



[urban-advisor.herokuapp.com](http://urban-advisor.herokuapp.com)

[Demo Video](#)

[GitLab](#)

CS5934 Capstone Project Report

December 8, 2021

Mark Paes, Srijja Gurijala, Steven Barnett, Xu Wang, Chris Luersen

# I. Product Summary

## Description

Our capstone project, entitled “Urban Advisor”, is a data-driven web-based decision support system targeted towards individuals who are weighing options to relocate to a new area. The application features an intake process that allows users to input preferences regarding their income, values, and lifestyle choices. From this, Urban Advisor will return an output of how up to three selected metropolitan areas compare against tailored quantitative metrics specific to the user’s input, and displays graphical data visualizations to assist in a user’s analysis of alternative locations.

## Functionalities

### Intake Form

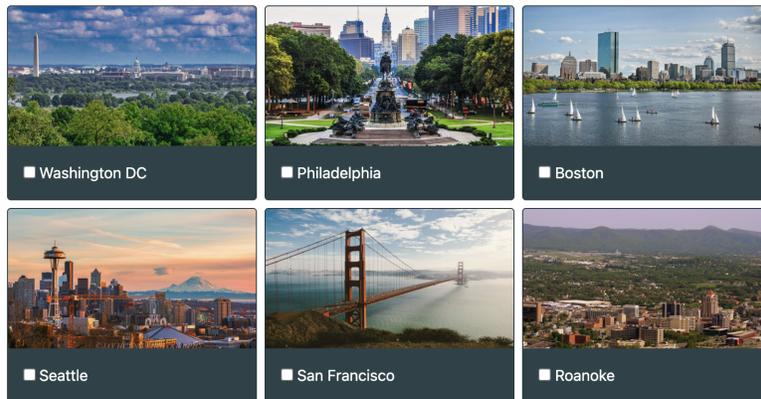
The first functionality showcased in the product is the intake questionnaire form. This form is constructed such that it does not require the user to create an account or release any identifying information.

### Selection of Cities and Features



Please answer the following questions for us to better evaluate your needs

Choose cities to compare (maximum 3)\*:



What are you looking for?

- Cost of Living
- Property Price
- Childcare
- Healthcare
- Crime Rate
- Food Options

## Cost of Living questions

### Lifestyle Options

Anticipated annual income (USD)\*:

How many members are in your household:

How often does your household eat meals at restaurants or get food delivered?

How often does your household get coffee?

How often does your household partake in entertainment (movies/nightlife/etc)?

How many packs of cigarettes does your household smoke?

How often does your household drink alcohol?

How frequently do members of your household drive?

How frequently does your household use a taxi or rideshare app?

Does your household use public transportation?

 Monthly Pass  On Demand Tickets  No

How many members of your household have a gym membership?

How much money do you spend on vacations per year?

How often do you buy new clothing/shoes?

## Property Price questions

### Property Price Options

Where are you looking to live?

Inside City Center

Outside of City Center

Do you plan to rent or buy?\*

Rent

Buy

How many square feet are you looking to buy?\*

How much are you prepared to pay as a down payment?\*

 %

## Childcare questions

### Childcare Options

Number of children going to daycare:

Number of children going to private school:

# Report

## Salary & City Comparison

### Here is your customized financial report:

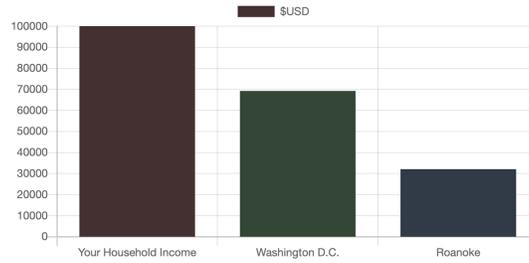
Currently your household income is \$100,000 per year.

To Live in **Washington D.C.:**

Your household income is 35.58% higher than the average household income. You can save approximately \$1,778.33 per month.

To Live in **Roanoke:**

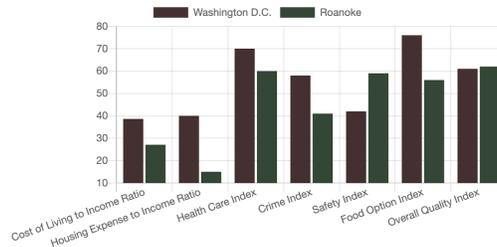
Your household income is 153.54% higher than the average household income. You can save approximately \$4,820.33 per month.



## Overall Quality of Life & Graphs

### Overall Quality of Life ⓘ

	Washington D.C.	Roanoke
Cost of Living to Income Ratio (%):	38.64 High	27.11 Moderate
Housing Expense to Income Ratio (%):	40.02 Very High	15.05 Moderate
Health Care Index:	70 High	60 High
Crime Index:	58 Moderate	41 Moderate
Safety Index:	42 Moderate	59 Moderate
Food Option Index:	76 High	56 Moderate
<b>Life Quality Score:</b>	<b>61</b> High	<b>62</b> High



## Cost of Living Report

### Cost of Living Report (Monthly)

	Washington D.C.	Roanoke
<b>Restaurant:</b>		
Estimated Restaurant Expense:	\$440.00	\$380.00
<b>Grocery:</b>		
Estimated Grocery Expense:	\$798.14	\$642.48
Estimated Smoking Expense:	\$0.00	\$0.00
Estimated Alcohol Expense:	\$128.00	\$88.00
<b>Transportation:</b>		
Estimated Public Transportation Expense:	\$0.00	\$0.00
Estimated Taxi and Ride Share Expense:	\$0.00	\$0.00
Estimated Gas Expense:	\$14.40	\$14.40
<b>Entertainment:</b>		
Estimated Fitness Center Expense:	\$0.00	\$0.00
Estimated entertainment(movies/nightlife/etc)?:	\$224.00	\$208.00
Estimated Vacation Expense:	\$166.67	\$166.67
<b>Shopping Spending:</b>		
Estimated Shopping Spending:	\$1,449.16	\$760.40
<b>Total:</b>		
Total Household Estimated Spending:	\$3,220.23	\$2,259.47

## Property Price Report

### Cost of Property Report

	Washington D.C.	Roanoke
To <b>Rent</b> a Two Bedrooms Apartment in Suburb:		
Estimated Monthly Payment:	\$3,335.15	\$1,254.24

## Childcare Report

### Cost of Child Care Report

	Washington D.C.	Roanoke
Estimated Daycare Monthly Expense:	\$0.00	\$0.00
Estimated Private School Monthly Expense:	\$0.00	\$0.00
<b>Total:</b>		
Total Childcare Estimated Spending:	\$0.00	\$0.00

## Healthcare Report

### Health Care Report

	Washington D.C.	Roanoke
<b>Healthcare Quality (%):</b>		
Medical Staff Skill/Competency:	79 High	64 High
Examination and Reporting Speed	74 High	58 Moderate
Modern Equipment	91 Very High	75 High
Report Accuracy/Completeness	75 High	66 High
Staff Friendliness/Courtesy	67 High	66 High
Reasonable Responsiveness/Waiting Times	62 High	42 Moderate
Satisfaction with Cost	49 Moderate	44 Moderate
Convenience of Location	80.00 Very High	78.00 High
<b>Health Care Expense (Per Visit):</b>		
Doctor's Visit	\$106.84	\$111.82
Dentist Visit	\$91.78	\$96.06
Optometrist Visit	\$100.11	\$104.78
RX Drug	\$425.57	\$445.41
Veterinary Visit	\$50.44	\$46.32

# Crime Report

## Crime and Safety Report

	Washington D.C.	Roanoke
<b>Crime Rates:</b>		
Crime Level	69 High	39 Low
Crime Increasing Over Time (Past Three Years)	64 High	62 High
Home Invasion/Burglary Worries	52 Moderate	50 Moderate
Mugging/Robbery Worries	56 Moderate	43 Moderate
Car Theft Worries	49 Moderate	36 Low
Item Theft from Car Worries	63 High	45 Moderate
Physical Altercation/Attack Worries	56 Moderate	36 Low
Verbal Confrontation/Insult Worries	59 Moderate	40 Moderate
Racist Violence Worries	44 Moderate	16 Very Low
Drug Use/Dealing Worries	64 High	64 High
Vandalism/Property Crime Worries	63 High	58 Moderate
Assault/Armed Robbery Worries	61 High	42 Moderate
Corruption and Bribery Worries	55 Moderate	23 Low

# Food Report

## Food and Restaurant Report:

	Washington D.C.	Roanoke
Restaurants per Square Mile	1.55	1.05
Cuisine Diversity and Proximity Index (lower is better)	2.24	3.93
Cuisines per Metro	86.00	76.00
Dollars Spent Out vs. at Dollars Spent on Groceries	1.16	0.75

# II. Design

## Front-End

### Wireframes

For the front-end layout, we developed low-to-medium fidelity wireframes by Balsamiq for organizing basic presentations of our web pages. During the progress of development, we gradually updated wireframes based on the new features that would be implemented in a specific sprint. Throughout the semester, we developed four versions of wireframes to present specific ideas and functionalities for each feature.

A Web Page  
https://powerfulfinancial.com

**Powerful Financial**  
Your smart financial calculator

**Welcome to Powerful Financial**  
Please answer the following questions for us to better evaluate your needs

Cities to evaluate (maximum three):  Washington D.C.  Philadelphia  Boston  Seattle  Silicon Valley  Roanoke

What are you looking for?  Cost of Living  Property Price  Crime Rate  Health Care  Child Care  Dining Option

**Lifestyle Options**

Your annual salary:

Member of Your household:

Eating Lunch or Dinner in Restaurant:  0% Of the time

For dining out, choosing inexpensive restaurants:  0% Of the time

Drinking Coffee outside of your home:  Moderate

City Life Entertaining (Movies, Night life,etc):  Moderate

Smoking (household overall):  No

Alcoholic Drinks (household overall):  Low

Frequency of Driving:  Moderate

Taxi or Rideshare App:  High

Public Transportation ticket:  Monthly number of family member paying:

Sport Memberships:  All household

Vacation Spending:  Per year

Buying Clothing and Shoes:  Moderate

**Property Price Options**

Rent:  Apartment : 1 bedroom

Estimate Mortgage:  20% down payment; Townhouse

**Child Care Options**

Number of Children going to daycare:

Number of Children going to private school:

[Contact Us](#) | [About Us](#) | [GitLab Link](#)

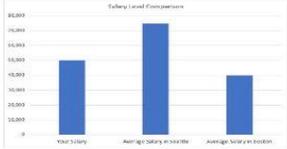
PowerFinancial 2021 <sup>TM</sup>



**Powerful Financial**  
 Your smart financial calculator

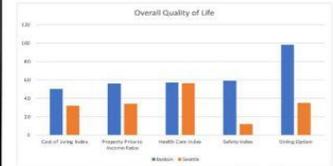
**Here is your customized financial report:**

Currently you earn \$42,000 per year.  
 This number 24% below average salary in Seattle.  
 This number 31% below average salary in Boston.



**Overall Quality of Life** [\(back to your questionnaire\)](#)

	Boston		Seattle	
Cost of Living Index	High	87.58	High	87.58
Property Price to Income Ratio	Moderate	49.73	Moderate	49.73
Health Care Index	High	74.01	High	74.01
Safety Index	Very Low	4.56	Very Low	4.56
Dining Option	Very Low	4.56	Very Low	4.56
Quality of Life Index	Very High	188.07	Very High	188.07



**Cost of Living Report (Monthly)**

- Restaurant:**  
Estimated Expense: \$500
  - Grocery:**  
Estimated Expense: \$800
  - Transportation:**  
Estimated Public Transportation Expense: \$200  
Estimated Gas Expense: \$200  
Estimated Taxi and Ride Share Expense: \$200
  - Entertainment:**  
Fitness Center: \$100  
Estimated Vacation Expense (amortized by month): \$200  
Estimated Cinema and Nightlife expense: \$100
  - Rent or Mortgage:**  
Estimated Payment: \$2000
- Total Household Estimated Spending: \$5000**

**Property Price Report**

**Child Care Expense (Monthly)**

Estimated Preschool or Daycare expense: \$ 1500  
 Estimated Private School Expense (amortized by month): \$2000

**Health Care Report**

**Crime Rate Report**

Level of crime	50.0	Moderate
Crime increasing in the past 3 years	74.59	High
Worries home broken and things stolen	47.21	Moderate
Worries being mugged or robbed	50.0	Moderate
Worries car stolen	74.59	High
Worries things from car stolen	47.21	Moderate
Worries attacked	50.0	Moderate
Worries being insulted	74.59	High
Worries being subject to a physical attack because of your skin color, ethnic origin, gender or religion	50.0	Moderate
Problem people using or dealing drugs	74.59	High
Problem property crimes such as vandalism and theft	47.21	Moderate
Problem violent crimes such as assault and armed robbery	50.0	Moderate
Problem corruption and bribery	74.59	High
	47.21	Moderate

**Restaurant Options**

Restaurants per Square Mile	9.24
Score for overall diversity and proximity of cuisines (lower is better)*	1.81
Cuisines per Metro	92
Dollars Spent Out vs. at Dollars Spent at Groceries	\$1.54
<b>Final Index (out of 100 possible)</b>	<b>92.6</b>

## The Questionnaire Page

Working from the wireframe, the questionnaire page is a relatively straightforward implementation of an HTML form. There are a series of checkboxes, select menus, radio buttons, and text input fields for the user to provide information for Urban Advisor to process.

Various questions and sections of the form are displayed dependent upon the user's interaction with previous questions. For example, one of the first items in the questionnaire asks the user whether they are interested in Property Price or Childcare options. Therefore, these items are set as 'display: none' by default, until the user checks each box to indicate they would like to engage with the tool's analysis in these areas.

Early in implementation, our team considered separating the different sections of the questionnaire into different HTML forms. While the different forms would be submitted to the backend simultaneously, we supposed that separating them might allow for cleaner and more separated backend logic. Ultimately, we decided to represent the entire questionnaire with a single form and process all responses in a single receiver method.

Most fields in the questionnaire have a default value assigned. Every select menu field is set by default to the option that indicates the user does not partake in or spend money on its related activity. Other fields, such as the cities checkboxes and text fields, require input. Form validation will not allow the user to submit the form until these values are provided.

Additional validation is performed to ensure that the user does not send invalid information to the backend. Each text input field that requires a number value is evaluated against a regular expression (regex) that validates that the input is indeed a number.

## The Report Page

Our report page contains eight sections: salary and remaining savings, summary of overall quality of life, cost of living calculation, housing expense calculation, childcare calculations, healthcare quality, crime rate and safety level and food options. Those contents in the report page are organized in table layouts.

This webpage is primarily based on HTML elements with CSS styling in a Django template. Django Template languages, such as `{% block content %}`, `{% for city in`

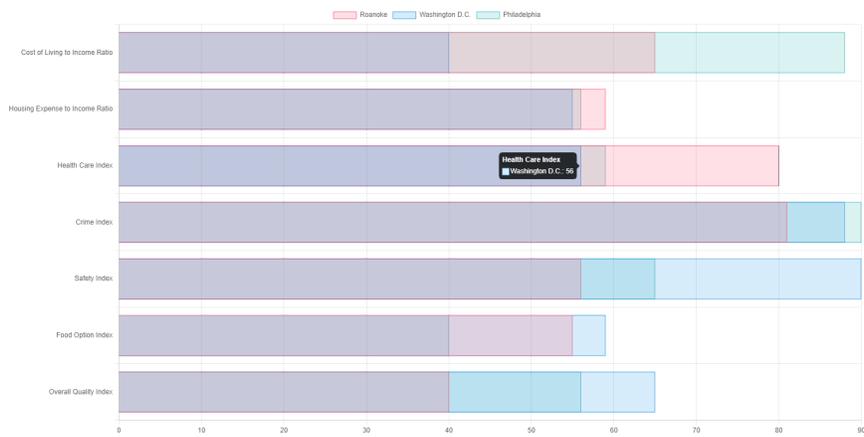
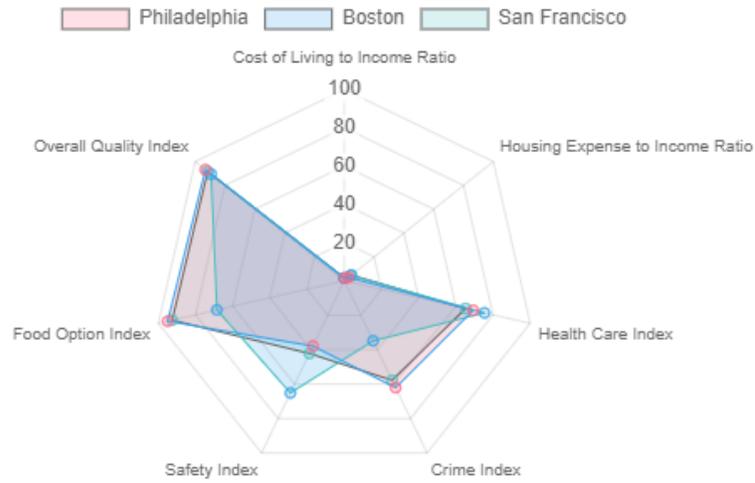
`cities_list %}`, `{% if user_info.food_options %}` etc., are used in this web page to dynamically display content based on the user's choice from the questionnaire page. For example, the healthcare table would only be displayed if the user selected the health option in the questionnaire page. The report page calls the Django template tags (`filter_extras.py`) to filter the data sent from the backend and transform them to be more matched to the needs of the report page. For instance, the rating modifiers “Very High”, “High”, “Moderate”, “Low”, “Very Low” are generated by calling the `generate_rating_qualifier` function based on the score of the passing quality index.

## The Methodology Page

The methodology page provides more information in terms of index numbers shown in the overall quality of life section and how we calculated those numbers. Moreover, for each section of index, we also provide sources of data for user's reference.

## Charts

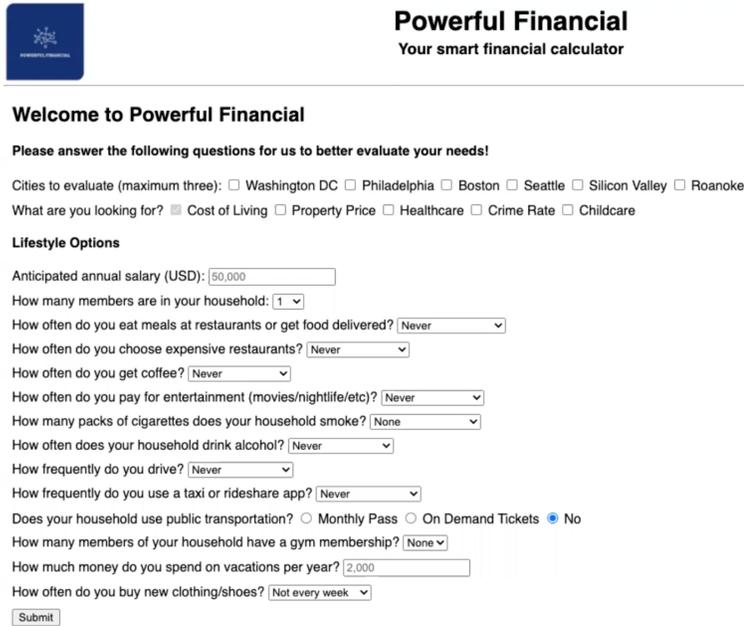
We used the Chart.js to generate graphs in the report page. Chart.js is an open source Javascript library for data visualization. We considered the bar chart as the most suitable option to visualize the income comparison data and the overall life quality index figures. Another possibility was a radar chart, but as seen in the image below, values too easily overlapped for it to be a viable option. Another option was whether our bar chart should be stacked or unstacked, and because of the list structure of our results page and the 3 city limit, we thought the comparison would be simple enough to have a stacked visual, hence the use of the stacked bar. The data and their labels used in the charts are organized through specific functions at the back-end. Those information are passed through `view.py` and directly injected into the `<script>` tag in the report template. We used the Django template language to render those data into the graph's dataset. The `<script>` tag contains an altered chart.js bar graph template which has a nice hover functionality for viewing specific numbers for each bar, which can be seen in the little gray box of the third graph image. As well as the ability to cross out certain cities, which helps when viewing three cities, but the user wants to compare just two. All three graphs below are of the same data and cities.



## Presentation and Styling

For the first two sprints of our project, the Urban Advisor UI was a barebones representation of the questionnaire form with simple tables on the report page. After our team implemented many of the features during these sprints, in sprint three we

overhauled the look of the site, drastically changing three important factors: title, logo, and colors.



**Powerful Financial**  
Your smart financial calculator

**Welcome to Powerful Financial**

Please answer the following questions for us to better evaluate your needs!

Cities to evaluate (maximum three):  Washington DC  Philadelphia  Boston  Seattle  Silicon Valley  Roanoke

What are you looking for?  Cost of Living  Property Price  Healthcare  Crime Rate  Childcare

**Lifestyle Options**

Anticipated annual salary (USD):

How many members are in your household:

How often do you eat meals at restaurants or get food delivered?

How often do you choose expensive restaurants?

How often do you get coffee?

How often do you pay for entertainment (movies/nightlife/etc)?

How many packs of cigarettes does your household smoke?

How often does your household drink alcohol?

How frequently do you drive?

How frequently do you use a taxi or rideshare app?

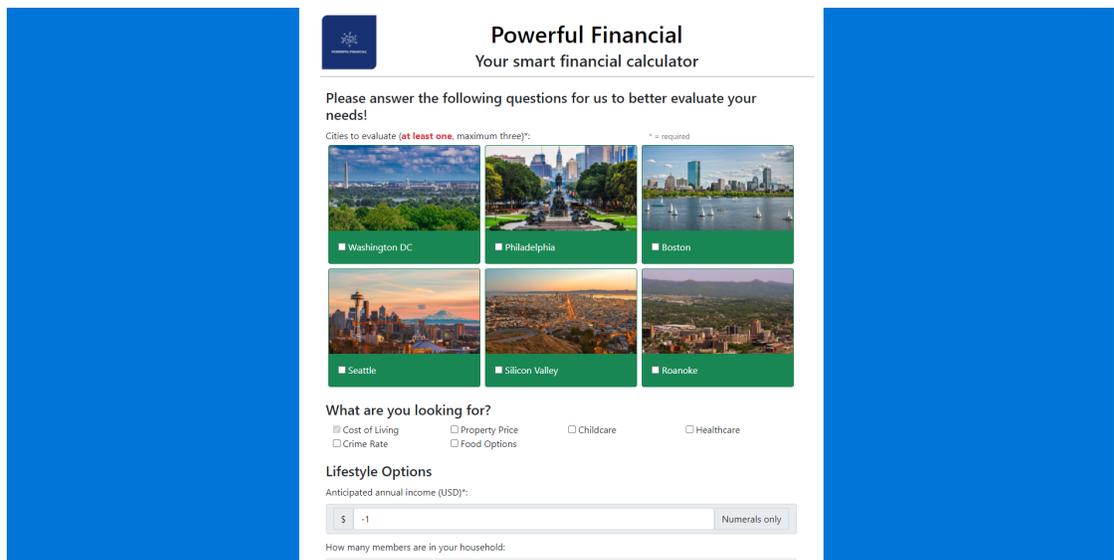
Does your household use public transportation?  Monthly Pass  On Demand Tickets  No

How many members of your household have a gym membership?

How much money do you spend on vacations per year?

How often do you buy new clothing/shoes?

We utilized the [SB Admin 2](#) Bootstrap template to modernize the input fields and as inspiration for the initial aesthetic for the site.



**Powerful Financial**  
Your smart financial calculator

Please answer the following questions for us to better evaluate your needs!

Cities to evaluate (at least one, maximum three)\*: \* = required

Washington DC  Philadelphia  Boston

Seattle  Silicon Valley  Roanoke

What are you looking for?

Cost of Living  Property Price  Childcare  Healthcare

Crime Rate  Food Options

**Lifestyle Options**

Anticipated annual income (USD)\*:

\$

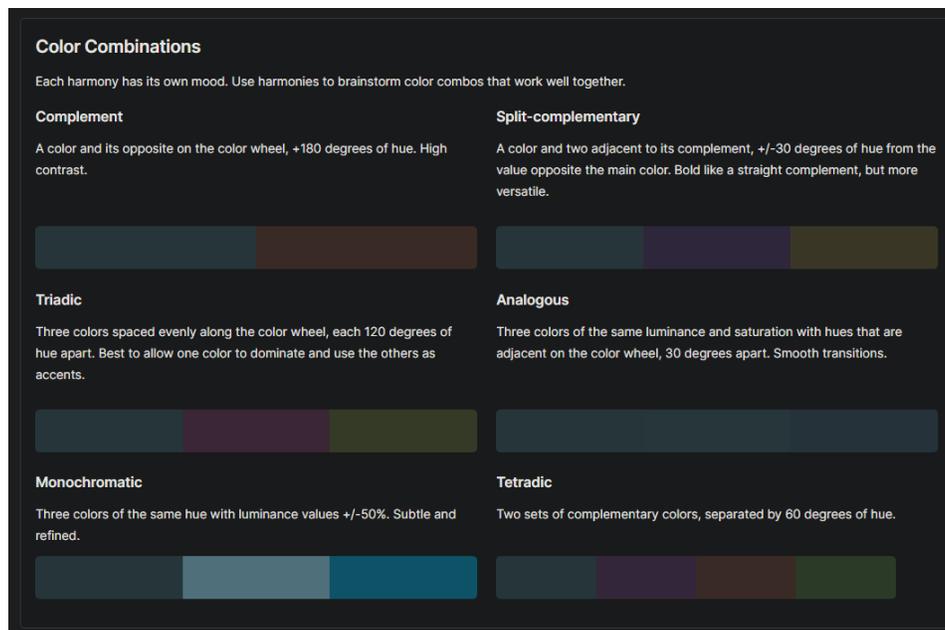
How many members are in your household:

During development, we referred to the project by multiple names whether it was Powerful Financial, Finance Calculator, or Cost of Living Calculator. To provide more uniformity we landed on Urban Advisor as a catchier, but also a more industry-sounding name to give the site more credibility.

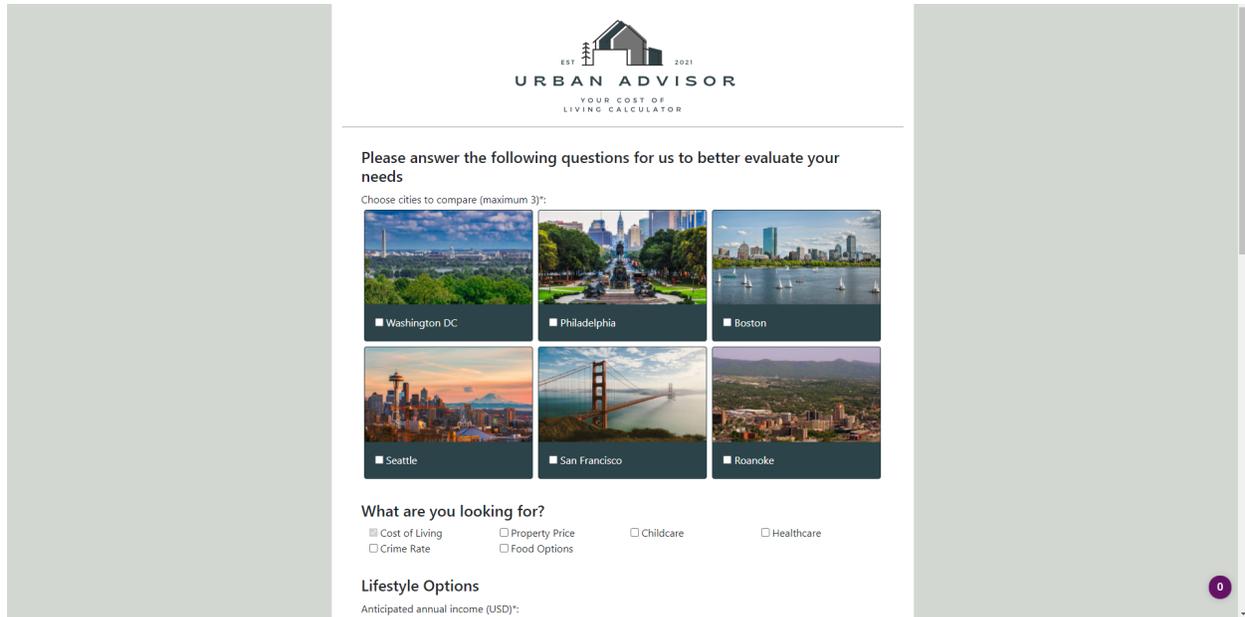
To give the site a more modern look we created a unique logo that makes the site feel more professional. There were a few options but ultimately decided on the right logo because of its more landscape appearance which looked better on the banner.



To provide more uniformity we did some color research to compare and contrast with the blueish-green of the logo, known as “Limed Spruce”. We also used the shade of gray in the house as the background, after tuning down the contrast to make it easier on the eyes. We wanted to use a set of like colors throughout the site so using Limed Spruce as our base shade we used a [color research site](#) to easily identify what these should be as seen in the image below. We then implemented these colors across the buttons and headers for the result page.



As such, the final appearance of the Urban Advisor site takes advantage of muted tones to provide a mature and sophisticated look.



## III. Back-End

### Django Filters

In the back-end, we implemented the customized Django filter tags to transform data in the backend more matching with our needs at the front-end. This part of logic works on displaying column names on the report page, generating modifiers for scores and indexes, and presenting the salary percentage. Compared with adding logic in the Javascript at the frontend, using Django filter tags provides a more straightforward way to maintain the codebase.

### Connection to the Front-end

The `view.py` file established the connection between the front-end templates and the back-end logic (`calculation.py` file). In the `view.py`, we created functions that receive `HttpRequest` from the webpage and display the views per user request. In the `register_form` function, by calling the `request.POST.get` method, we can collect data from user selections from the front-end. Then we passed those collected data into the back-end to process for calculation. In the end, we render the view of the report page template along with the data in the format of a dictionary to the frontend.

### Logic of calculation

### Overall Quality of Life

1. **Salary Comparison** =  $((\text{salary} - \text{average salary of every city}) \div \text{average salary of every city}) \times 100$
2. **Savings** =  $\text{Salary per month} - \text{Total expense}^*$
3. **Cost of living to income ratio** =  $\text{Total expense}^* / \text{monthly income}$
4. **Housing expense to income ratio** =  $\text{Housing expense}^* / \text{monthly income}$
5. **Overall quality of Life** =  $\text{Sum of scores from user selected options} / \text{Number of selected options}$ 
  - a. **Sum of scores from users options**  $^* = (100 - \text{cost of living to Income ratio}) + (100 - \text{housing expense to income ratio}) + \text{healthcare index} + \text{crime index} + \text{safety index} + \text{food option}$

*NOTE:*

*\*= Calculates the features chosen by the user*

Cost calculation for living expenses:

**Total household estimated Expense = Cost of food + cost for groceries + cost of entertainment + cost for shopping + cost of transport**

1. **Cost for food** =  $\text{cost of food at normal restaurants} + \text{cost at expensive restaurants} + \text{cost for coffee}$ 
  - a. **cost of food at normal restaurants** =  $\text{household members} \times \text{cost at restaurant} \times \text{number of times they go out} - \text{number of times they go to expensive restaurants} \times 4^*$
  - b. **cost at expensive restaurants** =  $\text{household members} \times \text{cost at expensive restaurant} \times \text{number of times they go to expensive restaurants} \times 4^*$
  - c. **cost for coffee** =  $\text{household members} \times \text{cost of coffee} \times \text{number of times they go out} \times 4^*$
2. **cost for groceries** =  $\text{cost of groceries per month} \times \text{household members}$
3. **cost of entertainment** =  $\text{gym membership} + \text{vacation spending} + \text{movies}$
4. **gym membership** =  $\text{household members with membership} \times \text{cost of membership per month}$
5. **vacation spending** =  $\text{user input} / 12^{**}$
6. **movies** =  $\text{household members} \times \text{cost of ticket} \times \text{number of times per week} \times 4^*$
7. **cost for shopping** =  $\text{household members} \times \text{average cost of shopping} \times \text{number. of times per month}$

*NOTE:*

*\*= number of weeks in a month*

*\*\*= 12 number of months in a year*

Cost calculation for transportation :

**cost of transport = cost for fuel + cost for public transport + cost for taxi/cabs**

1. **cost for fuel** =  $\text{miles per day} \times (\text{times traveled per week} \div \text{Average miles per gallon}^{**}) \times \text{Price of a gallon of gasoline per city} \times 4^*$

2. **cost for public transport** = number of members with monthly pass × cost of one pass + cost of tickets × 2 × number of trips per week × 4\*
3. **cost for taxi/ cabs** = number of miles per trip\*\* × 2 × number of trips per week × cost of one trip

*NOTE:*

\*= number of weeks in a month

\*\*= fixed average miles per gallon = 25, fixed number of miles per trip = 20

Cost calculation for housing:

**cost of housing = cost of renting or cost of buying**

**1.Monthly mortgage of buying a house** =  $(p \times r(1+r)^n)/((1+r)^n - 1)$

Where,

p = principal loan amount

r = monthly rate of interest

n = number of payments over the loan's lifetime, fixed to 30 years (360 months) in this case.

a.**Principal amount** = (property size × cost of 1 sqft) – down payment amount

b.**Down payment** = property size × cost of 1sqft × (down payment percentage ÷ 100)

Cost Calculation for childcare:

**Total estimated child care spending = Cost for children attending private schools + cost for children attending daycare**

1. **Cost for attending private schools** = number of children attending private schools × cost for one student at private school per month.
2. **Cost for attending daycare** = number of children attending daycare × cost for one student at daycare per month.

## Uniqueness and Originality

Overall, our project provides a tailored report based on the user's situation in terms of income and living demands. We believe there is no substitute or similar tool currently in the market. The competitive advantage of the system is providing a time and effort-efficient way for users to gather all information they need. Several websites provide part of functions that are similar to our system including online real estate marketplaces like Zillow and Apartment.com and also paycheck calculator websites like smartasset.com. However, these websites that provide similar features cannot be a substitute for our system as their users only can obtain one side of data. Our system integrated the income calculation and the living quality factor for a specific metropolitan area. By using our system, users can obtain all necessary information for their decisions

in just one step. There is no other website currently in the U.S. market that provides the same function compared to ours.

## IV. Data Report

### Introduction

The data was aggregated from several sources online providing free access to verified data. Some of these sites include numbeo.com, payscale.com, and bls.gov, which is the Bureau of Labor Statistics website. These data sources provided the base for developing a working prototype of our web app and gave basic information to fulfill the requirements of Sprint 1, the fresh grad. This basic information included common factors like day-to-day living finances, transportation, crime, and child care. For Sprint 2, we continued our exploration of the available data and added relevant healthcare information for our Elder users and housing information for our family users. The healthcare information was sourced from payscale.com, and the housing data was sourced from the Census Bureau Data API. Lastly, for Sprint 3 the main focus was on aggregating index scores for each of our features: property price, childcare, healthcare, crime rate, and food options. As well as food options by city, for example, restaurants for square miles, or variance of cuisine types. An interesting issue we ran into was determining clothing data for each city since for some users this may be location-dependent whether they shop small business or not, but for the majority of users, clothing prices at chain stores are universal throughout the US.

Focusing on the specific aspects of what each user would be looking for, or prioritizing when determining their cost of living helped us narrow down what specific data to include in our database. Using a question first development technique to then source our data enabled us to make a custom database, using aggregated data from multiple sources to ensure a complete and uniquely applicable back-end resource for our web app. Another benefit from making the custom database is how we were able to learn and see trends which helped us hypothesize how each user would want to interact with the front end and dynamically plan out the UI to be the most beneficial to display the most relevant information for each specific user. Some interesting points about the data are that much of the healthcare information came in the form of surveys. This will make it easier to conditionally provide specific data for our older users who may not be interested in all aspects of healthcare for a specific city. Also, housing trends seemed to increase the more suburban the user was examining, this was an interesting discovery that conflicted with our previous connotations of downtown square footage being more expensive than outside the city. In the final phase of the project, Chris developed chart.js code to display the data in an easy-to-understand format, with a level of interactivity for the user to do even closer cross-examinations of their selected cities.

# Data Analysis

## Sprint 1 - Fresh Grad User

<u>Monthly</u>	Roanoke	DC	Philly	Boston	Seattle	SF
<b>Restaurants:</b>						
<b>Meal, Inexpensive Restaurant</b>	15	15	15	20	18	20
<b>Meal for 2 People, Mid-range Restaurant, Three-course</b>	65	80	55	87.5	85	85
<b>Grocery:</b>						
<b>Grocery Daily</b>	10.36	12.87	12.95	13.44	13.41	15.99
<b>Grocery Monthly</b>	321.24	399.07	401.39	416.73	415.8	495.65
<b>Utilities:</b>						
<b>Basic (Electricity, Heating, Cooling, Water, Garbage) for 915 sq ft Apartment</b>	163.99	159.23	169.29	189.82	209.39	190.31
<b>Prepaid Mobile Plan - Call Only - 1 min</b>	0.1	0.17	0.18	0.08	0.13	0.14
<b>Internet (60 Mbps or More, Unlimited Data, Cable/ADSL)</b>	85.62	63.91	61.71	63.73	61.97	63.65
<b>Entertainment:</b>						
<b>Gym Membership</b>	35.33	83.59	37.15	76.04	54.48	81.66
<b>Movie Theater Ticket</b>	13	14	14	14	14	15

This user worked as our baseline for all other users we plan to secure data for because of this the breadth and exhaustiveness of our search took a considerable amount of time to aggregate accurately, and use data to fit our needs for the initial questionnaire UI. This scaled-down table showcasing a sample of the data we have, as you can see, is pretty specific, all the way down to the average price of a movie theater ticket in each city. A lot of this data was sourced from numbeo.com, which is one of the largest cost-of-living data sources available online, which utilizes, according to their website, a “crowd-sourced global database of quality of life information including housing indicators, perceived crime rates, and quality of healthcare, among many other statistics.” We were also able to source data and plan for future users, for example, mortgage interest rates for our family users, who will be focused on housing data.

## Sprint 2 - Elder User

Healthcare Quality(%):	Roanoke	DC	Philly	Boston	Seattle	SF
Skill and competency of medical staff	63.89	79.09	76.16	84.06	79.83	75.63
Speed in completing examination and reports	58.33	73.66	68.6	80.45	79.83	72.25
Equipment for modern diagnosis and treatment	75	91.36	85.62	91.99	93.2	82.26
Accuracy and completeness in filling out reports	65.62	75.45	75.62	84.54	81.3	73.71
Friendliness and courtesy of the staff	65.62	67.41	75	83.54	84.17	73.52

Health Care Expense (Payscale.com):	Roanoke	DC	Philly	Boston	Seattle	SF
Doctor's Visit	111.82	106.84	117.02	149.68	137.5	132.96
Dentist Visit	96.06	91.78	100.53	128.59	118.13	114.23
Optometrist Visit	104.78	100.11	109.65	140.26	128.85	124.59
RX Drug	445.41	425.57	466.14	596.23	547.72	529.64
Veterinary Visit	46.32	50.44	55.18	66.81	69.94	62.84

The first table here lists the data as percentages, this will be useful for allowing conditional statements in the questionnaire for a user to select which aspects of healthcare are important to them since not everyone cares about the same factors when deciding a health care provider. We thought conditional statements might be better than our regular theme of asking the frequency a user does something since it's hard to quantify those aspects when it comes to healthcare. The second table includes the going rates for different health care services in each city. To provide as much data as possible we included the average RX Drug price, however, while accurate, this data is extremely unreliable since the cost of a prescription can vary widely depending on the user's insurance. It'll mainly be used to give an idea of where prescription drug prices will generally trend higher.

## Sprint 2 - Family User

Real-Estate	Roanoke	DC	Philly	Boston	Seattle	SF
Price per Square Feet to Buy Apartment in City Center	224.23	758.86	435.03	1073.62	677.49	1302.9
Price per Square Feet to Buy	78.23	355.64	123.14	542.47	436.87	916.25

Apartment Outside of Center						
Median House Price(payscale.com)	283499	859866	449365	717943	673874	1146835

Housing income is going to be some of the most important information we'll provide from our data. This means we absolutely must ensure that our data is accurate and up to date. The data listed in the table above is from October 29<sup>th</sup>, 2021, from rate.com, which utilizes the Census Bureau API to provide real estate pricing information for every zip code in the US. For inside the city center, this was easy enough to just gather the data for each specific city listed. However, for outside the city center, we used the best judgment to choose a suburb the user is most likely interested in moving to and taking the average of the data for the surrounding area. These suburbs are listed in order by column: Blacksburg VA, Arlington VA, King of Prussia PA, Brookline MA, Kirkland WA, Berkeley CA.

### Sprint 3 - Traveler

Food	Roanoke	DC	Philly	Boston	Seattle	SF
Non-Chain Restaurants per Square Mile	1.05	1.55	10	3.12	1.35	9.24
The score for overall diversity and proximity of cuisines (lower is better)*	3.93	2.24	2.85	3.03	2.07	1.81
Cuisines per Metro	76	86	92	83	87	92

Travelers were an interesting user to support data for, especially for a cost of living calculator mainly focused on relocation and comparison expenses between cities. Because of this we ultimately landed on what someone visiting a city would be interested in which was food! The data we sourced was from Trulia research, a home search web app. While this was provided for the majority of the cities, Roanoke being the least populated was an outlier to find this we summarized the data we could access for Roanoke and compared it to the other cities to determine an average weight for the food data for our traveler user and applied that weight to an x value of each other cities data to determine what the missing Roanoke data would be. This seemed appropriate since this user represented our edge case user so we expected data sourcing for this would be more difficult since the databases we were using most likely wouldn't record data tailored to individuals just visiting cities.

### Sprint 3 - Mom

Summaries/Misc	Roanoke	DC	Philly	Boston	Seattle	SF
Dollars Spent Out vs. at Dollars Spent at Groceries	0.75	1.16	0.8	0.96	0.86	1.54
Average Food Costs (Weekly)	124.56	195.10	163.25	208.85	190.92	219.96

<b>Average Spending</b>	55797	89052	72726	91578	81728	91728
<b>Food Index</b>	56.2	76.4	95	68.5	65.5	92.6
<b>Crime Index</b>	40.78	58.45	62.06	34.88	50.27	57.8
<b>Safety Index</b>	59.22	41.55	37.94	65.12	49.73	42.2
<b>Health Care System Index</b>	59.65	69.62	69.38	75.44	74.01	65.25
<b>Clothing (Monthly)</b>	191	362.29	293.61	198.85	345.411	322.09

The mom user was the final user for Sprint 3 and our project as a whole. For this user, we determined they would be interested in the overall satisfaction of every factor of their city. We accumulated index scores for all and attributed a string rating system, color-coded, to provide a quick way to parse the data without being too difficult to understand. There's also average spending per household data since a mom user would most likely have more than 1 member in their household so this data would be particularly helpful for them since it'll make our salary expectation results at the top of our results page to be as accurate as possible for the user. We included clothing data here too as a miscellaneous data sample since it was very difficult to source accurate data on this since it varies so wildly by the person that it's hard to get firm statistics on it. The data is an overgeneralization between spending per individual and monthly spent on clothing sourced from BLS. This way we can at least give a proportional estimate of how much a user will spend on clothing based on their income.

## Conclusions

The final results of the data accumulated were used to process the entire backend of the web app's logic as well as being appropriately and simplistically displayed on the front end. The last step of implementation was the chart.js code with graph comparisons previously in the report. Many decision decisions and iterations take place to decide the outcome of the graphs with us ultimately deciding on a stacked histogram. Since the data was numerically-based either through survey data or currency this was the obvious choice, particularly because of the similarity in some of the data being able to effectively compare it amongst others was the most important for our users. Sourcing data was repeatedly an issue throughout the project including keeping data up to date without active API integration, as well as finding accurate and up-to-date information. The entirety of the data is cross-verified through census.gov and bls.gov free-access data but wasn't used as the primary source because of their extreme user unfriendliness. That's why we sourced the data across the web and once we found the specific data that would best suit our app we could specifically look up that data on one of the .gov websites to make sure it was accurate. At the end of the project, the results of data collection can be summarized as being up to date at the time of publication, federally verified, and relevant to the user stories provided in Phase 1 and 2 of the project.

## Sources

1. "Cost Of Living". 2021. *numbeo.com*. <https://www.numbeo.com/cost-of-living>

2. "Databases, Tables, and Calculators by Subject". 2021. *bls.gov*.  
<https://www.bls.gov/data/>
3. "Cost Of Living Calculator | Payscale". 2021. *Payscale.Com*.  
<https://www.payscale.com/cost-of-living-calculator>
4. "Free Paycheck Calculator: Hourly & Salary - SmartAsset". 2021. *smartasset.com*.  
<https://smartasset.com/taxes/paycheck-calculator>
5. "Shyft Moving Marketing Site". 2021. *Shyftmoving.Com*.  
<https://www.shyftmoving.com/location-usa/seattle>
6. 2021. *Zillow.Com*. <https://www.zillow.com>
7. "Real Estate Data By Zip | Real Estate Market Research | Guaranteed Rate". 2021.  
*rate.com*. <https://www.rate.com/research>
8. Bureau, US. 2021. "Census.Gov". *Census.Gov*. <https://www.census.gov/>
9. "America's Most Diverse Dining Destinations - Trulia Research". 2016. *Trulia Research*.  
<https://www.trulia.com/research/diverse-dining>

## V. Retrospection

This product was developed in 3 sprints. Each sprint lasted for about 4 weeks. During this time we designed a website that would provide a detailed report of the quality of living for selected cities based on preferences chosen by the user. We implemented 6 different user stories such that they targeted various needs of potential users,

In the first sprint, we developed the first version of our wireframe and were also successfully able to implement the first user story, a new graduate who wants to evaluate a job offer in a city. The user was asked to answer basic questions like salary, how many times in a week he would eat outside, his entertainment expenditure, and mode of transportation and its expense. A report of his total expected cost was calculated based on the responses.

During this sprint, the first difficulty was collecting data. It took a lot of time to confirm whether the data collected was consistent with the cities we chose. The second impediment we encountered was trying to send JSON objects that contain frontend data to the backend. We tried to use Ajax but were unable to implement it. We used HTTP post requests instead. Another issue we realized during the sprint was that the values asked in the questionnaire were inconsistent throughout the form and with the values in the backend. This issue was solved during sprint 2.

In the next sprint, we implemented two other user stories - where a young family is planning to move to a city and their major concern was rents/mortgages in the area and an elderly person whose priority was healthcare in the city. We also implemented the comparison feature. Now the user can select up to 3 cities from the given list of cities and compare the costs and quality of life among the cities.

During this sprint we realized that using ajax to send information to the backend was not a very feasible idea. We learned that Ajax requests were used to add front-end elements in the JQuery script and not to send data to the backend. So we continued to use the HTTP post request for fetching the data. Another issue we had during this sprint was within the database. It generated inconsistent ID values. We also had to add values to the database as we added more features. At instances, we found that we did not have sufficient data or data in a suitable format for the given questions in the questionnaire. Thus having to find data for specific questions and if the data existed for all the cities and

In this sprint, we decided to use graphs to show the comparisons between the cities while enhancing the user experience.

In the last sprint, we implemented the last 3 user stories - a young female who lives alone and cares about her safety, a mom whose utmost priority is schools for her kids, and a travel operator who loves food and would love to find a place filled with a variety of food options. In addition to these features, we added a salary comparison feature that compared the salary of the user with the average salary of each selected city. We also displayed the savings from the users' salaries after the total potential expenditure in each city. Most importantly we created a summary section where we displayed the overall quality of living in each city based on the features selected by the user. We added graphs for these sections to give a complete understanding of the report. In this sprint, most of the User Interface was also implemented. We designed a new logo for the website and renamed the product.

The major issue during this sprint was to generate the charts using Chart.js in Django templates. None of the team members worked on this previously and had to learn it on the fly. We had to learn about the features Chart.js offered from multiple sources for implementation. Another issue was to decide on how many graphs to use on the report page. We initially thought of displaying a comparison graph for every feature but we then realized that the report page would become cluttered with so many graphs and finally decided to use only 2 graphs.

On the whole, we had a wonderful experience learning new software and tools for the project. We were able to complete the project in the given time with all the promised features though we had a few hiccups during the process.

## Recommendations for the future:

Though we were able to complete the promised features in the given time, we do feel that this project could be expanded in the future. Some suggestions would be -

- Increase the number of available cities from 6
- Add more features or user stories
- Change the structure of the results
- Enhance the user experience by adding more graphs and pictures
- Add more data to the existing user stories to give more information
- Try to give more granular data like prices of houses in different counties