

Census API Dashboard: Student Build Guide

From Government Data to Business Intelligence

Setup Requirements

```
python

# Install everything needed
!pip install --quiet pandas plotly ipywidgets requests

# Your imports
import requests
import pandas as pd
import plotly.graph_objects as go
import ipywidgets as widgets
from IPython.display import display
```

Step 1: Get Your FREE API Key

1. Go to: <https://api.census.gov/data/key-signup.html>
2. Enter your email
3. Check email for key (instant)
4. Replace in code: `API_KEY = "your_key_here"`

Why it's free: Government data = public resource

Step 2: Understanding Census Variables

Common Variables You'll Want

| Code | Description | Use Case |
|-------------|-------------------------|------------------|
| DP03_0062E | Median Household Income | Purchasing power |
| DP05_0001E | Total Population | Market size |
| DP04_0089E | Median Home Value | Cost of living |
| DP03_0004E | Unemployment Rate | Economic health |
| DP02_0065PE | Bachelor's Degree % | Education level |
| DP05_0018E | Median Age | Demographics |

Finding More Variables

Visit: <https://api.census.gov/data/2022/acs/acs5/profile/variables.html>

Step 3: Building Your API Call

The Template

```
python
```

```
# Your configuration
API_KEY = "your_key_here"
STATE_FIPS = "37" # North Carolina

# Pick your variables (comma-separated)
variables = "NAME,DP03_0062E,DP05_0001E,DP04_0089E"

# Build the URL
url = f"https://api.census.gov/data/2022/acs/acs5/profile?
    get={variables}
    &for=county:*
    &in=state:{STATE_FIPS}
    &key={API_KEY}"
```

State FIPS Codes (Common Ones)

- California: 06
- Texas: 48
- Florida: 12
- New York: 36
- North Carolina: 37

Full list: <https://www.census.gov/library/reference/code-lists/ansi.html>

Step 4: Processing the Data

The Basic Pattern

```
python

# 1. Make the request
response = requests.get(url)

# 2. Convert to DataFrame
data = response.json()
df = pd.DataFrame(data[1:], columns=data[0])

# 3. Rename columns (make human-readable)
df.rename(columns={
    "DP03_0062E": "Income",
    "DP05_0001E": "Population",
    "NAME": "County"
}, inplace=True)

# 4. Convert strings to numbers
numeric_cols = ['Income', 'Population']
df[numeric_cols] = df[numeric_cols].apply(pd.to_numeric)
```

Step 5: Creating Business Metrics

Examples to Calculate

```
python
```

```

# Affordability Index
df['Affordability'] = df['Income'] / df['Home_Value']

# Market Opportunity Score
df['Opportunity'] = (
    df['Population'] * df['Income'] / df['Home_Value']
) / 1000000

# Economic Health Score
df['Health_Score'] = (
    df['Income'] * (100 - df['Unemployment_Rate'])
) / 1000

```

Step 6: Building Interactive Dashboard

Basic Interactive Setup

```

python

# Create sliders
income_slider = widgets.IntSlider(
    value=50000,
    min=30000,
    max=100000,
    step=5000,
    description='Min Income:'
)

# Create the chart
fig = go.FigureWidget()
fig.add_scatter(
    x=df['Income'],
    y=df['Home_Value'],
    mode='markers',
    text=df['County'] # Hover text
)

# Update function
def update_chart(change):
    filtered = df[df['Income'] >= income_slider.value]
    fig.data[0].x = filtered['Income']
    fig.data[0].y = filtered['Home_Value']

# Connect slider to function
income_slider.observe(update_chart, names='value')

# Display
display(widgets.VBox([income_slider, fig]))

```

Step 7: Chart Types for Different Insights

Bubble Chart (3+ Dimensions)

```

python

```

```
fig.add_scatter(
    x=df['Income'],
    y=df['Home_Value'],
    mode='markers',
    marker=dict(
        size=df['Population']/10000, # Bubble size
        color=df['Affordability'], # Color scale
        showscale=True
    ),
    text=df['County']
)
```

Bar Chart (Rankings)

```
python

top_10 = df.nlargest(10, 'Opportunity')
fig.add_bar(
    x=top_10['County'],
    y=top_10['Opportunity']
)
```

Heatmap (Geographic Patterns)

```
python

fig.add_heatmap(
    x=df['Income_Bucket'],
    y=df['Population_Bucket'],
    z=df['Home_Value']
)
```

Debugging Checklist

If API Call Fails

- Check API key is valid
- Verify STATE_FIPS code
- Check variable codes exist
- Remove spaces from URL

If Charts Don't Update

- Using FigureWidget not Figure?
- Called observe() method?
- Update function modifies data[0]?
- Display widgets together?

Practice Challenges

Challenge 1: Multi-State Comparison

Pull data for 3 states, combine, and compare

Challenge 2: Time Series

Get data for 2018-2022, show trends

Challenge 3: Custom Metric

Create your own "Best Place to Live" score

Challenge 4: Export Feature

Add button to save filtered data to CSV

Your Dashboard Should Answer

For Retailers

- Where do people have money to spend?
- Which markets are growing?
- Where is competition lowest?

For Real Estate

- Which counties are undervalued?
- Where is population growing fastest?
- What's the affordability trend?

For Employers

- Where can employees afford to live?
 - Which areas have educated workforce?
 - Where are labor costs reasonable?
-

Advanced Features to Add

1. Dropdown for State Selection

```
python
state_dropdown = widgets.Dropdown(
    options=[('North Carolina', '37'),
             ('South Carolina', '45')],
    description='State:'
)
```

2. Multi-Select for Variables

```
python
variable_select = widgets.SelectMultiple(
    options=['Income', 'Population', 'Education'],
    description='Metrics:'
)
```

3. Export Button

```
python
def export_data(b):
    filtered_df.to_csv('analysis.csv')

export_btn = widgets.Button(description='Export')
export_btn.on_click(export_data)
```

Real-World Project Ideas

Easy Project

Compare counties in your state. Which is best for:

- Starting a coffee shop?
- Opening a gym?
- Building affordable housing?

Medium Project

Track Census data over 5 years:

- Which counties are declining?

- Where is growth accelerating?
- Predict next year's values

Advanced Project

Combine Census + other APIs:

- Census demographics + Indeed job postings
 - Census income + Zillow housing prices
 - Census education + LinkedIn talent pool
-

Key Formulas Reference

Affordability Ratio

Home_Value / Income
< 3 = Affordable
3-5 = Moderate
> 5 = Expensive

Market Potential

Population × Income / 1,000,000
Higher = Better market

Economic Vitality

(Income × Employment_Rate) / Cost_Index
Higher = Healthier economy

Remember

You're not just pulling data—you're creating business intelligence. Every major corporation uses Census data for strategic decisions. Now you can too.

Pro tip: Combine this with machine learning next week to PREDICT which counties will grow!