R_Hawthorne_Python Project

August 25, 2023

Read in libraries

```
[3]: import openpyxl
     import pandas as pd
     import numpy as np
     import seaborn as sns
     import matplotlib.pyplot as plt
     import re
     import requests
```

Functions that I made/found/edited to make my life easier

```
[4]: def stats_df_creator (df, grouping, column):
         '''
         Parameters
         ----------
         df : dataframe of data
         grouping : column to group by
         column : column we want stats on
         Returns df with mean, median and third quantile values for column
         '''
         stats_df = df.groupby([grouping]).agg(
             median=(column , np.median),
             mean = (column, np.mean),
             third_quantile = ( column, lambda x: np.percentile(x, q=75))
             )
         return stats_df
```

```
[5]: def print_countries(index_phrase, df):
         '''
         Parameters
         ----------
         index_phrase : phrase decribing the current index that I am printing
         df : df that top 5 countries of that index are in
         prints the countries for the top 5 scaled index
         '''
         print('The 5 countries in which salary goes the farthest on the '␣
      ↪+str(index_phrase) + ' index are:\n')
```

```
    for idx, country_code in enumerate(df['employee_residence']):
        for key, value in country_code_dict.items():
            if country_code == value:
                print(key)
    return
```

[19]:
```
def convert_currency(amount, from_currency):
    '''
    Parameters
    ----------
    amount : amount of money to be converted
    from_currency: currency to be converted from
    Returns currency is USD
    '''
    response = requests.get("https://v6.exchangerate-api.com/v6/
 ↪45ab531ce52b1a50df0c239b/latest/USD")
    data = response.json()

    if 'conversion_rates' in data:
        rates = data['conversion_rates']
        if from_currency == '':
            return amount

        if from_currency in rates :
            converted_amount = amount / rates[from_currency]
            return converted_amount
        else:
            raise ValueError("Invalid currency!")
    else:
        raise ValueError("Unable to fetch exchange rates!")
    return
```

[7]:
```
def print_cities(index_phrase, df):
    '''
    Parameters
    ----------
    index_phrase : phrase decribing the current index that I am printing
    df : df that top 5 citiess of that index are in
    prints the cities for the top 5 scaled index
    '''
    print('The 5 cities in which salary goes the farthest on the '␣
 ↪+str(index_phrase) + ' index are:')

    for idx, city in enumerate(df['City']):
        print(city)
    return
```

Read in all the data files, including the currency codes I got from https://www.exchangerate-api.com/docs/supported-currencies .

Then remove parenthesis from the country codes df.

```
[8]: cost_of_living_df = pd.read_csv('cost_of_living.csv')
     country_codes_df = pd.read_excel('country_codes.xlsx', engine='openpyxl')
     ds_salaries_df = pd.read_csv('ds_salaries.csv')
     levels_fyi_salary_data_df = pd.read_csv('Levels_Fyi_Salary_Data.csv')
     currency_codes = pd.read_csv('currency_codes.csv')

     #removning the () from the country names
     country_codes_df['Country'] = country_codes_df['Country'].str.replace('\(.
      ↪*\)','')
```

```
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\2988162007.py:8:
FutureWarning: The default value of regex will change from True to False in a
future version.
  country_codes_df['Country'] =
country_codes_df['Country'].str.replace('\(.*\)','')
```

Convert currency codes df and country codes to dictionaries to be used later.

```
[9]: from collections import defaultdict
     # Function to return a default
     # values for keys that is not
     # present
     def def_value():
         return "Not Present"

     country_code_dict = defaultdict(def_value, zip(country_codes_df['Country'],␣
      ↪country_codes_df['Alpha-2 code']))

     currency_codes_dict= defaultdict(def_value, zip(currency_codes['Country'],␣
      ↪currency_codes['Currency Code']))
```

Start editing salary data:

Get just data science salaries for entry level (less then 4 years of expereince), fulltime employes from Levels_fyi_slary_data_df and ds_salaries_df

Then return columns with salary date, location, and salary

Reindex

```
[10]: data_science_levels_fyi_salary_data_df = levels_fyi_salary_data_df.
       ↪loc[(levels_fyi_salary_data_df["title"] =='Data Scientist')
                                     &(levels_fyi_salary_data_df["yearsofexperience"] <␣
       ↪4),
                                 ['timestamp','totalyearlycompensation',␣
 ↪'location']]



data_science_ds_salaries_df = ds_salaries_df.loc[(ds_salaries_df['job_title'] ==␣
 ↪'Data Scientist')
                     & (ds_salaries_df['employment_type'] == 'FT')
                     & (ds_salaries_df['experience_level'] == 'EN'),
                     ['work_year' , 'salary_in_usd' , 'employee_residence']]

data_science_ds_salaries_df = data_science_ds_salaries_df.reset_index(drop=True)

data_science_levels_fyi_salary_data_df = data_science_levels_fyi_salary_data_df.
 ↪reset_index(drop=True)

print(data_science_levels_fyi_salary_data_df.head())
print(data_science_ds_salaries_df.head())
```

```
            timestamp  totalyearlycompensation           location
0  6/17/2018 19:02:50                   200000        Seattle, WA
1  6/21/2018 10:54:35                   600000      Los Gatos, CA
2  8/15/2018 11:57:44                   120000     Washington, DC
3  8/15/2018 15:38:02                   220000        Redmond, WA
4  8/15/2018 20:38:36                   147000  San Francisco, CA
   work_year  salary_in_usd employee_residence
0       2020          51321                 FR
1       2020          39916                 FR
2       2020          62726                 DE
3       2020          49268                 DE
4       2020         105000                 US
```

cleaning data: For data_science_levels_fyi_salary_data_df Create work_year column

`Break location into city, state and country; then add country code`

```
[11]: data_science_levels_fyi_salary_data_df.dtypes

data_science_levels_fyi_salary_data_df['work_year'] = pd.
 ↪to_datetime(data_science_levels_fyi_salary_data_df['timestamp'] , format='%m/
 ↪%d/%Y %H:%M:%S').dt.year

data_science_levels_fyi_salary_data_df[['city','state','country']] =␣
 ↪data_science_levels_fyi_salary_data_df["location"].str.split(', ',expand=True)



#####add country for those locations that only had city and state
```

```
for idx, value in enumerate (data_science_levels_fyi_salary_data_df['state']):
    if (len(value) == 2) &␣
↪(data_science_levels_fyi_salary_data_df['country'][idx] == None):
        data_science_levels_fyi_salary_data_df['country'][idx] = 'United States'
    elif data_science_levels_fyi_salary_data_df['country'][idx] == None:
        print(idx)

###only printed index of 161 which correlates to Israel
data_science_levels_fyi_salary_data_df['country'][161] = 'Israel'

print(data_science_levels_fyi_salary_data_df.head())
```

```
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\3070310417.py:12:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  data_science_levels_fyi_salary_data_df['country'][idx] = 'United States'
```

```
161
           timestamp  totalyearlycompensation           location  work_year  \
0  6/17/2018 19:02:50                   200000        Seattle, WA       2018
1  6/21/2018 10:54:35                   600000      Los Gatos, CA       2018
2  8/15/2018 11:57:44                   120000     Washington, DC       2018
3  8/15/2018 15:38:02                   220000        Redmond, WA       2018
4  8/15/2018 20:38:36                   147000  San Francisco, CA       2018

            city state        country
0        Seattle    WA  United States
1      Los Gatos    CA  United States
2     Washington    DC  United States
3        Redmond    WA  United States
4  San Francisco    CA  United States
```

```
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\3070310417.py:17:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  data_science_levels_fyi_salary_data_df['country'][161] = 'Israel'
```

Add currency code for currency conversion from the currency code dictionary.

[12]:
```
data_science_levels_fyi_salary_data_df['currency_code']=''
data_science_levels_fyi_salary_data_df['employee_residence']=''

for idx, value in enumerate (data_science_levels_fyi_salary_data_df['country']):
    data_science_levels_fyi_salary_data_df['currency_code'][idx] = [val for key,␣
↪val in currency_codes_dict.items() if re.search(value, key)]
    data_science_levels_fyi_salary_data_df['employee_residence'][idx] = [val for␣
↪key, val in country_code_dict.items() if value in key]

print(data_science_levels_fyi_salary_data_df.head())
```

```
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\3301572926.py:5:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  data_science_levels_fyi_salary_data_df['currency_code'][idx] = [val for key,
val in currency_codes_dict.items() if re.search(value, key)]
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\3301572926.py:6:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  data_science_levels_fyi_salary_data_df['employee_residence'][idx] = [val for
key, val in country_code_dict.items() if value in key]
```

```
            timestamp  totalyearlycompensation           location  work_year  \
0  6/17/2018 19:02:50                   200000        Seattle, WA       2018
1  6/21/2018 10:54:35                   600000      Los Gatos, CA       2018
2  8/15/2018 11:57:44                   120000     Washington, DC       2018
3  8/15/2018 15:38:02                   220000        Redmond, WA       2018
4  8/15/2018 20:38:36                   147000  San Francisco, CA       2018

            city state        country currency_code employee_residence
0        Seattle    WA  United States         [USD]           [UM, US]
1      Los Gatos    CA  United States         [USD]           [UM, US]
2     Washington    DC  United States         [USD]           [UM, US]
3        Redmond    WA  United States         [USD]           [UM, US]
4  San Francisco    CA  United States         [USD]           [UM, US]
```

I don't know why Hong Kong won't work so I fixed that here. Also fixed countries that got two codes

```
[13]: for idx, value in enumerate (data_science_levels_fyi_salary_data_df['country']):
          if value == 'Hong Kong (SAR)':
              data_science_levels_fyi_salary_data_df['currency_code'][idx] = ["HKD"]
              data_science_levels_fyi_salary_data_df['employee_residence'][idx] =␣
      ↪['HK']

      for idx, value in enumerate (data_science_levels_fyi_salary_data_df['country']):
```

```
    if value == "United States":
        data_science_levels_fyi_salary_data_df['employee_residence'][idx] =␣
↪['US']
    if value == "India":
        data_science_levels_fyi_salary_data_df['employee_residence'][idx] =␣
↪['IN']
    if value == "Ireland":
        data_science_levels_fyi_salary_data_df['employee_residence'][idx] =␣
↪['IE']


print(data_science_levels_fyi_salary_data_df.head())
```

```
           timestamp  totalyearlycompensation           location  work_year  \
0  6/17/2018 19:02:50                   200000        Seattle, WA       2018
1  6/21/2018 10:54:35                   600000      Los Gatos, CA       2018
2  8/15/2018 11:57:44                   120000     Washington, DC       2018
3  8/15/2018 15:38:02                   220000        Redmond, WA       2018
4  8/15/2018 20:38:36                   147000  San Francisco, CA       2018

            city state        country currency_code employee_residence
0        Seattle    WA  United States         [USD]               [US]
1      Los Gatos    CA  United States         [USD]               [US]
2     Washington    DC  United States         [USD]               [US]
3        Redmond    WA  United States         [USD]               [US]
4  San Francisco    CA  United States         [USD]               [US]

C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\1514313522.py:3:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  data_science_levels_fyi_salary_data_df['currency_code'][idx] = ["HKD"]
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\1514313522.py:4:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  data_science_levels_fyi_salary_data_df['employee_residence'][idx] = ['HK']
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\1514313522.py:8:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  data_science_levels_fyi_salary_data_df['employee_residence'][idx] = ['US']
```

```
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\1514313522.py:10:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  data_science_levels_fyi_salary_data_df['employee_residence'][idx] = ['IN']
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\1514313522.py:12:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  data_science_levels_fyi_salary_data_df['employee_residence'][idx] = ['IE']
```

Convert all currancey to US currency

[20]:
```
data_science_levels_fyi_salary_data_df['salary_in_usd']=''



for idx, value in enumerate␣
↪(data_science_levels_fyi_salary_data_df['totalyearlycompensation']):
    if (data_science_levels_fyi_salary_data_df['currency_code'][idx] != ["USD"]):
        data_science_levels_fyi_salary_data_df['salary_in_usd'][idx] =␣
↪convert_currency(value,␣
↪data_science_levels_fyi_salary_data_df['currency_code'][idx][0] )
    else:
        data_science_levels_fyi_salary_data_df['salary_in_usd'][idx]=value



print(data_science_levels_fyi_salary_data_df.head())
```

```
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\3728537373.py:8:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  data_science_levels_fyi_salary_data_df['salary_in_usd'][idx]=value
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\3728537373.py:6:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  data_science_levels_fyi_salary_data_df['salary_in_usd'][idx] =
convert_currency(value,
data_science_levels_fyi_salary_data_df['currency_code'][idx][0] )
```

```
            timestamp  totalyearlycompensation          location  work_year  \
0  6/17/2018 19:02:50                   200000       Seattle, WA       2018
1  6/21/2018 10:54:35                   600000     Los Gatos, CA       2018
2  8/15/2018 11:57:44                   120000    Washington, DC       2018
3  8/15/2018 15:38:02                   220000       Redmond, WA       2018
4  8/15/2018 20:38:36                   147000  San Francisco, CA       2018

            city state        country currency_code employee_residence  \
0        Seattle    WA  United States         [USD]               [US]
1      Los Gatos    CA  United States         [USD]               [US]
2     Washington    DC  United States         [USD]               [US]
3        Redmond    WA  United States         [USD]               [US]
4  San Francisco    CA  United States         [USD]               [US]

  salary_in_usd
0        200000
1        600000
2        120000
3        220000
4        147000
```

Make copies to merge without extra columns and then merge

[21]:
```
data_science_levels_fyi_salary_data_df_merge =␣
↪data_science_levels_fyi_salary_data_df.
↪drop(['timestamp','totalyearlycompensation','location','currency_code'],axis=1)

for idx, value in␣
↪enumerate(data_science_levels_fyi_salary_data_df_merge['employee_residence']):
    data_science_levels_fyi_salary_data_df_merge['employee_residence'][idx]=␣
↪value[0]


salary_df = pd.merge(data_science_levels_fyi_salary_data_df_merge,␣
↪data_science_ds_salaries_df, how = 'outer')

print(salary_df.head())
```

```
   work_year          city state        country employee_residence  \
0       2018       Seattle    WA  United States                 US
1       2018     Los Gatos    CA  United States                 US
2       2018    Washington    DC  United States                 US
3       2018  Santa Monica    CA  United States                 US
4       2018       Redmond    WA  United States                 US

  salary_in_usd
0      200000.0
1      600000.0
```

```
2      120000.0
3      120000.0
4      220000.0
```

```
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\1026206038.py:4:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  data_science_levels_fyi_salary_data_df_merge['employee_residence'][idx]=
value[0]
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\1026206038.py:7:
FutureWarning: In a future version, the Index constructor will not infer numeric
dtypes when passed object-dtype sequences (matching Series behavior)
  salary_df = pd.merge(data_science_levels_fyi_salary_data_df_merge,
data_science_ds_salaries_df, how = 'outer')
```

Change money to 2023 dollars using SSA AWI values. Increase from: 2018 to 2019: 3.75% 2019 to 2021: 2.83% 2020 to 2021: 8.89% 2021 to 2022: 4.8% 2022 to 2023: 4.2% source: https://www.ssa.gov/oact/TR/TRassum.html and https://www.ssa.gov/oact/cola/awidevelop.html

[22]:
```
salary_df['salary_in_2023']=''

for idx, value in enumerate(salary_df['work_year']):
    if value == 2018:
        salary_df['salary_in_2023'][idx] = salary_df['salary_in_usd'][idx]*1.
 ↪0375*1.0283*1.089*1.048*1.042
    if value == 2019:
        salary_df['salary_in_2023'][idx] = salary_df['salary_in_usd'][idx]*1.
 ↪0283*1.089*1.048*1.042
    if value == 2020:
        salary_df['salary_in_2023'][idx] = salary_df['salary_in_usd'][idx]*1.
 ↪089*1.048*1.042
    if value == 2021:
        salary_df['salary_in_2023'][idx] = salary_df['salary_in_usd'][idx]*1.
 ↪048*1.042
    if value == 2022:
        salary_df['salary_in_2023'][idx] = salary_df['salary_in_usd'][idx]*1.042
print(salary_df.head())
```

```
   work_year           city state        country employee_residence  \
0       2018        Seattle    WA  United States                 US
1       2018      Los Gatos    CA  United States                 US
2       2018     Washington    DC  United States                 US
3       2018  Santa Monica    CA  United States                 US
4       2018        Redmond    WA  United States                 US
```

```
  salary_in_usd salary_in_2023
0      200000.0  253743.437031
1      600000.0  761230.311093
2      120000.0  152246.062219
3      120000.0  152246.062219
4      220000.0  279117.780734
```

```
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\49291514.py:5:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  salary_df['salary_in_2023'][idx] =
salary_df['salary_in_usd'][idx]*1.0375*1.0283*1.089*1.048*1.042
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\49291514.py:7:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  salary_df['salary_in_2023'][idx] =
salary_df['salary_in_usd'][idx]*1.0283*1.089*1.048*1.042
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\49291514.py:9:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  salary_df['salary_in_2023'][idx] =
salary_df['salary_in_usd'][idx]*1.089*1.048*1.042
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\49291514.py:11:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  salary_df['salary_in_2023'][idx] = salary_df['salary_in_usd'][idx]*1.048*1.042
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\49291514.py:13:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  salary_df['salary_in_2023'][idx] = salary_df['salary_in_usd'][idx]*1.042
```

Manipulating cost of living data. Sense we don't have data for most cities outside the US, I am planning to look at all data overall grouped by country. Then look more specifically at the US.

To do this I first am breaking apart the “City” column in the cost of living data into city, state and country.

2-digit country codes are then added to align with the salary data.

[23]:
```
cost_of_living_df[['city','state','country']] = cost_of_living_df["City"].str.
 ↪split(', ',expand=True)
cost_of_living_df['employee_residence']=''


for idx, value in enumerate (cost_of_living_df['state']):
    if (cost_of_living_df['country'][idx] == None):
        cost_of_living_df['country'][idx] = cost_of_living_df['state'][idx]

for idx, value in enumerate (cost_of_living_df['country']):
    cost_of_living_df['employee_residence'][idx] = [val for key, val in␣
 ↪country_code_dict.items() if value in key]


#the following pulled two keys from the dictionary
for idx, value in enumerate (cost_of_living_df['country']):
    if value == "United States":
        cost_of_living_df['employee_residence'][idx] = ['US']
    if value == "India":
        cost_of_living_df['employee_residence'][idx] = ['IN']
    if value == "Ireland":
        cost_of_living_df['employee_residence'][idx] = ['IE']
    if value == "Georgia":
        cost_of_living_df['employee_residence'][idx] = ['GE']
print(cost_of_living_df.head())
```

```
   Rank                 City  Cost of Living Index  Rent Index  \
0   NaN    Hamilton, Bermuda                149.02       96.10
1   NaN  Zurich, Switzerland                131.24       69.26
2   NaN   Basel, Switzerland                130.93       49.38
3   NaN     Zug, Switzerland                128.13       72.12
4   NaN  Lugano, Switzerland                123.99       44.99

   Cost of Living Plus Rent Index  Groceries Index  Restaurant Price Index  \
0                          124.22           157.89                  155.22
1                          102.19           136.14                  132.52
2                           92.70           137.07                  130.95
3                          101.87           132.61                  130.93
4                           86.96           129.17                  119.80

   Local Purchasing Power Index      city        state      country  \
0                         79.43  Hamilton      Bermuda      Bermuda
1                        129.79    Zurich  Switzerland  Switzerland
```

```
2                       111.53     Basel  Switzerland  Switzerland
3                       143.40       Zug  Switzerland  Switzerland
4                       111.96    Lugano  Switzerland  Switzerland

  employee_residence
0               [BM]
1               [CH]
2               [CH]
3               [CH]
4               [CH]
```

```
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\3238637228.py:7:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  cost_of_living_df['country'][idx] = cost_of_living_df['state'][idx]
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\3238637228.py:10:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  cost_of_living_df['employee_residence'][idx] = [val for key, val in
country_code_dict.items() if value in key]
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\3238637228.py:16:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  cost_of_living_df['employee_residence'][idx] = ['US']
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\3238637228.py:20:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  cost_of_living_df['employee_residence'][idx] = ['IE']
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\3238637228.py:18:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  cost_of_living_df['employee_residence'][idx] = ['IN']
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\3238637228.py:22:
```

```
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  cost_of_living_df['employee_residence'][idx] = ['GE']
```

replace unknown country code with none.

```
[24]: for idx, value in enumerate(cost_of_living_df['employee_residence']):
          if (len(cost_of_living_df['employee_residence'][idx]) == 1):
              cost_of_living_df['employee_residence'][idx]= value[0]
          else:
              cost_of_living_df['employee_residence'][idx] = None
```

```
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\73360534.py:3:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  cost_of_living_df['employee_residence'][idx]= value[0]
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\73360534.py:5:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  cost_of_living_df['employee_residence'][idx] = None
```

get stats for each of the five indexes

```
[25]: stat_for_cost_of_living = stats_df_creator( cost_of_living_df,
                                                  'employee_residence',
                                                  'Cost of Living Index')

      stat_for_rent_index = stats_df_creator( cost_of_living_df,
                                                  'employee_residence',
                                                  'Rent Index')
      stat_for_cost_of_living_plus_rent_index = stats_df_creator( cost_of_living_df,
                                                  'employee_residence',
                                                  'Cost of Living Plus Rent Index')
      stat_for_groceries_index = stats_df_creator( cost_of_living_df,
                                                  'employee_residence',
                                                  'Groceries Index')
      stat_for_restaurant_price_index = stats_df_creator( cost_of_living_df,
                                                  'employee_residence',
                                                  'Restaurant Price Index')
```

```python
print(stat_for_cost_of_living.head())
print(stat_for_rent_index.head())
print(stat_for_cost_of_living_plus_rent_index.head())
print(stat_for_groceries_index.head())
print(stat_for_restaurant_price_index.head())
```

```
                    median    mean  third_quantile
employee_residence
AE                  55.235  55.955         59.4975
AF                  21.350  21.350         21.3500
AL                  38.680  38.680         38.6800
AM                  34.010  34.010         34.0100
AR                  35.250  35.250         35.2500
                    median     mean  third_quantile
employee_residence
AE                  49.045  54.4525         63.4575
AF                   3.170   3.1700          3.1700
AL                  11.330  11.3300         11.3300
AM                  11.890  11.8900         11.8900
AR                  10.730  10.7300         10.7300
                    median   mean  third_quantile
employee_residence
AE                  53.095  55.25           59.57
AF                  12.830  12.83           12.83
AL                  25.860  25.86           25.86
AM                  23.640  23.64           23.64
AR                  23.750  23.75           23.75
                    median     mean  third_quantile
employee_residence
AE                  44.625  44.3725         48.6275
AF                  15.220  15.2200         15.2200
AL                  30.990  30.9900         30.9900
AM                  27.810  27.8100         27.8100
AR                  28.540  28.5400         28.5400
                    median     mean  third_quantile
employee_residence
AE                   59.03  56.3875         62.3525
AF                   14.85  14.8500         14.8500
AL                   29.86  29.8600         29.8600
AM                   31.01  31.0100         31.0100
AR                   34.35  34.3500         34.3500
```

I reviewed all the stats above and found that the values were very close to eachother for all three statistics. This implies a very low spread. I've decided to focus on the median as the measure to use for the indices

To that end the next step is to create a df of just these stats then turn it into a dictionary.

```
[26]: stat_median_index_df = stat_for_cost_of_living.
       ↪drop(['mean','third_quantile'],axis=1)
      stat_median_index_df = stat_median_index_df.rename(columns={"median":␣
       ↪"cost_of_living"})
      stat_median_index_df['rent_index'] = stat_for_rent_index['median']
      stat_median_index_df['cost_of_living_plus_rent_index'] =␣
       ↪stat_for_cost_of_living_plus_rent_index['median']
      stat_median_index_df['groceries_index'] = stat_for_groceries_index['median']
      stat_median_index_df['restuarant_price_index'] =␣
       ↪stat_for_restaurant_price_index['median']
      stat_median_index_df.reset_index(inplace=True)

      index_dict =  defaultdict(def_value,   [(i,[v,w,x,y,z ])
                                              for i, v,w,x,y,z
                                              in zip(stat_median_index_df.
       ↪employee_residence,
                                                                         ␣
       ↪stat_median_index_df.cost_of_living,
                                                                         ␣
       ↪stat_median_index_df.rent_index,
                                                                         ␣
       ↪stat_median_index_df.cost_of_living_plus_rent_index,
                                                                         ␣
       ↪stat_median_index_df.groceries_index,
                                                                         ␣
       ↪stat_median_index_df.restuarant_price_index) ])
```

Group Salaries by employee_residence(country) and calculate the 25th, median(50th) and 75 quantiles.

Reset index.

```
[27]: salary_percentile_df = salary_df.groupby(['employee_residence']).agg(
          first_quantile = ('salary_in_2023' , lambda x: np.percentile(x, q=25)),
          median = ('salary_in_2023' , lambda x: np.percentile(x, q=50)),
          third_quantile = ('salary_in_2023' , lambda x: np.percentile(x, q=75))
          )

      salary_percentile_df.reset_index(inplace=True)

      print(salary_percentile_df.head())
```

```
  employee_residence  first_quantile         median  third_quantile
0                 AE    44951.965027   44951.965027    44951.965027
1                 AT    20062.569140   20062.569140    20062.569140
2                 AU    57804.204508   65210.900679    77777.713339
3                 CA    68329.183659   78787.568122    90223.785407
4                 CH   134427.421658  138231.717691   169114.387210
```

Get values from index_dict for the countries we have salary and index data for.

There is no cost of living data for vietnam, but there was salary so I removed this from my data set.

Then scale each salary measure by each "cost of" index, then convert values to numeric.

The largest of these values indicate were salary will go the farthest in each catergory.

[29]:
```
index_vietnam =salary_percentile_df[salary_percentile_df['employee_residence']␣
 ↪== 'VN'].index
salary_percentile_df.drop(index_vietnam , inplace=True)


salary_percentile_df['cost_of_values']=''

for idx, salary in enumerate(salary_percentile_df['third_quantile']):
    salary_percentile_df['cost_of_values'][idx] = index_dict.
 ↪get(salary_percentile_df['employee_residence'][idx])


salary_percentile_df['cost_of_living_scaled_q1']=''
salary_percentile_df['rent_index_scaled_q1']=''
salary_percentile_df['cost_of_living_plus_rent_index_scaled_q1']=''
salary_percentile_df['groceries_index_scaled_q1']=''
salary_percentile_df['restuarant_price_index_q1']=''
salary_percentile_df['cost_of_living_scaled_median']=''
salary_percentile_df['rent_index_scaled_median']=''
salary_percentile_df['cost_of_living_plus_rent_index_scaled_median']=''
salary_percentile_df['groceries_index_scaled_median']=''
salary_percentile_df['restuarant_price_index_median']=''
salary_percentile_df['cost_of_living_scaled_q3']=''
salary_percentile_df['rent_index_scaled_q3']=''
salary_percentile_df['cost_of_living_plus_rent_index_scaled_q3']=''
salary_percentile_df['groceries_index_scaled_q3']=''
salary_percentile_df['restuarant_price_index_q3']=''


for idx, salary in enumerate(salary_percentile_df['third_quantile']):
    salary_percentile_df['cost_of_living_scaled_q3'][idx] =salary*100/
 ↪salary_percentile_df['cost_of_values'][idx][0]
    salary_percentile_df['rent_index_scaled_q3'][idx] = salary*100/
 ↪salary_percentile_df['cost_of_values'][idx][1]
    salary_percentile_df['cost_of_living_plus_rent_index_scaled_q3'][idx] =␣
 ↪salary*100/salary_percentile_df['cost_of_values'][idx][2]
    salary_percentile_df['groceries_index_scaled_q3'][idx] = salary*100/
 ↪salary_percentile_df['cost_of_values'][idx][3]
```

```
    salary_percentile_df['restuarant_price_index_q3'][idx] = salary*100/
 ↪salary_percentile_df['cost_of_values'][idx][4]


for idx, salary in enumerate(salary_percentile_df['median']):
    salary_percentile_df['cost_of_living_scaled_median'][idx] = salary*100/
 ↪salary_percentile_df['cost_of_values'][idx][0]
    salary_percentile_df['rent_index_scaled_median'][idx] = salary*100/
 ↪salary_percentile_df['cost_of_values'][idx][1]
    salary_percentile_df['cost_of_living_plus_rent_index_scaled_median'][idx] =␣
 ↪salary*100/salary_percentile_df['cost_of_values'][idx][2]
    salary_percentile_df['groceries_index_scaled_median'][idx] = salary*100/
 ↪salary_percentile_df['cost_of_values'][idx][3]
    salary_percentile_df['restuarant_price_index_median'][idx] = salary*100/
 ↪salary_percentile_df['cost_of_values'][idx][4]

for idx, salary in enumerate(salary_percentile_df['first_quantile']):
    salary_percentile_df['cost_of_living_scaled_q1'][idx] = salary*100/
 ↪salary_percentile_df['cost_of_values'][idx][0]
    salary_percentile_df['rent_index_scaled_q1'][idx] = salary*100/
 ↪salary_percentile_df['cost_of_values'][idx][1]
    salary_percentile_df['cost_of_living_plus_rent_index_scaled_q1'][idx] =␣
 ↪salary*100/salary_percentile_df['cost_of_values'][idx][2]
    salary_percentile_df['groceries_index_scaled_q1'][idx] = salary*100/
 ↪salary_percentile_df['cost_of_values'][idx][3]
    salary_percentile_df['restuarant_price_index_q1'][idx] = salary*100/
 ↪salary_percentile_df['cost_of_values'][idx][4]

salary_percentile_df['cost_of_living_scaled_q1'] = pd.
 ↪to_numeric(salary_percentile_df['cost_of_living_scaled_q1'], errors='coerce')
salary_percentile_df['rent_index_scaled_q1'] = pd.
 ↪to_numeric(salary_percentile_df['rent_index_scaled_q1'], errors='coerce')
salary_percentile_df['cost_of_living_plus_rent_index_scaled_q1'] = pd.
 ↪to_numeric(salary_percentile_df['cost_of_living_plus_rent_index_scaled_q1'],␣
 ↪errors='coerce')
salary_percentile_df['groceries_index_scaled_q1'] = pd.
 ↪to_numeric(salary_percentile_df['groceries_index_scaled_q1'], errors='coerce')
salary_percentile_df['restuarant_price_index_q1'] = pd.
 ↪to_numeric(salary_percentile_df['restuarant_price_index_q1'], errors='coerce')


salary_percentile_df['cost_of_living_scaled_median'] = pd.
 ↪to_numeric(salary_percentile_df['cost_of_living_scaled_median'],␣
 ↪errors='coerce')
salary_percentile_df['rent_index_scaled_median'] = pd.
 ↪to_numeric(salary_percentile_df['rent_index_scaled_median'], errors='coerce')
```

```
salary_percentile_df['cost_of_living_plus_rent_index_scaled_median'] = pd.
 ↪to_numeric(salary_percentile_df['cost_of_living_plus_rent_index_scaled_median'],␣
 ↪errors='coerce')
salary_percentile_df['groceries_index_scaled_median'] = pd.
 ↪to_numeric(salary_percentile_df['groceries_index_scaled_median'],␣
 ↪errors='coerce')
salary_percentile_df['restuarant_price_index_median'] = pd.
 ↪to_numeric(salary_percentile_df['restuarant_price_index_median'],␣
 ↪errors='coerce')


salary_percentile_df['cost_of_living_scaled_q3'] = pd.
 ↪to_numeric(salary_percentile_df['cost_of_living_scaled_q3'], errors='coerce')
salary_percentile_df['rent_index_scaled_q3'] = pd.
 ↪to_numeric(salary_percentile_df['rent_index_scaled_q3'], errors='coerce')
salary_percentile_df['cost_of_living_plus_rent_index_scaled_q3'] = pd.
 ↪to_numeric(salary_percentile_df['cost_of_living_plus_rent_index_scaled_q3'],␣
 ↪errors='coerce')
salary_percentile_df['groceries_index_scaled_q3'] = pd.
 ↪to_numeric(salary_percentile_df['groceries_index_scaled_q3'], errors='coerce')
salary_percentile_df['restuarant_price_index_q3'] = pd.
 ↪to_numeric(salary_percentile_df['restuarant_price_index_q3'], errors='coerce')



print(salary_percentile_df.head())
```

```
  employee_residence  first_quantile         median  third_quantile  \
0                 AE    44951.965027   44951.965027    44951.965027
1                 AT    20062.569140   20062.569140    20062.569140
2                 AU    57804.204508   65210.900679    77777.713339
3                 CA    68329.183659   78787.568122    90223.785407
4                 CH   134427.421658  138231.717691   169114.387210

                                      cost_of_values  \
0            [55.235, 49.045, 53.095, 44.625, 59.03]
1                [73.55, 30.14, 52.54, 66.99, 68.46]
2  [76.67500000000001, 37.595, 58.945, 77.295, 74...
3  [71.7, 34.955, 54.769999999999996, 69.985, 70...
4             [123.99, 59.55, 92.74, 129.17, 127.01]

   cost_of_living_scaled_q1  rent_index_scaled_q1  \
0              81383.117638          91654.531608
1              27277.456342          66564.595686
2              75388.594076         153755.032606
3              95298.721979         195477.567326
4             108417.954398         225738.743339
```

```
   cost_of_living_plus_rent_index_scaled_q1  groceries_index_scaled_q1  \
0                              84663.273429              100732.694739
1                              38185.323829               29948.602985
2                              98064.644174               74783.885773
3                             124756.588751               97634.041093
4                             144950.853632              104070.156893

   restuarant_price_index_q1  cost_of_living_scaled_median  \
0               76151.050359                  81383.117638
1               29305.534823                  27277.456342
2               77955.771420                  85048.452141
3               96585.177269                 109885.032249
4              105840.029650                 111486.182508

   rent_index_scaled_median  cost_of_living_plus_rent_index_scaled_median  \
0              91654.531608                                  84663.273429
1              66564.595686                                  38185.323829
2             173456.312485                                 110630.080039
3             225397.133807                                 143851.685452
4             232127.149775                                 149052.962790

   groceries_index_scaled_median  restuarant_price_index_median  \
0                  100732.694739                   76151.050359
1                   29948.602985                   29305.534823
2                   84366.260015                   87944.572729
3                  112577.792559                  111368.390872
4                  107015.342333                  108835.302489

   cost_of_living_scaled_q3  rent_index_scaled_q3  \
0              81383.117638          91654.531608
1              27277.456342          66564.595686
2             101438.165425         206883.131638
3             125835.126091         258114.105013
4             136393.569812         283987.216138

   cost_of_living_plus_rent_index_scaled_q3  groceries_index_scaled_q3  \
0                              84663.273429              100732.694739
1                              38185.323829               29948.602985
2                             131949.636677              100624.507846
3                             164732.125995              128918.747456
4                             182353.231842              130923.888836

   restuarant_price_index_q3
0               76151.050359
1               29305.534823
2              104892.398300
3              127533.798017
```

```
4            133150.450524
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\773068333.py:8:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  salary_percentile_df['cost_of_values'][idx] =
index_dict.get(salary_percentile_df['employee_residence'][idx])
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\773068333.py:29:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  salary_percentile_df['cost_of_living_scaled_q3'][idx]
=salary*100/salary_percentile_df['cost_of_values'][idx][0]
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\773068333.py:30:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  salary_percentile_df['rent_index_scaled_q3'][idx] =
salary*100/salary_percentile_df['cost_of_values'][idx][1]
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\773068333.py:31:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  salary_percentile_df['cost_of_living_plus_rent_index_scaled_q3'][idx] =
salary*100/salary_percentile_df['cost_of_values'][idx][2]
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\773068333.py:32:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  salary_percentile_df['groceries_index_scaled_q3'][idx] =
salary*100/salary_percentile_df['cost_of_values'][idx][3]
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\773068333.py:33:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
```

```
  salary_percentile_df['restuarant_price_index_q3'][idx] =
salary*100/salary_percentile_df['cost_of_values'][idx][4]
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\773068333.py:37:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  salary_percentile_df['cost_of_living_scaled_median'][idx] =
salary*100/salary_percentile_df['cost_of_values'][idx][0]
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\773068333.py:38:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  salary_percentile_df['rent_index_scaled_median'][idx] =
salary*100/salary_percentile_df['cost_of_values'][idx][1]
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\773068333.py:39:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  salary_percentile_df['cost_of_living_plus_rent_index_scaled_median'][idx] =
salary*100/salary_percentile_df['cost_of_values'][idx][2]
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\773068333.py:40:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  salary_percentile_df['groceries_index_scaled_median'][idx] =
salary*100/salary_percentile_df['cost_of_values'][idx][3]
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\773068333.py:41:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  salary_percentile_df['restuarant_price_index_median'][idx] =
salary*100/salary_percentile_df['cost_of_values'][idx][4]
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\773068333.py:44:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
```

```
  salary_percentile_df['cost_of_living_scaled_q1'][idx] =
salary*100/salary_percentile_df['cost_of_values'][idx][0]
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\773068333.py:45:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  salary_percentile_df['rent_index_scaled_q1'][idx] =
salary*100/salary_percentile_df['cost_of_values'][idx][1]
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\773068333.py:46:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  salary_percentile_df['cost_of_living_plus_rent_index_scaled_q1'][idx] =
salary*100/salary_percentile_df['cost_of_values'][idx][2]
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\773068333.py:47:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  salary_percentile_df['groceries_index_scaled_q1'][idx] =
salary*100/salary_percentile_df['cost_of_values'][idx][3]
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\773068333.py:48:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  salary_percentile_df['restuarant_price_index_q1'][idx] =
salary*100/salary_percentile_df['cost_of_values'][idx][4]
```

Finding top 5 of each index for each salary measyre, which returns all columnns. Remove all columns except the residency and the column its actually the top 5 of.

Then a graph was created to display this and the top 5 countries were printed.

This was done in the next three cells for the first quantile, median and third quantile.

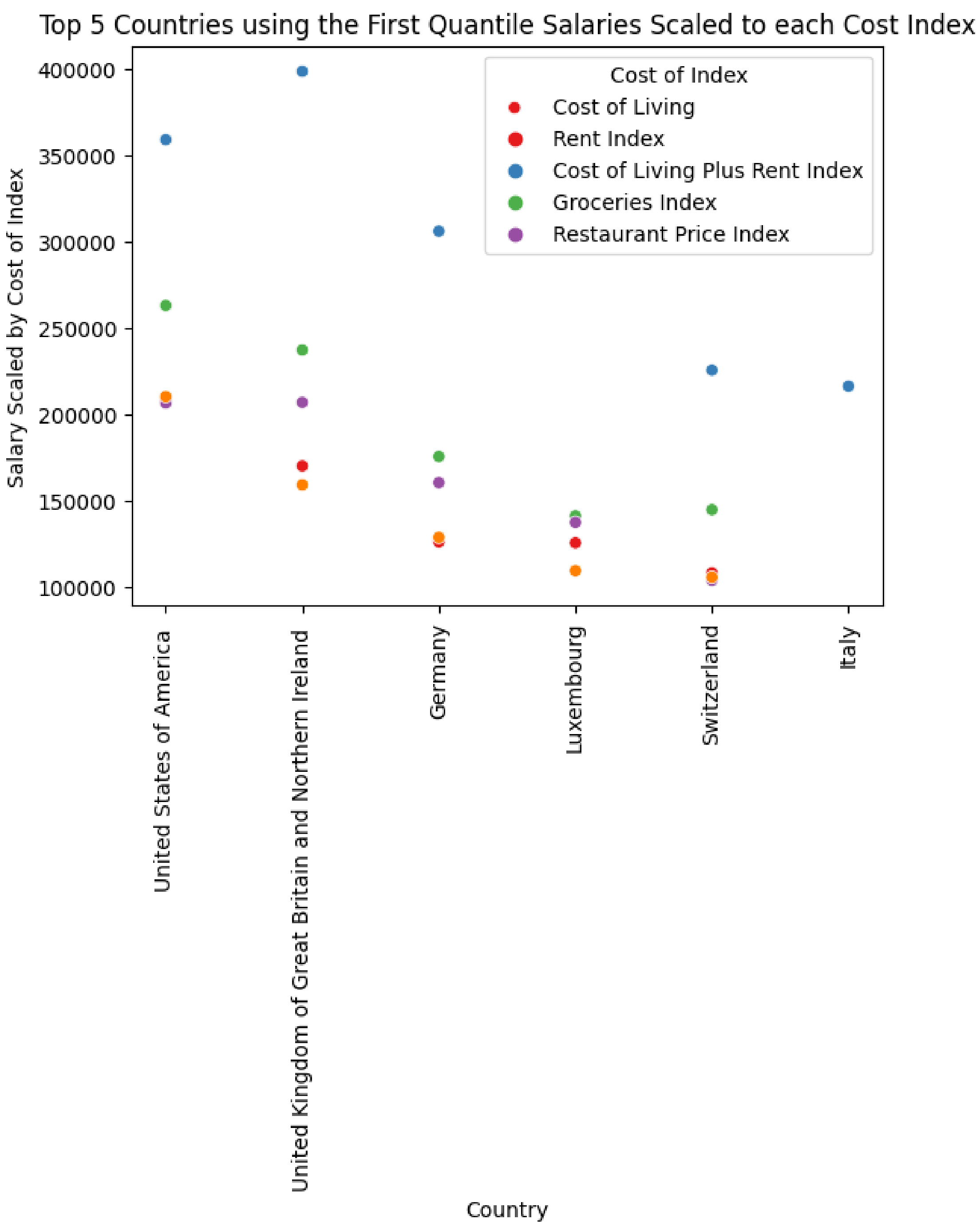
[30]:
```
top_5_cost_of_living_q1 = salary_percentile_df.nlargest(5,␣
 ↪'cost_of_living_scaled_q1')
top_5_cost_of_living_q1 = top_5_cost_of_living_q1[['employee_residence',␣
 ↪'cost_of_living_scaled_q1']]
```

```
top_5_rent_index_scaled_q1 = salary_percentile_df.nlargest(5,␣
 ↪'rent_index_scaled_q1')
top_5_rent_index_scaled_q1  = top_5_rent_index_scaled_q1[['employee_residence',␣
 ↪'rent_index_scaled_q1']]


top_5_cost_of_living_plus_rent_index_scaled_q1= salary_percentile_df.nlargest(5,␣
 ↪'cost_of_living_plus_rent_index_scaled_q1')
top_5_cost_of_living_plus_rent_index_scaled_q1 =␣
 ↪top_5_cost_of_living_plus_rent_index_scaled_q1[['employee_residence',␣
 ↪'cost_of_living_plus_rent_index_scaled_q1']]


top_5_groceries_index_scaled_q1 = salary_percentile_df.nlargest(5,␣
 ↪'groceries_index_scaled_q1')
top_5_groceries_index_scaled_q1 =␣
 ↪top_5_groceries_index_scaled_q1[['employee_residence',␣
 ↪'groceries_index_scaled_q1']]


top_5_restuarant_price_index_q1 = salary_percentile_df.nlargest(5,␣
 ↪'restuarant_price_index_q1')
top_5_restuarant_price_index_q1 =␣
 ↪top_5_restuarant_price_index_q1[['employee_residence',␣
 ↪'restuarant_price_index_q1']]


#merging
top_5_merged_q1 = pd.merge(top_5_cost_of_living_q1 , top_5_rent_index_scaled_q1␣
 ↪, how='outer', on='employee_residence')
top_5_merged_q1 = pd.merge(top_5_merged_q1 ,␣
 ↪top_5_cost_of_living_plus_rent_index_scaled_q1 , how='outer',␣
 ↪on='employee_residence')
top_5_merged_q1 = pd.merge(top_5_merged_q1 , top_5_groceries_index_scaled_q1 ,␣
 ↪how='outer', on='employee_residence')
top_5_merged_q1 = pd.merge(top_5_merged_q1 , top_5_restuarant_price_index_q1 ,␣
 ↪how='outer', on='employee_residence')

top_5_merged_q1['country']=''

for idx, country_code in enumerate(top_5_merged_q1['employee_residence']):
    for key, value in country_code_dict.items():
        if country_code == value:
            top_5_merged_q1['country'][idx] = key
```

```
top_5_merged_q1 = top_5_merged_q1.drop(['employee_residence'], axis = 1)

print(top_5_merged_q1.head())

# convert to long (tidy) form
top_5_merged_q1_melted = top_5_merged_q1.melt('country', var_name='index_q1d',␣
↪value_name='scaled_salary')
legend_labels = ['Cost of Living', 'Rent Index',
        'Cost of Living Plus Rent Index',
        'Groceries Index',
        'Restaurant Price Index']

print(top_5_merged_q1_melted.head())



sns.scatterplot(data= top_5_merged_q1_melted, x ='country', y="scaled_salary",
                hue="index_q1d", legend = 'full',  palette=sns.
↪color_palette("Set1", 5))
plt.title('Top 5 Countries using the First Quantile Salaries Scaled to each Cost␣
↪Index')
plt.xlabel("Country")
plt.xticks(rotation=90)
plt.ylabel("Salary Scaled by Cost of Index")
plt.legend(title='Cost of Index', loc='upper right',
           labels = legend_labels)
plt.show()


# print countries of top 5 using print_countries function

print('In terms of the first quantile the following are the lists of countries␣
↪where salary goes the farthest:\n')
print_countries('Cost of Living', top_5_cost_of_living_q1)
print_countries('Rent', top_5_rent_index_scaled_q1)
print_countries('Cost of Living plus Rent',␣
↪top_5_cost_of_living_plus_rent_index_scaled_q1)
print_countries('Groceries', top_5_groceries_index_scaled_q1)
print_countries('Restaurant Price', top_5_restuarant_price_index_q1 )
```

```
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\3418214267.py:32:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  top_5_merged_q1['country'][idx] = key
```

```
   cost_of_living_scaled_q1  rent_index_scaled_q1  \
0             209145.632834         359080.170000
1             170252.640607         398681.778271
2             126291.405610         306211.530049
3             125746.033897                   NaN
4             108417.954398         225738.743339

   cost_of_living_plus_rent_index_scaled_q1  groceries_index_scaled_q1  \
0                             263169.711370              206719.081293
1                             237415.907389              207074.757555
2                             175709.211646              160602.688041
3                             141366.341820              137619.192313
4                             144950.853632              104070.156893

   restuarant_price_index_q1  \
0              210439.559696
1              159340.170823
2              128986.443608
3              109652.867008
4              105840.029650

                                             country
0                           United States of America
1  United Kingdom of Great Britain and Northern I...
2                                            Germany
3                                         Luxembourg
4                                        Switzerland
                                             country  \
0                           United States of America
1  United Kingdom of Great Britain and Northern I...
2                                            Germany
3                                         Luxembourg
4                                        Switzerland

                  index_q1d  scaled_salary
0  cost_of_living_scaled_q1  209145.632834
1  cost_of_living_scaled_q1  170252.640607
2  cost_of_living_scaled_q1  126291.405610
3  cost_of_living_scaled_q1  125746.033897
4  cost_of_living_scaled_q1  108417.954398
```



```
In terms of the first quantile the following are the lists of countries where
salary goes the farthest:

The 5 countries in which salary goes the farthest on the Cost of Living index
are:
```

```
United States of America
United Kingdom of Great Britain and Northern Ireland
Germany
Luxembourg
Switzerland
The 5 countries in which salary goes the farthest on the Rent index are:

United Kingdom of Great Britain and Northern Ireland
United States of America
Germany
Switzerland
Italy
The 5 countries in which salary goes the farthest on the Cost of Living plus
Rent index are:

United States of America
United Kingdom of Great Britain and Northern Ireland
Germany
Switzerland
Luxembourg
The 5 countries in which salary goes the farthest on the Groceries index are:

United Kingdom of Great Britain and Northern Ireland
United States of America
Germany
Luxembourg
Switzerland
The 5 countries in which salary goes the farthest on the Restaurant Price index
are:

United States of America
United Kingdom of Great Britain and Northern Ireland
Germany
Luxembourg
Switzerland
```

[33]:
```
# median
top_5_cost_of_living_median = salary_percentile_df.nlargest(5,␣
 ↪'cost_of_living_scaled_median')
top_5_cost_of_living_median = top_5_cost_of_living_median[['employee_residence',␣
 ↪'cost_of_living_scaled_median']]


top_5_rent_index_scaled_median = salary_percentile_df.nlargest(5,␣
 ↪'rent_index_scaled_median')
```

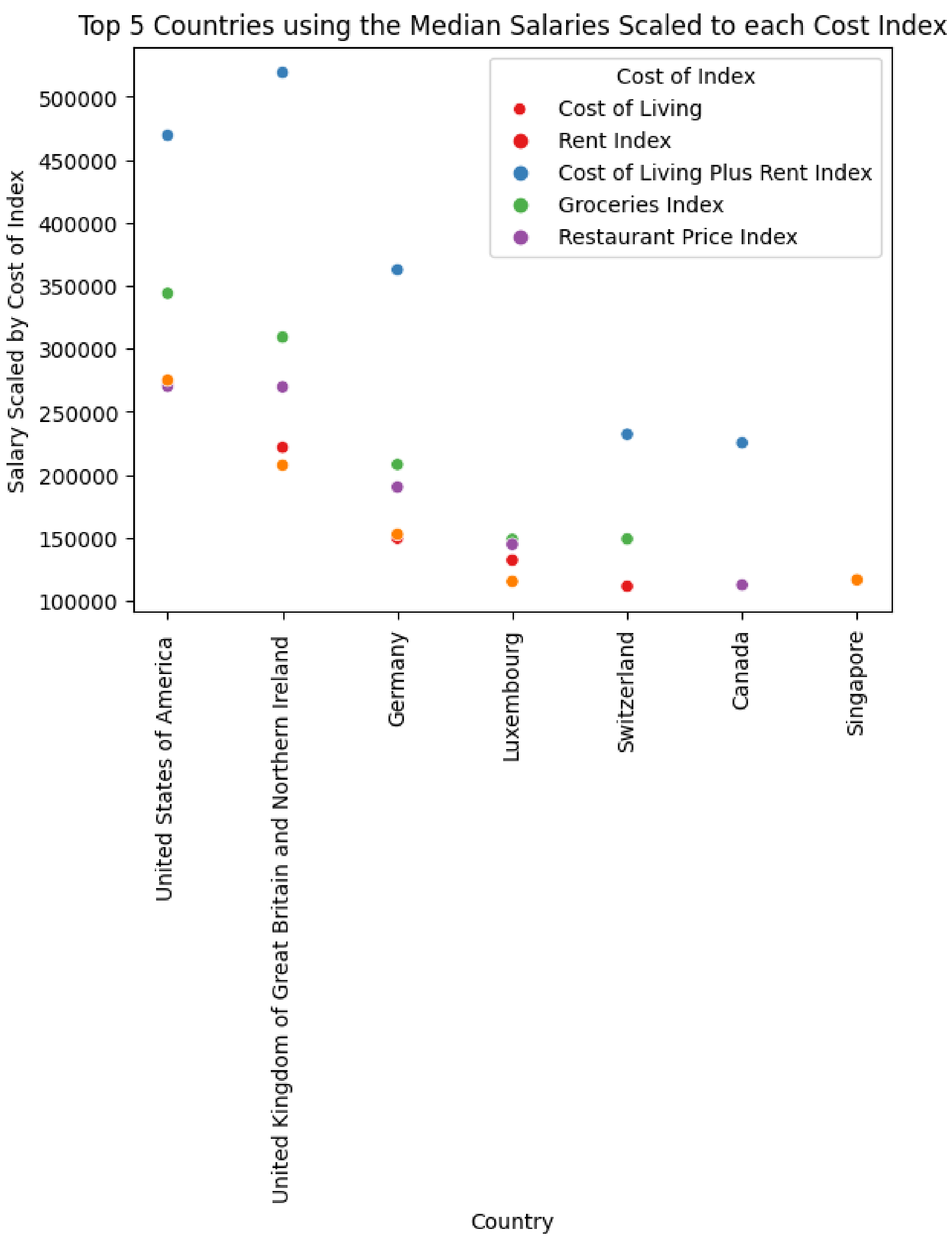
```
top_5_rent_index_scaled_median  =␣
↪top_5_rent_index_scaled_median[['employee_residence',␣
↪'rent_index_scaled_median']]


top_5_cost_of_living_plus_rent_index_scaled_median= salary_percentile_df.
↪nlargest(5, 'cost_of_living_plus_rent_index_scaled_median')
top_5_cost_of_living_plus_rent_index_scaled_median =␣
↪top_5_cost_of_living_plus_rent_index_scaled_median[['employee_residence',␣
↪'cost_of_living_plus_rent_index_scaled_median']]


top_5_groceries_index_scaled_median = salary_percentile_df.nlargest(5,␣
↪'groceries_index_scaled_median')
top_5_groceries_index_scaled_median =␣
↪top_5_groceries_index_scaled_median[['employee_residence',␣
↪'groceries_index_scaled_median']]


top_5_restuarant_price_index_median = salary_percentile_df.nlargest(5,␣
↪'restuarant_price_index_median')
top_5_restuarant_price_index_median =␣
↪top_5_restuarant_price_index_median[['employee_residence',␣
↪'restuarant_price_index_median']]


#merging
top_5_merged_median = pd.merge(top_5_cost_of_living_median ,␣
↪top_5_rent_index_scaled_median , how='outer', on='employee_residence')
top_5_merged_median = pd.merge(top_5_merged_median ,␣
↪top_5_cost_of_living_plus_rent_index_scaled_median , how='outer',␣
↪on='employee_residence')
top_5_merged_median = pd.merge(top_5_merged_median ,␣
↪top_5_groceries_index_scaled_median , how='outer', on='employee_residence')
top_5_merged_median = pd.merge(top_5_merged_median ,␣
↪top_5_restuarant_price_index_median , how='outer', on='employee_residence')

top_5_merged_median['country']=''

for idx, country_code in enumerate(top_5_merged_median['employee_residence']):
    for key, value in country_code_dict.items():
        if country_code == value:
            top_5_merged_median['country'][idx] = key


top_5_merged_median = top_5_merged_median.drop(['employee_residence'], axis = 1)
```

```
print(top_5_merged_median.head())


# convert to long (tidy) form
top_5_merged_median_melted = top_5_merged_median.melt('country',␣
↪var_name='index_mediand', value_name='scaled_salary')
legend_labels = ['Cost of Living', 'Rent Index',
        'Cost of Living Plus Rent Index',
        'Groceries Index',
        'Restaurant Price Index']

print(top_5_merged_median_melted.head())


sns.scatterplot(data= top_5_merged_median_melted, x ='country',␣
↪y="scaled_salary",
                hue="index_mediand", legend = 'full',  palette=sns.
↪color_palette("Set1", 5))
plt.title('Top 5 Countries using the Median Salaries Scaled to each Cost Index')
plt.xlabel("Country")
plt.xticks(rotation=90)
plt.ylabel("Salary Scaled by Cost of Index")
plt.legend(title='Cost of Index', loc='upper right',
           labels = legend_labels)
plt.show()

# print countries of top 5 using print_countries function

print('In terms of the median the following are the lists of countries where␣
↪salary goes the farthest:\n')
print_countries('Cost of Living', top_5_cost_of_living_median)
print_countries('Rent', top_5_rent_index_scaled_median)
print_countries('Cost of Living plus Rent',␣
↪top_5_cost_of_living_plus_rent_index_scaled_median)
print_countries('Groceries', top_5_groceries_index_scaled_median)
print_countries('Restaurant Price', top_5_restuarant_price_index_median )
```

```
   cost_of_living_scaled_median  rent_index_scaled_median  \
0                 273417.537730             469427.999040
1                 221754.120163             519283.146800
2                 149607.338159             362744.334840
3                 132249.734553                       NaN
4                 111486.182508             232127.149775

   cost_of_living_plus_rent_index_scaled_median  \
0                                 344043.590645
```

```
1                                309234.297148
2                                208148.664728
3                                148677.939184
4                                149052.962790

   groceries_index_scaled_median  restuarant_price_index_median  \
0                  270245.290055                  275109.097300
1                  269714.939550                  207540.624695
2                  190253.173151                  152799.934354
3                  144736.983655                  115324.214254
4                            NaN                            NaN

                                              country
0                            United States of America
1  United Kingdom of Great Britain and Northern I...
2                                             Germany
3                                          Luxembourg
4                                         Switzerland
                                              country  \
0                            United States of America
1  United Kingdom of Great Britain and Northern I...
2                                             Germany
3                                          Luxembourg
4                                         Switzerland

                 index_mediand  scaled_salary
0  cost_of_living_scaled_median  273417.537730
1  cost_of_living_scaled_median  221754.120163
2  cost_of_living_scaled_median  149607.338159
3  cost_of_living_scaled_median  132249.734553
4  cost_of_living_scaled_median  111486.182508
```

```
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\4077783730.py:33:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  top_5_merged_median['country'][idx] = key
```



In terms of the median the following are the lists of countries where salary goes the farthest:

The 5 countries in which salary goes the farthest on the Cost of Living index

```
are:

United States of America
United Kingdom of Great Britain and Northern Ireland
Germany
Luxembourg
Switzerland
The 5 countries in which salary goes the farthest on the Rent index are:

United Kingdom of Great Britain and Northern Ireland
United States of America
Germany
Switzerland
Canada
The 5 countries in which salary goes the farthest on the Cost of Living plus
Rent index are:

United States of America
United Kingdom of Great Britain and Northern Ireland
Germany
Switzerland
Luxembourg
The 5 countries in which salary goes the farthest on the Groceries index are:

United States of America
United Kingdom of Great Britain and Northern Ireland
Germany
Luxembourg
Canada
The 5 countries in which salary goes the farthest on the Restaurant Price index
are:

United States of America
United Kingdom of Great Britain and Northern Ireland
Germany
Singapore
Luxembourg
```

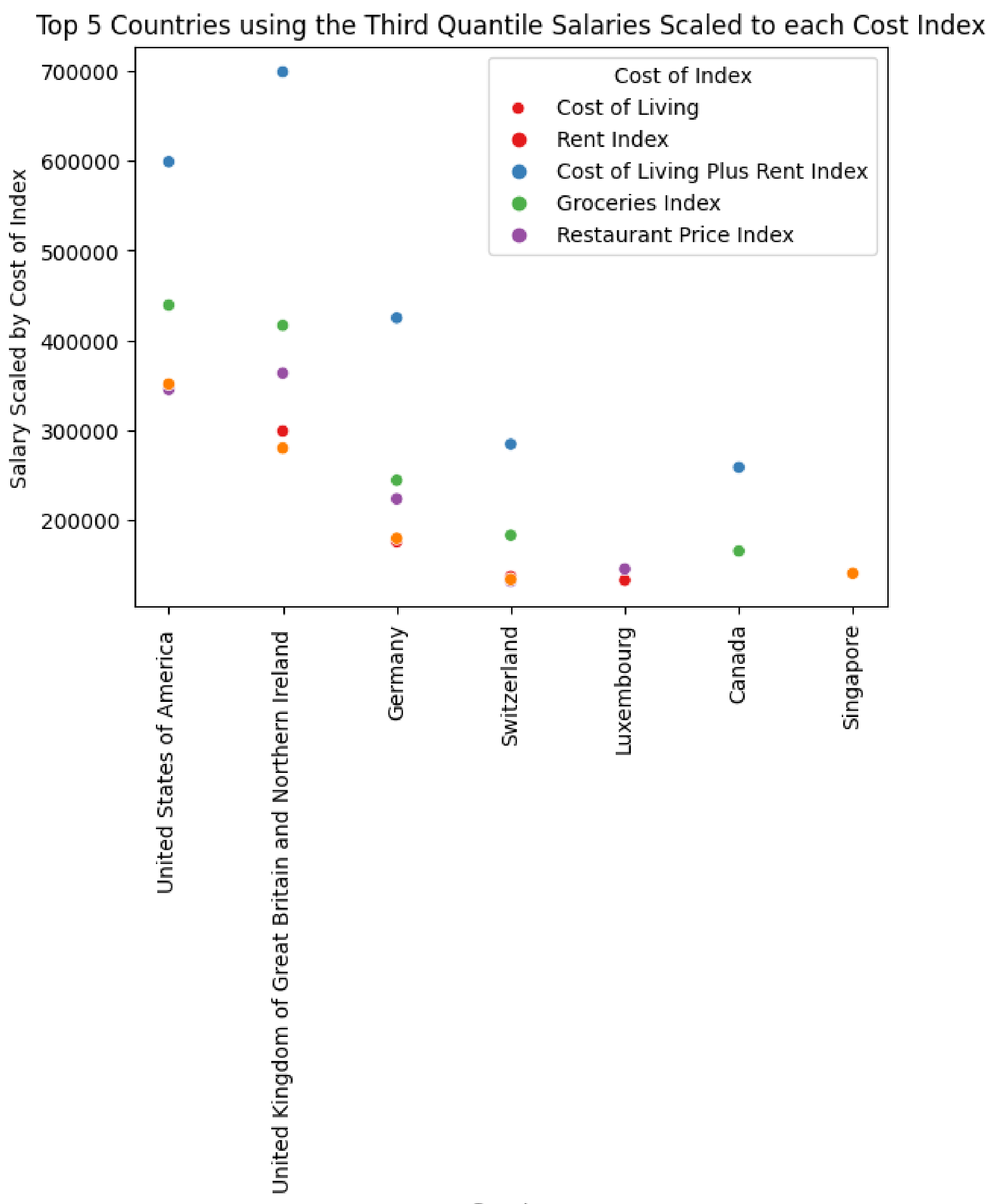
[34]:
```
# third quantile
top_5_cost_of_living_q3 = salary_percentile_df.nlargest(5,␣
↪'cost_of_living_scaled_q3')
top_5_cost_of_living_q3 = top_5_cost_of_living_q3[['employee_residence',␣
↪'cost_of_living_scaled_q3']]


top_5_rent_index_scaled_q3 = salary_percentile_df.nlargest(5,␣
↪'rent_index_scaled_q3')
```

```
top_5_rent_index_scaled_q3  = top_5_rent_index_scaled_q3[['employee_residence',␣
↪'rent_index_scaled_q3']]


top_5_cost_of_living_plus_rent_index_scaled_q3= salary_percentile_df.nlargest(5,␣
↪'cost_of_living_plus_rent_index_scaled_q3')
top_5_cost_of_living_plus_rent_index_scaled_q3 =␣
↪top_5_cost_of_living_plus_rent_index_scaled_q3[['employee_residence',␣
↪'cost_of_living_plus_rent_index_scaled_q3']]


top_5_groceries_index_scaled_q3 = salary_percentile_df.nlargest(5,␣
↪'groceries_index_scaled_q3')
top_5_groceries_index_scaled_q3 =␣
↪top_5_groceries_index_scaled_q3[['employee_residence',␣
↪'groceries_index_scaled_q3']]


top_5_restuarant_price_index_q3 = salary_percentile_df.nlargest(5,␣
↪'restuarant_price_index_q3')
top_5_restuarant_price_index_q3 =␣
↪top_5_restuarant_price_index_q3[['employee_residence',␣
↪'restuarant_price_index_q3']]


#merging
top_5_merged_q3 = pd.merge(top_5_cost_of_living_q3 , top_5_rent_index_scaled_q3␣
↪, how='outer', on='employee_residence')
top_5_merged_q3 = pd.merge(top_5_merged_q3 ,␣
↪top_5_cost_of_living_plus_rent_index_scaled_q3 , how='outer',␣
↪on='employee_residence')
top_5_merged_q3 = pd.merge(top_5_merged_q3 , top_5_groceries_index_scaled_q3 ,␣
↪how='outer', on='employee_residence')
top_5_merged_q3 = pd.merge(top_5_merged_q3 , top_5_restuarant_price_index_q3 ,␣
↪how='outer', on='employee_residence')

top_5_merged_q3['country']=''

for idx, country_code in enumerate(top_5_merged_q3['employee_residence']):
    for key, value in country_code_dict.items():
        if country_code == value:
            top_5_merged_q3['country'][idx] = key


top_5_merged_q3 = top_5_merged_q3.drop(['employee_residence'], axis = 1)
```

```
print(top_5_merged_q3.head())
# convert to long (tidy) form
top_5_merged_q3_melted = top_5_merged_q3.melt('country', var_name='index_q3d',␣
↪value_name='scaled_salary')
legend_labels = ['Cost of Living', 'Rent Index',
        'Cost of Living Plus Rent Index',
        'Groceries Index',
        'Restaurant Price Index']

print(top_5_merged_q3_melted.head())


sns.scatterplot(data= top_5_merged_q3_melted, x ='country', y="scaled_salary",
                hue="index_q3d", legend = 'full',  palette=sns.
↪color_palette("Set1", 5))
plt.title('Top 5 Countries using the Third Quantile Salaries Scaled to each Cost␣
↪Index')
plt.xlabel("Country")
plt.xticks(rotation=90)
plt.ylabel("Salary Scaled by Cost of Index")
plt.legend(title='Cost of Index', loc='upper right',
           labels = legend_labels)
plt.show()


# print countries of top 5 using print_countries function

print('In terms of the third quantile the following are the lists of contries␣
↪where salary goes the farthest:\n')
print_countries('Cost of Living', top_5_cost_of_living_q3)
print_countries('Rent', top_5_rent_index_scaled_q3)
print_countries('Cost of Living plus Rent',␣
↪top_5_cost_of_living_plus_rent_index_scaled_q3)
print_countries('Groceries', top_5_groceries_index_scaled_q3)
print_countries('Restaurant Price', top_5_restuarant_price_index_q3 )
```

```
   cost_of_living_scaled_q3  rent_index_scaled_q3  \
0             348984.263611         599167.800000
1             298713.361121         699499.130119
2             175256.461362         424934.293236
3             136393.569812         283987.216138
4             132249.734553                   NaN

   cost_of_living_plus_rent_index_scaled_q3  groceries_index_scaled_q3  \
0                             439129.838298              344935.274917
1                             416553.325851              363318.869018
2                             243834.285581              222870.738159
```

```
3                            182353.231842             130923.888836
4                                      NaN             144736.983655

   restuarant_price_index_q3  \
0              351143.333858
1              279567.105794
2              178996.405664
3              133150.450524
4                        NaN

                                             country
0                        United States of America
1  United Kingdom of Great Britain and Northern I...
2                                            Germany
3                                        Switzerland
4                                         Luxembourg
                                             country  \
0                        United States of America
1  United Kingdom of Great Britain and Northern I...
2                                            Germany
3                                        Switzerland
4                                         Luxembourg

                 index_q3d  scaled_salary
0  cost_of_living_scaled_q3  348984.263611
1  cost_of_living_scaled_q3  298713.361121
2  cost_of_living_scaled_q3  175256.461362
3  cost_of_living_scaled_q3  136393.569812
4  cost_of_living_scaled_q3  132249.734553

C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\2430392722.py:33:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  top_5_merged_q3['country'][idx] = key
```



```
In terms of the third quantile the following are the lists of contries where
salary goes the farthest:

The 5 countries in which salary goes the farthest on the Cost of Living index
are:
```

```
United States of America
United Kingdom of Great Britain and Northern Ireland
Germany
Switzerland
Luxembourg
The 5 countries in which salary goes the farthest on the Rent index are:

United Kingdom of Great Britain and Northern Ireland
United States of America
Germany
Switzerland
Canada
The 5 countries in which salary goes the farthest on the Cost of Living plus
Rent index are:

United States of America
United Kingdom of Great Britain and Northern Ireland
Germany
Switzerland
Canada
The 5 countries in which salary goes the farthest on the Groceries index are:

United Kingdom of Great Britain and Northern Ireland
United States of America
Germany
Luxembourg
Switzerland
The 5 countries in which salary goes the farthest on the Restaurant Price index
are:

United States of America
United Kingdom of Great Britain and Northern Ireland
Germany
Singapore
Switzerland
```

The United States was top 1 or 2 on each index for each salary measure. This was for the US as a whole. Now I consider just the US

Go back to salary_df and cost_of_living_df and filter for just US

Add quantile to us salary information

[35]:
```python
salary_us_df = salary_df[salary_df['employee_residence']=='US']

salary_us_quartile_df = salary_us_df.groupby(['city', 'state']).agg(
    first_quantile = ('salary_in_2023' , lambda x: np.percentile(x, q=25)),
    median = ('salary_in_2023' , lambda x: np.percentile(x, q=50)),
    third_quantile = ('salary_in_2023' , lambda x: np.percentile(x, q=75))
    )

cost_of_living_us_df =␣
 ↪cost_of_living_df[cost_of_living_df['employee_residence']=='US']


print(salary_us_quartile_df.head())
print(cost_of_living_us_df.head())
```

```
                   first_quantile         median  third_quantile
city          state
Albuquerque   NM     145902.476293  145902.476293   145902.476293
Alpharetta    GA     120121.760000  120121.760000   120121.760000
Ann Arbor     MI     200549.029750  200549.029750   200549.029750
Antioch       TN     149839.883424  149839.883424   149839.883424
Arizona City  AZ     114163.720704  135569.418336   156975.115968
    Rank                              City  Cost of Living Index  Rent Index  \
10   NaN       Honolulu, HI, United States                103.65       65.07
13   NaN       New York, NY, United States                100.00      100.00
18   NaN  Santa Barbara, CA, United States                 95.01       78.42
20   NaN       Berkeley, CA, United States                 94.36       88.22
21   NaN  San Francisco, CA, United States                 93.91      108.42

    Cost of Living Plus Rent Index  Groceries Index  Restaurant Price Index  \
10                           85.56           114.92                   94.28
13                          100.00           100.00                  100.00
18                           87.23            99.53                   99.41
20                           91.48           106.23                   78.85
21                          100.72            97.05                   93.40

    Local Purchasing Power Index           city state        country  \
10                         89.24       Honolulu    HI  United States
13                        100.00       New York    NY  United States
18                         93.86  Santa Barbara    CA  United States
20                         85.78       Berkeley    CA  United States
21                        133.16  San Francisco    CA  United States

   employee_residence
10                 US
13                 US
18                 US
20                 US
21                 US
```

Note there are no duplicate cities in the cost of living index data, so unlike when grouped by country there is no measures of central tendency to calculate when we look at cities individually.

merge cost of living and salary data, then scale salary by each cost of living index

[36]:
```
us_salary_cost_of_living_merge_df = pd.merge(salary_us_quartile_df ,
                                             cost_of_living_us_df,
                                             how='outer', on=['city', 'state'])


print(us_salary_cost_of_living_merge_df.head())
```

```
           city state  first_quantile         median  third_quantile  Rank  \
0   Albuquerque    NM   145902.476293  145902.476293   145902.476293   NaN
1    Alpharetta    GA   120121.760000  120121.760000   120121.760000   NaN
2     Ann Arbor    MI   200549.029750  200549.029750   200549.029750   NaN
3       Antioch    TN   149839.883424  149839.883424   149839.883424   NaN
4  Arizona City    AZ   114163.720704  135569.418336   156975.115968   NaN

                               City  Cost of Living Index  Rent Index  \
0  Albuquerque, NM, United States                  63.44       33.91
1                              NaN                    NaN         NaN
2    Ann Arbor, MI, United States                  70.28       47.97
3                              NaN                    NaN         NaN
4                              NaN                    NaN         NaN

   Cost of Living Plus Rent Index  Groceries Index  Restaurant Price Index  \
0                           49.60            64.60                   64.07
1                             NaN              NaN                     NaN
2                           59.82            74.16                   63.62
3                             NaN              NaN                     NaN
4                             NaN              NaN                     NaN

   Local Purchasing Power Index        country employee_residence
0                        122.44  United States                 US
1                           NaN            NaN                NaN
2                        159.99  United States                 US
3                           NaN            NaN                NaN
4                           NaN            NaN                NaN
```

remove the rank column which is all nan

drops rows that contain nan as they either are missing salary or index data

[37]:
```
us_salary_cost_of_living_merge_drop_df= us_salary_cost_of_living_merge_df.
 ↪drop(['Rank'], axis = 1)

us_salary_cost_of_living_merge_drop_df = us_salary_cost_of_living_merge_drop_df.
 ↪dropna(axis = 0)

us_salary_cost_of_living_merge_drop_df= us_salary_cost_of_living_merge_drop_df.
 ↪reset_index(drop=True)
```

```
print(us_salary_cost_of_living_merge_drop_df.head())
```

```
          city state  first_quantile         median  third_quantile  \
0  Albuquerque    NM   145902.476293  145902.476293   145902.476293
1    Ann Arbor    MI   200549.029750  200549.029750   200549.029750
2      Atlanta    GA   122488.158672  141962.080000   154596.705120
3       Austin    TX   126871.718516  146330.144000   175774.171408
4     Berkeley    CA   319166.443687  338732.202687   358297.961687

                         City  Cost of Living Index  Rent Index  \
0  Albuquerque, NM, United States                63.44       33.91
1    Ann Arbor, MI, United States                70.28       47.97
2      Atlanta, GA, United States                76.60       48.58
3       Austin, TX, United States                66.50       57.68
4     Berkeley, CA, United States                94.36       88.22

   Cost of Living Plus Rent Index  Groceries Index  Restaurant Price Index  \
0                           49.60            64.60                   64.07
1                           59.82            74.16                   63.62
2                           63.47            78.00                   70.94
3                           62.36            67.33                   73.74
4                           91.48           106.23                   78.85

   Local Purchasing Power Index        country employee_residence
0                        122.44  United States                 US
1                        159.99  United States                 US
2                        130.67  United States                 US
3                        158.21  United States                 US
4                         85.78  United States                 US
```

Calculate scaled salaries for each index and convert to numeric

[40]:
```
us_salary_cost_of_living_merge_drop_df['cost_of_living_scaled_q1']=''
us_salary_cost_of_living_merge_drop_df['rent_index_scaled_q1']=''
us_salary_cost_of_living_merge_drop_df['cost_of_living_plus_rent_index_scaled_q1']=''
us_salary_cost_of_living_merge_drop_df['groceries_index_scaled_q1']=''
us_salary_cost_of_living_merge_drop_df['restuarant_price_index_q1']=''

us_salary_cost_of_living_merge_drop_df['cost_of_living_scaled_median']=''
us_salary_cost_of_living_merge_drop_df['rent_index_scaled_median']=''
us_salary_cost_of_living_merge_drop_df['cost_of_living_plus_rent_index_scaled_median']=''
us_salary_cost_of_living_merge_drop_df['groceries_index_scaled_median']=''
us_salary_cost_of_living_merge_drop_df['restuarant_price_index_median']=''


us_salary_cost_of_living_merge_drop_df['cost_of_living_scaled_q3']=''
us_salary_cost_of_living_merge_drop_df['rent_index_scaled_q3']=''
```

```
us_salary_cost_of_living_merge_drop_df['cost_of_living_plus_rent_index_scaled_q3']=''
us_salary_cost_of_living_merge_drop_df['groceries_index_scaled_q3']=''
us_salary_cost_of_living_merge_drop_df['restuarant_price_index_q3']=''

for idx, salary in␣
 ↪enumerate(us_salary_cost_of_living_merge_drop_df['first_quantile']):
    us_salary_cost_of_living_merge_drop_df['cost_of_living_scaled_q1'][idx] =␣
 ↪salary*100/us_salary_cost_of_living_merge_drop_df['Cost of Living Index'][idx]
    us_salary_cost_of_living_merge_drop_df['rent_index_scaled_q1'][idx] =␣
 ↪salary*100/us_salary_cost_of_living_merge_drop_df['Rent Index'][idx]
   ␣
 ↪us_salary_cost_of_living_merge_drop_df['cost_of_living_plus_rent_index_scaled_q1'][idx]␣
 ↪= salary*100/us_salary_cost_of_living_merge_drop_df['Cost of Living Plus Rent␣
 ↪Index'][idx]
    us_salary_cost_of_living_merge_drop_df['groceries_index_scaled_q1'][idx] =␣
 ↪salary*100/us_salary_cost_of_living_merge_drop_df['Groceries Index'][idx]
    us_salary_cost_of_living_merge_drop_df['restuarant_price_index_q1'][idx] =␣
 ↪salary*100/us_salary_cost_of_living_merge_drop_df['Restaurant Price␣
 ↪Index'][idx]


for idx, salary in enumerate(us_salary_cost_of_living_merge_drop_df['median']):
    us_salary_cost_of_living_merge_drop_df['cost_of_living_scaled_median'][idx]␣
 ↪= salary*100/us_salary_cost_of_living_merge_drop_df['Cost of Living␣
 ↪Index'][idx]
    us_salary_cost_of_living_merge_drop_df['rent_index_scaled_median'][idx] =␣
 ↪salary*100/us_salary_cost_of_living_merge_drop_df['Rent Index'][idx]
   ␣
 ↪us_salary_cost_of_living_merge_drop_df['cost_of_living_plus_rent_index_scaled_median'][idx]␣
 ↪= salary*100/us_salary_cost_of_living_merge_drop_df['Cost of Living Plus Rent␣
 ↪Index'][idx]
    us_salary_cost_of_living_merge_drop_df['groceries_index_scaled_median'][idx]␣
 ↪= salary*100/us_salary_cost_of_living_merge_drop_df['Groceries Index'][idx]
    us_salary_cost_of_living_merge_drop_df['restuarant_price_index_median'][idx]␣
 ↪= salary*100/us_salary_cost_of_living_merge_drop_df['Restaurant Price␣
 ↪Index'][idx]


for idx, salary in␣
 ↪enumerate(us_salary_cost_of_living_merge_drop_df['third_quantile']):
    us_salary_cost_of_living_merge_drop_df['cost_of_living_scaled_q3'][idx] =␣
 ↪salary*100/us_salary_cost_of_living_merge_drop_df['Cost of Living Index'][idx]
    us_salary_cost_of_living_merge_drop_df['rent_index_scaled_q3'][idx] =␣
 ↪salary*100/us_salary_cost_of_living_merge_drop_df['Rent Index'][idx]
```

```
  ␣
↪us_salary_cost_of_living_merge_drop_df['cost_of_living_plus_rent_index_scaled_q3'][idx]␣
↪= salary*100/us_salary_cost_of_living_merge_drop_df['Cost of Living Plus Rent␣
↪Index'][idx]
    us_salary_cost_of_living_merge_drop_df['groceries_index_scaled_q3'][idx] =␣
↪salary*100/us_salary_cost_of_living_merge_drop_df['Groceries Index'][idx]
    us_salary_cost_of_living_merge_drop_df['restuarant_price_index_q3'][idx] =␣
↪salary*100/us_salary_cost_of_living_merge_drop_df['Restaurant Price␣
↪Index'][idx]

us_salary_cost_of_living_merge_drop_df['cost_of_living_scaled_q1'] = pd.
↪to_numeric(us_salary_cost_of_living_merge_drop_df['cost_of_living_scaled_q1'],␣
↪errors='coerce')
us_salary_cost_of_living_merge_drop_df['rent_index_scaled_q1'] = pd.
↪to_numeric(us_salary_cost_of_living_merge_drop_df['rent_index_scaled_q1'],␣
↪errors='coerce')
us_salary_cost_of_living_merge_drop_df['cost_of_living_plus_rent_index_scaled_q1']␣
↪= pd.
↪to_numeric(us_salary_cost_of_living_merge_drop_df['cost_of_living_plus_rent_index_scaled_q1']
↪errors='coerce')
us_salary_cost_of_living_merge_drop_df['groceries_index_scaled_q1'] = pd.
↪to_numeric(us_salary_cost_of_living_merge_drop_df['groceries_index_scaled_q1'],␣
↪errors='coerce')
us_salary_cost_of_living_merge_drop_df['restuarant_price_index_q1'] = pd.
↪to_numeric(us_salary_cost_of_living_merge_drop_df['restuarant_price_index_q1'],␣
↪errors='coerce')

us_salary_cost_of_living_merge_drop_df['cost_of_living_scaled_median'] = pd.
↪to_numeric(us_salary_cost_of_living_merge_drop_df['cost_of_living_scaled_median'],␣
↪errors='coerce')
us_salary_cost_of_living_merge_drop_df['rent_index_scaled_median'] = pd.
↪to_numeric(us_salary_cost_of_living_merge_drop_df['rent_index_scaled_median'],␣
↪errors='coerce')
us_salary_cost_of_living_merge_drop_df['cost_of_living_plus_rent_index_scaled_median']␣
↪= pd.
↪to_numeric(us_salary_cost_of_living_merge_drop_df['cost_of_living_plus_rent_index_scaled_medi
↪errors='coerce')
us_salary_cost_of_living_merge_drop_df['groceries_index_scaled_median'] = pd.
↪to_numeric(us_salary_cost_of_living_merge_drop_df['groceries_index_scaled_median'],␣
↪errors='coerce')
us_salary_cost_of_living_merge_drop_df['restuarant_price_index_median'] = pd.
↪to_numeric(us_salary_cost_of_living_merge_drop_df['restuarant_price_index_median'],␣
↪errors='coerce')
```

```
us_salary_cost_of_living_merge_drop_df['cost_of_living_scaled_q3'] = pd.
 ↪to_numeric(us_salary_cost_of_living_merge_drop_df['cost_of_living_scaled_q3'],␣
 ↪errors='coerce')
us_salary_cost_of_living_merge_drop_df['rent_index_scaled_q3'] = pd.
 ↪to_numeric(us_salary_cost_of_living_merge_drop_df['rent_index_scaled_q3'],␣
 ↪errors='coerce')
us_salary_cost_of_living_merge_drop_df['cost_of_living_plus_rent_index_scaled_q3']␣
 ↪= pd.
 ↪to_numeric(us_salary_cost_of_living_merge_drop_df['cost_of_living_plus_rent_index_scaled_q3']
 ↪errors='coerce')
us_salary_cost_of_living_merge_drop_df['groceries_index_scaled_q3'] = pd.
 ↪to_numeric(us_salary_cost_of_living_merge_drop_df['groceries_index_scaled_q3'],␣
 ↪errors='coerce')
us_salary_cost_of_living_merge_drop_df['restuarant_price_index_q3'] = pd.
 ↪to_numeric(us_salary_cost_of_living_merge_drop_df['restuarant_price_index_q3'],␣
 ↪errors='coerce')


print(us_salary_cost_of_living_merge_drop_df.head())
```

```
          city state  first_quantile         median  third_quantile  \
0  Albuquerque    NM   145902.476293  145902.476293   145902.476293
1    Ann Arbor    MI   200549.029750  200549.029750   200549.029750
2      Atlanta    GA   122488.158672  141962.080000   154596.705120
3       Austin    TX   126871.718516  146330.144000   175774.171408
4     Berkeley    CA   319166.443687  338732.202687   358297.961687

                             City  Cost of Living Index  Rent Index  \
0  Albuquerque, NM, United States                 63.44       33.91
1    Ann Arbor, MI, United States                 70.28       47.97
2      Atlanta, GA, United States                 76.60       48.58
3       Austin, TX, United States                 66.50       57.68
4     Berkeley, CA, United States                 94.36       88.22

   Cost of Living Plus Rent Index  Groceries Index  ...  \
0                           49.60            64.60  ...
1                           59.82            74.16  ...
2                           63.47            78.00  ...
3                           62.36            67.33  ...
4                           91.48           106.23  ...

   cost_of_living_scaled_median  rent_index_scaled_median  \
0                 229984.987851             430263.864031
1                 285357.185188             418071.773504
2                 185329.086162             292223.301770
3                 220045.329323             253693.037448
4                 358978.595472             383963.049974
```

```
  cost_of_living_plus_rent_index_scaled_median groceries_index_scaled_median  \
0                               294158.218332                  225855.226460
1                               335254.145353                  270427.494269
2                               223668.000630                  182002.666667
3                               234653.855035                  217332.755087
4                               370280.064153                  318866.800986

   restuarant_price_index_median  cost_of_living_scaled_q3  \
0                  227723.546579             229984.987851
1                  315229.534344             285357.185188
2                  200115.703411             201823.374830
3                  198440.661785             264322.062268
4                  429590.618500             379713.821203

   rent_index_scaled_q3  cost_of_living_plus_rent_index_scaled_q3  \
0         430263.864031                             294158.218332
1         418071.773504                             335254.145353
2         318231.175628                             243574.452686
3         304740.241692                             281870.063194
4         406141.421092                             391668.082299

   groceries_index_scaled_q3  restuarant_price_index_q3
0              225855.226460              227723.546579
1              270427.494269              315229.534344
2              198200.904000              217926.001015
3              261063.673560              238370.180917
4              337285.099960              454404.517042

[5 rows x 29 columns]
```

```
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\94921046.py:21:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  us_salary_cost_of_living_merge_drop_df['cost_of_living_scaled_q1'][idx] =
salary*100/us_salary_cost_of_living_merge_drop_df['Cost of Living Index'][idx]
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\94921046.py:22:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  us_salary_cost_of_living_merge_drop_df['rent_index_scaled_q1'][idx] =
salary*100/us_salary_cost_of_living_merge_drop_df['Rent Index'][idx]
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\94921046.py:23:
```

```
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  us_salary_cost_of_living_merge_drop_df['cost_of_living_plus_rent_index_scaled_
q1'][idx] = salary*100/us_salary_cost_of_living_merge_drop_df['Cost of Living
Plus Rent Index'][idx]
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\94921046.py:24:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  us_salary_cost_of_living_merge_drop_df['groceries_index_scaled_q1'][idx] =
salary*100/us_salary_cost_of_living_merge_drop_df['Groceries Index'][idx]
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\94921046.py:25:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  us_salary_cost_of_living_merge_drop_df['restuarant_price_index_q1'][idx] =
salary*100/us_salary_cost_of_living_merge_drop_df['Restaurant Price Index'][idx]
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\94921046.py:29:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  us_salary_cost_of_living_merge_drop_df['cost_of_living_scaled_median'][idx] =
salary*100/us_salary_cost_of_living_merge_drop_df['Cost of Living Index'][idx]
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\94921046.py:30:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  us_salary_cost_of_living_merge_drop_df['rent_index_scaled_median'][idx] =
salary*100/us_salary_cost_of_living_merge_drop_df['Rent Index'][idx]
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\94921046.py:31:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  us_salary_cost_of_living_merge_drop_df['cost_of_living_plus_rent_index_scaled_
median'][idx] = salary*100/us_salary_cost_of_living_merge_drop_df['Cost of
Living Plus Rent Index'][idx]
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\94921046.py:32:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  us_salary_cost_of_living_merge_drop_df['groceries_index_scaled_median'][idx] =
salary*100/us_salary_cost_of_living_merge_drop_df['Groceries Index'][idx]
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\94921046.py:33:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  us_salary_cost_of_living_merge_drop_df['restuarant_price_index_median'][idx] =
salary*100/us_salary_cost_of_living_merge_drop_df['Restaurant Price Index'][idx]
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\94921046.py:37:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  us_salary_cost_of_living_merge_drop_df['cost_of_living_scaled_q3'][idx] =
salary*100/us_salary_cost_of_living_merge_drop_df['Cost of Living Index'][idx]
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\94921046.py:38:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  us_salary_cost_of_living_merge_drop_df['rent_index_scaled_q3'][idx] =
salary*100/us_salary_cost_of_living_merge_drop_df['Rent Index'][idx]
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\94921046.py:39:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  us_salary_cost_of_living_merge_drop_df['cost_of_living_plus_rent_index_scaled_
q3'][idx] = salary*100/us_salary_cost_of_living_merge_drop_df['Cost of Living
Plus Rent Index'][idx]
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\94921046.py:40:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
```

```
  us_salary_cost_of_living_merge_drop_df['groceries_index_scaled_q3'][idx] =
salary*100/us_salary_cost_of_living_merge_drop_df['Groceries Index'][idx]
C:\Users\hawthorner\AppData\Local\Temp\ipykernel_22188\94921046.py:41:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  us_salary_cost_of_living_merge_drop_df['restuarant_price_index_q3'][idx] =
salary*100/us_salary_cost_of_living_merge_drop_df['Restaurant Price Index'][idx]
```

finding top 5 of each indice, which returns all columnns. so I removed all columns except the residency and the column its actually the top 5 of.

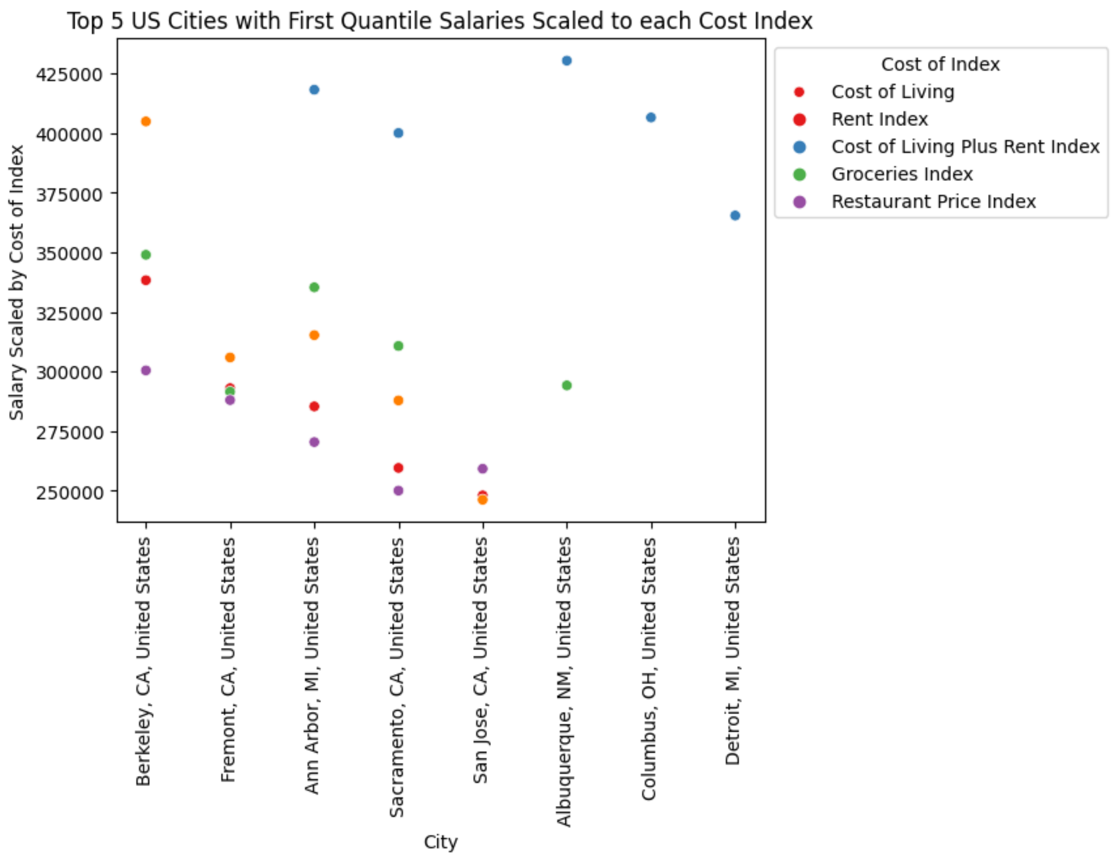
Then created a graphic and printed the top 5 for each index.

This was repeated with each of the first quantile, median, and third quantile.

[47]:
```
# first quantile

top_5_cost_of_living_us_q1 = us_salary_cost_of_living_merge_drop_df.nlargest(5,␣
 ↪'cost_of_living_scaled_q1')
top_5_cost_of_living_us_q1 = top_5_cost_of_living_us_q1[['City',␣
 ↪'cost_of_living_scaled_q1']]


top_5_rent_index_scaled_us_q1 = us_salary_cost_of_living_merge_drop_df.
 ↪nlargest(5, 'rent_index_scaled_q1')
top_5_rent_index_scaled_us_q1  = top_5_rent_index_scaled_us_q1[['City',␣
 ↪'rent_index_scaled_q1']]


top_5_cost_of_living_plus_rent_index_scaled_us_q1 =␣
 ↪us_salary_cost_of_living_merge_drop_df.nlargest(5,␣
 ↪'cost_of_living_plus_rent_index_scaled_q1')
top_5_cost_of_living_plus_rent_index_scaled_us_q1 =␣
 ↪top_5_cost_of_living_plus_rent_index_scaled_us_q1[['City',␣
 ↪'cost_of_living_plus_rent_index_scaled_q1']]


top_5_groceries_index_scaled_us_q1 = us_salary_cost_of_living_merge_drop_df.
 ↪nlargest(5, 'groceries_index_scaled_q1')
top_5_groceries_index_scaled_us_q1 = top_5_groceries_index_scaled_us_q1[['City',␣
 ↪'groceries_index_scaled_q1']]


top_5_restuarant_price_index_us_q1 = us_salary_cost_of_living_merge_drop_df.
 ↪nlargest(5, 'restuarant_price_index_q1')
```

```
top_5_restuarant_price_index_us_q1 = top_5_restuarant_price_index_us_q1[['City',␣
↪'restuarant_price_index_q1']]



#merging
top_5_merged_us_q1 = pd.merge(top_5_cost_of_living_us_q1 ,␣
↪top_5_rent_index_scaled_us_q1 , how='outer', on='City')
top_5_merged_us_q1 = pd.merge(top_5_merged_us_q1 ,␣
↪top_5_cost_of_living_plus_rent_index_scaled_us_q1 , how='outer', on='City')
top_5_merged_us_q1 = pd.merge(top_5_merged_us_q1 ,␣
↪top_5_groceries_index_scaled_us_q1 , how='outer', on='City')
top_5_merged_us_q1 = pd.merge(top_5_merged_us_q1 ,␣
↪top_5_restuarant_price_index_us_q1 , how='outer', on='City')

print(top_5_merged_us_q1.head())

# convert to long (tidy) form
top_5_merged_melted_us_q1 = top_5_merged_us_q1.melt('City',␣
↪var_name='index_measured', value_name='scaled_salary')

print(top_5_merged_melted_us_q1.head())
legend_labels = ['Cost of Living', 'Rent Index',
        'Cost of Living Plus Rent Index',
        'Groceries Index',
        'Restaurant Price Index']

ax = sns.scatterplot(data= top_5_merged_melted_us_q1, x ='City',␣
↪y="scaled_salary",
                hue="index_measured", palette=sns.color_palette("Set1", 5))
plt.title('Top 5 US Cities with First Quantile Salaries Scaled to each Cost␣
↪Index')
plt.xlabel("City")
plt.xticks(rotation=90)
plt.ylabel("Salary Scaled by Cost of Index")
plt.legend(title='Cost of Index',
           labels = legend_labels)
sns.move_legend(ax, "upper left", bbox_to_anchor=(1, 1))
plt.show()

# print countries of top 5 using print_countries function

print('The top five cities for each index for the first quantile of salaries are:
↪\n')
print_cities('Cost of Living', top_5_cost_of_living_us_q1)
print_cities('Rent', top_5_rent_index_scaled_us_q1)
print_cities('Cost of Living plus Rent',␣
 ↪top_5_cost_of_living_plus_rent_index_scaled_us_q1)
print_cities('Groceries', top_5_groceries_index_scaled_us_q1)
print_cities('Restaurant Price', top_5_restuarant_price_index_us_q1 )
```

```
                          City  cost_of_living_scaled_q1  \
0    Berkeley, CA, United States             338243.369741
1     Fremont, CA, United States             292997.866728
2   Ann Arbor, MI, United States             285357.185188
3  Sacramento, CA, United States             259585.159322
4    San Jose, CA, United States             248053.634432

   rent_index_scaled_q1  cost_of_living_plus_rent_index_scaled_q1  \
0                   NaN                             348892.046007
1                   NaN                             291503.380965
2         418071.773504                             335254.145353
3         399930.607478                             310688.369571
4                   NaN                                       NaN

   groceries_index_scaled_q1  restuarant_price_index_q1
0              300448.502012              404776.719959
1              288023.897638              305873.265942
2              270427.494269              315229.534344
3              250080.309352              287861.201880
4              259237.677499              246249.608000
                          City            index_measured  scaled_salary
0    Berkeley, CA, United States  cost_of_living_scaled_q1  338243.369741
1     Fremont, CA, United States  cost_of_living_scaled_q1  292997.866728
2   Ann Arbor, MI, United States  cost_of_living_scaled_q1  285357.185188
3  Sacramento, CA, United States  cost_of_living_scaled_q1  259585.159322
4    San Jose, CA, United States  cost_of_living_scaled_q1  248053.634432
```



```
The top five cities for each index for the first quantile of salaries are:

The 5 cities in which salary goes the farthest on the Cost of Living index are:
Berkeley, CA, United States
Fremont, CA, United States
Ann Arbor, MI, United States
Sacramento, CA, United States
San Jose, CA, United States
The 5 cities in which salary goes the farthest on the Rent index are:
Albuquerque, NM, United States
Ann Arbor, MI, United States
Columbus, OH, United States
Sacramento, CA, United States
Detroit, MI, United States
The 5 cities in which salary goes the farthest on the Cost of Living plus Rent
index are:
Berkeley, CA, United States
Ann Arbor, MI, United States
Sacramento, CA, United States
Albuquerque, NM, United States
```

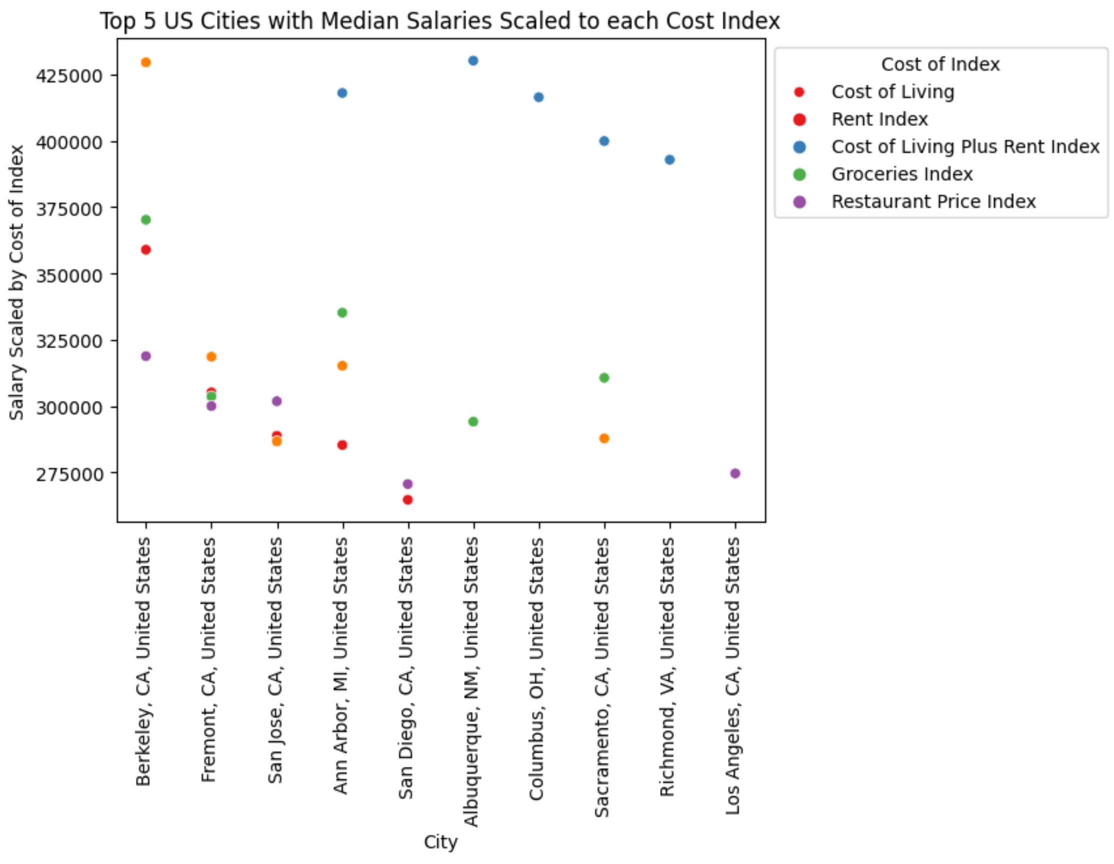
```
Fremont, CA, United States
The 5 cities in which salary goes the farthest on the Groceries index are:
Berkeley, CA, United States
Fremont, CA, United States
Ann Arbor, MI, United States
San Jose, CA, United States
Sacramento, CA, United States
The 5 cities in which salary goes the farthest on the Restaurant Price index
are:
Berkeley, CA, United States
Ann Arbor, MI, United States
Fremont, CA, United States
Sacramento, CA, United States
San Jose, CA, United States
```

[48]:
```
top_5_cost_of_living_us_median = us_salary_cost_of_living_merge_drop_df.
 ↪nlargest(5, 'cost_of_living_scaled_median')
top_5_cost_of_living_us_median = top_5_cost_of_living_us_median[['City',␣
 ↪'cost_of_living_scaled_median']]


top_5_rent_index_scaled_us_median = us_salary_cost_of_living_merge_drop_df.
 ↪nlargest(5, 'rent_index_scaled_median')
top_5_rent_index_scaled_us_median  = top_5_rent_index_scaled_us_median[['City',␣
 ↪'rent_index_scaled_median']]


top_5_cost_of_living_plus_rent_index_scaled_us_median =␣
 ↪us_salary_cost_of_living_merge_drop_df.nlargest(5,␣
 ↪'cost_of_living_plus_rent_index_scaled_median')
top_5_cost_of_living_plus_rent_index_scaled_us_median =␣
 ↪top_5_cost_of_living_plus_rent_index_scaled_us_median[['City',␣
 ↪'cost_of_living_plus_rent_index_scaled_median']]


top_5_groceries_index_scaled_us_median = us_salary_cost_of_living_merge_drop_df.
 ↪nlargest(5, 'groceries_index_scaled_median')
top_5_groceries_index_scaled_us_median =␣
 ↪top_5_groceries_index_scaled_us_median[['City',␣
 ↪'groceries_index_scaled_median']]


top_5_restuarant_price_index_us_median = us_salary_cost_of_living_merge_drop_df.
 ↪nlargest(5, 'restuarant_price_index_median')
top_5_restuarant_price_index_us_median =␣
 ↪top_5_restuarant_price_index_us_median[['City',␣
 ↪'restuarant_price_index_median']]
```

```
#merging
top_5_merged_us_median = pd.merge(top_5_cost_of_living_us_median ,␣
↪top_5_rent_index_scaled_us_median , how='outer', on='City')
top_5_merged_us_median = pd.merge(top_5_merged_us_median ,␣
↪top_5_cost_of_living_plus_rent_index_scaled_us_median , how='outer', on='City')
top_5_merged_us_median = pd.merge(top_5_merged_us_median ,␣
↪top_5_groceries_index_scaled_us_median , how='outer', on='City')
top_5_merged_us_median = pd.merge(top_5_merged_us_median ,␣
↪top_5_restuarant_price_index_us_median , how='outer', on='City')

print(top_5_merged_us_median.head())


# convert to long (tidy) form
top_5_merged_melted_us_median = top_5_merged_us_median.melt('City',␣
↪var_name='index_measured', value_name='scaled_salary')

print(top_5_merged_melted_us_median.head())


ax = sns.scatterplot(data= top_5_merged_melted_us_median, x ='City',␣
↪y="scaled_salary",
                hue="index_measured", palette=sns.color_palette("Set1", 5))
plt.title('Top 5 US Cities with Median Salaries Scaled to each Cost Index')
plt.xlabel("City")
plt.xticks(rotation=90)
plt.ylabel("Salary Scaled by Cost of Index")
plt.legend(title='Cost of Index',
           labels = legend_labels)
sns.move_legend(ax, "upper left", bbox_to_anchor=(1, 1))
plt.show()

# print countries of top 5 using print_countries function


print_cities('Cost of Living', top_5_cost_of_living_us_median)
print_cities('Rent', top_5_rent_index_scaled_us_median)
print_cities('Cost of Living plus Rent',␣
↪top_5_cost_of_living_plus_rent_index_scaled_us_median)
print_cities('Groceries', top_5_groceries_index_scaled_us_median)
print_cities('Restaurant Price', top_5_restuarant_price_index_us_median )
```

```
                         City  cost_of_living_scaled_median  \
0   Berkeley, CA, United States                  358978.595472
```

```
1    Fremont, CA, United States                 305220.032970
2   San Jose, CA, United States                 288842.009833
3  Ann Arbor, MI, United States                 285357.185188
4  San Diego, CA, United States                 264723.083652

   rent_index_scaled_median  cost_of_living_plus_rent_index_scaled_median  \
0                       NaN                                 370280.064153
1                       NaN                                 303663.205956
2                       NaN                                           NaN
3             418071.773504                                 335254.145353
4                       NaN                                           NaN

   groceries_index_scaled_median  restuarant_price_index_median
0                  318866.800986                  429590.618500
1                  300038.578829                  318632.518926
2                  301865.086414                  286741.340671
3                            NaN                  315229.534344
4                  270640.085657                            NaN
                           City                index_measured  scaled_salary
0   Berkeley, CA, United States  cost_of_living_scaled_median  358978.595472
1    Fremont, CA, United States  cost_of_living_scaled_median  305220.032970
2   San Jose, CA, United States  cost_of_living_scaled_median  288842.009833
3  Ann Arbor, MI, United States  cost_of_living_scaled_median  285357.185188
4  San Diego, CA, United States  cost_of_living_scaled_median  264723.083652
```



```
The 5 cities in which salary goes the farthest on the Cost of Living index are:
Berkeley, CA, United States
Fremont, CA, United States
San Jose, CA, United States
Ann Arbor, MI, United States
San Diego, CA, United States
The 5 cities in which salary goes the farthest on the Rent index are:
Albuquerque, NM, United States
Ann Arbor, MI, United States
Columbus, OH, United States
Sacramento, CA, United States
Richmond, VA, United States
The 5 cities in which salary goes the farthest on the Cost of Living plus Rent
index are:
Berkeley, CA, United States
Ann Arbor, MI, United States
Sacramento, CA, United States
Fremont, CA, United States
Albuquerque, NM, United States
The 5 cities in which salary goes the farthest on the Groceries index are:
```

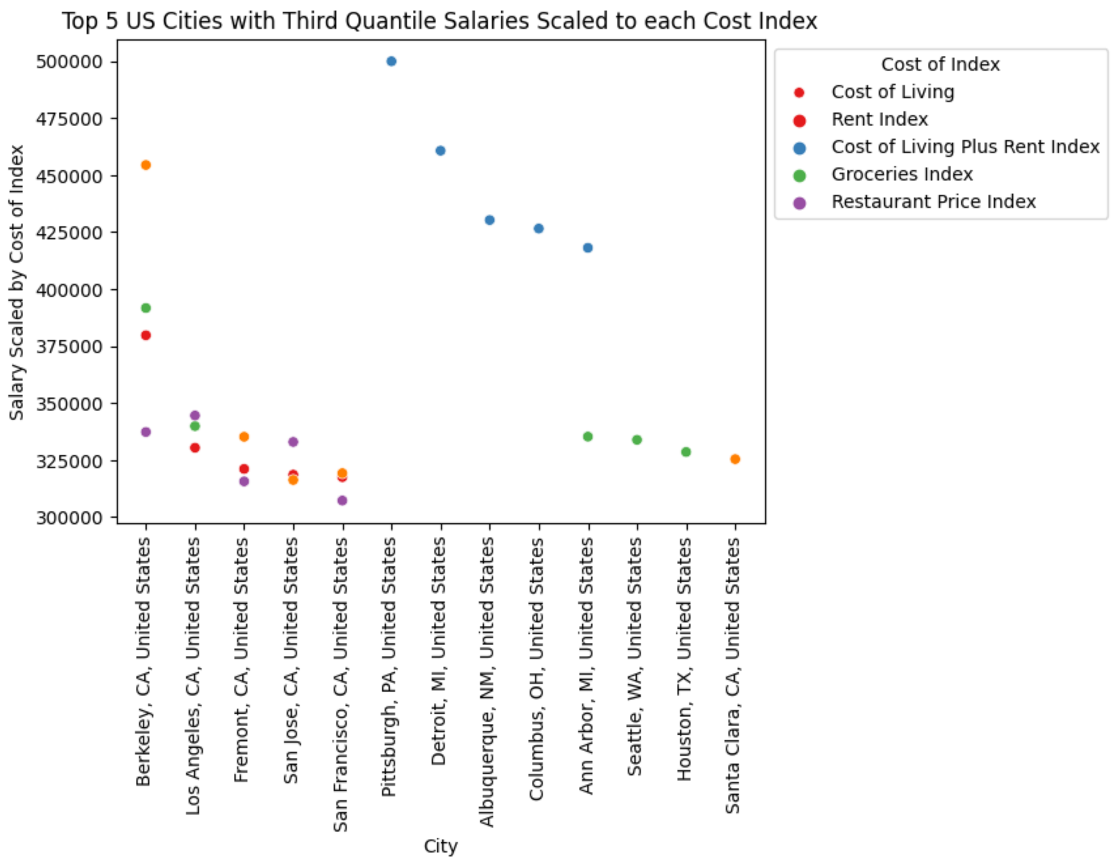
```
Berkeley, CA, United States
San Jose, CA, United States
Fremont, CA, United States
Los Angeles, CA, United States
San Diego, CA, United States
The 5 cities in which salary goes the farthest on the Restaurant Price index
are:
Berkeley, CA, United States
Fremont, CA, United States
Ann Arbor, MI, United States
Sacramento, CA, United States
San Jose, CA, United States
```

[49]:
```
#third qunatile
top_5_cost_of_living_us_q3 = us_salary_cost_of_living_merge_drop_df.nlargest(5,␣
↪'cost_of_living_scaled_q3')
top_5_cost_of_living_us_q3 = top_5_cost_of_living_us_q3[['City',␣
↪'cost_of_living_scaled_q3']]


top_5_rent_index_scaled_us_q3 = us_salary_cost_of_living_merge_drop_df.
↪nlargest(5, 'rent_index_scaled_q3')
top_5_rent_index_scaled_us_q3  = top_5_rent_index_scaled_us_q3[['City',␣
↪'rent_index_scaled_q3']]


top_5_cost_of_living_plus_rent_index_scaled_us_q3 =␣
↪us_salary_cost_of_living_merge_drop_df.nlargest(5,␣
↪'cost_of_living_plus_rent_index_scaled_q3')
top_5_cost_of_living_plus_rent_index_scaled_us_q3 =␣
↪top_5_cost_of_living_plus_rent_index_scaled_us_q3[['City',␣
↪'cost_of_living_plus_rent_index_scaled_q3']]


top_5_groceries_index_scaled_us_q3 = us_salary_cost_of_living_merge_drop_df.
↪nlargest(5, 'groceries_index_scaled_q3')
top_5_groceries_index_scaled_us_q3 = top_5_groceries_index_scaled_us_q3[['City',␣
↪'groceries_index_scaled_q3']]


top_5_restuarant_price_index_us_q3 = us_salary_cost_of_living_merge_drop_df.
↪nlargest(5, 'restuarant_price_index_q3')
top_5_restuarant_price_index_us_q3 = top_5_restuarant_price_index_us_q3[['City',␣
↪'restuarant_price_index_q3']]
```

```
#merging
top_5_merged_us_q3 = pd.merge(top_5_cost_of_living_us_q3 ,␣
↪top_5_rent_index_scaled_us_q3 , how='outer', on='City')
top_5_merged_us_q3 = pd.merge(top_5_merged_us_q3 ,␣
↪top_5_cost_of_living_plus_rent_index_scaled_us_q3 , how='outer', on='City')
top_5_merged_us_q3 = pd.merge(top_5_merged_us_q3 ,␣
↪top_5_groceries_index_scaled_us_q3 , how='outer', on='City')
top_5_merged_us_q3 = pd.merge(top_5_merged_us_q3 ,␣
↪top_5_restuarant_price_index_us_q3 , how='outer', on='City')

print(top_5_merged_us_q3.head())

# convert to long (tidy) form
top_5_merged_melted_us_q3 = top_5_merged_us_q3.melt('City',␣
↪var_name='index_measured', value_name='scaled_salary')
print(top_5_merged_melted_us_q3.head())


ax = sns.scatterplot(data= top_5_merged_melted_us_q3, x ='City',␣
↪y="scaled_salary",
                hue="index_measured", palette=sns.color_palette("Set1", 5))
plt.title('Top 5 US Cities with Third Quantile Salaries Scaled to each Cost␣
↪Index')
plt.xlabel("City")
plt.xticks(rotation=90)
plt.ylabel("Salary Scaled by Cost of Index")
plt.legend(title='Cost of Index',
           labels = legend_labels)
sns.move_legend(ax, "upper left", bbox_to_anchor=(1, 1))
plt.show()

# print countries of top 5 using print_countries function

print('The top five cities for each index for the third quantile of salaries are:
↪\n')
print_cities('Cost of Living', top_5_cost_of_living_us_q3)
print_cities('Rent', top_5_rent_index_scaled_us_q3)
print_cities('Cost of Living plus Rent',␣
↪top_5_cost_of_living_plus_rent_index_scaled_us_q3)
print_cities('Groceries', top_5_groceries_index_scaled_us_q3)
print_cities('Restaurant Price', top_5_restuarant_price_index_us_q3 )
```

```
                              City  cost_of_living_scaled_q3  \
0       Berkeley, CA, United States             379713.821203
1    Los Angeles, CA, United States             330376.554211
2        Fremont, CA, United States             321075.436776
3       San Jose, CA, United States             318557.978374
```

```
4  San Francisco, CA, United States           317483.269632

   rent_index_scaled_q3  cost_of_living_plus_rent_index_scaled_q3  \
0                   NaN                              391668.082299
1                   NaN                              339861.253936
2                   NaN                                        NaN
3                   NaN                                        NaN
4                   NaN                                        NaN

   groceries_index_scaled_q3  restuarant_price_index_q3
0              337285.099960              454404.517042
1              344515.661417                        NaN
2              315624.819282              335184.667238
3              332920.864681              316241.193076
4              307211.271006              319216.850655
                               City           index_measured  scaled_salary
0      Berkeley, CA, United States  cost_of_living_scaled_q3  379713.821203
1   Los Angeles, CA, United States  cost_of_living_scaled_q3  330376.554211
2       Fremont, CA, United States  cost_of_living_scaled_q3  321075.436776
3      San Jose, CA, United States  cost_of_living_scaled_q3  318557.978374
4  San Francisco, CA, United States  cost_of_living_scaled_q3  317483.269632
```



```
The top five cities for each index for the third quantile of salaries are:

The 5 cities in which salary goes the farthest on the Cost of Living index are:
Berkeley, CA, United States
Los Angeles, CA, United States
Fremont, CA, United States
San Jose, CA, United States
San Francisco, CA, United States
The 5 cities in which salary goes the farthest on the Rent index are:
Pittsburgh, PA, United States
Detroit, MI, United States
Albuquerque, NM, United States
Columbus, OH, United States
Ann Arbor, MI, United States
The 5 cities in which salary goes the farthest on the Cost of Living plus Rent
index are:
Berkeley, CA, United States
Los Angeles, CA, United States
Ann Arbor, MI, United States
Seattle, WA, United States
Houston, TX, United States
The 5 cities in which salary goes the farthest on the Groceries index are:
Los Angeles, CA, United States
Berkeley, CA, United States
San Jose, CA, United States
Fremont, CA, United States
San Francisco, CA, United States
The 5 cities in which salary goes the farthest on the Restaurant Price index
are:
Berkeley, CA, United States
Fremont, CA, United States
Santa Clara, CA, United States
San Francisco, CA, United States
San Jose, CA, United States
```

What I have learned is that I am not moving anywhere where my salary will go the farthest as I have zero intention of leaving coastal New Hampshire to live in California, the midwest or Texas. (Actually it seems New England was sorely underrepresented in the data, so perhaps more extemsive data would show NH actually is the best.)