Consumer Consternation for the US and NC

a. **Data Source**: data for the calculation required by this page is from [Opportunity Insight](https://www.opportunityinsight.org), [Morning Consult](https://www.morningconsult.com) and [Safegraph](https://www.safegraph.com).

b. **Update Schedule**:
   i. **Data from Opportunity Insight**: the common available period for all daily series from Jan 8, 2020 to the most recent observation are updated irregularly.
   ii. **Data from Morning Consult**: semi-month frequency data from Jan 1, 2020 to the most recent observation are updated at the beginning and the middle of the month.
   iii. **Data from Safegraph**: weekly data updated on each Friday.

c. **Input Series Calculation**:
   i. **Consumer Consternation** = First Principle Comonent \{Spend ACF, Spend AER, Google Non-essential Mobility, Safegraph Non-essential Mobility, Consumer Confidence\}
   ii. **Spend ACF**: data for spend_acf is from [Opportunity Insight](https://www.opportunityinsight.org) as percentage change of seasonally adjusted credit/debit card spending relative to Jan, 2020 in accommodation and food service MCCs, 7 day moving average. We convert the percentage change to index with Jan 2020 =100.
   iii. **Spend AER**: data for spend_aer is from [Opportunity Insight](https://www.opportunityinsight.org) as percentage change of seasonally adjusted credit/debit card spending relative to Jan, 2020 in art, entertainment, and recreation MCCs, 7 day moving average. We convert the percentage change to index with Jan 2020 =100.
   iv. **Google Non-essential Mobility** = (GPS Retail and Recreation + GPS Parks)/(GPS Residential + GPS Away from Home)
      1. GPS Retail and Recreation: data for gps_retail_and_recreation is from [Opportunity Insight](https://www.opportunityinsight.org) as percentage change of time spent at retail and recreation locations relative to Jan, 2020. We convert the percentage change to index with Jan 2020 =100.
      2. GPS Parks: data for gps_parks is from [Opportunity Insight](https://www.opportunityinsight.org) as percentage change of time spent at parks relative to Jan, 2020. We convert the percentage change to index with Jan 2020 =100.
      3. GPS Residential: data for gps_residential is from [Opportunity Insight](https://www.opportunityinsight.org) as percentage change of time spent at residential locations relative to Jan, 2020. We convert the percentage change to index with Jan 2020 =100.
      4. GPS Away from Home: data for gps_away_from_home is from [Opportunity Insight](https://www.opportunityinsight.org) as percentage change of time spent outside of residential locations relative to Jan, 2020. We convert the percentage change to index with Jan 2020 =100.
   v. **Safegraph Non-essential Mobility** = Non-essential Visit Counts/Total Visit Counts
1. Data for raw visit counts to 6 million points-of-interest (POI) in North America is from Safegraph.

2. We aggregate the raw visit counts to POI by industry. Non-essential Visit Counts is the total visit counts to the POIs in non-essential industries during the week and Total Visit Counts is the total visit counts to all the POIs during the week.

vi. **Consumer Confidence**: data for consumer confidence is from Morning Consult in semi-month frequency. Weekly data is constructed by equate the data for week \( \{t\} \) to the value of the nearest date with available data.

d. **Index Calculation**

i. The principle components for the above series are estimated for the period Feb 2, 2020 to June 26, 2020. The index is a transformation of the first principle component (PC1):

\[
\text{Index} = -\text{PC1} + \text{level}, \quad \text{where the level equals to 3 for the US and 2.96 for NC.}
\]

\[
\text{PC1} = C_1 \times \text{standardized}\{\text{Spend AER}\} + C_2 \times \text{standardized}\{\text{Spend ACF}\} + C_3 \times \text{standardized}\{\text{Google Non-essential Mobility}\} + C_4 \times \text{standardized}\{\text{Safegraph Non-essential Mobility}\} + C_5 \times \text{standardized}\{\text{Consumer Confidence}\}
\]

The values of coefficients \( C_1, C_2, C_3, C_4 \) and \( C_5 \) are provided in the following table:

<table>
<thead>
<tr>
<th></th>
<th>C1</th>
<th>C2</th>
<th>C3</th>
<th>C4</th>
<th>C5</th>
</tr>
</thead>
<tbody>
<tr>
<td>US</td>
<td>0.5224</td>
<td>0.5337</td>
<td>0.4600</td>
<td>0.3343</td>
<td>0.3446</td>
</tr>
<tr>
<td>NC</td>
<td>0.5475</td>
<td>0.5703</td>
<td>0.3658</td>
<td>0.2258</td>
<td>0.4359</td>
</tr>
</tbody>
</table>

\[
\text{Standardized}\{X\} = (X - \text{mean}\{X\})/\text{standard deviation}\{X\}
\]

The values of the mean for each variable are provided in the following table:

<table>
<thead>
<tr>
<th></th>
<th>Spend AER</th>
<th>Spend ACF</th>
<th>Google Non-essential Mobility</th>
<th>Safegraph Non-essential Mobility</th>
<th>Consumer Confidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>US</td>
<td>52.11</td>
<td>61.64</td>
<td>96.86</td>
<td>97.05</td>
<td>97.32</td>
</tr>
<tr>
<td>NC</td>
<td>55.81</td>
<td>59.40</td>
<td>106.83</td>
<td>97.26</td>
<td>101.96</td>
</tr>
</tbody>
</table>

The values of the standard deviation for each variable are provided in the following table:

<table>
<thead>
<tr>
<th></th>
<th>Spend AER</th>
<th>Spend ACF</th>
<th>Google Non-essential Mobility</th>
<th>Safegraph Non-essential Mobility</th>
<th>Consumer Confidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>US</td>
<td>28.20</td>
<td>23.84</td>
<td>17.57</td>
<td>5.37</td>
<td>14.24</td>
</tr>
<tr>
<td>NC</td>
<td>28.95</td>
<td>24.93</td>
<td>14.84</td>
<td>6.04</td>
<td>14.36</td>
</tr>
</tbody>
</table>