

# Auriana Anderson Project 2

December 13, 2024

1. Of course we do have to start by importing all of our data and libraies. I will do data first and as I want to use more libraries, I will install by case, forr now, I will only be adding pandas. I will use my first cell only for libraries and data.
2. We have 4 different data files to use. I'm a very step by step person and the first thing I have looked at is the Cost of Living File as well as the Country codes file.
3. My first thought is these need to be combined. I'm thinking we take the Cost of living file, split the city column. the format is "city, country" so we split after the comma into two columns, city and country. we can then join these two data sets by the country column. From there I will decide if I want to group it.

## 1 Project 2

### 1.0.1 Auriana Anderson

### 1.0.2 December 6, 2024

```
[3941]: import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
from IPython.display import display
cost_of_living = pd.read_csv('Project 2/Project Data/cost_of_living.csv')
country_codes = pd.read_excel('Project 2/Project Data/country_codes.xlsx')
ds_salaries = pd.read_csv('Project 2/Project Data/ds_salaries.csv')
Fyi = pd.read_csv('Project 2/Project Data/Levels_Fyi_Salary_Data.csv')
print(cost_of_living)
```

	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	
..	...	...	...	...	
573	NaN	Kanpur, India	20.79	3.60	
574	NaN	Karachi, Pakistan	20.75	4.84	
575	NaN	Rawalpindi, Pakistan	20.52	4.78	
576	NaN	Multan, Pakistan	18.68	2.94	
577	NaN	Peshawar, Pakistan	18.55	2.37	

	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	
..	...	...	...	
573	12.73	22.19	13.31	
574	13.29	18.48	15.21	
575	13.14	18.51	16.18	
576	11.30	18.37	11.80	
577	10.97	16.62	14.39	

	Local Purchasing Power Index
0	79.43
1	129.79
2	111.53
3	143.40
4	111.96
..	...
573	38.83
574	29.16
575	22.91
576	25.09
577	26.00

[578 rows x 8 columns]

This step turned out to be more complicated as I realized in the city column some are formatted as [city, state] and some are [city, state, country]. I will attempt to create a function to handle this. Im expecting some of the results in my new city column to be [city, state] while some will be [city] The purpose of this is to be able to do a join by the country code.

```
[3944]: cost_of_living['City'] = cost_of_living['City'].astype(str)

def city_country(city):
    #best method is to split on the second comma which will keep
    two_parts = city.rsplit(',',2)
    if len(two_parts) == 3:
        return two_parts[0].strip(), two_parts[1].strip(), two_parts[2].strip()
    elif len(two_parts) == 2:
        return two_parts[0].strip(), 'no state provided', two_parts[1].strip()
    else:
        return two_parts[0].strip(), 'no state provided','no country provided'

cost_of_living[['city', 'state','country']] = cost_of_living['City'].
    ↪apply(lambda x: pd.Series(city_country(x)))
```

```
cost_of_living['country'] = cost_of_living['country'].str.strip().str.lower()
```

```
[3946]: cost_of_living['city'] = cost_of_living['city'].astype(str).str.strip().str.
        ↪lower()
cost_of_living['state'] = cost_of_living['state'].astype(str).str.strip().str.
        ↪lower()
cost_of_living['country'] = cost_of_living['country'].astype(str).str.strip().
        ↪str.lower()

print(cost_of_living.iloc[293])
```

Rank	NaN
City	Akron, OH, United States
Cost of Living Index	62.2
Rent Index	22.9
Cost of Living Plus Rent Index	43.78
Groceries Index	63.55
Restaurant Price Index	55.56
Local Purchasing Power Index	102.89
city	akron
state	oh
country	united states

Name: 293, dtype: object

Now I think we remove the original City column so there is no confusion further down the line (the original column is City and my new columns are city and country). We should also be good to do our join after that.

I looked at a column where I knew there was three parts city, state country and realized the country codes popped up as Nan this means that maybe I need to first of all change them all to lowercase and create a standard so that they match properly, so I will do another function to create standardized country names before I merge below so that they all properly map.

```
[3949]: cost_of_living.drop('City', axis = 1, inplace = True)

country_codes.rename(columns = {'Country':'country'}, inplace = True)

# print(cost_of_living)
```

Standardizing country names so that the codes are mapping properly below- I think I have to create a dictionary- and then reurunning everything below:

```
[3952]: country_codes['country'] = country_codes['country'].astype(str).str.strip().str.
        ↪lower()

country_codes = country_codes.drop_duplicates(subset=['country'])
```

```
[3954]: us_states_abbrev = {

    'alabama': 'al', 'alaska': 'ak', 'arizona': 'az', 'arkansas': 'ar',
    ↪ 'california': 'ca'
    , 'colorado': 'co', 'connecticut': 'ct', 'delaware': 'de', 'florida': 'fl',
    ↪ 'georgia': 'ga'
    , 'hawaii': 'hi', 'idaho': 'id', 'illinois': 'il', 'indiana': 'in', 'iowa':
    ↪ 'ia'
    , 'kansas': 'ks', 'kentucky': 'ky', 'louisiana': 'la', 'maine': 'me',
    ↪ 'maryland': 'md'
    , 'massachusetts': 'ma', 'michigan': 'mi', 'minnesota': 'mn', 'mississippi':
    ↪ 'ms'
    , 'missouri': 'mo', 'montana': 'mt', 'nebraska': 'ne', 'nevada': 'nv', 'new
    ↪ hampshire': 'nh'
    , 'new jersey': 'nj', 'new mexico': 'nm', 'new york': 'ny', 'north carolina':
    ↪ 'nc'
    , 'north dakota': 'nd', 'ohio': 'oh', 'oklahoma': 'ok', 'oregon': 'or',
    ↪ 'pennsylvania': 'pa'
    , 'rhode island': 'ri', 'south carolina': 'sc', 'south dakota': 'sd',
    ↪ 'tennessee': 'tn'
    , 'texas': 'tx', 'utah': 'ut', 'vermont': 'vt', 'virginia': 'va',
    ↪ 'washington': 'wa'
    , 'west virginia': 'wv', 'wisconsin': 'wi', 'wyoming': 'wy', 'district of
    ↪ columbia': 'dc'
}
```

```
[3956]: country_map = {

    'united states of america (the)': 'united states'
    , 'bahamas (the)': 'bahamas', 'russian federation (the)': 'russia'
    , 'united kingdom of great britain and northern ireland (the)': 'united
    ↪ kingdom'
    , 'netherlands (the)': 'netherlands', 'korea (the republic of)': 'south korea'
    , 'taiwan (province of china)': 'taiwan', 'united arab emirates (the)': 'united
    ↪ arab emirates'
    , 'philippines (the)': 'philippines' , 'czechia': 'czech republic'
    , "côte d'ivoire": 'ivory coast', 'venezuela (bolivarian republic of)':
    ↪ 'venezuela'
    , 'dominican republic (the)': 'dominican republic', 'viet nam': 'vietnam'
    , 'syrian arab republic': 'syria', 'republic of north macedonia': 'north
    ↪ macedonia'
    , 'tanzania, united republic of': 'tanzania', 'moldova (the republic of)':
    ↪ 'moldova'
    , 'kosovo (disputed territory)': 'kosovo', 'iran (islamic republic of)': 'iran'
    , 'bolivia (plurinational state of)': 'bolivia', 'hong kong (sar)': 'hong kong'
    , 'norway': 'norway', 'bermuda': 'bermuda' , 'lebanon': 'lebanon'
    , 'jersey': 'jersey' , 'israel': 'israel', 'iceland': 'iceland'
}
```

```

    , 'luxembourg': 'luxembourg', 'finland': 'finland', 'macao': 'macao'
    , 'cyprus': 'cyprus', 'qatar': 'qatar', 'trinidad and tobago': 'trinidad and
↪tobago'
    , 'greece': 'greece', 'maldives': 'maldives', 'slovenia': 'slovenia', 'cuba':
↪'cuba' , 'estonia': 'estonia'
    , 'panama': 'panama', 'bahrain': 'bahrain', 'china': 'china', 'saudi arabia':
↪'saudi arabia'
    , 'jordan': 'jordan', 'uruguay': 'uruguay', 'portugal': 'portugal', 'croatia':
↪'croatia'
    , 'jamaica': 'jamaica', 'latvia': 'latvia', 'oman': 'oman', 'senegal': 'senegal'
    , 'ethiopia': 'ethiopia', 'thailand': 'thailand', 'cambodia': 'cambodia'
    , 'slovakia': 'slovakia', 'suriname': 'suriname', 'kuwait': 'kuwait', 'costa
↪rica': 'costa rica'
    , 'lithuania': 'lithuania', 'hungary': 'hungary' , 'zimbabwe':
↪'zimbabwe', 'chile': 'chile'
    , 'el salvador': 'el salvador', 'south africa': 'south africa', 'guatemala':
↪'guatemala'
    , 'poland': 'poland', 'indonesia': 'indonesia', 'botswana':
↪'botswana', 'bulgaria': 'bulgaria'
    , 'ecuador': 'ecuador', 'romania': 'romania', 'serbia': 'serbia'
    , 'malaysia': 'malaysia' , 'morocco': 'morocco', 'montenegro': 'montenegro'
    , 'fiji': 'fiji', 'ghana': 'ghana' , 'bosnia and herzegovina': 'bosnia and
↪herzegovina'
    , 'iraq': 'iraq', 'nigeria': 'nigeria', 'syria': 'syria', 'uganda': 'uganda'
    , 'kenya': 'kenya' , 'argentina': 'argentina', 'bangladesh': 'bangladesh'
    , 'mongolia': 'mongolia', 'peru': 'peru', 'ukraine': 'ukraine' , 'armenia':
↪'armenia'
    , 'tanzania': 'tanzania' , 'sri lanka': 'sri lanka', 'zambia':
↪'zambia', 'belarus': 'belarus'
    , 'egypt': 'egypt', 'rwanda': 'rwanda', 'azerbaijan': 'azerbaijan', 'turkey':
↪'turkey'
    , 'georgia': 'georgia', 'paraguay': 'paraguay' , 'kazakhstan': 'kazakhstan'
    , 'tunisia': 'tunisia', 'nepal': 'nepal', 'algeria': 'algeria', 'uzbekistan':
↪'uzbekistan'
    , 'colombia': 'colombia' , 'kyrgyzstan': 'kyrgyzstan', 'pakistan': 'pakistan'
    , 'afghanistan': 'afghanistan', 'marshall islands (the)': 'marshall islands'
}

country_codes['country'] = country_codes['country'].replace(country_map)

print(country_codes.iloc[181])

```

```

country      russia
Alpha-2 code  RU
Alpha-3 code  RUS
Numeric      643
Name: 181, dtype: object

```

updating country for the united states now have No country provided

```
[3959]: def country_update(each_row):
        if each_row['country'] == 'no country provided':
            state = each_row['location'].split(',')[1].strip()
            if state in us_states_abbrev:
                each_row['country'] = 'united states'
        return each_row

cost_of_living = cost_of_living.apply(country_update, axis = 1)

cost_of_living_countries = set(cost_of_living['country'].unique())
country_codes_countries = set(country_codes['country'].unique())

# print(cost_of_living_countries)
# print(country_codes_countries)
```

```
[3961]: cost_of_living_with_codes = cost_of_living.merge(country_codes
                                                         ,on = 'country'
                                                         ,how = 'outer')

print(cost_of_living_with_codes)
```

	Rank	Cost of Living Index	Rent Index	Cost of Living Plus Rent Index \
0	NaN	21.35	3.17	12.83
1	NaN	38.68	11.33	25.86
2	NaN	29.84	6.67	18.98
3	NaN	NaN	NaN	NaN
4	NaN	NaN	NaN	NaN
..	...	...	...	...
696	NaN	NaN	NaN	NaN
697	NaN	NaN	NaN	NaN
698	NaN	33.57	10.18	22.60
699	NaN	45.69	9.56	28.75
700	NaN	NaN	NaN	NaN

	Groceries Index	Restaurant Price Index	Local Purchasing Power Index \
0	15.22	14.85	22.79
1	30.99	29.86	31.15
2	30.25	20.79	21.78
3	NaN	NaN	NaN
4	NaN	NaN	NaN
..	...	...	...
696	NaN	NaN	NaN
697	NaN	NaN	NaN
698	32.85	23.63	37.48
699	37.05	39.05	17.59
700	NaN	NaN	NaN

	city	state	country	Alpha-2 code	Alpha-3 code	\
0	kabul	no state provided	afghanistan	AF	AFG	
1	tirana	no state provided	albania	AL	ALB	
2	algiers	no state provided	algeria	DZ	DZA	
3	NaN	NaN	american samoa	AS	ASM	
4	NaN	NaN	andorra	AD	AND	
..	...	...	...	...	...	
696	NaN	NaN	western sahara	EH	ESH	
697	NaN	NaN	yemen	YE	YEM	
698	lusaka	no state provided	zambia	ZM	ZMB	
699	harare	no state provided	zimbabwe	ZW	ZWE	
700	NaN	NaN	åland islands	AX	ALA	

	Numeric
0	4.0
1	8.0
2	12.0
3	16.0
4	20.0
..	...
696	732.0
697	887.0
698	894.0
699	716.0
700	248.0

[701 rows x 13 columns]

identifying missing country codes so that I can add mapping

```
[3964]: cost_of_living_with_codes_clean = cost_of_living_with_codes.drop(index = 535)
# print(cost_of_living_with_codes_clean)
print(cost_of_living_with_codes_clean.iloc[49])
print(cost_of_living_with_codes_clean.shape)
```

Rank	NaN
Cost of Living Index	36.84
Rent Index	11.08
Cost of Living Plus Rent Index	24.77
Groceries Index	29.88
Restaurant Price Index	31.75
Local Purchasing Power Index	43.54
city	brasilia
state	no state provided
country	brazil
Alpha-2 code	BR
Alpha-3 code	BRA
Numeric	76.0

Name: 49, dtype: object  
(700, 13)

The only missing code now is kosovo which for what we have in our data doesn't matter. I Will delete it.

Now that those are merged. I will take a look at the next two data sets: ds\_salaries and Levels\_Fyi\_salary\_Data and see what I might use/need from there to see if I need to do more merging (probably) before I do the salary conversions to USD. I will go ahead and add these data sets at the top.

1. Focusing on Fyi\_Salary\_Data, I think we do another clean of the location column. I think we might also consider making everything lowercase before the merge so that there is no difficulties when merging. I will use the same function as I did before but changing names/values

```
[3968]: Fyi['location'] = Fyi['location'].astype(str).str.strip().str.lower()

def location_split(location):
    three_parts = location.rsplit(',',2)
    if len(three_parts) == 3:
        return three_parts[0].strip(), three_parts[1].strip(), three_parts[2].
        ↪strip()
    elif len(three_parts) ==2 :
        return three_parts[0].strip(), three_parts[1].strip(), 'no country_
        ↪provided'
    else:
        return three_parts[0].strip(), 'no state provided', 'no country_
        ↪provided'

Fyi[['city', 'state', 'country']] = Fyi['location'].apply(lambda x: pd.
    ↪Series(location_split(x)))

Fyi['country'] = Fyi['country'].replace(['south',
                                         'korea south',
                                         'south korea'],
                                         'south korea')

Fyi.loc[(Fyi['city'] == 'seoul, kg') &
        (Fyi['state'] == 'korea'), ['city', 'state']] = ['seoul', 'kg']

Fyi['city'] = Fyi['city'].astype(str).str.strip().str.lower()
Fyi['state'] = Fyi['state'].astype(str).str.strip().str.lower()
Fyi['country'] = Fyi['country'].astype(str).str.strip().str.lower()

# print(Fyi.iloc[54996])
```

```
[3969]: # print(Fyi.iloc[116])
```

I need to create country mappings for Fyi as well Maybe also a US state map for Fyi



```
[3971]: country_map_fyi = {
    'hong kong (sar)': 'hong kong'
    , 'marshall islands (the)': 'marshall islands'
    , 'burma': 'myanmar'
    , 'netherlands antilles': 'netherlands'
    , 'yugoslavia': 'serbia'
}

Fyi['country'] = Fyi['country'].replace(country_map_fyi)
```

```
[3972]: # print(Fyi['country'].nunique())
# print(cost_of_living_with_codes_clean['country'].nunique())

unique_countries_fyi = Fyi['country'].unique()
unique_countries_colc = cost_of_living_with_codes_clean['country'].unique()

countries_in_fyi_not_in_colc = set(unique_countries_fyi) -
    ↪set(unique_countries_colc)
print(f"in Fyi but not in cost_of_living_unique:
    ↪{countries_in_fyi_not_in_colc}")

#south Korea wasn't in a standard format so I will have to adjust
    ↪location_split above to accomodate for it
south_rows = Fyi[Fyi['country'] == 'south']
#print(south_rows)
```

in Fyi but not in cost\_of\_living\_unique: {'no country provided'}

I think we actually concatenate ds\_salaries and Fyi before merging with the other merged data (cost of living with country codes). First let me focus on the cleaning up the data sets

```
[3974]: print(Fyi)
```

	timestamp	company	level	title \
0	6/7/2017 11:33:27	Oracle	L3	Product Manager
1	6/10/2017 17:11:29	eBay	SE 2	Software Engineer
2	6/11/2017 14:53:57	Amazon	L7	Product Manager
3	6/17/2017 0:23:14	Apple	M1	Software Engineering Manager
4	6/20/2017 10:58:51	Microsoft	60	Software Engineer
...	...	...	...	...
62637	9/9/2018 11:52:32	Google	T4	Software Engineer
62638	9/13/2018 8:23:32	Microsoft	62	Software Engineer
62639	9/13/2018 14:35:59	MSFT	63	Software Engineer
62640	9/16/2018 16:10:35	Salesforce	Lead MTS	Software Engineer
62641	1/29/2019 5:12:59	apple	ict3	Software Engineer

	totalyearlycompensation	location	yearsofexperience \
0	127000	redwood city, ca	1.5
1	100000	san francisco, ca	5.0

2	310000	seattle, wa	8.0
3	372000	sunnyvale, ca	7.0
4	157000	mountain view, ca	5.0
...	...	...	...
62637	327000	seattle, wa	10.0
62638	237000	redmond, wa	2.0
62639	220000	seattle, wa	14.0
62640	280000	san francisco, ca	8.0
62641	200000	sunnyvale, ca	0.0

	yearsatcompany	tag	basesalary	...	\
0	1.5	NaN	107000.0	...	
1	3.0	NaN	0.0	...	
2	0.0	NaN	155000.0	...	
3	5.0	NaN	157000.0	...	
4	3.0	NaN	0.0	...	
...	...	...	...	...	
62637	1.0	Distributed Systems (Back-End)	155000.0	...	
62638	2.0	Full Stack	146900.0	...	
62639	12.0	Full Stack	157000.0	...	
62640	4.0	iOS	194688.0	...	
62641	0.0	ML / AI	155000.0	...	

	Race_Asian	Race_White	Race_Two_Or_More	Race_Black	Race_Hispanic	\
0	0	0	0	0	0	
1	0	0	0	0	0	
2	0	0	0	0	0	
3	0	0	0	0	0	
4	0	0	0	0	0	
...	...	...	...	...	...	
62637	0	0	0	0	0	
62638	0	0	0	0	0	
62639	0	0	0	0	0	
62640	0	0	0	0	0	
62641	0	0	0	0	0	

	Race	Education	city	state	country
0	NaN	NaN	redwood city	ca	no country provided
1	NaN	NaN	san francisco	ca	no country provided
2	NaN	NaN	seattle	wa	no country provided
3	NaN	NaN	sunnyvale	ca	no country provided
4	NaN	NaN	mountain view	ca	no country provided
...	...	...	...	...	...
62637	NaN	NaN	seattle	wa	no country provided
62638	NaN	NaN	redmond	wa	no country provided
62639	NaN	NaN	seattle	wa	no country provided
62640	NaN	NaN	san francisco	ca	no country provided
62641	NaN	NaN	sunnyvale	ca	no country provided

[62642 rows x 32 columns]

```
[3975]: Fyi.rename(columns ={'levels':'experience_level'
                             , 'totalyearlycompensation':'salary'
                             }, inplace = True)

Fyi['timestamp'] = pd.to_datetime(Fyi['timestamp'])

Fyi['work_year'] = Fyi['timestamp'].dt.year

Fyi = Fyi.drop(columns =['timestamp'])

Fyi.loc[Fyi['state'].str.lower().isin(us_states_abbrev.values()), 'country'] =
    ↪ 'united states'

# print(Fyi)
```

I think now I can create some type of conversion for the salaries so that they are all in usd

```
[3983]: no_country_df = Fyi[Fyi['country'] == 'no country provided']

#print(no_country_df)

#issues with some of the states still as 'no country provided-here is the fix:
Fyi.loc[
    (Fyi['country'] == 'no country provided') &
    (Fyi['state'].str.lower().isin(us_states_abbrev.keys()))
, 'country'] = 'united utates'

#9061 could potentially affect my data so I will fix just this entry
Fyi.loc[9061, 'country'] = 'israel'
Fyi.loc[9061, 'state'] = 'no state provided'
# print(Fyi.loc[9061])
# print(Fyi.loc[9075])
```

```
[3985]: # unique_countries = Fyi['country'].unique()
# print(unique_countries)
# print(Fyi)
conversion_rates = {
    'united states':1, 'united kingdom':1.26, 'ireland':1.05, 'india':0.01,
    ↪ 'belarus':0.30
    , 'no country provided':1 , 'canada':0.70 , 'russia':0.009, 'switzerland':1.12
    ↪ , 'singapore':0.74
    , 'germany':1.05, 'japan':0.007, 'sweden':0.09 , 'australia':0.64 , 'israel':0.28
    ↪ , 'poland':0.24 , 'china':0.14
```

```

, 'luxembourg':1.05 , 'czech republic':0.04 , 'pakistan':0.004 , 'new zealand':0.
↪58, 'denmark':0.14, 'france':1.05
, 'hong kong':0.13 , 'south africa':0.06, 'united arab emirates':0.27, 'hungary':
↪0.003, 'brazil':0.17
, 'bulgaria':0.54 , 'philippines':0.01 , 'indonesia':0.00006, 'puerto rico':1, ↪
↪ 'taiwan':0.03, 'romania':0.21
, 'mexico': 0.05, 'costa rica':0.002, 'marshall islands': 1, 'vietnam': 0.000039, ↪
↪ 'panama':1, 'argentina':0.0010
, 'norway':0.09, 'moldova': 0.05, 'netherlands':1.05, 'estonia':1.05, 'kenya':0.
↪008, 'turkey':0.03 , 'italy':1.05
, 'lithuania':1.05, 'south korea':0.0007, 'ukraine':0.02, 'jordan':1.41, ↪
↪ 'thailand':0.03, 'colombia':0.0002
, 'serbia':0.009, 'portugal':1.05, 'guatemala':0.13 , 'slovakia':1.05, ↪
↪ 'bangladesh':0.008, 'finland':1.05 , 'chile':0.001
, 'malaysia':0.23, 'peru':0.27 , 'austria':1.05, 'belgium':1.05 , 'myanmar':0.
↪0005, 'qatar':0.27, 'saudi arabia':0.27
, 'spain':1.05 , 'ghana':0.07 , 'kazakhstan':0.002 , 'uzbekistan':0.00008, ↪
↪ 'armenia':0.003 , 'morocco':0.10 , 'iraq':0.0008
, 'trinidad and tobago':0.15 , 'egypt':0.02
}

#conversion rates from:www.xe.com

def salary_conversion(each_row):
    conversion_rate = conversion_rates.get(each_row['country'],1)
    return each_row['salary']*conversion_rate

Fyi['salary_in_usd'] = Fyi.apply(salary_conversion, axis = 1)

#based on this, the conversions seem to be working
# print(Fyi.iloc[60000])

```

Now I will add empty columns so its easy to concatenate Fyi and ds\_salaries

```

[3988]: Fyi[['company_size', 'company_location'
, 'remote_ratio', 'employee_residence'
, 'salary_currency'
, 'employment_type']] = np.nan

# print(Fyi.columns)

Fyi =Fyi[['work_year', 'level', 'employment_type'
, 'title', 'salary', 'salary_currency'
, 'salary_in_usd', 'employee_residence'
, 'remote_ratio', 'company_location', 'company_size'
, 'company', 'location', 'yearsofexperience'
, 'yearsatcompany', 'tag', 'basesalary', 'stockgrantvalue', 'bonus'

```

```

        , 'gender', 'otherdetails', 'cityid', 'dmaid', 'rowNumber'
        , 'Masters_Degree', 'Bachelors_Degree', 'Doctorate_Degree',
↪ 'Highschool'
        , 'Some_College', 'Race_Asian', 'Race_White', 'Race_Two_Or_More'
        , 'Race_Black', 'Race_Hispanic', 'Race', 'Education', 'city',
↪ 'state', 'country']]

# print(Fyi)

```

Now I can add empty columns to ds\_salaries that match Fyi for the concatenation

```

[3991]: ds_salaries.rename(columns = {'job_title': 'title'}, inplace = True)

ds_salaries[['company', 'location', 'yearsofexperience'
            , 'yearsatcompany', 'tag', 'basesalary', 'stockgrantvalue', 'bonus'
            , 'gender', 'otherdetails', 'cityid', 'dmaid', 'rowNumber'
            , 'Masters_Degree', 'Bachelors_Degree', 'Doctorate_Degree',
↪ 'Highschool'
            , 'Some_College', 'Race_Asian', 'Race_White', 'Race_Two_Or_More'
            , 'Race_Black', 'Race_Hispanic', 'Race', 'Education', 'city',
↪ 'state', 'country']] = np.nan

#print(ds_salaries)

ds_salaries = ds_salaries.drop('Unnamed: 0'
                               , axis = 1)

print(ds_salaries)

```

	work_year	experience_level	employment_type	title \
0	2020	MI	FT	Data Scientist
1	2020	SE	FT	Machine Learning Scientist
2	2020	SE	FT	Big Data Engineer
3	2020	MI	FT	Product Data Analyst
4	2020	SE	FT	Machine Learning Engineer
..	...	...	...	...
602	2022	SE	FT	Data Engineer
603	2022	SE	FT	Data Engineer
604	2022	SE	FT	Data Analyst
605	2022	SE	FT	Data Analyst
606	2022	MI	FT	AI Scientist

	salary	salary_currency	salary_in_usd	employee_residence	remote_ratio \
0	70000	EUR	79833	DE	0
1	260000	USD	260000	JP	0
2	85000	GBP	109024	GB	50
3	20000	USD	20000	HN	0
4	150000	USD	150000	US	50

..	...	...	...	...	...
602	154000	USD	154000	US	100
603	126000	USD	126000	US	100
604	129000	USD	129000	US	0
605	150000	USD	150000	US	100
606	200000	USD	200000	IN	100

	company_location	...	Race_Asian	Race_White	Race_Two_Or_More	\
0	DE	...	NaN	NaN	NaN	
1	JP	...	NaN	NaN	NaN	
2	GB	...	NaN	NaN	NaN	
3	HN	...	NaN	NaN	NaN	
4	US	...	NaN	NaN	NaN	
..	...	...	...	...	...	
602	US	...	NaN	NaN	NaN	
603	US	...	NaN	NaN	NaN	
604	US	...	NaN	NaN	NaN	
605	US	...	NaN	NaN	NaN	
606	US	...	NaN	NaN	NaN	

	Race_Black	Race_Hispanic	Race	Education	city	state	country
0	NaN	NaN	NaN	NaN	NaN	NaN	NaN
1	NaN	NaN	NaN	NaN	NaN	NaN	NaN
2	NaN	NaN	NaN	NaN	NaN	NaN	NaN
3	NaN	NaN	NaN	NaN	NaN	NaN	NaN
4	NaN	NaN	NaN	NaN	NaN	NaN	NaN
..	...	...	...	...	...	...	...
602	NaN	NaN	NaN	NaN	NaN	NaN	NaN
603	NaN	NaN	NaN	NaN	NaN	NaN	NaN
604	NaN	NaN	NaN	NaN	NaN	NaN	NaN
605	NaN	NaN	NaN	NaN	NaN	NaN	NaN
606	NaN	NaN	NaN	NaN	NaN	NaN	NaN

[607 rows x 39 columns]

I think the best method here is to assume the employee\_residence is the country. I will find unique countries and map them so that they go to the country column properly.

```
[3994]: ds_salaries['country_code'] = ds_salaries['employee_residence']

ds_sal_codes = ds_salaries.merge(country_codes
                                ,left_on = 'country_code'
                                ,right_on = 'Alpha-2 code'
                                , how = 'left')

ds_sal_codes = ds_sal_codes.drop(columns = ['Numeric'
                                           , 'Alpha-2 code'])
```

```

        , 'Alpha-3 code'])

ds_sal_codes['country'] = ds_sal_codes['country_x'].
↳fillna(ds_sal_codes['country_y'])

ds_sal_codes = ds_sal_codes.drop(columns = ['country_x'
                                           , 'country_y'
                                           , 'country_code'])

print(ds_sal_codes)

```

	work_year	experience_level	employment_type	title \
0	2020	MI	FT	Data Scientist
1	2020	SE	FT	Machine Learning Scientist
2	2020	SE	FT	Big Data Engineer
3	2020	MI	FT	Product Data Analyst
4	2020	SE	FT	Machine Learning Engineer
..	...	...	...	...
602	2022	SE	FT	Data Engineer
603	2022	SE	FT	Data Engineer
604	2022	SE	FT	Data Analyst
605	2022	SE	FT	Data Analyst
606	2022	MI	FT	AI Scientist

	salary	salary_currency	salary_in_usd	employee_residence	remote_ratio \
0	70000	EUR	79833	DE	0
1	260000	USD	260000	JP	0
2	85000	GBP	109024	GB	50
3	20000	USD	20000	HN	0
4	150000	USD	150000	US	50
..	...	...	...	...	...
602	154000	USD	154000	US	100
603	126000	USD	126000	US	100
604	129000	USD	129000	US	0
605	150000	USD	150000	US	100
606	200000	USD	200000	IN	100

	company_location	...	Race_Asian	Race_White	Race_Two_Or_More \
0	DE	...	NaN	NaN	NaN
1	JP	...	NaN	NaN	NaN
2	GB	...	NaN	NaN	NaN
3	HN	...	NaN	NaN	NaN
4	US	...	NaN	NaN	NaN
..	...	...	...	...	...
602	US	...	NaN	NaN	NaN
603	US	...	NaN	NaN	NaN
604	US	...	NaN	NaN	NaN
605	US	...	NaN	NaN	NaN

606		US	...	NaN		NaN		NaN
	Race_Black	Race_Hispanic	Race	Education	city	state		country
0	NaN	NaN	NaN	NaN	NaN	NaN		germany
1	NaN	NaN	NaN	NaN	NaN	NaN		japan
2	NaN	NaN	NaN	NaN	NaN	NaN		united kingdom
3	NaN	NaN	NaN	NaN	NaN	NaN		honduras
4	NaN	NaN	NaN	NaN	NaN	NaN		united states
..	...	...	...	...	...	...		...
602	NaN	NaN	NaN	NaN	NaN	NaN		united states
603	NaN	NaN	NaN	NaN	NaN	NaN		united states
604	NaN	NaN	NaN	NaN	NaN	NaN		united states
605	NaN	NaN	NaN	NaN	NaN	NaN		united states
606	NaN	NaN	NaN	NaN	NaN	NaN		india

[607 rows x 39 columns]

```
[3996]: ds_Fyi_combined = pd.concat([Fyi,ds_sal_codes], axis = 0
                                     , ignore_index = True)

print(ds_Fyi_combined)
```

	work_year	level	employment_type		title	salary	\
0	2017	L3	NaN		Product Manager	127000	
1	2017	SE 2	NaN		Software Engineer	100000	
2	2017	L7	NaN		Product Manager	310000	
3	2017	M1	NaN	Software Engineering Manager		372000	
4	2017	60	NaN		Software Engineer	157000	
...	...	...	...		...	...	
63244	2022	NaN	FT		Data Engineer	154000	
63245	2022	NaN	FT		Data Engineer	126000	
63246	2022	NaN	FT		Data Analyst	129000	
63247	2022	NaN	FT		Data Analyst	150000	
63248	2022	NaN	FT		AI Scientist	200000	

	salary_currency	salary_in_usd	employee_residence	remote_ratio	\
0	NaN	127000.0	NaN	NaN	
1	NaN	100000.0	NaN	NaN	
2	NaN	310000.0	NaN	NaN	
3	NaN	372000.0	NaN	NaN	
4	NaN	157000.0	NaN	NaN	
...	...	...	...	...	
63244	USD	154000.0	US	100.0	
63245	USD	126000.0	US	100.0	
63246	USD	129000.0	US	0.0	
63247	USD	150000.0	US	100.0	
63248	USD	200000.0	IN	100.0	



	company_location	...	Race_White	Race_Two_Or_More	Race_Black	\
0	NaN	...	0.0	0.0	0.0	
1	NaN	...	0.0	0.0	0.0	
2	NaN	...	0.0	0.0	0.0	
3	NaN	...	0.0	0.0	0.0	
4	NaN	...	0.0	0.0	0.0	
...	...	...	...	...	...	
63244	US	...	NaN	NaN	NaN	
63245	US	...	NaN	NaN	NaN	
63246	US	...	NaN	NaN	NaN	
63247	US	...	NaN	NaN	NaN	
63248	US	...	NaN	NaN	NaN	

	Race_Hispanic	Race	Education	city	state	country	\
0	0.0	NaN	NaN	redwood city	ca	united states	
1	0.0	NaN	NaN	san francisco	ca	united states	
2	0.0	NaN	NaN	seattle	wa	united states	
3	0.0	NaN	NaN	sunnyvale	ca	united states	
4	0.0	NaN	NaN	mountain view	ca	united states	
...	...	...	...	...	...	...	
63244	NaN	NaN	NaN	NaN	NaN	united states	
63245	NaN	NaN	NaN	NaN	NaN	united states	
63246	NaN	NaN	NaN	NaN	NaN	united states	
63247	NaN	NaN	NaN	NaN	NaN	united states	
63248	NaN	NaN	NaN	NaN	NaN	india	

	experience_level
0	NaN
1	NaN
2	NaN
3	NaN
4	NaN
...	...
63244	SE
63245	SE
63246	SE
63247	SE
63248	MI

[63249 rows x 40 columns]

This looks good, now we should subset for job title only to be Data Scientist, this may make the data a little easier to work with

```
[3999]: ds_title_only_ds_Fyi_combined = ds_Fyi_combined[ds_Fyi_combined['title'].str.
        ↪lower() == 'data scientist']

print(ds_title_only_ds_Fyi_combined)
```

	work_year	level	employment_type		title	salary	\
419	2018	Senior	NaN	Data Scientist	233000		
440	2018	64	NaN	Data Scientist	218000		
444	2018	26	NaN	Data Scientist	180000		
454	2018	Staff	NaN	Data Scientist	500000		
495	2018	5	NaN	Data Scientist	370000		
...	...	...	...	...	...		
63234	2022	NaN	FT	Data Scientist	230000		
63235	2022	NaN	FT	Data Scientist	150000		
63238	2022	NaN	FT	Data Scientist	210000		
63240	2022	NaN	FT	Data Scientist	160000		
63241	2022	NaN	FT	Data Scientist	130000		

	salary_currency	salary_in_usd	employee_residence	remote_ratio	\
419	NaN	233000.0	NaN	NaN	
440	NaN	218000.0	NaN	NaN	
444	NaN	180000.0	NaN	NaN	
454	NaN	500000.0	NaN	NaN	
495	NaN	370000.0	NaN	NaN	
...	...	...	...	...	
63234	USD	230000.0	US	100.0	
63235	USD	150000.0	US	100.0	
63238	USD	210000.0	US	100.0	
63240	USD	160000.0	US	100.0	
63241	USD	130000.0	US	100.0	

	company_location	...	Race_White	Race_Two_Or_More	Race_Black	\
419	NaN	...	0.0	0.0	0.0	
440	NaN	...	0.0	0.0	0.0	
444	NaN	...	0.0	0.0	0.0	
454	NaN	...	0.0	0.0	0.0	
495	NaN	...	0.0	0.0	0.0	
...	...	...	...	...	...	
63234	US	...	NaN	NaN	NaN	
63235	US	...	NaN	NaN	NaN	
63238	US	...	NaN	NaN	NaN	
63240	US	...	NaN	NaN	NaN	
63241	US	...	NaN	NaN	NaN	

	Race_Hispanic	Race	Education	city	state	country	\
419	0.0	NaN	NaN	san francisco	ca	united states	
440	0.0	NaN	NaN	seattle	wa	united states	
444	0.0	NaN	NaN	san jose	ca	united states	
454	0.0	NaN	NaN	san francisco	ca	united states	
495	0.0	NaN	NaN	seattle	wa	united states	
...	...	...	...	...	...	...	
63234	NaN	NaN	NaN	NaN	NaN	united states	
63235	NaN	NaN	NaN	NaN	NaN	united states	

63238	NaN	NaN	NaN	NaN	NaN	united states
63240	NaN	NaN	NaN	NaN	NaN	united states
63241	NaN	NaN	NaN	NaN	NaN	united states

	experience_level
419	NaN
440	NaN
444	NaN
454	NaN
495	NaN
...	...
63234	SE
63235	SE
63238	SE
63240	MI
63241	MI

[2721 rows x 40 columns]

Perhaps now we can merge our 2 major datasets: cost\_of\_living\_with\_codes and ds\_title\_only\_ds\_Fyi\_combined

finally we shall inner join these datasets. If we need to do global averages and such, I can use the separate data sets

```
[4003]: cost_country_data_scientist_full = pd.merge(ds_title_only_ds_Fyi_combined,
                                                    cost_of_living_with_codes,
                                                    left_on = 'country'
                                                    ,right_on = 'country'
                                                    ,how = 'inner'

)

cost_country_data_scientist_full['city'] =_
↳cost_country_data_scientist_full['city_x'].
↳fillna(cost_country_data_scientist_full['city_y'])

cost_country_data_scientist_full = cost_country_data_scientist_full.
↳drop(columns = ['city_x'

↳      , 'city_y'])

cost_country_data_scientist_full['state'] =_
↳cost_country_data_scientist_full['state_x'].
↳fillna(cost_country_data_scientist_full['state_y'])
```

```

cost_country_data_scientist_full = cost_country_data_scientist_full.
↳ drop(columns = ['state_x'

↳      , 'state_y'

↳      , 'Alpha-2 code'

↳      , 'Alpha-3 code'

↳      , 'Numeric'])

print(cost_country_data_scientist_full)

```

	work_year	level	employment_type		title	salary \
0	2018	Senior	NaN	Data Scientist	233000	
1	2018	Senior	NaN	Data Scientist	233000	
2	2018	Senior	NaN	Data Scientist	233000	
3	2018	Senior	NaN	Data Scientist	233000	
4	2018	Senior	NaN	Data Scientist	233000	
...	...	...	...	...	...	
231695	2022	NaN	FT	Data Scientist	130000	
231696	2022	NaN	FT	Data Scientist	130000	
231697	2022	NaN	FT	Data Scientist	130000	
231698	2022	NaN	FT	Data Scientist	130000	
231699	2022	NaN	FT	Data Scientist	130000	

	salary_currency	salary_in_usd	employee_residence	remote_ratio \
0	NaN	233000.0	NaN	NaN
1	NaN	233000.0	NaN	NaN
2	NaN	233000.0	NaN	NaN
3	NaN	233000.0	NaN	NaN
4	NaN	233000.0	NaN	NaN
...	...	...	...	...
231695	USD	130000.0	US	100.0
231696	USD	130000.0	US	100.0
231697	USD	130000.0	US	100.0
231698	USD	130000.0	US	100.0
231699	USD	130000.0	US	100.0

	company_location	...	experience_level	Rank	Cost of Living Index \
0	NaN	...	NaN	NaN	103.65
1	NaN	...	NaN	NaN	100.00
2	NaN	...	NaN	NaN	95.01
3	NaN	...	NaN	NaN	94.36
4	NaN	...	NaN	NaN	93.91
...	...	...	...	...	...
231695	US	...	MI	NaN	62.29

231696	US	...	MI	NaN	62.20
231697	US	...	MI	NaN	59.26
231698	US	...	MI	NaN	58.92
231699	US	...	MI	NaN	55.92

	Rent Index	Cost of Living Plus Rent Index	Groceries Index	\
0	65.07		85.56	114.92
1	100.00		100.00	100.00
2	78.42		87.23	99.53
3	88.22		91.48	106.23
4	108.42		100.72	97.05
...	...		...	
231695	34.91		49.45	58.08
231696	22.90		43.78	63.55
231697	25.60		43.48	57.28
231698	24.26		42.67	53.08
231699	23.17		40.56	54.45

	Restaurant Price Index	Local Purchasing Power Index	city	\
0	94.28	89.24	san francisco	
1	100.00	100.00	san francisco	
2	99.41	93.86	san francisco	
3	78.85	85.78	san francisco	
4	93.40	133.16	san francisco	
...	...	...	...	
231695	69.54	109.95	memphis	
231696	55.56	102.89	akron	
231697	64.63	131.07	little rock	
231698	57.42	119.24	wichita	
231699	48.18	118.77	el paso	

	state
0	ca
1	ca
2	ca
3	ca
4	ca
...	...
231695	tn
231696	oh
231697	ar
231698	ks
231699	tx

[231700 rows x 47 columns]

I think we look at salary and how far it would go based off each cost of living index by country

```
[4006]: cost_country_data_scientist_full['salary_in_usd'] =_
↳cost_country_data_scientist_full['salary_in_usd'].fillna(0)

Columns_4_cost_of_living = [
    'Cost of Living Index'
    , 'Rent Index'
    , 'Cost of Living Plus Rent Index'
    , 'Groceries Index'
    , 'Restaurant Price Index'
    , 'Local Purchasing Power Index'
]

for column in Columns_4_cost_of_living:
    new_col = f'{column}(salary to cost ratio)'
    cost_country_data_scientist_full[new_col] =_
↳cost_country_data_scientist_full['salary_in_usd']/
↳cost_country_data_scientist_full[column].fillna(1)
```

```
[4008]: cost_country_data_scientist_full['country'] =_
↳cost_country_data_scientist_full['country'].str.title()
cost_country_data_scientist_full['city'] =_
↳cost_country_data_scientist_full['city'].str.title()
```

Top 10 countries for the indexes now. Creating a dictionary

```
[4011]: top_10_country_each_index = {}

for column in Columns_4_cost_of_living:
    sal_cols = f'{column}(salary to cost ratio)'
    top_10 = cost_country_data_scientist_full.nlargest(10, sal_cols)[['country'
                                                                    , 'city'
                                                                    ,_
↳'salary_in_usd'
                                                                    ]
    ↳, sal_cols]]
    top_10_country_each_index[column] = top_10
```

```
[4012]: num_cols = 3
num_rows = 2
fig, axes = plt.subplots(num_cols, num_rows, figsize = (15,10))
axes = axes.flatten()

for i, column in enumerate(Columns_4_cost_of_living):
    sal_cols = f'{column}(salary to cost ratio)'
    top_10 = top_10_country_each_index[column]

    sns.barplot(
```

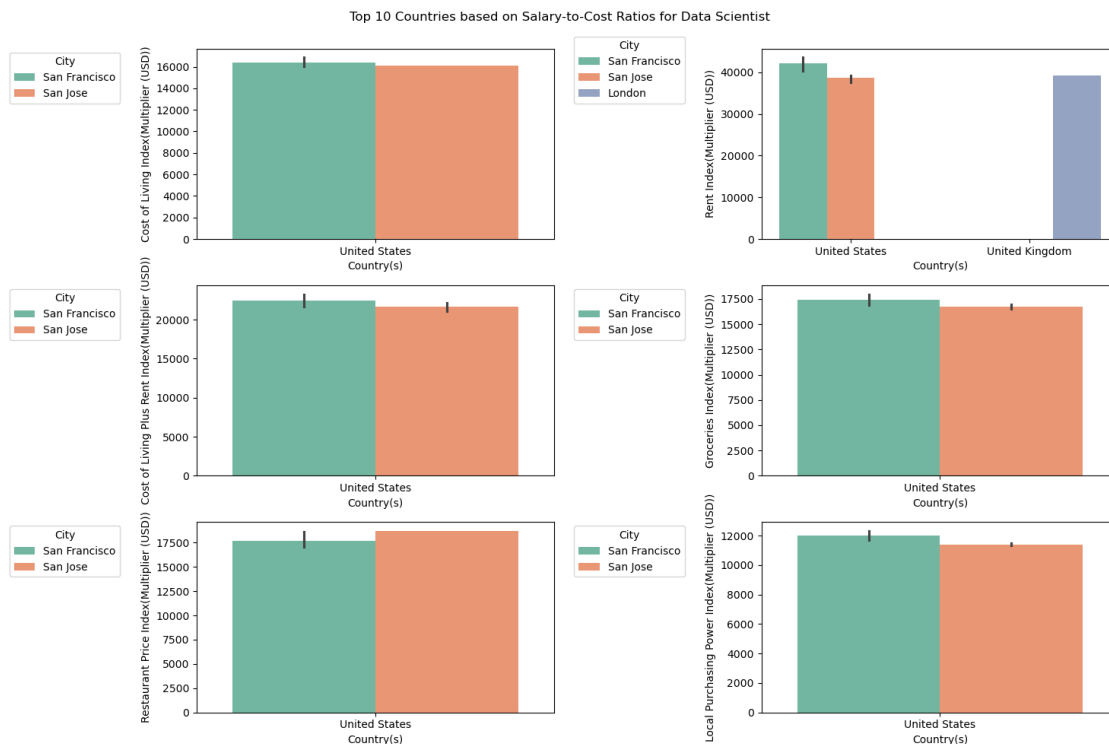
```

data = top_10,
x = 'country',
y = sal_cols,
hue = 'city',
palette = 'Set2',
ax = axes[i])

axes[i].set_xlabel('Country(s)', fontsize = 10)
axes[i].set_ylabel(f'{column}(Multiplier (USD))', fontsize= 10)
axes[i].legend(title = 'City', loc = 'lower right', bbox_to_anchor =(-0.2, .
↪685))

fig.suptitle('Top 10 Countries based on Salary-to-Cost Ratios for Data_
↪Scientist')
plt.tight_layout()

```



Although this is a relatively set of simple plots, I think that it is quite informative. It looks at all cost of living indices and provides us with the top 10 countries, which turned out to mainly be the US results showing (I will focus on certain cost of living indices below for a little bit more of a comprehensive review). I filtered my data for only Data scientists and from there I found the Multiplier for several different cost of living Indexes. I then wanted to see what the top 10 countries were where one's money would go the farthest, and it turned out to be mainly the United States. Quite Frankly, this wasn't what I was expecting for some reason. The only other country that made

it into the top 10 was the United Kingdom, and that was only for 1 category of our cost of living Indexes. I decided to go back and check if we could maybe get some city data because not all the datapoints had cities, and to my surprise, the top 3 cities that came out were San Francisco, San Jose, and London. For the most part San Francisco and San Jose have basically identical cost of living indices and therefore have almost identical multipliers. Rent index is slightly higher for San Francisco than San Jose. Looking at the Rent Multiplier San Jose has more value for rent expense and London has the lowest value for rent (most expensive). Looking at the Grocery and Restaurant index, San Jose seems to be the better option. San Jose would overall maximize the dollar of a Data Scientist.

```
[4016]: country_groups = cost_country_data_scientist_full.groupby('country').agg({
    'salary_in_usd': 'mean',
    'Cost of Living Index': 'mean',
    'Rent Index': 'median',
    'Groceries Index': 'mean'
}).reset_index()

country_groups = country_groups.rename(columns = {
    'salary_in_usd': 'Average salary in USD',
    'Cost of Living Index': 'Average Cost of Living Index',
    'Rent Index': 'Median Rent Index',
    'Groceries Index': 'Average Groceries Index',
    'country': 'Country'
})

[4018]: top_10_paid = country_groups.nlargest(10, 'Average salary in USD')[['Country'
    , 'Average salary in_
    ↪USD'
    , 'Average Cost of_
    ↪Living Index'
    , 'Median Rent Index'
    , 'Average Groceries_
    ↪Index']]

bottom_10_paid = country_groups.nsmallest(10, 'Average salary in USD')[['Country'
    , 'Average salary in_
    ↪USD'
    , 'Average Cost of_
    ↪Living Index'
    , 'Median Rent Index'
    , 'Average Groceries_
    ↪Index']]

print('Top 10 highest Average Salary for Data Scientist by Country')
display(top_10_paid)
print('Lowest Average Salary for Data Scientist by Country')
display(bottom_10_paid)
```

Top 10 highest Average Salary for Data Scientist by Country



	Country	Average salary in USD	Average Cost of Living Index \
34	United States	215465.032120	73.252000
33	United Kingdom	176727.210526	70.495588
28	Switzerland	172933.250000	124.075714
8	Germany	103998.937500	67.281154
19	Netherlands	100800.000000	76.229286
0	Algeria	100000.000000	29.840000
17	Luxembourg	98962.500000	82.990000
1	Australia	97468.600000	77.601000
25	Singapore	92639.192308	83.980000
2	Austria	91237.000000	72.870000

	Median Rent Index	Average Groceries Index
34	41.680	74.003684
33	30.055	58.282059
28	59.550	126.945714
8	27.635	52.963077
19	36.965	65.190000
0	6.670	30.250000
17	63.430	75.830000
1	37.595	77.064000
25	66.430	77.080000
2	30.140	66.658000

#### Lowest Average Salary for Data Scientist by Country

	Country	Average salary in USD	Average Cost of Living Index \
29	Taiwan	2060.000000	63.600000
12	India	2706.844660	25.376304
18	Mexico	2859.000000	36.645000
31	Ukraine	3433.333333	31.088000
23	Russia	3537.800000	34.770000
35	Vietnam	4000.000000	37.930000
27	Sweden	8475.000000	75.460000
6	China	11690.000000	45.816667
16	Japan	13636.666667	79.313333
22	Poland	18823.333333	40.687000

	Median Rent Index	Average Groceries Index
29	20.275	77.905000
12	5.010	27.320000
18	15.340	35.843333
31	10.740	26.548000
23	10.445	29.440000
35	15.030	39.285000
27	28.430	68.756000
6	20.440	49.670000
16	42.710	86.570000
22	15.355	33.434000

Sometimes its nice to have a quick visuals for people who don't want to do a super deep dive and just want to see what are the top places where they could maximize their pay or where are the places they should avoid. You can then look at the cost of living indicies and make a call. For example, most of the salaries in the bottom table would put many people under the minimum wage in the US so maybe you avoid these countries.

```
[4021]: #S2Cr will stand for Salary to cost ratio, names are getting too long.
country_groups['Salary to Cost Ratio for Cost of Living'] =
    country_groups['Average salary in USD']/country_groups['Average Cost of
    Living Index']
country_groups['Salary to Cost Ratio for Rent'] = country_groups['Average
    salary in USD']/country_groups['Median Rent Index']
country_groups['Salary to Cost Ratio for Groceries'] = country_groups['Average
    salary in USD']/country_groups['Average Groceries Index']

top_10_cost_of_living = country_groups.nlargest(10,'Salary to Cost Ratio for
    Cost of Living')[['Country', 'Salary to Cost Ratio for Cost of Living']]
top_10_rent = country_groups.nlargest(10,'Salary to Cost Ratio for
    Rent')[['Country', 'Salary to Cost Ratio for Rent']]
top_10_groceries = country_groups.nlargest(10,'Salary to Cost Ratio for
    Groceries')[['Country', 'Salary to Cost Ratio for Groceries']]

print('Top 10 Countries where your Salary goes furthest for Cost of living')
display(top_10_cost_of_living)
print('Top 10 Countries where your Salary goes furthest for Rent')
display(top_10_rent)
print('Top 10 Countries where your Salary goes furthest for Groceries')
display(top_10_groceries)
```

Top 10 Countries where your Salary goes furthest for Cost of living

	Country	Salary to Cost Ratio for Cost of Living
0	Algeria	3351.206434
34	United States	2941.421833
33	United Kingdom	2506.925823
8	Germany	1545.736533
28	Switzerland	1393.771948
20	Nigeria	1339.405304
19	Netherlands	1322.326440
1	Australia	1256.022474
2	Austria	1252.051599
17	Luxembourg	1192.462947

Top 10 Countries where your Salary goes furthest for Rent

	Country	Salary to Cost Ratio for Rent
0	Algeria	14992.503748

33	United Kingdom	5880.126785
34	United States	5169.506529
9	Greece	4743.708839
3	Brazil	4051.687328
8	Germany	3763.305138
21	Philippines	3482.496195
30	Turkey	3156.651017
11	Hungary	3112.804878
2	Austria	3027.106835

Top 10 Countries where your Salary goes furthest for Groceries

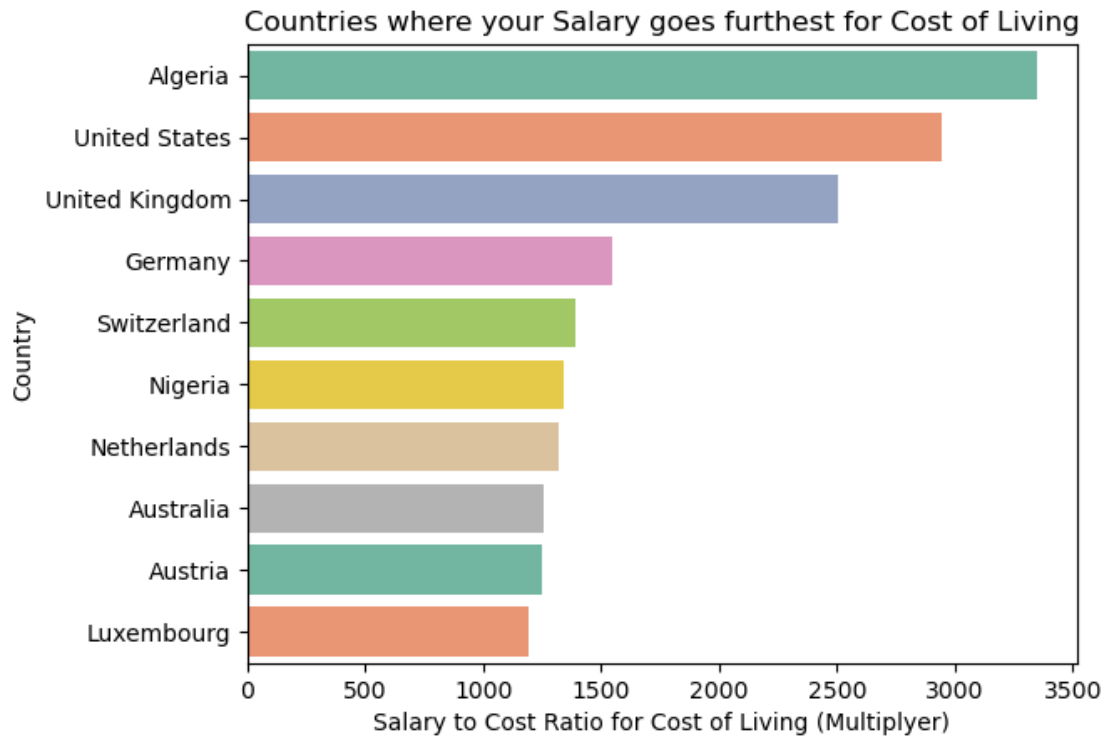
	Country	Salary to Cost Ratio for Groceries
0	Algeria	3305.785124
33	United Kingdom	3032.274667
34	United States	2911.544667
8	Germany	1963.612077
19	Netherlands	1546.249425
9	Greece	1511.052225
2	Austria	1368.732935
28	Switzerland	1362.261428
13	Ireland	1361.248334
3	Brazil	1348.572224

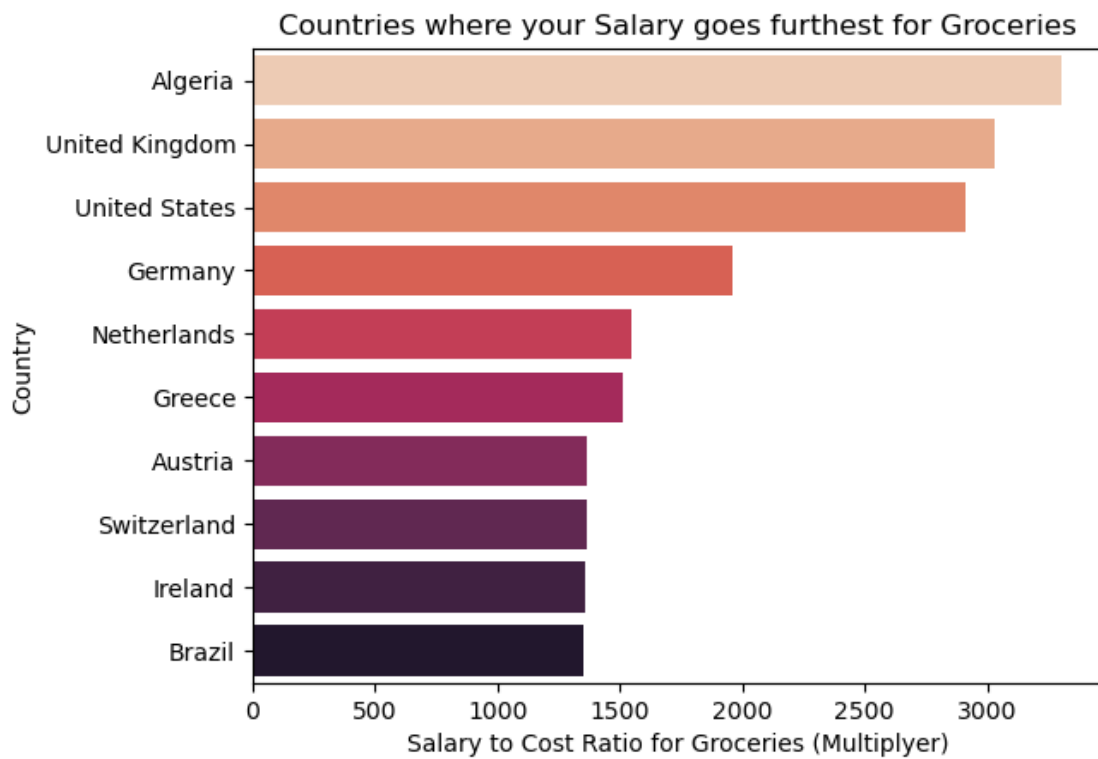
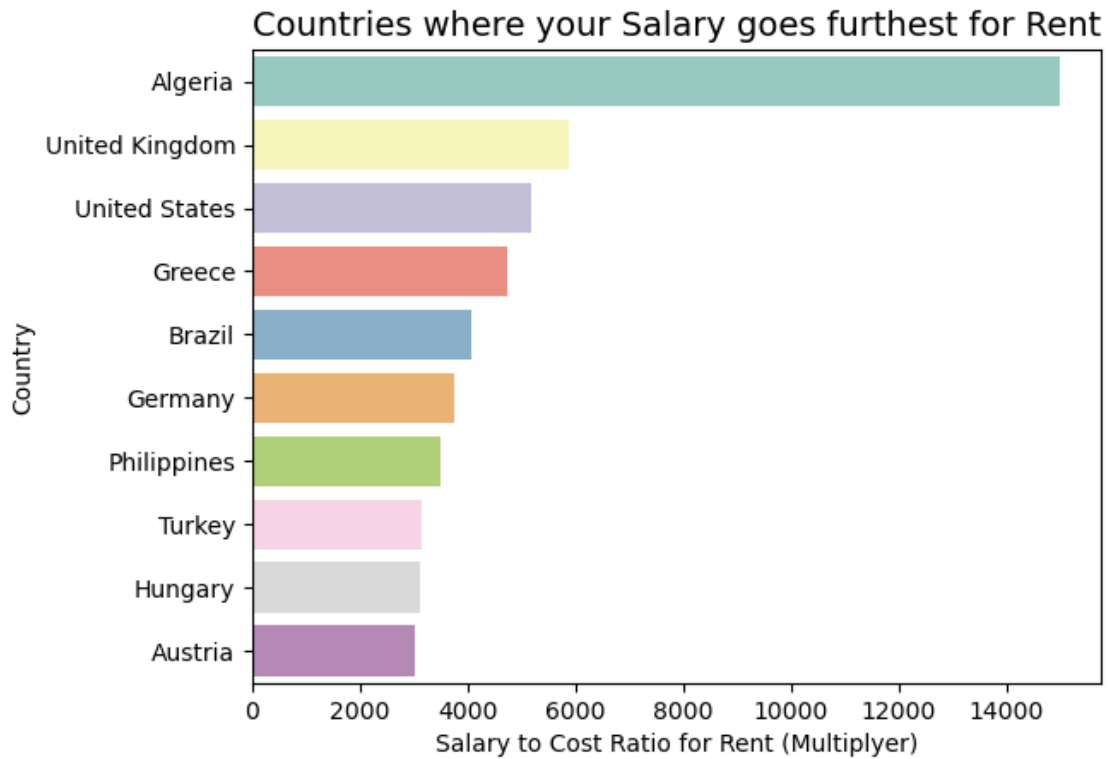
```
[4023]: ax = sns.barplot(top_10_cost_of_living,
                        x = 'Salary to Cost Ratio for Cost of Living',
                        y = 'Country',
                        palette = 'Set2',
                        hue = 'Country')
ax.set_xlabel('Salary to Cost Ratio for Cost of Living (Multiplier)')
ax.set_title('Countries where your Salary goes furthest for Cost of Living',
             ↪fontsize=12)
plt.show()

ax = sns.barplot(top_10_rent,
                 x = 'Salary to Cost Ratio for Rent',
                 y = 'Country',
                 palette = 'Set3',
                 hue = 'Country')
ax.set_xlabel('Salary to Cost Ratio for Rent (Multiplier)')
ax.set_title('Countries where your Salary goes furthest for Rent', fontsize=14)
plt.show()

ax = sns.barplot(top_10_groceries,
                 x = 'Salary to Cost Ratio for Groceries',
                 y = 'Country',
                 palette = 'rocket_r',
                 hue = 'Country')
```

```
ax.set_xlabel('Salary to Cost Ratio for Groceries (Multiplier)')
ax.set_title('Countries where your Salary goes furthest for Groceries',
             ↪fontsize=12)
plt.show()
```





While this analysis is similar to the first, I think it is a little more informative because it focuses on 3 specific cost-of-living indicies which help bring more country comparisons into the analysis.

Cost of Living: Algeria takes the lead ahead of the United states meaning they have exceptional cost of living affordability. They are followed by the US then the UK which also has favorable cost of living affordability for a Data Scientist salary.

Rent:

Algeria takes the lead again indicating that housing is really affordable. The other countries are not even close here by a landslide. If Algeria isn't an option, the next best bets would be the UK, US or Greece. Hungary and Austria are at the bottom indicating the salaries are not great for covering rent.

Groceries:

Algeria wins again here. Salaries of a Data Scientist would be very effective and go furthest here for covering grocery costs. The UK and US are not too far behind here, making them good options for groceries. Switzerland, Ireland, Brazil are at the bottom indicating that the salaries there do not go far when it comes to covering groceries.

Overall, Algeria seems to be the winner. It would be the most affordable overall when looking at countries. The US and UK also follow behind closely as far as salary to cost ratio.

I think there is a lot of people in this world and many have kids. I think It would be interesting to simulate the data for a family of 3

```
[4027]: family = 2
groceries = 1.8
cost_live = 1.8

country_groups['Cost of Living Index of a Family of 3'] = \
    country_groups['Average Cost of Living Index']*cost_live
country_groups['Rent Index of a Family of 3'] = country_groups['Median Rent_
    Index']*family
country_groups['Groceries Index of a Family of 3'] = country_groups['Average_
    Groceries Index']*groceries

country_groups['Salary to Cost Ratio for Cost of Living of a Family of 3'] = \
    country_groups['Average salary in USD']/country_groups['Cost of Living Index_
    of a Family of 3']
country_groups['Salary to Cost Ratio for Rent of a Family of 3'] = \
    country_groups['Average salary in USD']/country_groups['Rent Index of a_
    Family of 3']
country_groups['Salary to Cost Ratio for Groceries of a Family of 3'] = \
    country_groups['Average salary in USD']/country_groups['Groceries Index of a_
    Family of 3']
```

```

top_10_cost_of_living_for_3_family = country_groups.nlargest(10
                                                                , 'Salary to Cost_
↳Ratio for Cost of Living of a Family of 3')[['Country'

↳
                                                                , 'Cost of Living Index of a_
↳Family of 3']]
top_10_rent_for_3_family = country_groups.nlargest(10
                                                                , 'Salary to Cost Ratio for_
↳Rent of a Family of 3')[['Country'

↳
                                                                , 'Rent Index of a Family of 3']]
top_10_groceries_for_3_family = country_groups.nlargest(10
                                                                , 'Salary to Cost Ratio_
↳for Groceries of a Family of 3')[['Country'

↳
                                                                , 'Groceries Index of a Family of 3']]
top_10_cost_of_living_for_3_family = top_10_cost_of_living_for_3_family.
↳sort_values(by = 'Cost of Living Index of a Family of 3',

↳
↳ ascending = False)

top_10_rent_for_3_family = top_10_rent_for_3_family.sort_values(by = 'Rent_
↳Index of a Family of 3',

↳
↳ ascending = False)

top_10_groceries_for_3_family = top_10_groceries_for_3_family.sort_values(by =
↳'Groceries Index of a Family of 3',

↳
↳ ascending = False)

print('Top 10 Countries where your Salary goes furthest for Cost of living for_
↳a Family of 3')
display(top_10_cost_of_living_for_3_family)
print('Top 10 Countries where your Salary goes furthest for Rent for a Family_
↳of 3')
display(top_10_rent_for_3_family)
print('Top 10 Countries where your Salary goes furthest for Groceries for a_
↳Family of 3')
display(top_10_groceries_for_3_family)

```

Top 10 Countries where your Salary goes furthest for Cost of living for a Family of 3

	Country	Cost of Living Index of a Family of 3
28	Switzerland	223.336286
17	Luxembourg	149.382000

1	Australia	139.681800
19	Netherlands	137.212714
34	United States	131.853600
2	Austria	131.166000
33	United Kingdom	126.892059
8	Germany	121.106077
20	Nigeria	67.194000
0	Algeria	53.712000

Top 10 Countries where your Salary goes furthest for Rent for a Family of 3

	Country	Rent Index of a Family of 3
34	United States	83.36
2	Austria	60.28
33	United Kingdom	60.11
8	Germany	55.27
9	Greece	28.85
21	Philippines	26.28
11	Hungary	22.96
3	Brazil	19.36
0	Algeria	13.34
30	Turkey	12.78

Top 10 Countries where your Salary goes furthest for Groceries for a Family of 3

	Country	Groceries Index of a Family of 3
28	Switzerland	228.502286
34	United States	133.206632
2	Austria	119.984400
19	Netherlands	117.342000
13	Ireland	114.777000
33	United Kingdom	104.907706
8	Germany	95.333538
9	Greece	81.513000
0	Algeria	54.450000
3	Brazil	52.349143

```
[4029]: ax = sns.barplot(top_10_cost_of_living_for_3_family,
                        x = 'Cost of Living Index of a Family of 3',
                        y = 'Country',
                        palette = 'Set2',
                        hue = 'Country')
ax.set_xlabel('Salary to Cost Ratio for Cost of Living for a family of 3_
↳(Multiplier)')
ax.set_title('Countries where your Salary goes furthest for Cost of Living for_
↳a family of 3', fontsize=9)
plt.show()

ax = sns.barplot(top_10_rent_for_3_family,
```



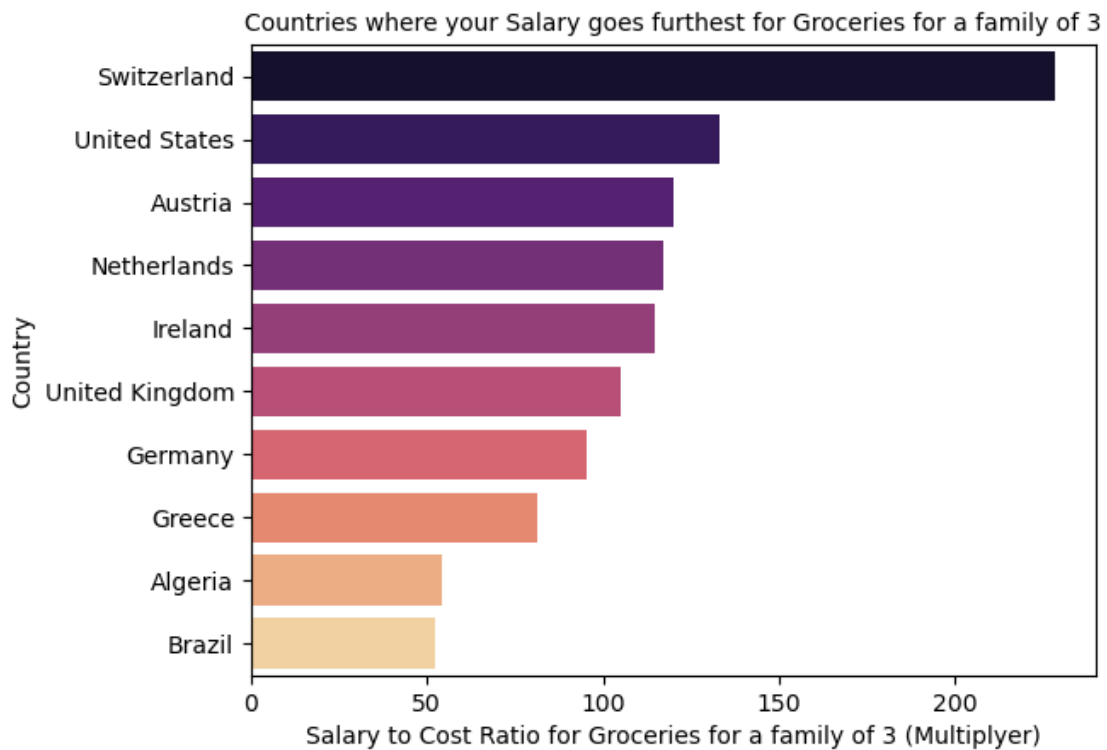
```

        x = 'Rent Index of a Family of 3',
        y = 'Country',
        palette = 'Set3',
        hue = 'Country')
ax.set_xlabel('Salary to Cost Ratio for Rent for a family of 3 (Multiplier)')
ax.set_title('Countries where your Salary goes furthest for Rent for a family
↳ of 3', fontsize=10)
plt.show()

ax = sns.barplot(top_10_groceries_for_3_family,
                 x = 'Groceries Index of a Family of 3',
                 y = 'Country',
                 palette = 'magma',
                 hue = 'Country')
ax.set_xlabel('Salary to Cost Ratio for Groceries for a family of 3
↳ (Multiplier)')
ax.set_title('Countries where your Salary goes furthest for Groceries for a
↳ family of 3', fontsize=10)
plt.show()

```





The first major thing to point out is that once family starts to be involved, Algeria, while on the list is at the bottom and does poorly compared to the last set of graphs.

Cost of Living: When it comes to cost of living, your dollar goes the furthest in Switzerland and it takes the lead by quite a bit. With a Family of 3, Nigeria and Algeria is probably not the place to be on a Data scientist salary. The Us is in the middle here, so not the best but also not the worst.

Rent:

When it comes to rent, US seems to be the best option for a family of 3, followed by a tie between Austria and the UK.

Groceries:

In Switzerland, your dollar goes the furthest when it comes to buying food for a family of 3. The US and Austria follow behind in 2nd and 3rd place. Brazil is at the bottom, so its not ideal at all for a family of 3.

I think the key takeawys here, if you are an entry level data scientist, who has a family, your ideal location is going to be somewhere in Switzerland or the US because that is where your dollar is going to go the furthest. Even though the US wasn't as high as switzerland, it made it in the top 10 for all 3 categories, where as Switzerland didn't make the list for the rent graph. Switzerland will be the best as far as groceries and cost of living but might be a little tough when it comes to rent.

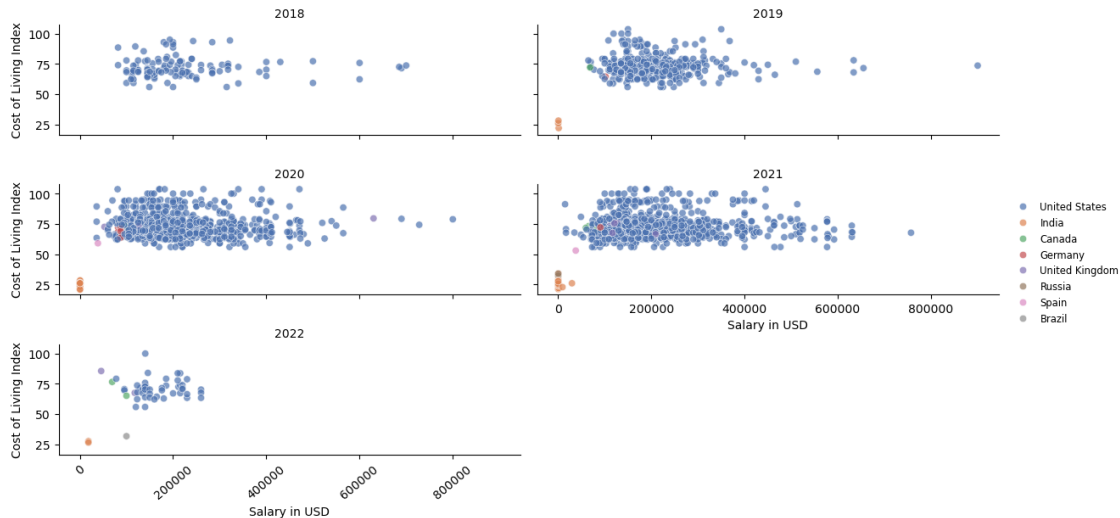
```
[4032]: #There are too many data points so going to try .sample(frac = 0.01) which
# create multi graphs similar to the first one
data_sample = cost_country_data_scientist_full.sample(frac = 0.01, random_state=
↳ 42)

grid = sns.FacetGrid(data = data_sample
                    ,col = 'work_year'
                    ,col_wrap = 2
                    , height = 2
                    ,aspect = 3)

grid.map(sns.scatterplot
        , 'salary_in_usd'
        , 'Cost of Living Index'
        , data = data_sample
        , alpha = 0.7
        , hue = 'country'
        , palette = 'deep'
        )

grid.set_axis_labels('Salary in USD')
grid.add_legend(fontsize = 'small')
grid.set_titles(col_template = "{col_name}")
plt.xticks(rotation = 40)
```

```
[4032]: (array([-200000.,      0., 200000., 400000., 600000., 800000.,
                1000000.]),
         [Text(-200000.0, 0, '-200000'),
          Text(0.0, 0, '0'),
          Text(200000.0, 0, '200000'),
          Text(400000.0, 0, '400000'),
          Text(600000.0, 0, '600000'),
          Text(800000.0, 0, '800000'),
          Text(1000000.0, 0, '1000000')])
```



The majority of the points on the graph are overwhelmingly United states. The salary distribution seemed to have expanded over the years but seemed to have dipped in 2022. Cost of Living Index mainly clusters between 50 and 100 but there are some outliers. The US seems to have higher salary ranges, however the cost of living also seems to be pretty high. India seems to be consistently on the bottom of the graphs, indicating low salary but also low cost of living. Germany, Canada, and UK seem to have moderately high salaries but cost of living seems to be also in the 50 to 100 range. The years 2020 and 2021 seem to have the most compact data probably reflecting pandemic times (shift to remote work).

Based off of all I analyzed, it seems like the US is the place to be as a Data Scientist. The US has high salaries and has pretty good cost of living indices to keep up with it. If you want a family down the road, it would still be generally affordable to live. Germany also has relatively high salaries but not nearly as high as the US. Since the cost of living indices in my last graph show it between 50-100, and it did make it on my top 10 graphs, I would say that the salary is relatively balanced with the cost of living. The UK would take second place over Germany though because it has high salaries. It was in the top 10 for my second set of graphs, although it drastically placed lower when a family became involved. The cost of living index did also place between 50 and 100. Lastly, I would say India consistently placed low and would not be a recommended place to take on a Data scientist role.