Zach_Yek_Exercise_8

March 29, 2023

1 Import Dependencies

We begin by importing the necessary libraries.

[1]:
```
# Data analysis
import pandas as pd
import geopandas as gpd
pd.set_option('display.max_columns', None)

# Data visualization
import matplotlib.pyplot as plt
import seaborn as sns
import folium
sns.set()
```

2 Preprocessing

Next, read in the relevant shapefiles, starting with the Malaysian state & federal territories data.

[2]:
```
# Load Malaysia state map into GeoDataFrame
msia_states = gpd.read_file('../data/malaysia/states/MYS_adm1.shp')

# Fix typos
msia_states['NAME_1'] = msia_states['NAME_1'].replace('Trengganu', 'Terengganu')

# Display first 5 rows
msia_states.head()
```

[2]:

	ID_0	ISO	NAME_0	ID_1	NAME_1	HASC_1	CCN_1	CCA_1	TYPE_1	ENGTYPE_1	NL_NAME_1
0	136	MYS	Malaysia	1	Johor	MY.JH	0	NaN	Negeri	State	NaN
1	136	MYS	Malaysia	2	Kedah	MY.KH	0	NaN			
2	136	MYS	Malaysia	3	Kelantan	MY.KN	0	NaN			
3	136	MYS	Malaysia	4	Kuala Lumpur	MY.KL	0	NaN			
4	136	MYS	Malaysia	5	Labuan	MY.LA	0	NaN			

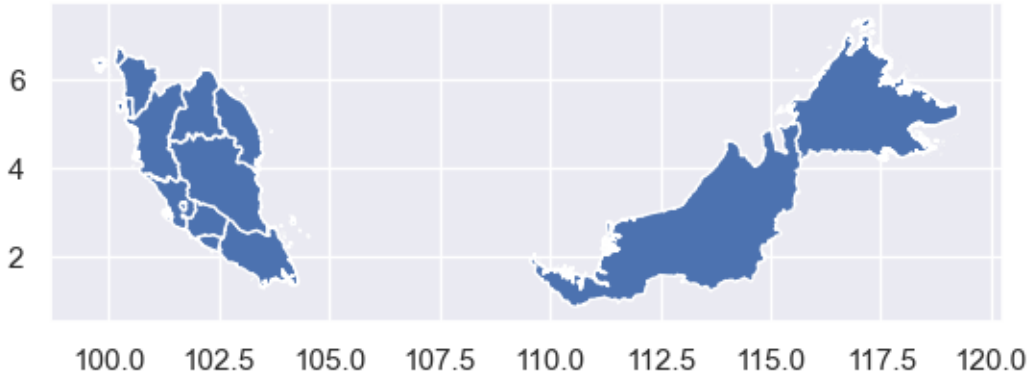
```
1              Negeri              State        NaN
2              Negeri              State        NaN
3  Wilayah Persekutuan  Federal Territory        NaN
4  Wilayah Persekutuan  Federal Territory        NaN

                          VARNAME_1  \
0          Johor Darul Takzim|Johore
1                   Kedah Darul Aman
2                                NaN
3  Federal Territory of Kuala Lumpur
4        Federal Territory of Labuan

                                            geometry
0  MULTIPOLYGON (((103.42134 1.30583, 103.42113 1…
1  MULTIPOLYGON (((100.32889 5.66444, 100.32917 5…
2  MULTIPOLYGON (((102.17395 6.20126, 102.17395 6…
3  POLYGON ((101.73227 3.03781, 101.70284 3.03007…
4  MULTIPOLYGON (((115.25285 5.38809, 115.25571 5…
```

We can visualize these data to make sure everything is in order.

[3]:
```
# Visualize GeoDF
msia_states.plot()
plt.show()
```



Indeed, no issues of note. Also load in the 2022 general election (hereafter: GE-15) data.

[4]:
```
# Load Malaysia GE-15 results
msia_ge15 = pd.read_csv('../data/malaysia/ge15/combined_results_parliament_ge15.
  ↪csv')

# Fix typos
msia_ge15['state'] = msia_ge15['state'].replace('KL', 'Kuala Lumpur')
```

```
msia_ge15['state'] = msia_ge15['state'].replace('Penang', 'Pulau Pinang')

# Display first 5 rows
msia_ge15.head()
```

[4]:

	Unnamed: 0	year	name	coalition	party_code	votes	vote_share	parliament_code_digits	constituency	state	total_votes	gender	results_added	spr_id	winner
0	641	2022	RUSYDAN RUSMI	PN	PAS	24267	53.583731	1	PADANG BESAR	Perlis	45288	F	1	1069.0	1.0
1	644	2022	ZAHIDA ZARIK KHAN	BN	UMNO	11753	25.951687	1	PADANG BESAR	Perlis	45288	M	1	259.0	0.0
2	645	2022	MOHAMAD SAAD @ YAHYA	PH	AMANAH	7085	15.644321	1	PADANG BESAR	Perlis	45288	F	1	118.0	0.0
3	643	2022	ZAHIDI ZAINUL ABIDIN	NaN	IND	1939	4.281487	1	PADANG BESAR	Perlis	45288	F	1	1113.0	0.0
4	642	2022	KO CHU LIANG	NaN	WARISAN	244	0.538774	1	PADANG BESAR	Perlis	45288	F	1	969.0	0.0

Merge the dataframes along the state column; rename and reorder the columns where appropriate.

[5]:
```
# Merge dataframes by state
df = msia_states.merge(msia_ge15, left_on='NAME_1', right_on='state')

# Drop unnecessary columns
df = df[['ID_1', 'ENGTYPE_1', 'VARNAME_1', 'geometry', 'year',
         'name', 'coalition', 'party_code', 'votes', 'vote_share',
         'parliament_code_digits', 'constituency', 'state', 'total_votes',␣
 ↪'gender', 'winner']]

# Rename columns
df.rename(columns={
    'ID_1': 'state_id',
    'ENGTYPE_1': 'state_type',
    'VARNAME_1': 'state_alt_name',
    'name': 'candidate_name',
    'votes': 'votes_received',
    'gender': 'candidate_sex'
    }, inplace=True)
```

```
# Reorder columns
df = df[['state', 'state_id', 'state_type', 'state_alt_name', 'year',
    'candidate_name', 'candidate_sex', 'coalition', 'party_code',␣
 ↪'constituency',
    'parliament_code_digits', 'votes_received', 'vote_share', 'total_votes',␣
 ↪'winner', 'geometry']]

# Display first 5 rows
df.head()
```

[5]:

	state	state_id	state_type	state_alt_name	year	candidate_name	candidate_sex	coalition	party_code	constituency	parliament_code_digits	votes_received	vote_share	total_votes	winner	geometry
0	Johor	1	State	Johor Darul Takzim|Johore	2022	YUNESWARAN RAMARAJ	F	PH	PKR	SEGAMAT	140	23437	46.270631	50652	1.0	MULTIPOLYGON (((103.42134 1.30583, 103.42113 1…
1	Johor	1	State	Johor Darul Takzim|Johore	2022	RAMASAMY MUTHUSAMY	F	BN	MIC	SEGAMAT	140	17768	35.078575	50652	0.0	MULTIPOLYGON (((103.42134 1.30583, 103.42113 1…
2	Johor	1	State	Johor Darul Takzim|Johore	2022	POOBALAN PONNUSAMY	F	PN	BERSATU	SEGAMAT	140	8385	16.554134	50652	0.0	MULTIPOLYGON (((103.42134 1.30583, 103.42113 1…
3	Johor	1	State	Johor Darul Takzim|Johore	2022	SYED HAIROUL FAIZEY SYED ALI	F	GTA	PUTRA	SEGAMAT	140	1062	2.096660	50652	0.0	MULTIPOLYGON (((103.42134 1.30583, 103.42113 1…
4	Johor	1	State	Johor Darul Takzim|Johore	2022	ZALIHA MUSTAFA	M	PH	PKR	SEKIJANG	141	18941	39.266538	48237	1.0	MULTIPOLYGON (((103.42134 1.30583, 103.42113 1…

Finally, create a separate dataframe containing the winning coalition in each state/federal territory. Note, a coalition is considered to be the winner in a state if they earn the most seats in that state; a seat is earned when `winner == 1`.

[6]:
```
# Filter winning rows only
winning_rows = df[df['winner'] == 1]

# Group winning rows by state and coalition, then count the number of times␣
 ↪each coalition won in each state
```

```
state_coalition_counts = winning_rows.groupby(['state',␣
 ↪'coalition'])['coalition'].count().reset_index(name='seats_won')

# For each state, find the coalition that won the most seats
winning_coalition = state_coalition_counts.loc[state_coalition_counts.
 ↪groupby('state')['seats_won'].idxmax()].reset_index(drop=True)

# Calculate the percent of total seats won by the winning coalition
total_seats_by_state = df[df['winner'] == 1].groupby('state')['winner'].sum().
 ↪astype('int').reset_index(name='total_seats')
winning_coalition = pd.merge(winning_coalition, total_seats_by_state,␣
 ↪on='state')
winning_coalition['percent_of_total_seats_won'] =␣
 ↪round(winning_coalition['seats_won'] / winning_coalition['total_seats'] *␣
 ↪100, 2)

# Display results
winning_coalition
```

[6]:

	state	coalition	seats_won	total_seats	percent_of_total_seats_won
0	Johor	PH	15	26	57.69
1	Kedah	PN	13	14	92.86
2	Kelantan	PN	14	14	100.00
3	Kuala Lumpur	PH	10	11	90.91
4	Melaka	PH	3	6	50.00
5	Negeri Sembilan	BN	5	8	62.50
6	Pahang	PN	7	14	50.00
7	Perak	PH	11	24	45.83
8	Perlis	PN	3	3	100.00
9	Pulau Pinang	PH	10	13	76.92
10	Putrajaya	PN	1	1	
11	Sabah	BN	7	26	
12	Sarawak	GPS	22	30	
13	Selangor	PH	16	22	
14	Terengganu	PN	8	8	

```
10                    100.00
11                     26.92
12                     73.33
13                     72.73
14                    100.00
```

3 Data Visualization

It remains to create an interactive election map to visualize the Malaysian GE-15 results, where coalitions are colored based on their official colors. We'll also include popups displaying key election information for each state/federal territory, such as the number of seats won and the percent of total seats won.

[7]:
```
# Create a dictionary mapping coalitions to their respective colors
coalition_colors = {'BN': 'blue',
                    'PH': 'red',
                    'PN': 'lightblue',
                    'GPS': 'pink'}

# Generate interactive map object
m = folium.Map(location=[4.2105, 108.9758], tiles='cartodbpositron',␣
 ↪zoom_start=6)

# Loop through each state and add a colored polygon for each state's boundary
for index, row in winning_coalition.iterrows():
    state, coalition, = row['state'], row['coalition']
    color = coalition_colors.get(coalition, 'white')

    # Find the row in the original dataframe corresponding to the current state
    state_data = df[df['state'] == state]

    # Create the popup message
    popup_html = f"<b>{state}</b><br/><br/>Winner: {coalition}<br/>Seats:␣
 ↪{row['seats_won']} (<u>{row['percent_of_total_seats_won']}%</u> of total␣
 ↪seats)"

    # Create the polygon with appropriate customizations and add it to the map
    folium.GeoJson(state_data['geometry'].iloc[0],
                   name=state,
                   style_function=lambda x, color=color: {'fillColor': color,
                                                          'fillOpacity': 0.7,
                                                          'color': 'black',
                                                          'weight': 1},
                   tooltip=state).add_to(m).add_child(folium.Popup(popup_html))

# Add a layer control to the map
folium.LayerControl().add_to(m)
```

```
# Save the map to an HTML file
m.save('../msia_ge_15_map.html')

# Display results
m
```

[7]: <folium.folium.Map at 0x7fbb7913cfa0>

As we can see, the center-left coalition PH (Malay: Pakatan Harapan, English: Alliance of Hope; colored red) and center-right coalition PN (Malay: Perikatan Nasional, English: National Alliance; colored light blue) are tied for most victories at 6 states each. The usually formidable right-wing coalition BN (Malay: Barisan Nasional, English: National Front; colored blue) only managed to secure 2 states, likely due to the ongoing corruption investigations involving ex-party leaders. Finally, GPS (Malay: Gabungan Parti Sarawak, English: Sarawak Parties Alliance; colored light pink) have secured their stronghold state of Sarawak as usual, with a clear majority - 73.33% of total seats won in the state.

Note the geographic trends in the GE-15 results, i.e. states along the West coast of the peninsula tend to be more left-leaning, while states along the East coast tend to favor center-right to right-wing parties.