Northern Africa
## 19	53.4	-0.2	Africa	Southern Africa
## 20	15.8	4.8	Europe	Western Europe
## 21	17.0	2.6	Europe	Northern Europe
## 22	28.5	-0.1	Americas	South America
## 23	11.5	8.0	Oceania	Australia and New Zealand
## 24	10.7	-1.4	Americas	Central America
## 25	7.2	2.1	Asia	Western Asia
## 26	26.6	-14.1	Americas	Caribbean
## 27	14.2	-5.0	Asia	Central Asia
## 28	16.5	-5.0	Africa	Eastern Africa
## 29	20.2	7.6	Asia	Western Asia
## 30	NA	-7.2	Americas	Caribbean
## 31	NA	-5.3	Americas	Caribbean
## 32	23.7	-0.1	Americas	South America

## 33	NA	8.4	Americas	Caribbean
## 34	20.8	1.1	Europe	Western Europe
## 35	21.5	0.0	Americas	South America
## 36	7.4	-1.7	Africa	Eastern Africa
## 37	9.4	3.6	Europe	Western Europe
## 38	8.7	-0.6	Africa	Western Africa
## 39	18.1	0.3	Americas	South America
## 40	7.4	-9.0	Europe	Eastern Europe
## 41	3.9	0.0	Africa	Western Africa
## 42	17.9	2.3	Europe	Eastern Europe
## 43	11.3	2.5	Europe	Northern Europe
## 44	11.1	5.6	Americas	Northern America
## 45	42.2	-4.7	Asia	Western Asia
## 46	7.4	-0.2	Africa	Eastern Africa
## 47	NA	-1.9	Asia	Central Asia
## 48	42.2	-4.2	Asia	Western Asia
## 49	27.8	-0.6	Africa	Western Africa
## 50	24.2	-9.4	Americas	Caribbean
## 51	7.2	1.9	Europe	Western Europe
## 52	NA	-1.1	Asia	Central Asia
## 53	11.8	8.1	Oceania	Australia and New Zealand
## 54	2.9	-0.8	Africa	Eastern Africa
## 55	21.4	-3.1	Asia	Southern Asia
## 56	20.8	-7.9	Africa	Middle Africa
## 57	7.9	4.6	Europe	Western Europe
## 58	7.9	0.0	Americas	South America
## 59	11.8	-3.1	Europe	Northern Europe
## 60	20.3	0.3	Europe	Southern Europe
## 61	8.6	3.0	Americas	Northern America
## 62	25.9	-0.9	Americas	South America
## 63	29.3	-1.3	Americas	Caribbean
## 64	6.2	1.5	Europe	Western Europe
## 65	10.6	0.7	Europe	Eastern Europe
## 66	9.1	6.6	Europe	Southern Europe
## 67	8.1	-1.3	Africa	Western Africa
## 68	8.8	1.5	Europe	Southern Europe
## 69	NA	-29.9	Oceania	Polynesia
## 70	25.2	-0.2	Africa	Eastern Africa
## 71	10.2	1.3	Europe	Eastern Europe
## 72	40.5	0.0	Africa	Eastern Africa
## 73	23.9	0.0	Africa	Eastern Africa
## 74	17.0	1.7	Europe	Eastern Europe
## 75	11.7	-0.3	Europe	Eastern Europe
## 76	24.0	0.0	Africa	Eastern Africa
## 77	18.5	-0.6	Americas	South America
## 78	6.9	-1.9	Americas	Central America
## 79	NA	-1.3	Oceania	Melanesia
## 80	29.6	-0.3	Americas	Caribbean
## 81	28.9	2.3	Asia	South-Eastern Asia
## 82	12.2	-5.9	Europe	Northern Europe
## 83	8.5	-2.4	Americas	Central America
## 84	11.6	1.0	Africa	Eastern Africa
## 85	10.2	2.3	Asia	Eastern Asia
## 86	20.2	-4.3	Asia	Western Asia

## 87	10.5	-0.3	Asia	South-Eastern Asia
## 88	31.9	-8.1	Oceania	Polynesia
## 89	34.3	7.0	Europe	Southern Europe
## 90	6.9	-0.3	Asia	South-Eastern Asia
## 91	17.6	-0.1	Asia	Southern Asia
## 92	12.7	-0.3	Europe	Eastern Europe
## 93	15.9	-12.7	Asia	Southern Asia
## 94	16.8	-0.8	Asia	Eastern Asia
## 95	3.7	0.0	Asia	South-Eastern Asia
## 96	9.1	-1.6	Africa	Western Africa
## 97	27.6	-0.3	Asia	Southern Asia
## 98	32.2	3.2	Europe	Southern Europe
## 99	23.7	-1.0	Europe	Southern Europe
## 100	6.7	2.3	Europe	Eastern Europe
## 101	15.4	-6.2	Oceania	Melanesia
## 102	14.9	0.2	Europe	Eastern Europe
## 103	8.7	1.7	Asia	Eastern Asia
## 104	22.5	0.0	Asia	Southern Asia
## 105	11.1	-5.9	Europe	Northern Europe
## 106	16.9	-3.9	Africa	Western Africa
## 107	14.7	-1.8	Americas	South America
## 108	31.9	-3.3	Europe	Southern Europe
## 109	NA	5.1	Africa	Eastern Africa
## 110	9.6	-4.8	Americas	Central America
## 111	16.5	-1.1	Asia	South-Eastern Asia
## 112	14.2	13.3	Europe	Western Europe
## 113	27.4	6.6	Europe	Southern Europe
## 114	29.7	0.0	Europe	Southern Europe
## 115	NA	-0.9	Africa	Middle Africa
## 116	29.9	0.1	Asia	Western Asia
## 117	13.8	3.9	Europe	Northern Europe
## 118	0.7	-0.7	Africa	Western Africa
## 119	39.4	-0.2	Africa	Middle Africa
## 120	14.5	-0.1	Americas	South America
## 121	3.9	-0.4	Africa	Eastern Africa
## 122	5.5	1.2	Africa	Western Africa
## 123	46.2	-1.7	Americas	Caribbean
## 124	NA	0.0	Europe	Southern Europe
## 125	NA	-2.6	Americas	Caribbean
## 126	5.0	-1.7	Americas	Central America
## 127	3.6	0.0	Asia	Eastern Asia
## 128	10.2	-0.1	Americas	Central America
## 129	6.3	-0.3	Africa	Middle Africa
## 130	35.6	-11.3	Asia	Western Asia
## 131	38.0	0.0	Africa	Southern Africa
## 132	16.2	-0.2	Europe	Eastern Europe
## 133	20.6	-3.3	Africa	Eastern Africa
## 134	NA	-1.7	Asia	Central Asia
## 135	5.6	0.3	Africa	Western Africa
## 136	18.2	-1.0	Asia	South-Eastern Asia
## 137	7.8	-0.9	Asia	Southern Asia
## 138	9.1	11.8	Asia	South-Eastern Asia
## 139	NA	8.9	Americas	Caribbean
## 140	NA	-1.9	Americas	Caribbean

## 141	1.0	0.0	Africa	Eastern Africa
## 142	36.3	-5.5	Asia	Western Asia
## 143	35.7	3.9	Africa	Middle Africa
## 144	5.3	3.3	Asia	Eastern Asia
## 145	0.4	6.5	Asia	Western Asia
## 146	3.8	0.4	Asia	Central Asia
## 147	2.3	-2.9	Africa	Western Africa
## 148	NA	4.9	Europe	Western Europe
## 149	NA	1.2	Americas	Caribbean
## 150	13.4	0.0	Asia	Western Asia
## 151	NA	15.5	Americas	Caribbean
## 152	NA	-0.1	Africa	Middle Africa
## 153	19.5	-2.3	Africa	Eastern Africa
## 154	NA	-88.7	Asia	Western Asia
## 155	13.1	-1.6	Africa	Western Africa
## 156	5.3	10.6	Asia	Western Asia
## 157	1.0	0.0	Africa	Western Africa
## 158	1.1	-0.3	Asia	South-Eastern Asia
## 159	NA	-3.8	Africa	Western Africa
## 160	21.0	-1.3	Asia	Southern Asia
## 161	14.8	-3.5	Africa	Eastern Africa
## 162	2.0	-1.4	Asia	South-Eastern Asia
## 163	15.2	-0.8	Africa	Western Africa
## 164	3.6	0.0	Oceania	Melanesia
## 165	29.3	1.6	Americas	Northern America
## 166	8.7	-0.9	Africa	Middle Africa
## 167	26.6	8.3	Europe	Western Europe
## 168	38.6	0.2	Africa	Eastern Africa
## 169	12.8	-3.0	Asia	Southern Asia
## 170	NA	0.0	Africa	Middle Africa
## 171	56.7	-0.7	Oceania	Polynesia
## 172	55.4	-1.8	Europe	Southern Europe
## 173	48.7	-0.7	Africa	Northern Africa
## 174	45.4	0.4	Europe	Southern Europe
## 175	39.9	0.9	Europe	Southern Europe
## 176	39.3	-0.9	Africa	Northern Africa
## 177	38.4	3.8	Oceania	Melanesia
## 178	36.0	2.9	Africa	Southern Africa
## 179	35.8	27.1	Asia	Western Asia
## 180	33.8	-0.4	Europe	Southern Europe
## 181	29.6	-0.3	Africa	Northern Africa
## 182	29.4	-11.0	Oceania	Micronesia
## 183	29.4	-4.9	Europe	Southern Europe
## 184	28.8	4.7	Asia	Western Asia
## 185	26.6	-11.3	Oceania	Micronesia
## 186	25.8	0.0	Americas	Caribbean
## 187	25.6	-0.5	Asia	Western Asia
## 188	24.5	-0.2	Asia	Western Asia
## 189	22.2	-1.9	Africa	Northern Africa
## 190	20.6	-6.5	Oceania	Polynesia
## 191	17.1	-2.8	Oceania	Micronesia
## 192	15.4	-3.3	Asia	Western Asia
## 193	14.6	-3.4	Americas	South America
## 194	13.8	13.0	Americas	Caribbean

## 195	13.8	-0.2	Africa	Western Africa
## 196	13.5	-2.7	Americas	Caribbean
## 197	13.4	0.5	Americas	South America
## 198	11.0	-4.5	Oceania	Micronesia
## 199	10.1	5.2	Europe	Northern Europe
## 200	8.7	-5.4	Americas	Caribbean
## 201	6.9	7.6	Asia	Western Asia
## 202	6.7	-1.8	Asia	South-Eastern Asia
## 203	5.6	0.9	Oceania	Micronesia
## 204	NA	11.1	Americas	Caribbean
## 205	NA	6.0	Americas	Caribbean
## 206	NA	2.3	Europe	Northern Europe
## 207	NA	2.1	Americas	Caribbean
## 208	NA	1.9	Europe	Northern Europe
## 209	NA	0.8	Asia	Eastern Asia
## 210	NA	0.0	Africa	Middle Africa
## 211	NA	0.0	Europe	Northern Europe
## 212	NA	0.0	Asia	Eastern Asia
## 213	NA	0.0	Africa	Western Africa
## 214	NA	-0.4	Asia	Eastern Asia
## 215	NA	-0.4	Africa	Northern Africa
## 216	NA	-3.0	Americas	Caribbean
## 217	NA	-3.3	Europe	Southern Europe
## 218	NA	-3.8	Africa	Eastern Africa
## 219	NA	-4.3	Oceania	Polynesia
## 220	NA	-6.0	Americas	Northern America
## 221	NA	-6.0	Americas	Caribbean
## 222	NA	-7.5	Americas	Caribbean
## 223	NA	-7.7	Americas	Northern America
## 224	NA	-11.6	Africa	Eastern Africa
## 225	NA	-15.4	Oceania	Micronesia
## 226	NA	-17.9	Oceania	Polynesia
## 227	NA	-26.1	Oceania	Polynesia

```
income_status_df <- df_vars[c("income", "country", "expenditure", "youth_unemployment", "net_migration",
income_status_df
```

##	income	country	expenditure
## 1	Upper middle income	Cuba	12.8
## 2	Lower middle income	Micronesia (Federated States of)	12.5
## 3	Lower middle income	Solomon Islands	9.9
## 4	Not classified	Montserrat	8.8
## 5	High income	Norway	7.9
## 6	High income	Denmark	7.8
## 7	High income	Iceland	7.7
## 8	Low income	Sierra Leone	7.7
## 9	Upper middle income	Belize	7.6
## 10	High income	Sweden	7.6
## 11	Lower middle income	Bolivia	7.3
## 12	Lower middle income	Eswatini	7.1
## 13	Upper middle income	Costa Rica	7.0
## 14	Lower middle income	Lesotho	7.0
## 15	Lower middle income	Bhutan	6.9

## 16	High income	Oman	6.8
## 17	Lower middle income	Timor-Leste	6.8
## 18	Lower middle income	Tunisia	6.6
## 19	Upper middle income	South Africa	6.5
## 20	High income	Belgium	6.4
## 21	High income	Finland	6.4
## 22	Upper middle income	Brazil	6.3
## 23	High income	New Zealand	6.3
## 24	Lower middle income	Honduras	6.1
## 25	High income	Israel	6.1
## 26	High income	Puerto Rico	6.1
## 27	Lower middle income	Kyrgyzstan	6.0
## 28	Lower middle income	Zimbabwe	5.9
## 29	High income	Cyprus	5.8
## 30	Upper middle income	St. Vincent & Grenadines	5.7
## 31	Upper middle income	Dominica	5.6
## 32	Upper middle income	Argentina	5.5
## 33	High income	Aruba	5.5
## 34	High income	France	5.5
## 35	High income	Guyana	5.5
## 36	Low income	Mozambique	5.5
## 37	High income	Austria	5.4
## 38	Low income	Burkina Faso	5.4
## 39	High income	Chile	5.4
## 40	Upper middle income	Moldova	5.4
## 41	Low income	Togo	5.4
## 42	Upper middle income	Ukraine	5.4
## 43	High income	United Kingdom	5.4
## 44	High income	Canada	5.3
## 45	Lower middle income	Palestinian Territories	5.3
## 46	Lower middle income	Kenya	5.3
## 47	Lower middle income	Uzbekistan	5.3
## 48	Lower middle income	Palestinian Territories	5.3
## 49	Lower middle income	Cape Verde	5.2
## 50	Upper middle income	Jamaica	5.2
## 51	High income	Netherlands	5.2
## 52	Lower middle income	Tajikistan	5.2
## 53	High income	Australia	5.1
## 54	Low income	Burundi	5.1
## 55	Lower middle income	Nepal	5.1
## 56	Lower middle income	São Tomé & Príncipe	5.1
## 57	High income	Switzerland	5.1
## 58	Upper middle income	Ecuador	5.0
## 59	High income	Estonia	5.0
## 60	High income	Portugal	5.0
## 61	High income	United States	5.0
## 62	High income	Uruguay	5.0
## 63	High income	Curaçao	4.9
## 64	High income	Germany	4.9
## 65	Upper middle income	Belarus	4.8
## 66	High income	Malta	4.8
## 67	Lower middle income	Senegal	4.8
## 68	High income	Slovenia	4.8
## 69	Not classified	Cook Islands	4.7

## 70	Low income	Ethiopia	4.7
## 71	High income	Hungary	4.7
## 72	Low income	Malawi	4.7
## 73	Upper middle income	Mauritius	4.7
## 74	High income	Russia	4.7
## 75	High income	Poland	4.6
## 76	Lower middle income	Zambia	4.6
## 77	Upper middle income	Colombia	4.5
## 78	Upper middle income	Mexico	4.5
## 79	Lower middle income	Vanuatu	4.5
## 80	High income	Barbados	4.4
## 81	High income	Brunei	4.4
## 82	High income	Latvia	4.4
## 83	Lower middle income	Nicaragua	4.4
## 84	High income	Seychelles	4.4
## 85	High income	South Korea	4.3
## 86	Upper middle income	Turkey	4.3
## 87	Upper middle income	Malaysia	4.2
## 88	Lower middle income	Samoa	4.2
## 89	High income	Spain	4.2
## 90	Lower middle income	Vietnam	4.2
## 91	Low income	Afghanistan	4.1
## 92	High income	Bulgaria	4.1
## 93	Upper middle income	Maldives	4.1
## 94	Upper middle income	Mongolia	4.1
## 95	Upper middle income	Thailand	4.1
## 96	Lower middle income	Ghana	4.0
## 97	Upper middle income	Iran	4.0
## 98	High income	Italy	4.0
## 99	High income	Croatia	3.9
## 100	High income	Czechia	3.9
## 101	Upper middle income	Fiji	3.9
## 102	High income	Slovakia	3.9
## 103	High income	Hong Kong SAR China	3.8
## 104	Lower middle income	India	3.8
## 105	High income	Lithuania	3.8
## 106	Low income	Mali	3.8
## 107	Upper middle income	Peru	3.8
## 108	Upper middle income	Albania	3.6
## 109	Lower middle income	Djibouti	3.6
## 110	Upper middle income	El Salvador	3.6
## 111	Upper middle income	Indonesia	3.6
## 112	High income	Luxembourg	3.6
## 113	High income	San Marino	3.6
## 114	Upper middle income	Serbia	3.6
## 115	Lower middle income	Congo - Brazzaville	3.5
## 116	Upper middle income	Georgia	3.5
## 117	High income	Ireland	3.5
## 118	Low income	Niger	3.5
## 119	Lower middle income	Angola	3.4
## 120	Upper middle income	Paraguay	3.4
## 121	Lower middle income	Tanzania	3.4
## 122	Lower middle income	Côte d'Ivoire	3.3
## 123	Upper middle income	St. Lucia	3.3

## 124	High income	Andorra	3.2
## 125	Upper middle income	Grenada	3.2
## 126	Upper middle income	Guatemala	3.2
## 127	High income	Japan	3.2
## 128	High income	Panama	3.2
## 129	Lower middle income	Cameroon	3.1
## 130	Lower middle income	Jordan	3.1
## 131	Upper middle income	Namibia	3.1
## 132	High income	Romania	3.1
## 133	Low income	Rwanda	3.1
## 134	Upper middle income	Turkmenistan	3.1
## 135	Lower middle income	Benin	2.9
## 136	Lower middle income	Laos	2.9
## 137	Lower middle income	Pakistan	2.9
## 138	High income	Singapore	2.9
## 139	High income	Turks & Caicos Islands	2.9
## 140	Lower middle income	Haiti	2.8
## 141	Low income	Madagascar	2.8
## 142	Upper middle income	Armenia	2.7
## 143	Upper middle income	Gabon	2.7
## 144	High income	Macao SAR China	2.7
## 145	High income	Qatar	2.7
## 146	Upper middle income	Kazakhstan	2.6
## 147	Low income	Liberia	2.6
## 148	High income	Liechtenstein	2.6
## 149	High income	St. Kitts & Nevis	2.6
## 150	Upper middle income	Azerbaijan	2.5
## 151	High income	British Virgin Islands	2.5
## 152	Low income	Chad	2.5
## 153	Lower middle income	Comoros	2.5
## 154	Lower middle income	Lebanon	2.5
## 155	Low income	Gambia	2.4
## 156	High income	Bahrain	2.3
## 157	Lower middle income	Guinea	2.3
## 158	Lower middle income	Cambodia	2.2
## 159	Low income	Guinea-Bissau	2.1
## 160	Lower middle income	Sri Lanka	2.1
## 161	Low income	Uganda	2.1
## 162	Lower middle income	Myanmar (Burma)	1.9
## 163	Lower middle income	Mauritania	1.9
## 164	Lower middle income	Papua New Guinea	1.9
## 165	High income	Bermuda	1.5
## 166	Low income	Congo - Kinshasa	1.5
## 167	High income	Monaco	1.5
## 168	Low income	South Sudan	1.5
## 169	Lower middle income	Bangladesh	1.3
## 170	Low income	Central African Republic	1.2
## 171	High income	French Polynesia	NA
## 172	Upper middle income	Kosovo	NA
## 173	Upper middle income	Libya	NA
## 174	Upper middle income	North Macedonia	NA
## 175	High income	Greece	NA
## 176	Upper middle income	Algeria	NA
## 177	High income	New Caledonia	NA

## 178	Upper middle income	Botswana	NA
## 179	Low income	Syria	NA
## 180	Upper middle income	Bosnia & Herzegovina	NA
## 181	Lower middle income	Egypt	NA
## 182	High income	Guam	NA
## 183	Upper middle income	Montenegro	NA
## 184	High income	Saudi Arabia	NA
## 185	High income	Nauru	NA
## 186	High income	Bahamas	NA
## 187	Upper middle income	Iraq	NA
## 188	Low income	Yemen	NA
## 189	Lower middle income	Morocco	NA
## 190	Upper middle income	Tuvalu	NA
## 191	Lower middle income	Kiribati	NA
## 192	High income	Kuwait	NA
## 193	Not classified	Venezuela	NA
## 194	High income	Cayman Islands	NA
## 195	Lower middle income	Nigeria	NA
## 196	Upper middle income	Dominican Republic	NA
## 197	Upper middle income	Suriname	NA
## 198	Upper middle income	Marshall Islands	NA
## 199	High income	Isle of Man	NA
## 200	High income	Trinidad & Tobago	NA
## 201	High income	United Arab Emirates	NA
## 202	Lower middle income	Philippines	NA
## 203	High income	Palau	NA
## 204	Not classified	Anguilla	NA
## 205	High income	Sint Maarten	NA
## 206	Not classified	Jersey	NA
## 207	High income	Antigua & Barbuda	NA
## 208	Not classified	Guernsey	NA
## 209	High income	Taiwan	NA
## 210	Upper middle income	Equatorial Guinea	NA
## 211	High income	Faroe Islands	NA
## 212	Low income	North Korea	NA
## 213	Not classified	St. Helena	NA
## 214	Upper middle income	China	NA
## 215	Low income	Sudan	NA
## 216	Not classified	St. Barthélemy	NA
## 217	High income	Gibraltar	NA
## 218	Low income	Somalia	NA
## 219	Not classified	Wallis & Futuna	NA
## 220	High income	Greenland	NA
## 221	High income	Saint Martin (French part)	NA
## 222	High income	British Virgin Islands	NA
## 223	Not classified	St. Pierre & Miquelon	NA
## 224	Low income	Eritrea	NA
## 225	High income	Northern Mariana Islands	NA
## 226	Upper middle income	Tonga	NA
## 227	High income	American Samoa	NA
##	youth_unemployment	net_migration	continent
## 1	6.1	-3.7	Americas
## 2	18.9	-20.9	Oceania
## 3	1.3	-1.6	Oceania

## 4	NA	0.0	Americas
## 5	9.7	4.0	Europe
## 6	9.4	2.8	Europe
## 7	6.1	3.3	Europe
## 8	9.4	-1.2	Africa
## 9	15.3	-1.0	Americas
## 10	16.8	5.2	Europe
## 11	6.9	-0.3	Americas
## 12	47.1	-6.8	Africa
## 13	20.6	0.8	Americas
## 14	34.4	-6.1	Africa
## 15	10.7	0.0	Asia
## 16	13.7	-0.4	Asia
## 17	13.2	-3.9	Asia
## 18	35.0	-1.4	Africa
## 19	53.4	-0.2	Africa
## 20	15.8	4.8	Europe
## 21	17.0	2.6	Europe
## 22	28.5	-0.1	Americas
## 23	11.5	8.0	Oceania
## 24	10.7	-1.4	Americas
## 25	7.2	2.1	Asia
## 26	26.6	-14.1	Americas
## 27	14.2	-5.0	Asia
## 28	16.5	-5.0	Africa
## 29	20.2	7.6	Asia
## 30	NA	-7.2	Americas
## 31	NA	-5.3	Americas
## 32	23.7	-0.1	Americas
## 33	NA	8.4	Americas
## 34	20.8	1.1	Europe
## 35	21.5	0.0	Americas
## 36	7.4	-1.7	Africa
## 37	9.4	3.6	Europe
## 38	8.7	-0.6	Africa
## 39	18.1	0.3	Americas
## 40	7.4	-9.0	Europe
## 41	3.9	0.0	Africa
## 42	17.9	2.3	Europe
## 43	11.3	2.5	Europe
## 44	11.1	5.6	Americas
## 45	42.2	-4.7	Asia
## 46	7.4	-0.2	Africa
## 47	NA	-1.9	Asia
## 48	42.2	-4.2	Asia
## 49	27.8	-0.6	Africa
## 50	24.2	-9.4	Americas
## 51	7.2	1.9	Europe
## 52	NA	-1.1	Asia
## 53	11.8	8.1	Oceania
## 54	2.9	-0.8	Africa
## 55	21.4	-3.1	Asia
## 56	20.8	-7.9	Africa
## 57	7.9	4.6	Europe

## 58	7.9	0.0	Americas
## 59	11.8	-3.1	Europe
## 60	20.3	0.3	Europe
## 61	8.6	3.0	Americas
## 62	25.9	-0.9	Americas
## 63	29.3	-1.3	Americas
## 64	6.2	1.5	Europe
## 65	10.6	0.7	Europe
## 66	9.1	6.6	Europe
## 67	8.1	-1.3	Africa
## 68	8.8	1.5	Europe
## 69	NA	-29.9	Oceania
## 70	25.2	-0.2	Africa
## 71	10.2	1.3	Europe
## 72	40.5	0.0	Africa
## 73	23.9	0.0	Africa
## 74	17.0	1.7	Europe
## 75	11.7	-0.3	Europe
## 76	24.0	0.0	Africa
## 77	18.5	-0.6	Americas
## 78	6.9	-1.9	Americas
## 79	NA	-1.3	Oceania
## 80	29.6	-0.3	Americas
## 81	28.9	2.3	Asia
## 82	12.2	-5.9	Europe
## 83	8.5	-2.4	Americas
## 84	11.6	1.0	Africa
## 85	10.2	2.3	Asia
## 86	20.2	-4.3	Asia
## 87	10.5	-0.3	Asia
## 88	31.9	-8.1	Oceania
## 89	34.3	7.0	Europe
## 90	6.9	-0.3	Asia
## 91	17.6	-0.1	Asia
## 92	12.7	-0.3	Europe
## 93	15.9	-12.7	Asia
## 94	16.8	-0.8	Asia
## 95	3.7	0.0	Asia
## 96	9.1	-1.6	Africa
## 97	27.6	-0.3	Asia
## 98	32.2	3.2	Europe
## 99	23.7	-1.0	Europe
## 100	6.7	2.3	Europe
## 101	15.4	-6.2	Oceania
## 102	14.9	0.2	Europe
## 103	8.7	1.7	Asia
## 104	22.5	0.0	Asia
## 105	11.1	-5.9	Europe
## 106	16.9	-3.9	Africa
## 107	14.7	-1.8	Americas
## 108	31.9	-3.3	Europe
## 109	NA	5.1	Africa
## 110	9.6	-4.8	Americas
## 111	16.5	-1.1	Asia

## 112	14.2	13.3	Europe
## 113	27.4	6.6	Europe
## 114	29.7	0.0	Europe
## 115	NA	-0.9	Africa
## 116	29.9	0.1	Asia
## 117	13.8	3.9	Europe
## 118	0.7	-0.7	Africa
## 119	39.4	-0.2	Africa
## 120	14.5	-0.1	Americas
## 121	3.9	-0.4	Africa
## 122	5.5	1.2	Africa
## 123	46.2	-1.7	Americas
## 124	NA	0.0	Europe
## 125	NA	-2.6	Americas
## 126	5.0	-1.7	Americas
## 127	3.6	0.0	Asia
## 128	10.2	-0.1	Americas
## 129	6.3	-0.3	Africa
## 130	35.6	-11.3	Asia
## 131	38.0	0.0	Africa
## 132	16.2	-0.2	Europe
## 133	20.6	-3.3	Africa
## 134	NA	-1.7	Asia
## 135	5.6	0.3	Africa
## 136	18.2	-1.0	Asia
## 137	7.8	-0.9	Asia
## 138	9.1	11.8	Asia
## 139	NA	8.9	Americas
## 140	NA	-1.9	Americas
## 141	1.0	0.0	Africa
## 142	36.3	-5.5	Asia
## 143	35.7	3.9	Africa
## 144	5.3	3.3	Asia
## 145	0.4	6.5	Asia
## 146	3.8	0.4	Asia
## 147	2.3	-2.9	Africa
## 148	NA	4.9	Europe
## 149	NA	1.2	Americas
## 150	13.4	0.0	Asia
## 151	NA	15.5	Americas
## 152	NA	-0.1	Africa
## 153	19.5	-2.3	Africa
## 154	NA	-88.7	Asia
## 155	13.1	-1.6	Africa
## 156	5.3	10.6	Asia
## 157	1.0	0.0	Africa
## 158	1.1	-0.3	Asia
## 159	NA	-3.8	Africa
## 160	21.0	-1.3	Asia
## 161	14.8	-3.5	Africa
## 162	2.0	-1.4	Asia
## 163	15.2	-0.8	Africa
## 164	3.6	0.0	Oceania
## 165	29.3	1.6	Americas

## 166	8.7	-0.9	Africa
## 167	26.6	8.3	Europe
## 168	38.6	0.2	Africa
## 169	12.8	-3.0	Asia
## 170	NA	0.0	Africa
## 171	56.7	-0.7	Oceania
## 172	55.4	-1.8	Europe
## 173	48.7	-0.7	Africa
## 174	45.4	0.4	Europe
## 175	39.9	0.9	Europe
## 176	39.3	-0.9	Africa
## 177	38.4	3.8	Oceania
## 178	36.0	2.9	Africa
## 179	35.8	27.1	Asia
## 180	33.8	-0.4	Europe
## 181	29.6	-0.3	Africa
## 182	29.4	-11.0	Oceania
## 183	29.4	-4.9	Europe
## 184	28.8	4.7	Asia
## 185	26.6	-11.3	Oceania
## 186	25.8	0.0	Americas
## 187	25.6	-0.5	Asia
## 188	24.5	-0.2	Asia
## 189	22.2	-1.9	Africa
## 190	20.6	-6.5	Oceania
## 191	17.1	-2.8	Oceania
## 192	15.4	-3.3	Asia
## 193	14.6	-3.4	Americas
## 194	13.8	13.0	Americas
## 195	13.8	-0.2	Africa
## 196	13.5	-2.7	Americas
## 197	13.4	0.5	Americas
## 198	11.0	-4.5	Oceania
## 199	10.1	5.2	Europe
## 200	8.7	-5.4	Americas
## 201	6.9	7.6	Asia
## 202	6.7	-1.8	Asia
## 203	5.6	0.9	Oceania
## 204	NA	11.1	Americas
## 205	NA	6.0	Americas
## 206	NA	2.3	Europe
## 207	NA	2.1	Americas
## 208	NA	1.9	Europe
## 209	NA	0.8	Asia
## 210	NA	0.0	Africa
## 211	NA	0.0	Europe
## 212	NA	0.0	Asia
## 213	NA	0.0	Africa
## 214	NA	-0.4	Asia
## 215	NA	-0.4	Africa
## 216	NA	-3.0	Americas
## 217	NA	-3.3	Europe
## 218	NA	-3.8	Africa
## 219	NA	-4.3	Oceania

```
## 220          NA          -6.0 Americas
## 221          NA          -6.0 Americas
## 222          NA          -7.5 Americas
## 223          NA          -7.7 Americas
## 224          NA         -11.6  Africa
## 225          NA         -15.4  Oceania
## 226          NA         -17.9  Oceania
## 227          NA         -26.1  Oceania
```

```
income_sort_map <- c(
  "Not classified" = 5,
  "Low income" = 1,
  "Lower middle income" = 2,
  "Upper middle income" = 3,
  "High income" = 4
)
```

```
income_status_df$income_rank <- income_sort_map[income_status_df$income]
```

```
income_status_df <- income_status_df[order(income_status_df$income_rank),]
```

```
income_status_df
```

##	income	country	expenditure
## 8	Low income	Sierra Leone	7.7
## 36	Low income	Mozambique	5.5
## 38	Low income	Burkina Faso	5.4
## 41	Low income	Togo	5.4
## 54	Low income	Burundi	5.1
## 70	Low income	Ethiopia	4.7
## 72	Low income	Malawi	4.7
## 91	Low income	Afghanistan	4.1
## 106	Low income	Mali	3.8
## 118	Low income	Niger	3.5
## 133	Low income	Rwanda	3.1
## 141	Low income	Madagascar	2.8
## 147	Low income	Liberia	2.6
## 152	Low income	Chad	2.5
## 155	Low income	Gambia	2.4
## 159	Low income	Guinea-Bissau	2.1
## 161	Low income	Uganda	2.1
## 166	Low income	Congo - Kinshasa	1.5
## 168	Low income	South Sudan	1.5
## 170	Low income	Central African Republic	1.2
## 179	Low income	Syria	NA
## 188	Low income	Yemen	NA
## 212	Low income	North Korea	NA
## 215	Low income	Sudan	NA
## 218	Low income	Somalia	NA
## 224	Low income	Eritrea	NA
## 2	Lower middle income	Micronesia (Federated States of)	12.5
## 3	Lower middle income	Solomon Islands	9.9
## 11	Lower middle income	Bolivia	7.3

## 12	Lower middle income	Eswatini	7.1
## 14	Lower middle income	Lesotho	7.0
## 15	Lower middle income	Bhutan	6.9
## 17	Lower middle income	Timor-Leste	6.8
## 18	Lower middle income	Tunisia	6.6
## 24	Lower middle income	Honduras	6.1
## 27	Lower middle income	Kyrgyzstan	6.0
## 28	Lower middle income	Zimbabwe	5.9
## 45	Lower middle income	Palestinian Territories	5.3
## 46	Lower middle income	Kenya	5.3
## 47	Lower middle income	Uzbekistan	5.3
## 48	Lower middle income	Palestinian Territories	5.3
## 49	Lower middle income	Cape Verde	5.2
## 52	Lower middle income	Tajikistan	5.2
## 55	Lower middle income	Nepal	5.1
## 56	Lower middle income	São Tomé & Príncipe	5.1
## 67	Lower middle income	Senegal	4.8
## 76	Lower middle income	Zambia	4.6
## 79	Lower middle income	Vanuatu	4.5
## 83	Lower middle income	Nicaragua	4.4
## 88	Lower middle income	Samoa	4.2
## 90	Lower middle income	Vietnam	4.2
## 96	Lower middle income	Ghana	4.0
## 104	Lower middle income	India	3.8
## 109	Lower middle income	Djibouti	3.6
## 115	Lower middle income	Congo - Brazzaville	3.5
## 119	Lower middle income	Angola	3.4
## 121	Lower middle income	Tanzania	3.4
## 122	Lower middle income	Côte d'Ivoire	3.3
## 129	Lower middle income	Cameroon	3.1
## 130	Lower middle income	Jordan	3.1
## 135	Lower middle income	Benin	2.9
## 136	Lower middle income	Laos	2.9
## 137	Lower middle income	Pakistan	2.9
## 140	Lower middle income	Haiti	2.8
## 153	Lower middle income	Comoros	2.5
## 154	Lower middle income	Lebanon	2.5
## 157	Lower middle income	Guinea	2.3
## 158	Lower middle income	Cambodia	2.2
## 160	Lower middle income	Sri Lanka	2.1
## 162	Lower middle income	Myanmar (Burma)	1.9
## 163	Lower middle income	Mauritania	1.9
## 164	Lower middle income	Papua New Guinea	1.9
## 169	Lower middle income	Bangladesh	1.3
## 181	Lower middle income	Egypt	NA
## 189	Lower middle income	Morocco	NA
## 191	Lower middle income	Kiribati	NA
## 195	Lower middle income	Nigeria	NA
## 202	Lower middle income	Philippines	NA
## 1	Upper middle income	Cuba	12.8
## 9	Upper middle income	Belize	7.6
## 13	Upper middle income	Costa Rica	7.0
## 19	Upper middle income	South Africa	6.5
## 22	Upper middle income	Brazil	6.3

## 30	Upper middle income	St. Vincent & Grenadines	5.7
## 31	Upper middle income	Dominica	5.6
## 32	Upper middle income	Argentina	5.5
## 40	Upper middle income	Moldova	5.4
## 42	Upper middle income	Ukraine	5.4
## 50	Upper middle income	Jamaica	5.2
## 58	Upper middle income	Ecuador	5.0
## 65	Upper middle income	Belarus	4.8
## 73	Upper middle income	Mauritius	4.7
## 77	Upper middle income	Colombia	4.5
## 78	Upper middle income	Mexico	4.5
## 86	Upper middle income	Turkey	4.3
## 87	Upper middle income	Malaysia	4.2
## 93	Upper middle income	Maldives	4.1
## 94	Upper middle income	Mongolia	4.1
## 95	Upper middle income	Thailand	4.1
## 97	Upper middle income	Iran	4.0
## 101	Upper middle income	Fiji	3.9
## 107	Upper middle income	Peru	3.8
## 108	Upper middle income	Albania	3.6
## 110	Upper middle income	El Salvador	3.6
## 111	Upper middle income	Indonesia	3.6
## 114	Upper middle income	Serbia	3.6
## 116	Upper middle income	Georgia	3.5
## 120	Upper middle income	Paraguay	3.4
## 123	Upper middle income	St. Lucia	3.3
## 125	Upper middle income	Grenada	3.2
## 126	Upper middle income	Guatemala	3.2
## 131	Upper middle income	Namibia	3.1
## 134	Upper middle income	Turkmenistan	3.1
## 142	Upper middle income	Armenia	2.7
## 143	Upper middle income	Gabon	2.7
## 146	Upper middle income	Kazakhstan	2.6
## 150	Upper middle income	Azerbaijan	2.5
## 172	Upper middle income	Kosovo	NA
## 173	Upper middle income	Libya	NA
## 174	Upper middle income	North Macedonia	NA
## 176	Upper middle income	Algeria	NA
## 178	Upper middle income	Botswana	NA
## 180	Upper middle income	Bosnia & Herzegovina	NA
## 183	Upper middle income	Montenegro	NA
## 187	Upper middle income	Iraq	NA
## 190	Upper middle income	Tuvalu	NA
## 196	Upper middle income	Dominican Republic	NA
## 197	Upper middle income	Suriname	NA
## 198	Upper middle income	Marshall Islands	NA
## 210	Upper middle income	Equatorial Guinea	NA
## 214	Upper middle income	China	NA
## 226	Upper middle income	Tonga	NA
## 5	High income	Norway	7.9
## 6	High income	Denmark	7.8
## 7	High income	Iceland	7.7
## 10	High income	Sweden	7.6
## 16	High income	Oman	6.8

## 20	High income	Belgium	6.4
## 21	High income	Finland	6.4
## 23	High income	New Zealand	6.3
## 25	High income	Israel	6.1
## 26	High income	Puerto Rico	6.1
## 29	High income	Cyprus	5.8
## 33	High income	Aruba	5.5
## 34	High income	France	5.5
## 35	High income	Guyana	5.5
## 37	High income	Austria	5.4
## 39	High income	Chile	5.4
## 43	High income	United Kingdom	5.4
## 44	High income	Canada	5.3
## 51	High income	Netherlands	5.2
## 53	High income	Australia	5.1
## 57	High income	Switzerland	5.1
## 59	High income	Estonia	5.0
## 60	High income	Portugal	5.0
## 61	High income	United States	5.0
## 62	High income	Uruguay	5.0
## 63	High income	Curaçao	4.9
## 64	High income	Germany	4.9
## 66	High income	Malta	4.8
## 68	High income	Slovenia	4.8
## 71	High income	Hungary	4.7
## 74	High income	Russia	4.7
## 75	High income	Poland	4.6
## 80	High income	Barbados	4.4
## 81	High income	Brunei	4.4
## 82	High income	Latvia	4.4
## 84	High income	Seychelles	4.4
## 85	High income	South Korea	4.3
## 89	High income	Spain	4.2
## 92	High income	Bulgaria	4.1
## 98	High income	Italy	4.0
## 99	High income	Croatia	3.9
## 100	High income	Czechia	3.9
## 102	High income	Slovakia	3.9
## 103	High income	Hong Kong SAR China	3.8
## 105	High income	Lithuania	3.8
## 112	High income	Luxembourg	3.6
## 113	High income	San Marino	3.6
## 117	High income	Ireland	3.5
## 124	High income	Andorra	3.2
## 127	High income	Japan	3.2
## 128	High income	Panama	3.2
## 132	High income	Romania	3.1
## 138	High income	Singapore	2.9
## 139	High income	Turks & Caicos Islands	2.9
## 144	High income	Macao SAR China	2.7
## 145	High income	Qatar	2.7
## 148	High income	Liechtenstein	2.6
## 149	High income	St. Kitts & Nevis	2.6
## 151	High income	British Virgin Islands	2.5

## 156	High income	Bahrain	2.3
## 165	High income	Bermuda	1.5
## 167	High income	Monaco	1.5
## 171	High income	French Polynesia	NA
## 175	High income	Greece	NA
## 177	High income	New Caledonia	NA
## 182	High income	Guam	NA
## 184	High income	Saudi Arabia	NA
## 185	High income	Nauru	NA
## 186	High income	Bahamas	NA
## 192	High income	Kuwait	NA
## 194	High income	Cayman Islands	NA
## 199	High income	Isle of Man	NA
## 200	High income	Trinidad & Tobago	NA
## 201	High income	United Arab Emirates	NA
## 203	High income	Palau	NA
## 205	High income	Sint Maarten	NA
## 207	High income	Antigua & Barbuda	NA
## 209	High income	Taiwan	NA
## 211	High income	Faroe Islands	NA
## 217	High income	Gibraltar	NA
## 220	High income	Greenland	NA
## 221	High income	Saint Martin (French part)	NA
## 222	High income	British Virgin Islands	NA
## 225	High income	Northern Mariana Islands	NA
## 227	High income	American Samoa	NA
## 4	Not classified	Montserrat	8.8
## 69	Not classified	Cook Islands	4.7
## 193	Not classified	Venezuela	NA
## 204	Not classified	Anguilla	NA
## 206	Not classified	Jersey	NA
## 208	Not classified	Guernsey	NA
## 213	Not classified	St. Helena	NA
## 216	Not classified	St. Barthélemy	NA
## 219	Not classified	Wallis & Futuna	NA
## 223	Not classified	St. Pierre & Miquelon	NA
##	youth_unemployment	net_migration	continent income_rank
## 8	9.4	-1.2	Africa 1
## 36	7.4	-1.7	Africa 1
## 38	8.7	-0.6	Africa 1
## 41	3.9	0.0	Africa 1
## 54	2.9	-0.8	Africa 1
## 70	25.2	-0.2	Africa 1
## 72	40.5	0.0	Africa 1
## 91	17.6	-0.1	Asia 1
## 106	16.9	-3.9	Africa 1
## 118	0.7	-0.7	Africa 1
## 133	20.6	-3.3	Africa 1
## 141	1.0	0.0	Africa 1
## 147	2.3	-2.9	Africa 1
## 152	NA	-0.1	Africa 1
## 155	13.1	-1.6	Africa 1
## 159	NA	-3.8	Africa 1
## 161	14.8	-3.5	Africa 1

## 166	8.7	-0.9	Africa	1
## 168	38.6	0.2	Africa	1
## 170	NA	0.0	Africa	1
## 179	35.8	27.1	Asia	1
## 188	24.5	-0.2	Asia	1
## 212	NA	0.0	Asia	1
## 215	NA	-0.4	Africa	1
## 218	NA	-3.8	Africa	1
## 224	NA	-11.6	Africa	1
## 2	18.9	-20.9	Oceania	2
## 3	1.3	-1.6	Oceania	2
## 11	6.9	-0.3	Americas	2
## 12	47.1	-6.8	Africa	2
## 14	34.4	-6.1	Africa	2
## 15	10.7	0.0	Asia	2
## 17	13.2	-3.9	Asia	2
## 18	35.0	-1.4	Africa	2
## 24	10.7	-1.4	Americas	2
## 27	14.2	-5.0	Asia	2
## 28	16.5	-5.0	Africa	2
## 45	42.2	-4.7	Asia	2
## 46	7.4	-0.2	Africa	2
## 47	NA	-1.9	Asia	2
## 48	42.2	-4.2	Asia	2
## 49	27.8	-0.6	Africa	2
## 52	NA	-1.1	Asia	2
## 55	21.4	-3.1	Asia	2
## 56	20.8	-7.9	Africa	2
## 67	8.1	-1.3	Africa	2
## 76	24.0	0.0	Africa	2
## 79	NA	-1.3	Oceania	2
## 83	8.5	-2.4	Americas	2
## 88	31.9	-8.1	Oceania	2
## 90	6.9	-0.3	Asia	2
## 96	9.1	-1.6	Africa	2
## 104	22.5	0.0	Asia	2
## 109	NA	5.1	Africa	2
## 115	NA	-0.9	Africa	2
## 119	39.4	-0.2	Africa	2
## 121	3.9	-0.4	Africa	2
## 122	5.5	1.2	Africa	2
## 129	6.3	-0.3	Africa	2
## 130	35.6	-11.3	Asia	2
## 135	5.6	0.3	Africa	2
## 136	18.2	-1.0	Asia	2
## 137	7.8	-0.9	Asia	2
## 140	NA	-1.9	Americas	2
## 153	19.5	-2.3	Africa	2
## 154	NA	-88.7	Asia	2
## 157	1.0	0.0	Africa	2
## 158	1.1	-0.3	Asia	2
## 160	21.0	-1.3	Asia	2
## 162	2.0	-1.4	Asia	2
## 163	15.2	-0.8	Africa	2

## 164	3.6	0.0	Oceania	2
## 169	12.8	-3.0	Asia	2
## 181	29.6	-0.3	Africa	2
## 189	22.2	-1.9	Africa	2
## 191	17.1	-2.8	Oceania	2
## 195	13.8	-0.2	Africa	2
## 202	6.7	-1.8	Asia	2
## 1	6.1	-3.7	Americas	3
## 9	15.3	-1.0	Americas	3
## 13	20.6	0.8	Americas	3
## 19	53.4	-0.2	Africa	3
## 22	28.5	-0.1	Americas	3
## 30	NA	-7.2	Americas	3
## 31	NA	-5.3	Americas	3
## 32	23.7	-0.1	Americas	3
## 40	7.4	-9.0	Europe	3
## 42	17.9	2.3	Europe	3
## 50	24.2	-9.4	Americas	3
## 58	7.9	0.0	Americas	3
## 65	10.6	0.7	Europe	3
## 73	23.9	0.0	Africa	3
## 77	18.5	-0.6	Americas	3
## 78	6.9	-1.9	Americas	3
## 86	20.2	-4.3	Asia	3
## 87	10.5	-0.3	Asia	3
## 93	15.9	-12.7	Asia	3
## 94	16.8	-0.8	Asia	3
## 95	3.7	0.0	Asia	3
## 97	27.6	-0.3	Asia	3
## 101	15.4	-6.2	Oceania	3
## 107	14.7	-1.8	Americas	3
## 108	31.9	-3.3	Europe	3
## 110	9.6	-4.8	Americas	3
## 111	16.5	-1.1	Asia	3
## 114	29.7	0.0	Europe	3
## 116	29.9	0.1	Asia	3
## 120	14.5	-0.1	Americas	3
## 123	46.2	-1.7	Americas	3
## 125	NA	-2.6	Americas	3
## 126	5.0	-1.7	Americas	3
## 131	38.0	0.0	Africa	3
## 134	NA	-1.7	Asia	3
## 142	36.3	-5.5	Asia	3
## 143	35.7	3.9	Africa	3
## 146	3.8	0.4	Asia	3
## 150	13.4	0.0	Asia	3
## 172	55.4	-1.8	Europe	3
## 173	48.7	-0.7	Africa	3
## 174	45.4	0.4	Europe	3
## 176	39.3	-0.9	Africa	3
## 178	36.0	2.9	Africa	3
## 180	33.8	-0.4	Europe	3
## 183	29.4	-4.9	Europe	3
## 187	25.6	-0.5	Asia	3

## 190	20.6	-6.5	Oceania	3
## 196	13.5	-2.7	Americas	3
## 197	13.4	0.5	Americas	3
## 198	11.0	-4.5	Oceania	3
## 210	NA	0.0	Africa	3
## 214	NA	-0.4	Asia	3
## 226	NA	-17.9	Oceania	3
## 5	9.7	4.0	Europe	4
## 6	9.4	2.8	Europe	4
## 7	6.1	3.3	Europe	4
## 10	16.8	5.2	Europe	4
## 16	13.7	-0.4	Asia	4
## 20	15.8	4.8	Europe	4
## 21	17.0	2.6	Europe	4
## 23	11.5	8.0	Oceania	4
## 25	7.2	2.1	Asia	4
## 26	26.6	-14.1	Americas	4
## 29	20.2	7.6	Asia	4
## 33	NA	8.4	Americas	4
## 34	20.8	1.1	Europe	4
## 35	21.5	0.0	Americas	4
## 37	9.4	3.6	Europe	4
## 39	18.1	0.3	Americas	4
## 43	11.3	2.5	Europe	4
## 44	11.1	5.6	Americas	4
## 51	7.2	1.9	Europe	4
## 53	11.8	8.1	Oceania	4
## 57	7.9	4.6	Europe	4
## 59	11.8	-3.1	Europe	4
## 60	20.3	0.3	Europe	4
## 61	8.6	3.0	Americas	4
## 62	25.9	-0.9	Americas	4
## 63	29.3	-1.3	Americas	4
## 64	6.2	1.5	Europe	4
## 66	9.1	6.6	Europe	4
## 68	8.8	1.5	Europe	4
## 71	10.2	1.3	Europe	4
## 74	17.0	1.7	Europe	4
## 75	11.7	-0.3	Europe	4
## 80	29.6	-0.3	Americas	4
## 81	28.9	2.3	Asia	4
## 82	12.2	-5.9	Europe	4
## 84	11.6	1.0	Africa	4
## 85	10.2	2.3	Asia	4
## 89	34.3	7.0	Europe	4
## 92	12.7	-0.3	Europe	4
## 98	32.2	3.2	Europe	4
## 99	23.7	-1.0	Europe	4
## 100	6.7	2.3	Europe	4
## 102	14.9	0.2	Europe	4
## 103	8.7	1.7	Asia	4
## 105	11.1	-5.9	Europe	4
## 112	14.2	13.3	Europe	4
## 113	27.4	6.6	Europe	4

## 117	13.8	3.9	Europe	4
## 124	NA	0.0	Europe	4
## 127	3.6	0.0	Asia	4
## 128	10.2	-0.1	Americas	4
## 132	16.2	-0.2	Europe	4
## 138	9.1	11.8	Asia	4
## 139	NA	8.9	Americas	4
## 144	5.3	3.3	Asia	4
## 145	0.4	6.5	Asia	4
## 148	NA	4.9	Europe	4
## 149	NA	1.2	Americas	4
## 151	NA	15.5	Americas	4
## 156	5.3	10.6	Asia	4
## 165	29.3	1.6	Americas	4
## 167	26.6	8.3	Europe	4
## 171	56.7	-0.7	Oceania	4
## 175	39.9	0.9	Europe	4
## 177	38.4	3.8	Oceania	4
## 182	29.4	-11.0	Oceania	4
## 184	28.8	4.7	Asia	4
## 185	26.6	-11.3	Oceania	4
## 186	25.8	0.0	Americas	4
## 192	15.4	-3.3	Asia	4
## 194	13.8	13.0	Americas	4
## 199	10.1	5.2	Europe	4
## 200	8.7	-5.4	Americas	4
## 201	6.9	7.6	Asia	4
## 203	5.6	0.9	Oceania	4
## 205	NA	6.0	Americas	4
## 207	NA	2.1	Americas	4
## 209	NA	0.8	Asia	4
## 211	NA	0.0	Europe	4
## 217	NA	-3.3	Europe	4
## 220	NA	-6.0	Americas	4
## 221	NA	-6.0	Americas	4
## 222	NA	-7.5	Americas	4
## 225	NA	-15.4	Oceania	4
## 227	NA	-26.1	Oceania	4
## 4	NA	0.0	Americas	5
## 69	NA	-29.9	Oceania	5
## 193	14.6	-3.4	Americas	5
## 204	NA	11.1	Americas	5
## 206	NA	2.3	Europe	5
## 208	NA	1.9	Europe	5
## 213	NA	0.0	Africa	5
## 216	NA	-3.0	Americas	5
## 219	NA	-4.3	Oceania	5
## 223	NA	-7.7	Americas	5

```

# define the metrics and groups
metrics <- c("expenditure", "youth_unemployment", "net_migration")
income_levels <- unique(income_status_df$income)

# initialize a list to store summary rows

```



```

summary_list <- list()

# loop through each income level
for (inc in income_levels) {
  group_data <- subset(income_status_df, income_status_df$income == inc)
  summary_row <- list(income = inc)

  # compute average and median for each metric
  for (metric in metrics) {
    avg_val <- mean(group_data[[metric]], na.rm = TRUE)
    med_val <- median(group_data[[metric]], na.rm = TRUE)

    summary_row[[paste0("average_", metric)]] <- avg_val
    summary_row[[paste0("median_", metric)]] <- med_val
  }

  # append the row to the list
  summary_list[[inc]] <- as.data.frame(summary_row)
}

# combine all summaries into a single data frame
income_summary_df <- do.call(rbind, summary_list)
rownames(income_summary_df) <- NULL # clean row names
print(income_summary_df)

```

```

##           income average_expenditure median_expenditure
## 1      Low income           3.585000           3.30
## 2 Lower middle income           4.508511           4.20
## 3 Upper middle income           4.530769           4.10
## 4      High income           4.561290           4.65
## 5    Not classified           6.750000           6.75
## average_youth_unemployment median_youth_unemployment average_net_migration
## 1              15.40000              13.1             -0.5384615
## 2              17.10222              14.2             -3.9653846
## 3              22.81489              20.2             -2.1592593
## 4              16.46812              12.7              1.4588235
## 5              14.60000              14.6             -3.3000000
## median_net_migration
## 1              -0.65
## 2              -1.35
## 3              -0.75
## 4               1.70
## 5              -1.50

```

High income countries have the highest average and median expenditure, as expected.

Upper middle income countries show the highest youth unemployment on average.

Low income countries have the lowest expenditure and relatively high youth unemployment.

- Look at the standard deviation and the interquartile range of the variables per income status instead of the location statistics above. Do you gain additional insights? Briefly comment the results.

```

# define metrics and income levels
income_groups <- list(
  "Low income" = subset(income_status_df, income == "Low income"),
  "Lower middle income" = subset(income_status_df, income == "Lower middle income"),
  "Upper middle income" = subset(income_status_df, income == "Upper middle income"),
  "High income" = subset(income_status_df, income == "High income"),
  "Not classified" = subset(income_status_df, income == "Not classified")
)

variability_summary <- data.frame()

# loop through each group and compute SD and IQR
for (name in names(income_groups)) {
  group <- income_groups[[name]]
  row <- list(income = name)

  for (metric in metrics) {
    sd_val <- sd(group[[metric]], na.rm = TRUE)
    iqr_val <- IQR(group[[metric]], na.rm = TRUE)

    row[[paste0("sd_", metric)]] <- sd_val
    row[[paste0("iqr_", metric)]] <- iqr_val
  }

  variability_summary <- rbind(variability_summary, as.data.frame(row))
}

print(variability_summary)

```

```

##           income sd_expenditure iqr_expenditure sd_youth_unemployment
## 1      Low income      1.708885          2.475          12.64116
## 2 Lower middle income      2.167430          2.400          12.48353
## 3 Upper middle income      1.835921          1.850          13.59768
## 4      High income      1.467948          1.800          10.34322
## 5    Not classified      2.899138          2.050              NA
## iqr_youth_unemployment sd_net_migration iqr_net_migration
## 1             16.9          6.153248          2.575
## 2             15.6         12.549258          2.725
## 3             17.5          3.809844          3.600
## 4             14.6          6.276322          5.100
## 5              0.0         10.622617          5.500

```

High-income countries often show lower standard deviations and IQRs, indicating more consistent expenditure and youth unemployment rates across countries in that group. In contrast to that, upper-middle and lower-middle income countries show greater variability, which means they are less stable.

- Extend the analysis of the statistics median and IQR to **each income status and continent combination**. Play around with displaying the resulting table. Use `pivot_longer()` and/or `pivot_wider()` to generate different outputs. Discuss the results as well as the readability of the different tables.

```

# initialize an empty data frame to store the results
extended_variability_summary <- data.frame()

```

```

# loop through each combination of income status and continent
for (income_name in unique(income_status_df$income)) {
  for (continent_name in unique(income_status_df$continent)) {
    # subset the data for the current income and continent
    group <- subset(income_status_df, income == income_name & continent == continent_name)

    # initialize the row with the income and continent
    row <- list(income = income_name, continent = continent_name)

    # loop through the metrics (assuming 'metrics' is already defined as the columns you want to compute)
    for (metric in metrics) {
      # Calculate the median and IQR for the current metric
      median_val <- median(group[[metric]], na.rm = TRUE)
      iqr_val <- IQR(group[[metric]], na.rm = TRUE)

      # add the computed values to the row
      row[[paste0("median_", metric)]] <- median_val
      row[[paste0("iqr_", metric)]] <- iqr_val
    }

    # append the row to the summary data frame
    extended_variability_summary <- rbind(extended_variability_summary, as.data.frame(row))
  }
}

extended_variability_summary

```

	income	continent	median_expenditure	iqr_expenditure
## 1	Low income	Africa	3.10	2.650
## 2	Low income	Asia	4.10	0.000
## 3	Low income	Oceania	NA	NA
## 4	Low income	Americas	NA	NA
## 5	Low income	Europe	NA	NA
## 6	Lower middle income	Africa	3.80	1.975
## 7	Lower middle income	Asia	4.00	2.700
## 8	Lower middle income	Oceania	4.50	5.700
## 9	Lower middle income	Americas	5.25	2.400
## 10	Lower middle income	Europe	NA	NA
## 11	Upper middle income	Africa	3.90	2.150
## 12	Upper middle income	Asia	3.80	1.100
## 13	Upper middle income	Oceania	3.90	0.000
## 14	Upper middle income	Americas	5.00	2.100
## 15	Upper middle income	Europe	4.80	1.800
## 16	High income	Africa	4.40	0.000
## 17	High income	Asia	3.80	2.300
## 18	High income	Oceania	5.70	0.600
## 19	High income	Americas	4.95	2.400
## 20	High income	Europe	4.70	1.450
## 21	Not classified	Africa	NA	NA
## 22	Not classified	Asia	NA	NA
## 23	Not classified	Oceania	4.70	0.000
## 24	Not classified	Americas	8.80	0.000
## 25	Not classified	Europe	NA	NA

##	median_youth_unemployment	iqr_youth_unemployment	median_net_migration
## 1	9.05	14.175	-0.85
## 2	24.50	9.100	-0.05
## 3	NA	NA	NA
## 4	NA	NA	NA
## 5	NA	NA	NA
## 6	16.50	20.400	-0.60
## 7	13.70	14.100	-1.80
## 8	17.10	15.300	-2.20
## 9	8.50	1.900	-1.65
## 10	NA	NA	NA
## 11	38.00	8.150	0.00
## 12	16.65	13.425	-0.45
## 13	15.40	4.800	-6.35
## 14	14.60	12.200	-1.70
## 15	29.70	15.900	-0.40
## 16	11.60	0.000	1.00
## 17	8.90	9.275	2.30
## 18	26.60	22.250	-0.70
## 19	21.50	15.500	0.15
## 20	12.45	7.525	2.10
## 21	NA	NA	0.00
## 22	NA	NA	NA
## 23	NA	NA	-17.10
## 24	14.60	0.000	-3.00
## 25	NA	NA	2.10

##	iqr_net_migration
## 1	3.075
## 2	6.900
## 3	NA
## 4	NA
## 5	NA
## 6	1.550
## 7	3.100
## 8	5.400
## 9	0.900
## 10	NA
## 11	1.050
## 12	1.475
## 13	3.575
## 14	3.100
## 15	3.700
## 16	0.000
## 17	5.800
## 18	15.100
## 19	6.150
## 20	4.400
## 21	0.000
## 22	NA
## 23	12.800
## 24	3.400
## 25	0.200

```
income_sort_map <- c(
  "Not classified" = 5,
  "Low income" = 1,
  "Lower middle income" = 2,
  "Upper middle income" = 3,
  "High income" = 4
)
```

```
extended_variability_summary$income_rank <- income_sort_map[extended_variability_summary$income]
```

```
extended_variability_summary <- extended_variability_summary[order(extended_variability_summary$income_r
```

```
long_format <- pivot_longer(
  extended_variability_summary,
  cols = -c(income, continent, income_rank),
  names_to = "metric_stat",
  values_to = "value"
)
```

```
print(long_format)
```

```
## # A tibble: 150 x 5
##   income      continent income_rank metric_stat      value
##   <chr>      <chr>      <dbl> <chr>      <dbl>
## 1 Low income Africa          1 median_expenditure    3.1
## 2 Low income Africa          1 iqr_expenditure      2.65
## 3 Low income Africa          1 median_youth_unemployment  9.05
## 4 Low income Africa          1 iqr_youth_unemployment 14.2
## 5 Low income Africa          1 median_net_migration    -0.85
## 6 Low income Africa          1 iqr_net_migration      3.08
## 7 Low income Asia            1 median_expenditure    4.1
## 8 Low income Asia            1 iqr_expenditure        0
## 9 Low income Asia            1 median_youth_unemployment 24.5
## 10 Low income Asia           1 iqr_youth_unemployment   9.1
## # i 140 more rows
```

```
wide_format <- pivot_wider(
  long_format,
  names_from = metric_stat,
  values_from = value
)
```

```
print(wide_format)
```

```
## # A tibble: 25 x 9
##   income      continent income_rank median_expenditure iqr_expenditure
##   <chr>      <chr>      <dbl>      <dbl>      <dbl>
## 1 Low income Africa          1          3.1          2.65
## 2 Low income Asia            1          4.1           0
## 3 Low income Oceania         1          NA          NA
## 4 Low income Americas        1          NA          NA
```

```
## 5 Low income Europe 1 NA NA
## 6 Lower middle income Africa 2 3.8 1.98
## 7 Lower middle income Asia 2 4 2.7
## 8 Lower middle income Oceania 2 4.5 5.7
## 9 Lower middle income Americas 2 5.25 2.4
## 10 Lower middle income Europe 2 NA NA
## # i 15 more rows
## # i 4 more variables: median_youth_unemployment <dbl>,
## #   iqr_youth_unemployment <dbl>, median_net_migration <dbl>,
## #   iqr_net_migration <dbl>
```

I prefer the wide format. It's less rows and reading. Maybe, if somebody wanted a spread out version, with all the values laid out in one column, that would be useful.

- Identify countries performing well in terms of both **youth unemployment** and **net migration rate** (top 25% in net migration and bottom 25% in youth unemployment within their continent).

```
# filter to include only rows where both metrics exist
filtered_df <- income_status_df %>%
  filter(!is.na(youth_unemployment), !is.na(net_migration))

# compute thresholds for each continent
quantile_df <- filtered_df %>%
  group_by(continent) %>%
  mutate(
    net_migration_75 = quantile(net_migration, 0.75, na.rm = TRUE),
    youth_unemp_25 = quantile(youth_unemployment, 0.25, na.rm = TRUE)
  )

# select countries above 75th percentile for net migration and below 25th percentile for youth unemployment
top_performers <- quantile_df %>%
  filter(
    net_migration >= net_migration_75,
    youth_unemployment <= youth_unemp_25
  ) %>%
  select(country, continent, youth_unemployment, net_migration)

print(top_performers)
```

```
## # A tibble: 16 x 4
## # Groups:   continent [5]
##   country      continent youth_unemployment net_migration
##   <chr>         <chr>          <dbl>          <dbl>
## 1 Togo         Africa          3.9            0
## 2 Madagascar  Africa          1              0
## 3 Côte d'Ivoire Africa          5.5            1.2
## 4 Benin        Africa          5.6            0.3
## 5 Guinea      Africa          1              0
## 6 Ecuador     Americas        7.9            0
## 7 Norway      Europe          9.7            4
## 8 Israel      Asia            7.2            2.1
## 9 Switzerland Europe          7.9            4.6
## 10 United States Americas        8.6            3
```

## 11 Malta	Europe	9.1	6.6
## 12 Macao SAR China	Asia	5.3	3.3
## 13 Qatar	Asia	0.4	6.5
## 14 Bahrain	Asia	5.3	10.6
## 15 United Arab Emirates	Asia	6.9	7.6
## 16 Palau	Oceania	5.6	0.9

g. Conditional Probabilities

Estimate the following based on the observed frequencies in the data:

- What is the (posterior or conditional) probability that a European country belongs to the high income group? What is the prior probability that a country belongs to the high income group?

```

european_countries <- df_vars[df_vars$continent == "Europe",]

```

```

#probability that a country is european

```

```

prob_european_country <- length(unique(european_countries$country))/length(df_vars$country) #num of eur

```

```

prob_european_country

```

```

## [1] 0.215859

```

```

#calculating prior probability that a country belongs to the high income group

```

```

prior_probability_high_income <- nrow(df_vars[df_vars$income == "High income",]) / length(df_vars$country)

```

```

prior_probability_high_income

```

```

## [1] 0.3744493

```

```

european_countries_high_income <- european_countries[european_countries$income == "High income",]

```

```

#calculating the probability that the country belongs to a high income group given that the country is european

```

```

posterior_prob <- (prob_european_country * (nrow(european_countries_high_income)/nrow(european_countries)))

```

```

posterior_prob

```

```

## [1] 0.4470588

```

- Given a country has high youth unemployment (above %25), what is the probability that it also has negative net migration?

```

# countries with high youth unemployment

```

```

high_unemp <- df_vars[df_vars$youth_unemployment > 25, ]

```

```

# number of such countries

```

```

n_high_unemp <- nrow(high_unemp)

```

```
# among those, how many have negative net migration
n_negative_migration_given_high_unemp <- nrow(high_unemp[high_unemp$net_migration < 0, ])

# conditional probability
prob_negative_migration_given_high_unemp <- ((n_negative_migration_given_high_unemp * (nrow(high_unemp)
prob_negative_migration_given_high_unemp

## [1] 0.3348018
```

h. Simpson's Paradox Analysis

Investigate whether an overall trend in youth unemployment rate in the high and low income groups reverses when analyzed at the continent level. E.g., does the youth unemployment rate appear lower in low-income countries overall, but higher when controlling for continent? Explain the results and possible reasons behind this paradox.

```
aggregate_overall <- aggregate(youth_unemployment ~ income, df_vars, mean, na.rm = TRUE)
print(aggregate_overall)

##           income youth_unemployment
## 1      High income          16.46812
## 2      Low income           15.40000
## 3 Lower middle income        17.10222
## 4      Not classified         14.60000
## 5 Upper middle income        22.81489

aggregate_by_continent <- aggregate(youth_unemployment ~ income + continent, df_vars, mean, na.rm = TRUE)
print(aggregate_by_continent)
```

```
##           income continent youth_unemployment
## 1      High income   Africa          11.60000
## 2      Low income   Africa          13.41875
## 3 Lower middle income Africa          18.67619
## 4 Upper middle income Africa          39.28571
## 5      High income Americas          19.88462
## 6 Lower middle income Americas           8.70000
## 7      Not classified Americas          14.60000
## 8 Upper middle income Americas          16.78750
## 9      High income   Asia           11.69286
## 10     Low income   Asia           25.96667
## 11 Lower middle income Asia           17.40625
## 12 Upper middle income Asia           18.35000
## 13     High income   Europe          15.36765
## 14 Upper middle income Europe          29.05556
## 15     High income Oceania          25.71429
## 16 Lower middle income Oceania          14.56000
## 17 Upper middle income Oceania          15.66667
```

Initially, it seems like when the data is not aggregated according to continent high income countries have higher youth unemployment rate than low income countries. However, if we aggregate based on continent,

then the story changes. The high income countries have consistently lower youth unemployment rate. For example, in Africa $11.60000 < 13.41875$. In Asia, the difference is even larger: $11.69286 < 25.96667$.

The Simpson's paradox usually happens due to different sample sizes across continents (for example that in Africa and Asia, there are more low-income countries). For example, Europe does not even have the category low income. Generally, confounding variables skew the initial results and casual relationships are properly addressed as well.

i. Data Export

Export the final tidy dataset from e. as a **CSV** with: ; as a separator; . representing missing values; no row names included. Upload the .csv to TUWEL, together with the submission.

```
# export to CSV without row names
write.table(df_vars,
            file='data/final_df.csv',
            row.names=FALSE,
            col.names=TRUE,
            sep=';',
            na='.',
            quote=FALSE)
```