finland_real_estate_population_preprocessing

November 10, 2025

1 Finland Population Analysis

1.1 Runtime Setup

[1]:
```
# data processing
import pandas as pd
import numpy as np

# plotting
import matplotlib.pyplot as plt
import seaborn as sns
import geopandas as gpd
```

1.2 Artifacts and Constants

[2]:
```
# input
population_finland_file_path = "../data/population_finland_stat_fi.csv"
real_estate_finland_file_path = "../data/real_estate_finland_stat_fi.csv"
regions_mapping_file_path = "../data/regions_stat_fi.csv"
map_finland_file_path = "../data/map_finland/maakunta1000k_2025Polygon.shp"
# output
population_real_estate_finland_file_path = "../data/preprocessed/
 ↪population_real_estate_fi.csv"
```

1.3 Data Loading

[3]:
```
population_finland_raw = pd.read_csv(population_finland_file_path,␣
 ↪encoding="windows-1252")
population_finland_raw
```

[3]:

	Area	Information	1990	1991	\
0	Akaa	Population 31 Dec	16048.00	16096.00	
1	Akaa	Share of persons aged under 15, %	18.50	18.50	
2	Akaa	Share of persons aged 15 to 64, %	65.70	65.50	
3	Akaa	Share of persons aged 65 or over, %	15.80	16.10	
4	Akaa	Demographic dependency ratio	52.20	52.70	
…	…	…	…	…	
5231	Äänekoski	Foreign-language speakers	35.00	57.00	

```
5232  Äänekoski        Citizens of foreign countries     47.00     80.00
5233  Äänekoski                  Persons born abroad    223.00    248.00
5234  Äänekoski      Persons with foreign background     64.00     91.00
5235  Äänekoski                        Land area, km²    888.12    888.12

          1992      1993      1994      1995      1996      1997  …  \
0     16201.00  16142.00  16038.00  15986.00  15924.00  15840.00  …
1        18.80     18.60     18.90     18.70     18.60     18.30  …
2        65.20     65.00     64.40     64.30     64.20     64.40  …
3        16.00     16.40     16.70     17.00     17.20     17.30  …
4        53.40     53.80     55.20     55.50     55.70     55.40  …
…        …         …         …         …         …         …  …
5231     67.00     89.00     96.00     98.00    102.00    119.00  …
5232    101.00    126.00    137.00    135.00    141.00    170.00  …
5233    264.00    283.00    286.00    290.00    283.00    298.00  …
5234    103.00    123.00    128.00    130.00    136.00    154.00  …
5235    888.12    888.15    888.07    888.07    888.07    888.08  …

          2015      2016      2017      2018      2019      2020      2021  \
0     17043.00  16923.00  16769.00  16611.00  16475.00  16391.00  16467.00
1        18.50     18.30     18.00     17.70     17.20     16.50     16.30
2        60.50     60.20     59.80     59.40     59.30     59.30     58.90
3        21.00     21.50     22.20     22.90     23.50     24.20     24.80
4        65.30     66.20     67.20     68.30     68.70     68.60     69.70
…        …         …         …         …         …         …         …
5231    291.00    319.00    305.00    295.00    332.00    341.00    342.00
5232    234.00    247.00    226.00    212.00    246.00    262.00    261.00
5233    443.00    466.00    456.00    443.00    478.00    494.00    489.00
5234    304.00    330.00    317.00    310.00    340.00    355.00    358.00
5235    884.49    884.54    884.57    884.57    884.57    884.58    884.62

          2022     2023    2024
0     16473.00  16405.0   16387
1        15.70     15.3    15.0
2        58.90     59.1    59.2
3        25.40     25.6    25.8
4        69.80     69.2    68.9
…        …         …       …
5231    331.00    495.0     604
5232    242.00    390.0     495
5233    484.00    640.0     740
5234    342.00    504.0     612
5235    884.61    884.6  884.61

[5236 rows x 37 columns]
```

[4]:
```
real_estate_finland_raw = pd.read_csv(real_estate_finland_file_path,␣
↪encoding="windows-1252")
real_estate_finland_raw
```

[4]:

	Region	2015Q1 Index	2015Q1 Quarterly change, %	\
0	Whole country	100.7	.	
1	Greater Helsinki	101.3	.	
2	Whole country - Greater Helsinki	100.5	.	
3	Satellite municipalities	100.3	.	
4	Over 100 000 inhabitants	101.8	.	
5	20 000 - 100 000 inhabitants	100.0	.	
6	Under 20 000 inhabitants	100.2	.	
7	Southern Finland	101.9	.	
8	Western Finland	97.8	.	
9	Eastern Finland	108.4	.	
10	Northern Finland	94.3	.	

	2015Q1 Annual change, %	2015Q1 Real price index	\
0	.	100.9	
1	.	101.5	
2	.	100.6	
3	.	100.5	
4	.	102.0	
5	.	100.1	
6	.	100.4	
7	.	102.1	
8	.	97.9	
9	.	108.6	
10	.	94.5	

	2015Q1 Quarterly change, % (real price index)	\
0	.	
1	.	
2	.	
3	.	
4	.	
5	.	
6	.	
7	.	
8	.	
9	.	
10	.	

	2015Q1 Annual change, % (real price index)	\
0	.	
1	.	
2	.	

3	.
4	.
5	.
6	.
7	.
8	.
9	.
10	.

	2015Q1 Price per square meter (EUR/m2)	2015Q1 Lower quartile	\
0	19.3	5.0	
1	150.0	134.5	
2	15.0	4.4	
3	38.2	41.6	
4	61.3	41.4	
5	20.4	8.0	
6	8.3	3.0	
7	35.1	10.0	
8	13.9	3.6	
9	11.9	3.6	
10	9.8	2.8	

	2015Q1 Medianprice	…	2025Q2 Annual change, %	2025Q2 Real price index	\
0	18.7	…	-5.2	90.8	
1	169.5	…	-23.9	131.7	
2	14.1	…	2.2	79.9	
3	61.3	…	11.0	98.6	
4	92.7	…	-13.5	116.4	
5	27.1	…	8.9	79.9	
6	6.7	…	-13.4	77.6	
7	44.9	…	-8.9	100.6	
8	13.6	…	6.0	80.5	
9	9.9	…	2.0	49.4	
10	9.1	…	-11.5	91.2	

	2025Q2 Quarterly change, % (real price index)	\
0	2.9	
1	0.6	
2	3.6	
3	9.7	
4	7.0	
5	6.7	
6	-8.7	
7	-0.9	
8	13.7	
9	2.3	
10	3.3	

	2025Q2 Annual change, % (real price index)
0	-5.6
1	-24.2
2	1.8
3	10.5
4	-13.9
5	8.4
6	-13.8
7	-9.3
8	5.6
9	1.6
10	-11.8

	2025Q2 Price per square meter (EUR/m2)	2025Q2 Lower quartile
0	21.3	3.7
1	202.0	108.8
2	15.5	3.5
3	38.0	27.0
4	100.0	39.3
5	20.9	5.8
6	9.5	2.4
7	39.9	9.4
8	15.6	3.0
9	5.4	1.0
10	13.3	3.0

	2025Q2 Medianprice	2025Q2 Upper quartile	2025Q2 Average area m2
0	14.6	46.4	3004
1	208.0	269.1	1786
2	12.8	41.2	3071
3	78.5	107.6	2755
4	75.0	183.7	1870
5	27.8	57.7	2896
6	7.0	16.5	3408
7	32.0	78.0	2591
8	13.3	32.1	2990
9	3.3	9.0	4939
10	9.8	42.0	2857

	2025Q2 Number
0	573
1	40
2	533
3	39
4	87
5	218

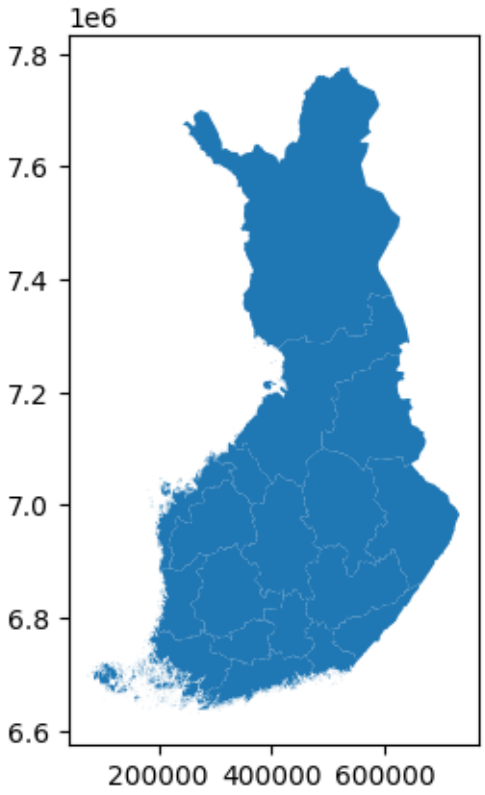
```
6             268
7             225
8             183
9              54
10            111

[11 rows x 505 columns]
```

[5]:
```
regions_mapping = pd.read_csv(regions_mapping_file_path)
regions_mapping
```

[5]:
```
    Municipality              Region          Province
0           Akaa           Pirkanmaa   Western Finland
1        Alajärvi  South Ostrobothnia   Western Finland
2      Alavieska  North Ostrobothnia  Northern Finland
3         Alavus  South Ostrobothnia   Western Finland
4       Asikkala         Päijät-Häme   Western Finland
..           …                   …               …
303    Ylivieska  North Ostrobothnia  Northern Finland
304     Ylöjärvi           Pirkanmaa   Western Finland
305        Ypäjä         Kanta-Häme   Western Finland
306       Ähtäri  South Ostrobothnia   Western Finland
307    Äänekoski     Central Finland   Western Finland

[308 rows x 3 columns]
```

[6]:
```
map_finland = gpd.read_file(map_finland_file_path)
map_finland.plot()
```

[6]:
```
<Axes: >
```



1.4 Data Cleaning

The data provided by the Statistics Finland website is quite clean already. For direct correct representation in the form of one single table, it needs to be restructured using the pandas `melt` function. The Area and Information columns are used repeatedly to transform whole columns into new rows.

Concerning the data quality, only empty values marked as `.` need to be filled. In the preprocessing, each of these dots is replaced by NaN. This ensures that all following aggregations work correctly.

1.4.1 Population

[7]:
```
population_finland = population_finland_raw.melt(
    id_vars=["Area", "Information"],
    var_name="Year",
    value_name="Value"
)
population_finland["Value"] = pd.to_numeric(
    population_finland["Value"]
    .astype(str)
    .str.strip()
    .replace(".", np.nan) # empty values are set to . in the dataset
```

```
)
population_finland["Year"] = population_finland["Year"].astype(int)

population_finland = population_finland.pivot_table(
    index=["Area", "Year"],
    columns="Information",
    values="Value"
).reset_index()


population_finland.columns.name = None
population_finland = population_finland.sort_values(["Area", "Year"]).
 ↪reset_index(drop=True)

population_finland
```

[7]:

	Area	Year	Average age, both sexes	Average age, men	Average age, women	Citizens of foreign countries	Demographic dependency ratio	Economic dependency ratio
0	Akaa	1990	38.6	36.3	40.8	70.0	52.2	130.7
1	Akaa	1991	38.8	36.6	41.0	84.0	52.7	152.3
2	Akaa	1992	38.8	36.6	40.9	76.0	53.4	171.6
3	Akaa	1993	39.1	37.0	41.1	96.0	53.8	192.3
4	Akaa	1994	39.3	37.2	41.3	99.0		
…	…	…	…	…	…	…		
10775	Äänekoski	2020	46.5	45.1	48.0	262.0		
10776	Äänekoski	2021	46.9	45.5	48.3	261.0		
10777	Äänekoski	2022	47.2	45.9	48.6	242.0		
10778	Äänekoski	2023	47.6	46.2	48.9	390.0		
10779	Äänekoski	2024	47.9	46.5	49.3	495.0		

```
4                              55.2                      183.2
…                              …                         …
10775                          75.9                      190.7
10776                          76.9                      174.2
10777                          77.9                      168.1
10778                          78.0                      183.7
10779                          79.8                        NaN

       Finnish speakers  Foreign-language speakers  Land area, km²  \
0               15958.0                       65.0          293.08
1               15993.0                       78.0          293.08
2               16111.0                       66.0          293.08
3               16027.0                       83.0          292.99
4               15928.0                       83.0          292.99
…                 …                           …             …
10775           18211.0                      341.0          884.58
10776           17949.0                      342.0          884.62
10777           17761.0                      331.0          884.61
10778           17450.0                      495.0          884.60
10779           17113.0                      604.0          884.61

       Persons born abroad  Persons with foreign background  \
0                    170.0                             96.0
1                    191.0                            108.0
2                    177.0                             93.0
3                    198.0                            110.0
4                    191.0                            109.0
…                    …                                …
10775                494.0                            355.0
10776                489.0                            358.0
10777                484.0                            342.0
10778                640.0                            504.0
10779                740.0                            612.0

       Population 31 Dec  Sami speakers  Share of persons aged 15 to 64, %  \
0                16048.0            0.0                                65.7
1                16096.0            0.0                                65.5
2                16201.0            0.0                                65.2
3                16142.0            0.0                                65.0
4                16038.0            0.0                                64.4
…                  …                …                                  …
10775            18577.0            6.0                                56.8
10776            18318.0            6.0                                56.5
10777            18120.0            7.0                                56.2
10778            17971.0            7.0                                56.2
10779            17740.0            7.0                                55.6
```

```
       Share of persons aged 65 or over, %  Share of persons aged under 15, %  \
0                                     15.8                                18.5
1                                     16.1                                18.5
2                                     16.0                                18.8
3                                     16.4                                18.6
4                                     16.7                                18.9
…                                      …                                   …
10775                                 27.9                                15.2
10776                                 28.6                                14.9
10777                                 29.2                                14.6
10778                                 29.6                                14.2
10779                                 30.4                                14.0

       Swedish speakers
0                  25.0
1                  25.0
2                  24.0
3                  32.0
4                  27.0
…                   …
10775              19.0
10776              21.0
10777              21.0
10778              19.0
10779              16.0

[10780 rows x 19 columns]
```

1.4.2 Real Estate Prices

[8]:
```
real_estate_finland = real_estate_finland_raw.melt(id_vars=["Region"],␣
 ↪var_name="Variable", value_name="Value")

real_estate_finland["Year"] = real_estate_finland["Variable"].str.
 ↪extract(r"^(\d{4})Q\d").astype(int)
real_estate_finland["Quarter"] = real_estate_finland["Variable"].str.
 ↪extract(r"^\d{4}Q(\d)").astype(int)
real_estate_finland["Indicator"] = real_estate_finland["Variable"].str.
 ↪replace(r"^\d{4}Q\d\s*", "", regex=True)

real_estate_finland["Value"] = pd.to_numeric(
    real_estate_finland["Value"]
    .astype(str)
    .str.strip()
    .replace(".", np.nan) # empty values are set to . in the dataset
)
```

```
real_estate_finland = (
    real_estate_finland.pivot_table(
        index=["Region", "Year", "Quarter"],
        columns="Indicator",
        values="Value"
    ).reset_index()
)

real_estate_finland.columns.name = None
real_estate_finland = real_estate_finland.sort_values(["Region", "Year",␣
 ↪"Quarter"]).reset_index(drop=True)
real_estate_finland
```

[8]:

	Region	Year	Quarter	Annual change, %	\
0	20 000 - 100 000 inhabitants	2015	1	NaN	
1	20 000 - 100 000 inhabitants	2015	2	NaN	
2	20 000 - 100 000 inhabitants	2015	3	NaN	
3	20 000 - 100 000 inhabitants	2015	4	NaN	
4	20 000 - 100 000 inhabitants	2016	1	4.8	
..	…	…	…	…	
457	Whole country - Greater Helsinki	2024	2	-7.1	
458	Whole country - Greater Helsinki	2024	3	0.3	
459	Whole country - Greater Helsinki	2024	4	-12.4	
460	Whole country - Greater Helsinki	2025	1	-13.8	
461	Whole country - Greater Helsinki	2025	2	2.2	

	Annual change, % (real price index)	Average area m2	Index	\
0	NaN	2460.0	100.0	
1	NaN	2221.0	102.9	
2	NaN	2802.0	94.2	
3	NaN	2698.0	103.2	
4	4.9	2118.0	104.8	
..	…	…	…	
457	-8.5	3076.0	96.0	
458	-0.7	2963.0	104.6	
459	-13.2	3043.0	92.7	
460	-14.3	3034.0	94.8	
461	1.8	3071.0	98.2	

	Lower quartile	Medianprice	Number	Price per square meter (EUR/m2)	\
0	8.0	27.1	242.0	20.4	
1	11.0	32.1	364.0	24.7	
2	6.7	21.7	289.0	17.0	
3	8.0	28.0	258.0	20.1	
4	8.7	30.0	231.0	24.1	
..	…	…	…	…	
457	4.0	14.1	570.0	16.1	

```
458              3.0          16.2   458.0                              18.1
459              3.5          12.0   431.0                              15.5
460              3.3          13.8   384.0                              18.9
461              3.5          12.8   533.0                              15.5

     Quarterly change, %  Quarterly change, % (real price index)  \
0                    NaN                                     NaN
1                    2.9                                     2.7
2                   -8.4                                    -8.4
3                    9.6                                     9.4
4                    1.5                                     1.9
..                   …                                       …
457                -12.7                                   -12.7
458                  9.0                                     9.0
459                -11.4                                   -11.7
460                  2.3                                     2.0
461                  3.5                                     3.6

     Real price index  Upper quartile
0               100.1            49.0
1               102.8            57.7
2                94.2            48.9
3               103.1            50.4
4               105.0            59.9
..                …               …
457              78.5            44.1
458              85.6            45.1
459              75.6            50.7
460              77.1            50.0
461              79.9            41.2

[462 rows x 15 columns]
```

1.4.3 Combining Datasets

Sadly, the real estate data is not available in the same regional granularity as the population data. For further analyses, the population statistics are aggregated to provinces. Another aggregation to regions allows for nice plots used mainly for exploration of the dataset below.

Additionally, the population data is only available in yearly intervals. Because of this, the time granularity of the real estate data is reduced to years as well.

Finally, the result is one data table directly relating real estate prices and population statistics in Finnish provinces over time.

[9]:
```python
def get_population_agg_operations(data):
    return {
```

```
        "Average age, both sexes": lambda x: np.average(x, weights=data.loc[x.
 ↪index, "Population 31 Dec"]),
        "Average age, men": lambda x: np.average(x, weights=data.loc[x.index,␣
 ↪"Population 31 Dec"]),
        "Average age, women": lambda x: np.average(x, weights=data.loc[x.index,␣
 ↪"Population 31 Dec"]),
        "Citizens of foreign countries": "sum",
        "Demographic dependency ratio": "mean",
        "Economic dependency ratio": "mean",
        "Finnish speakers": "sum",
        "Foreign-language speakers": "sum",
        "Land area, km²": "sum",
        "Persons born abroad": "sum",
        "Persons with foreign background": "sum",
        "Population 31 Dec": "sum",
        "Sami speakers": "sum",
        "Share of persons aged 15 to 64, %": lambda x: np.average(x,␣
 ↪weights=data.loc[x.index, "Population 31 Dec"]),
        "Share of persons aged 65 or over, %": lambda x: np.average(x,␣
 ↪weights=data.loc[x.index, "Population 31 Dec"]),
        "Share of persons aged under 15, %": lambda x: np.average(x,␣
 ↪weights=data.loc[x.index, "Population 31 Dec"]),
        "Swedish speakers": "sum"
    }
```

[10]:
```
population_finland_region = population_finland
population_finland_region = population_finland_region.merge(
    regions_mapping,
    left_on="Area",
    right_on="Municipality",
    how="left"
)

population_finland_region = population_finland_region.drop(columns=["Area"])
population_finland_region = population_finland_region.groupby(["Year",␣
 ↪"Region"]).agg(get_population_agg_operations(population_finland_region)).
 ↪reset_index()
```

[11]:
```
population_finland_province = population_finland
population_finland_province = population_finland_province.merge(
    regions_mapping,
    left_on="Area",
    right_on="Municipality",
    how="left"
)

population_finland_province = population_finland_province.drop(columns=["Area"])
```

```
population_finland_province = population_finland_province.groupby(["Year",␣
↪"Province"]).agg(get_population_agg_operations(population_finland_province)).
↪reset_index()
```

[12]:
```
real_estate_finland_yearly = real_estate_finland.loc[
        real_estate_finland["Region"].isin(["Northern Finland", "Eastern␣
↪Finland", "Southern Finland", "Western Finland"])
        & real_estate_finland["Quarter"].eq(4)
    ]

real_estate_finland_yearly = real_estate_finland_yearly.
↪drop(columns=["Quarter", "Quarterly change, %", "Quarterly change, % (real␣
↪price index)"])
```

[30]:
```
population_real_estate_finland = population_finland_province.merge(
    real_estate_finland_yearly,
    left_on=["Province", "Year"],
    right_on=["Region", "Year"],
    how="inner"
)

population_real_estate_finland.head()
```

[30]:

	Year	Province	Average age, both sexes	Average age, men	\
0	2015	Eastern Finland	45.030691	43.614491	
1	2015	Northern Finland	41.411696	40.261485	
2	2015	Southern Finland	40.918147	39.496620	
3	2015	Western Finland	42.959321	41.516291	
4	2016	Eastern Finland	45.244514	43.845629	

	Average age, women	Citizens of foreign countries	\
0	46.397441	11391.0	
1	42.598357	12539.0	
2	42.217560	133971.0	
3	44.357175	70521.0	
4	46.604816	12096.0	

	Demographic dependency ratio	Economic dependency ratio	Finnish speakers	\
0	74.051163	193.097674	546426.0	
1	71.769492	185.086441	647500.0	
2	64.540000	146.645000	1580028.0	
3	71.039634	158.221341	2082114.0	
4	75.934884	191.344186	542865.0	

	Foreign-language speakers	…	Annual change, %	\
0	16148.0	…	NaN	
1	15790.0	…	NaN	

```
2                   198794.0  …               NaN
3                    97236.0  …               NaN
4                    17351.0  …             -17.4

   Annual change, % (real price index)  Average area m2  Index  \
0                                  NaN           4189.0   95.6
1                                  NaN           3766.0   90.4
2                                  NaN           2669.0   99.1
3                                  NaN           2565.0  101.3
4                                -18.0           3927.0   78.9

   Lower quartile  Medianprice  Number  Price per square meter (EUR/m2)  \
0             1.5          4.7    74.0                             10.0
1             1.7          7.4   128.0                              7.7
2             8.6         35.0   318.0                             32.3
3             4.3         13.6   206.0                             13.7
4             1.9          5.0    74.0                              7.0

   Real price index Upper quartile
0              95.5           13.7
1              90.3           22.5
2              99.0           75.8
3             101.2           33.6
4              78.3           15.0

[5 rows x 30 columns]
```

1.5 Persisting Cleaned Data

[31]:
```
population_real_estate_finland.to_csv(population_real_estate_finland_file_path,␣
↪index=False)
```

1.6 Data Exploration

1.6.1 Summary statistics

The fact that we can directly calculate lots of summary statistics for all columns shows that the resulting dataset is of much higher quality than the original one. With the raw data, it was impossible to calculate any aggregate measure without decoding the values.

[33]:
```
population_real_estate_finland.describe()
```

[33]:
```
              Year  Average age, both sexes  Average age, men  \
count    40.000000                40.000000         40.000000
mean   2019.500000                43.584810         42.274561
std       2.908872                 1.836223          1.821447
min    2015.000000                40.918147         39.496620
25%    2017.000000                42.076508         40.798215
```

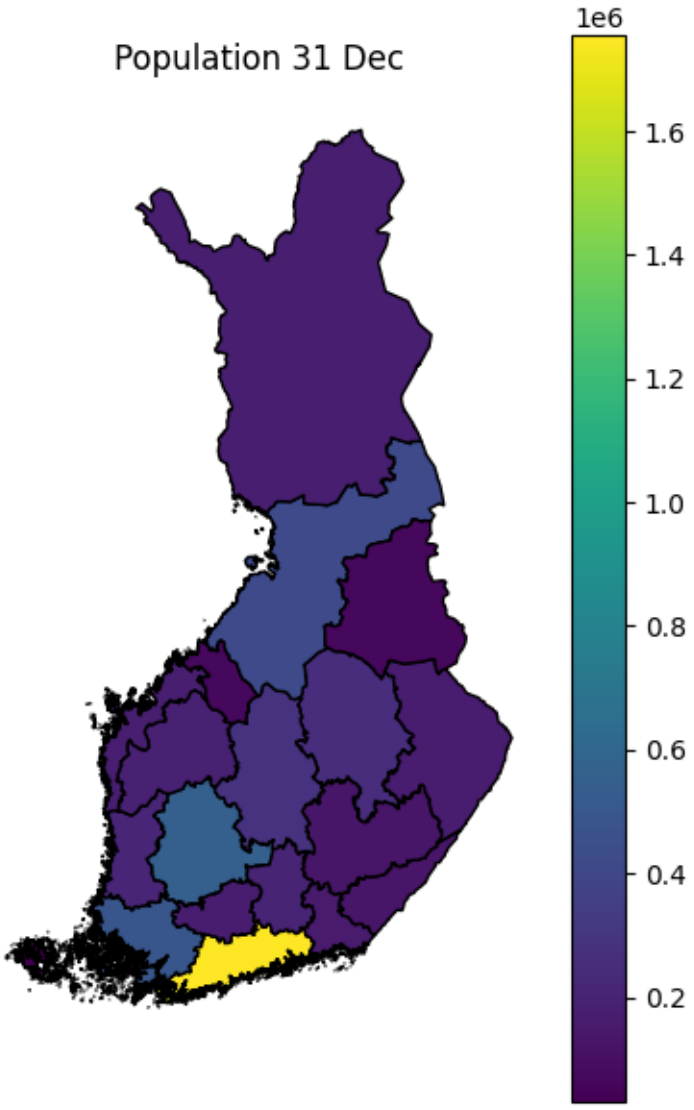
```
50%    2019.500000                43.257826         42.005827
75%    2022.000000                44.788909         43.419490
max    2024.000000                47.166381         45.858776

       Average age, women  Citizens of foreign countries  \
count           40.000000                      40.000000
mean            44.865188                   72925.275000
std              1.855516                   67957.769545
min             42.217560                   11391.000000
25%             43.343334                   13839.000000
50%             44.498159                   47531.000000
75%             46.139584                  131325.000000
max             48.433474                  231495.000000

       Demographic dependency ratio  Economic dependency ratio  \
count                     40.000000                  36.000000
mean                      78.005531                 164.529043
std                        7.607170                  18.189370
min                       64.540000                 138.617500
25%                       71.570625                 148.567866
50%                       78.038978                 162.685247
75%                       82.909079                 182.790589
max                       94.941860                 193.097674

       Finnish speakers  Foreign-language speakers  Land area, km²  …  \
count      4.000000e+01                  40.000000       40.000000  …
mean       1.200601e+06              109967.925000    75418.356500  …
std        6.494616e+05              106934.587778    49784.275017  …
min        5.083170e+05               15790.000000    17835.190000  …
25%        6.085050e+05               19411.250000    40769.935000  …
50%        1.105234e+06               64497.000000    67231.485000  …
75%        1.696713e+06              186960.500000   101695.955000  …
max        2.082114e+06              361986.000000   149726.900000  …

       Annual change, %  Annual change, % (real price index)  Average area m2  \
count         36.000000                           36.000000        40.000000
mean           1.483333                           -0.741667      3241.375000
std           20.279441                           19.874957       776.516438
min          -53.000000                          -54.800000      2146.000000
25%           -9.050000                          -10.425000      2642.000000
50%            1.350000                            0.500000      3049.500000
75%           14.550000                           13.250000      3734.500000
max           47.500000                           42.000000      5064.000000

           Index  Lower quartile  Medianprice     Number  \
count   40.00000       40.000000    40.000000   40.00000
mean   101.89750        4.560000    16.900000  190.72500
```

```
std     20.00812        3.892649    15.514162  130.86595
min     48.60000        1.000000     3.600000   37.00000
25%     90.27500        1.900000     5.975000   84.75000
50%    101.10000        3.150000    10.750000  148.50000
75%    108.45000        4.350000    19.075000  249.25000
max    158.70000       14.200000    53.400000  576.00000

       Price per square meter (EUR/m2)  Real price index  Upper quartile
count                        40.000000         40.000000         40.0000
mean                         18.575000         94.635000         46.1300
std                          13.616802         17.684015         33.6412
min                           4.000000         40.000000         10.0000
25%                           8.475000         88.075000         20.6750
50%                          14.300000         95.550000         33.4500
75%                          21.050000        101.475000         62.9000
max                          47.700000        133.400000        118.8000

[8 rows x 28 columns]
```

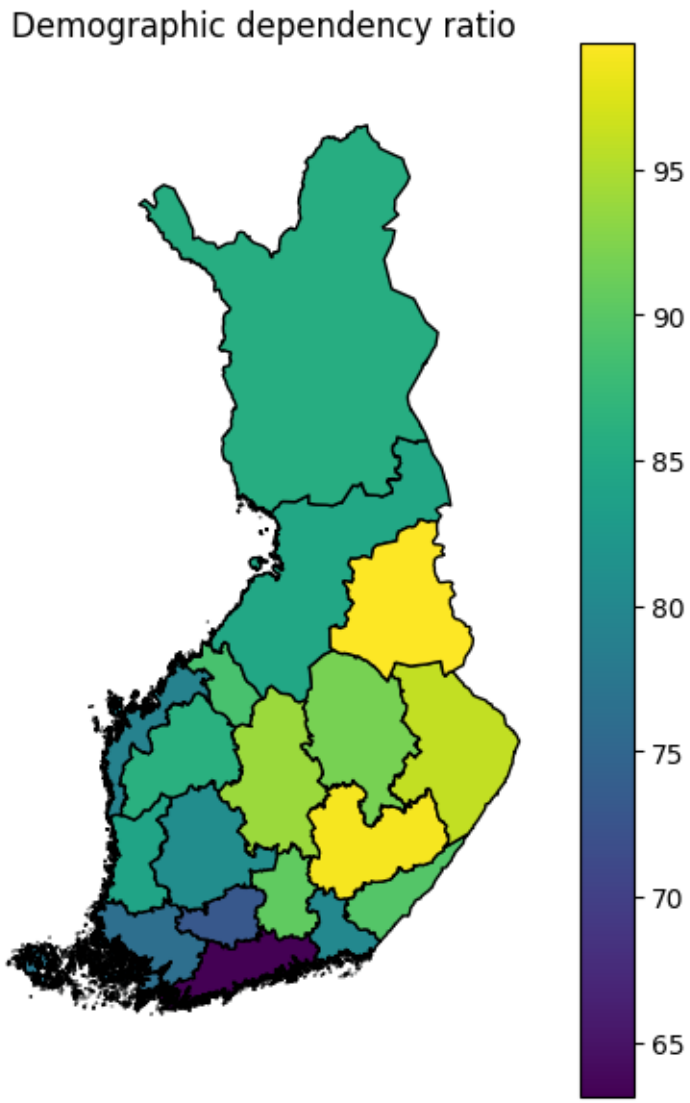
1.6.2 Finland Map Plots

[15]:
```
def plot_country_map(data, column_name, country_map=map_finland, cmap =␣
↪"viridis", figsize = (4, 6)):
    country_map_data = country_map.merge(
        data,
        left_on="name",
        right_on="Region",
        how="left"
    )

    fig, ax = plt.subplots(figsize=figsize)
    country_map_data.plot(column=column_name, cmap=cmap, legend=True, ax=ax,␣
↪edgecolor="black")
    ax.set_axis_off()
    plt.title(column_name)

    plt.tight_layout()
```

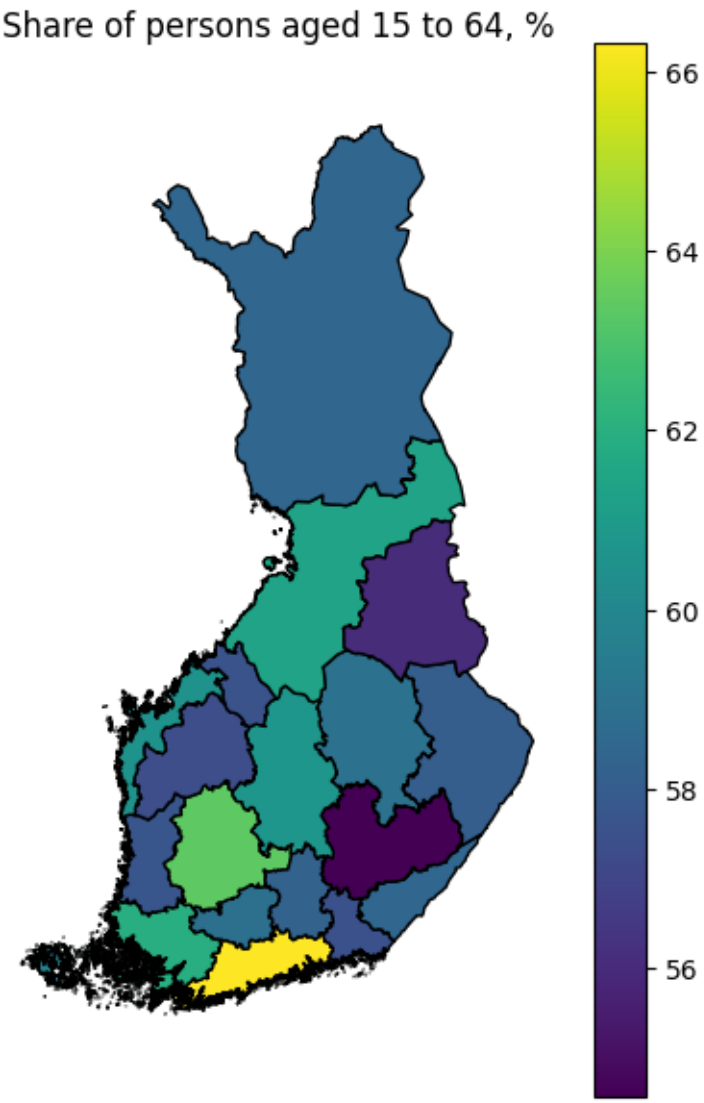
[27]:
```
plot_country_map(population_finland_region[population_finland_region["Year"] ==␣
↪2024], "Population 31 Dec")
```



[16]:
```
plot_country_map(population_finland_region[population_finland_region["Year"] ==␣
↪2024], "Demographic dependency ratio")
```



[21]:
```
plot_country_map(population_finland_region[population_finland_region["Year"] ==␣
↪2024], "Share of persons aged 15 to 64, %")
```



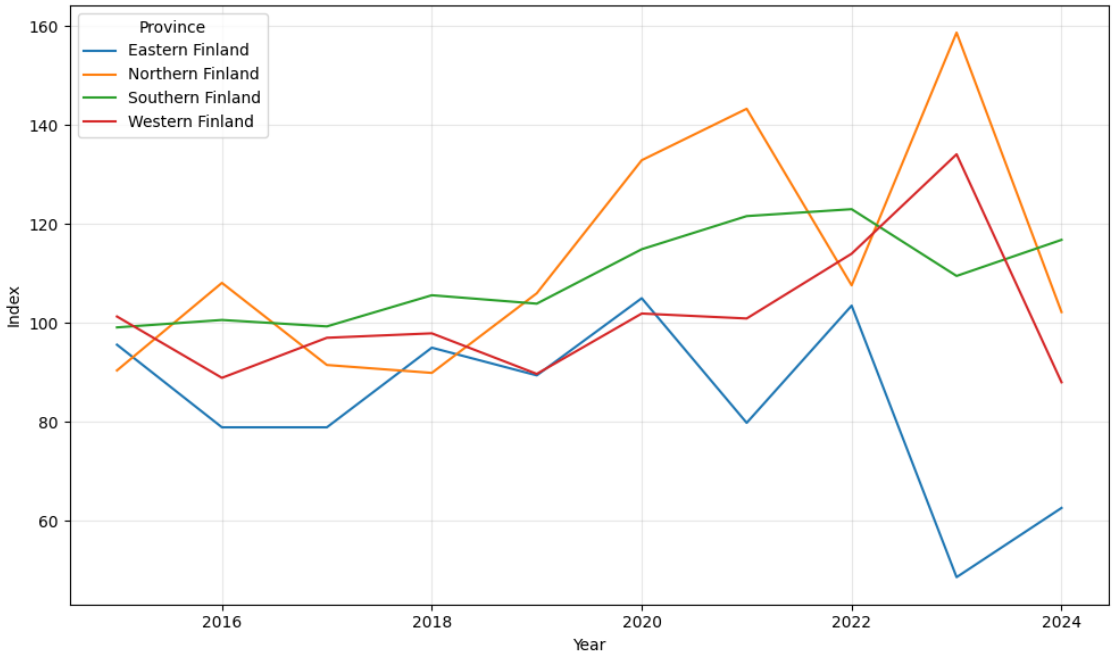
1.6.3 Timeseries Plots

[28]:
```
def plot_province_timeseries(
    data,
    x_column,
    y_column,
    provinces = ["Eastern Finland", "Northern Finland", "Southern Finland",␣
 ↪"Western Finland"],
    figsize = (10, 6)
):
    plt.figure(figsize=figsize)

    for province in provinces:
```

```
        province_data = data[data["Province"] == province]
        plt.plot(province_data[x_column], province_data[y_column],␣
↪label=province)

    plt.xlabel(x_column)
    plt.ylabel(y_column)
    plt.legend(title="Province")
    plt.grid(True, alpha=0.3)
    plt.tight_layout()
```

1.6.4 Real Estate Index

[19]:
```
plot_province_timeseries(population_real_estate_finland, "Year", "Index")
```



1.6.5 Population Dynamics

Without normalization, the plot does not look great. After dividing by the first value, one can observe the real population change over the last years. Visually, one can already observer that population changes and real estate prices had a similar trend in the last years.

[26]:
```
plot_province_timeseries(
    population_real_estate_finland.assign(
        population_normed=lambda df: df.groupby("Province")["Population 31␣
↪Dec"].transform(lambda x: x / x.iloc[0])
    ),
```

```
    "Year",
    "population_normed"
)
```