# APPENDIX A DATA SOURCES

In this section, link to my GitHub that contain the data sources I used in this research are provided.

## 1 COVID-19 Incident Data

* COVID-19 Case Data:
  + <https://github.com/theo-end/Tsinghua_Masters_Thesis/blob/main/Indices/Read%20Files/Case_Data.csv>
* COVID-19 Death Data:
  + <https://github.com/theo-end/Tsinghua_Masters_Thesis/blob/main/Indices/Read%20Files/Death_Data.csv>
* COVID-19 Testing Data:
  + <https://github.com/theo-end/Tsinghua_Masters_Thesis/blob/main/Indices/Read%20Files/covid-testing-all-observations.csv>

## 2 Government Response Data

<https://github.com/theo-end/Tsinghua_Masters_Thesis/blob/main/Indices/Read%20Files/OxCGRT_timeseries_all.xlsx>

## 3 Pandemic Preparedness Data

<https://github.com/theo-end/Tsinghua_Masters_Thesis/blob/main/Indices/Read%20Files/GHS%20Rankings.csv>

## 4 Healthcare Performance Data

<https://github.com/theo-end/Tsinghua_Masters_Thesis/blob/main/Indices/Read%20Files/WHO%20Healthcare%20Rankings.csv>

## 5 Global Economic Data

<https://github.com/theo-end/Tsinghua_Masters_Thesis/blob/main/Indices/Read%20Files/IMF%20Economic%20Rankings.csv>

## 6 Population Data

<https://github.com/theo-end/Tsinghua_Masters_Thesis/blob/main/Indices/Read%20Files/Population_Data.csv>

## 7 Press Freedom Data

<https://github.com/theo-end/Tsinghua_Masters_Thesis/blob/main/Indices/Read%20Files/Press%20Freedom%20Rankings.csv>

# APPENDIX B OUTLIERS

In this section, I have provided links to my GitHub with the outliers removed through my outlier removal algorithms. I have also provided pseudocode for these algorithms.

## 1 Known Outliers

<https://github.com/theo-end/Tsinghua_Masters_Thesis/blob/main/Indices/Read%20Files/Known_Outliers.csv>

## 2 Negative Outliers

* COVID-19 Negative Case Outliers
  + <https://github.com/theo-end/Tsinghua_Masters_Thesis/blob/main/Indices/Output%20Files/Cases_Negative_Instances.csv>
* COVID-19 Negative Death Outliers
  + <https://github.com/theo-end/Tsinghua_Masters_Thesis/blob/main/Indices/Output%20Files/Deaths_Negative_Instances.csv>

## 3 Manual Outliers

<https://github.com/theo-end/Tsinghua_Masters_Thesis/blob/main/Indices/Read%20Files/Manual_Outliers.csv>

## 4 New Value Algorithm

## Redistribution Algorithm

# APPENDIX C SMOOTHENING, INTERPOLATION, & PAIRING

In this section, links to my GitHub where graphs detailing the smoothed and interpolated data will be provided. The pseudocode for the peak finding algorithms will also be provided.

## 1 Raw, Moving Average, and Smoothed Data Graphs

<https://github.com/theo-end/Tsinghua_Masters_Thesis/blob/main/Indices/Output%20Files/Basic_Data_Graphs.pdf>

## 2 Peak Finding Graphs

<https://github.com/theo-end/Tsinghua_Masters_Thesis/blob/main/Indices/Output%20Files/Peak_Finding_Graphs.pdf>

## 3 Key Point Addition Graphs

<https://github.com/theo-end/Tsinghua_Masters_Thesis/blob/main/Indices/Output%20Files/Interpolation_Graphs.pdf>

## 4 Initial Peaks Algorithm

## 5 Valley Finding Algorithm

## 6 Peak Pruning Algorithm

## 7 Final Pruning Algorithm

## 8 Key Point Addition Algorithm

## 9 Peak Pairing Graphs

<https://github.com/theo-end/Tsinghua_Masters_Thesis/blob/main/Indices/Output%20Files/Peak_Pairing_Graphs.pdf>

# APPENDIX D CALCULATED METRICS

The link to the master excel sheet that contain all of the calculated metrics for every single country can be found at the following link.

* <https://github.com/theo-end/Tsinghua_Masters_Thesis/blob/main/Indices/Output%20Files/Country_Metrics.xlsx>

# APPENDIX E METRIC CLASSIFICATION

In this section, classification lists for all the calculated metrics are provided. These detail how each specific metric was calculated within each metric category. For example, *Total Cases per Million* is classified as a Total Incidents Metric under the Outbreak Severity Metric category. Therefore, it is calculated using the Total Incident Metrics equation.

## 1 Outbreak Severity Metrics

* Total Incidents Metrics
  + Total Cases per Million
  + Total Deaths per Million
  + Total Tests per Million
* Summation Ration Metrics
  + Case-Death Ratio
  + Test-Case Ratio
* Peak Pair Ratio Metrics
  + Case-Death Pair Peak Ratio
* Number of Incident Peaks Metrics
  + Number of Cases Peaks
  + Number of Deaths Peaks
* Rate of Growth Metrics
  + Cases Average Growth Rate
  + Cases Maximum Growth Rate
  + Cases Average Growth Rate (First Outbreak)
  + Cases Maximum Growth Rate (First Outbreak)
  + Deaths Average Growth Rate
  + Deaths Maximum Growth Rate
  + Deaths Average Growth Rate (First Outbreak)
  + Deaths Maximum Growth Rate (First Outbreak)
* Rate of Submission Metrics
  + Cases Average Submission Rate
  + Cases Maximum Submission Rate
  + Cases Average Submission Rate (First Outbreak)
  + Cases Maximum Submission Rate (First Outbreak)
  + Deaths Average Submission Rate
  + Deaths Maximum Submission Rate
  + Deaths Average Submission Rate (First Outbreak)
  + Deaths Maximum Submission Rate (First Outbreak)
* Length of Outbreak Metrics
  + Cases Growth Length
  + Cases Submission Length
  + Cases Total Length
  + Cases Growth Length (First Outbreak)
  + Cases Submission Length (First Outbreak)
  + Cases Total Length (First Outbreak)
  + Deaths Growth Length
  + Deaths Submission Length
  + Deaths Total Length
  + Deaths Growth Length (First Outbreak)
  + Deaths Submission Length (First Outbreak)
  + Deaths Total Length (First Outbreak)
* Incident Peak Values Metrics
  + Cases Peak Value
  + Cases Valley Value–Cases Peak Value (First Outbreak)
  + Cases Valley Value (First Outbreak)
  + Deaths Peak Value–Deaths Valley Value
  + Deaths Peak Value (First Outbreak)
  + Deaths Valley Value (First Outbreak)

## 2 Government Response Metrics

* Maximum Index Value Metrics
  + Maximum Stringency
  + Maximum Government Response
  + Maximum Containment Health
  + Maximum Economic Support
* Index Ratio Metrics
  + Economic Support to Containment Health Ratio
  + Economic Support to Stringency Ratio
  + Economic Support to Government Response Ratio
* Length of Elevated Response Metrics
  + Number of Days Some Sectors Closed
  + Number of Days All Non-Essential Sectors Closed
  + Number of Days Public Transport Closed
  + Number of Days Stay-at-Home except for Essential Trips
  + Number of Days Stay-at-Home Total Lockdown
  + Number of Days Internal Movement Restricted
  + Number of Days International Bans for some Countries
  + Number of Days International Bans Total Border Closure
  + Number of Days Public Information Campaign
  + Number of Days Facial Coverings in Some Public Places
  + Number of Days Facial Coverings in All Public Places
  + Number of Days Facial Coverings Mandate
  + Number of Days Some Schools Closed
  + Number of Days All Schools Closed
  + Number of Days Public Events Cancelled
  + Number of Days Restricting Gatherings (<1000)
  + Number of Days Restricting Gatherings (<100)
  + Number of Days Restricting Gatherings (<10)

## 3 Risk Tolerance Metrics

* Number of Incidents before Index Peak Metrics
  + Number of Cases Before Peak Containment Health
  + Number of Cases Before Peak Economic Support
  + Number of Cases Before Peak Government Response
  + Number of Cases Before Peak Stringency
  + Number of Deaths Before Peak Containment Health
  + Number of Deaths Before Peak Economic Support
  + Number of Deaths Before Peak Government Response
  + Number of Deaths Before Peak Stringency
* Incident Growth Rate before Index Peak Metrics
  + Average Case Growth Before Peak Containment Health
  + Average Case Growth Before Peak Economic Support
  + Average Case Growth Before Peak Government Response
  + Average Case Growth Before Peak Stringency
  + Average Death Growth Before Peak Containment Health
  + Average Death Growth Before Peak Economic Support
  + Average Death Growth Before Peak Government Response
  + Average Death Growth Before Peak Stringency
  + Maximum Case Growth Before Peak Containment Health
  + Maximum Case Growth Before Peak Economic Support
  + Maximum Case Growth Before Peak Government Response
  + Maximum Case Growth Before Peak Stringency
  + Maximum Death Growth Before Peak Containment Health
  + Maximum Death Growth Before Peak Economic Support
  + Maximum Death Growth Before Peak Government Response
  + Maximum Death Growth Before Peak Stringency
* Index Peak to Preceding Incidents Ratio Metrics
  + First Maximum Containment Health to Preceding Cases Ratio
  + First Maximum Containment Health to Preceding Deaths Ratio
  + First Maximum Economic Support to Preceding Cases Ratio
  + First Maximum Economic Support to Preceding Deaths Ratio
  + First Maximum Government Response to Preceding Cases Ratio
  + First Maximum Government Response to Preceding Deaths Ratio
  + First Maximum Stringency to Preceding Cases Ratio
  + First Maximum Stringency to Preceding Deaths Ratio
  + Number of Incidents before Subindex Threshold Metrics
  + Number of Cases Before All Non-Essential Sectors Closed
  + Number of Cases Before All Schools Closed
  + Number of Cases Before Facial Coverings in All Public Places
  + Number of Cases Before Facial Coverings in Some Public Places
  + Number of Cases Before Facial Coverings Mandate
  + Number of Cases Before Internal Movement Restricted
  + Number of Cases Before International Bans for some Countries
  + Number of Cases Before International Bans Total Border Closure
  + Number of Cases Before Public Events Cancelled
  + Number of Cases Before Public Information Campaign
  + Number of Cases Before Public Transport Closed
  + Number of Cases Before Restricting Gatherings (<10)
  + Number of Cases Before Restricting Gatherings (<100)
  + Number of Cases Before Restricting Gatherings (<1000)
  + Number of Cases Before Some Schools Closed
  + Number of Cases Before Some Sectors Closed
  + Number of Cases Before Stay-at-Home except for Essential Trips
  + Number of Cases Before Stay-at-Home Total Lockdown
  + Number of Deaths Before All Non-Essential Sectors Closed
  + Number of Deaths Before All Schools Closed
  + Number of Deaths Before Facial Coverings in All Public Places
  + Number of Deaths Before Facial Coverings in Some Public Places
  + Number of Deaths Before Facial Coverings Mandate
  + Number of Deaths Before Internal Movement Restricted
  + Number of Deaths Before International Bans for some Countries
  + Number of Deaths Before International Bans Total Border Closure
  + Number of Deaths Before Public Events Cancelled
  + Number of Deaths Before Public Information Campaign
  + Number of Deaths Before Public Transport Closed
  + Number of Deaths Before Restricting Gatherings (<10)
  + Number of Deaths Before Restricting Gatherings (<100)
  + Number of Deaths Before Restricting Gatherings (<1000)
  + Number of Deaths Before Some Schools Closed
  + Number of Deaths Before Some Sectors Closed
  + Number of Deaths Before Stay-at-Home except for Essential Trips
  + Number of Deaths Before Stay-at-Home Total Lockdown
* Incident Growth Rate before Subindex Threshold Metrics
  + Average Case Rate Before All Non-Essential Sectors Closed
  + Average Case Rate Before All Schools Closed
  + Average Case Rate Before Facial Coverings in All Public Places
  + Average Case Rate Before Facial Coverings in Some Public Places
  + Average Case Rate Before Facial Coverings Mandate
  + Average Case Rate Before Public Events Cancelled
  + Average Case Rate Before Public Information Campaign
  + Average Case Rate Before Restricting Gatherings (<10)
  + Average Case Rate Before Restricting Gatherings (<100)
  + Average Case Rate Before Restricting Gatherings (<1000)
  + Average Case Rate Before Some Schools Closed
  + Average Case Rate Before Some Sectors Closed
  + Average Cases Rate Before Internal Movement Restricted
  + Average Cases Rate Before International Bans for some Countries
  + Average Cases Rate Before International Bans Total Border Closure
  + Average Cases Rate Before Public Transport Closed
  + Average Cases Rate Before Stay-at-Home except for Essential Trips
  + Average Cases Rate Before Stay-at-Home Total Lockdown
  + Average Death Rate Before All Non-Essential Sectors Closed
  + Average Death Rate Before All Schools Closed
  + Average Death Rate Before Facial Coverings in All Public Places
  + Average Death Rate Before Facial Coverings in Some Public Places
  + Average Death Rate Before Facial Coverings Mandate
  + Average Death Rate Before Public Events Cancelled
  + Average Death Rate Before Public Information Campaign
  + Average Death Rate Before Restricting Gatherings (<10)
  + Average Death Rate Before Restricting Gatherings (<100)
  + Average Death Rate Before Restricting Gatherings (<1000)
  + Average Death Rate Before Some Schools Closed
  + Average Death Rate Before Some Sectors Closed
  + Average Deaths Rate Before Internal Movement Restricted
  + Average Deaths Rate Before International Bans for some Countries
  + Average Deaths Rate Before International Bans Total Border Closure
  + Average Deaths Rate Before Public Transport Closed
  + Average Deaths Rate Before Stay-at-Home except for Essential Trips
  + Average Deaths Rate Before Stay-at-Home Total Lockdown
  + Maximum Case Rate Before All Non-Essential Sectors Closed
  + Maximum Case Rate Before All Schools Closed
  + Maximum Case Rate Before Facial Coverings in All Public Places
  + Maximum Case Rate Before Facial Coverings in Some Public Places
  + Maximum Case Rate Before Facial Coverings Mandate
  + Maximum Case Rate Before Internal Movement Restricted
  + Maximum Case Rate Before International Bans for some Countries
  + Maximum Case Rate Before International Bans Total Border Closure
  + Maximum Case Rate Before Public Events Cancelled
  + Maximum Case Rate Before Public Information Campaign
  + Maximum Case Rate Before Public Transport Closed
  + Maximum Case Rate Before Restricting Gatherings (<10)
  + Maximum Case Rate Before Restricting Gatherings (<100)
  + Maximum Case Rate Before Restricting Gatherings (<1000)
  + Maximum Case Rate Before Some Schools Closed
  + Maximum Case Rate Before Some Sectors Closed
  + Maximum Case Rate Before Stay-at-Home except for Essential Trips
  + Maximum Case Rate Before Stay-at-Home Total Lockdown
  + Maximum Death Rate Before All Non-Essential Sectors Closed
  + Maximum Death Rate Before All Schools Closed
  + Maximum Death Rate Before Facial Coverings in All Public Places
  + Maximum Death Rate Before Facial Coverings in Some Public Places
  + Maximum Death Rate Before Facial Coverings Mandate
  + Maximum Death Rate Before Internal Movement Restricted
  + Maximum Death Rate Before International Bans for some Countries
  + Maximum Death Rate Before International Bans Total Border Closure
  + Maximum Death Rate Before Public Events Cancelled
  + Maximum Death Rate Before Public Information Campaign
  + Maximum Death Rate Before Public Transport Closed
  + Maximum Death Rate Before Restricting Gatherings (<10)
  + Maximum Death Rate Before Restricting Gatherings (<100)
  + Maximum Death Rate Before Restricting Gatherings (<1000)
  + Maximum Death Rate Before Some Schools Closed
  + Maximum Death Rate Before Some Sectors Closed
  + Maximum Death Rate Before Stay-at-Home except for Essential Trips
  + Maximum Death Rate Before Stay-at-Home Total Lockdown

# APPENDIX F CONFOUNDING VARIABLE CLASSIFICATION

The list the detail the scaling classification (i.e. ratio, integer, ordinal, or nominal) of all the confounding variables is shown below.

* Ratio/Integer Metrics
  + GDP
  + Government Net Lending/Borrowing (% of GDP)
  + Median Age
  + Population Density (per sq km)
  + Press Freedom Score
  + Unemployment Rate
  + WHO Healthcare Index Score
* Ordinal Metrics
  + Press Freedom Rank
  + WHO Healthcare Rank
* Nominal Metrics
  + Categorical Income Level
  + Geographic Region
  + Press Freedom Category

# APPENDIX G DETAILED SUBINDEX DESCRIPTION

A link to my GitHub page that contains a detailed breakdown of every index and subindex that was calculated to make the composite index can be found at the link below. It has the relative and absolution weight of every metric used in each index.

* <https://github.com/theo-end/Tsinghua_Masters_Thesis/blob/main/Index_Weighting_System.xlsx>

# APPENDIX H STATISTICAL CORRLEATION TESTING

This section contains links to my GitHub where the excel files and graphical files detailing the results of all of the statistical correlation testing can be found. The excel files are contain the type of test performed between every metric, its results, and its significance.

## 1 Confounding Variables vs Outbreak Severity Metrics

* Excel File
  + <https://github.com/theo-end/Tsinghua_Masters_Thesis/blob/main/Indices/Output%20Files/Confounding_Variable_COVID_19_Metrics.xlsx>
* Graphical Results
  + <https://github.com/theo-end/Tsinghua_Masters_Thesis/blob/main/Indices/Output%20Files/Confounding_Variable_COVID_19_Metrics.pdf>

## 2 GHS Rankings vs Outbreak Severity Metrics

* Excel File
  + <https://github.com/theo-end/Tsinghua_Masters_Thesis/blob/main/Indices/Output%20Files/Pandemic_Prepardness_COVID_19_Metrics.xlsx>
* Graphical Results
  + <https://github.com/theo-end/Tsinghua_Masters_Thesis/blob/main/Indices/Output%20Files/Pandemic_Prepardness_COVID_19_Metrics.pdf>

## 3 Confounding Variables vs Government Response Metrics

* Excel File
  + <https://github.com/theo-end/Tsinghua_Masters_Thesis/blob/main/Indices/Output%20Files/Confounding_Variables_vs_Oxford_Indices_Tables.xlsx>
* Graphical Results
  + <https://github.com/theo-end/Tsinghua_Masters_Thesis/blob/main/Indices/Output%20Files/Confounding_Variables_vs_Oxford_Indices_Graphs.pdf>

## 4 GHS Rankings vs Government Response Metrics

* Excel File
  + <https://github.com/theo-end/Tsinghua_Masters_Thesis/blob/main/Indices/Output%20Files/Pandemic_Prepardness_Rankings_vs_Oxford_Indice_Metrics_Tables.xlsx>
* Graphical Results
  + <https://github.com/theo-end/Tsinghua_Masters_Thesis/blob/main/Indices/Output%20Files/Pandemic_Prepardness_Rankings_vs_Oxford_Indice_Metrics_Graphs.pdf>

## 5 Confounding Variables vs Risk Tolerance Metrics

* Excel File
  + <https://github.com/theo-end/Tsinghua_Masters_Thesis/blob/main/Indices/Output%20Files/Confounding_Variables_vs_Risk_Tolerance_Tables.xlsx>
* Graphical Results
  + <https://github.com/theo-end/Tsinghua_Masters_Thesis/blob/main/Indices/Output%20Files/Confounding_Variables_vs_Risk_Tolerance.pdf>

## 6 GHS Rankings vs Risk Tolerance Metrics

* Excel File
  + <https://github.com/theo-end/Tsinghua_Masters_Thesis/blob/main/Indices/Output%20Files/Pandemic_Prepardness_Rankings_vs_Risk_Tolerance_Tables.xlsx>
* Graphical Results
  + <https://github.com/theo-end/Tsinghua_Masters_Thesis/blob/main/Indices/Output%20Files/Pandemic_Prepardness_Rankings_vs_Risk_Tolerance.pdf>

# APPENDIX I FULL INDEX RESULTS

A link to my GitHub where the full index results can be found is located at the link below.

* <https://github.com/theo-end/Tsinghua_Masters_Thesis/blob/main/Indices/Output%20Files/Composite_Index.xlsx>

# APPENDIX J CODE

A link to my GitHub where the full code I wrote to execute my research can be found at the link below.

* <https://github.com/theo-end/Tsinghua_Masters_Thesis/tree/main/Code/Thesis%20Analysis>