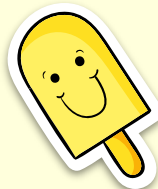
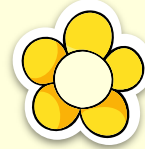
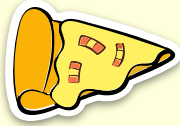
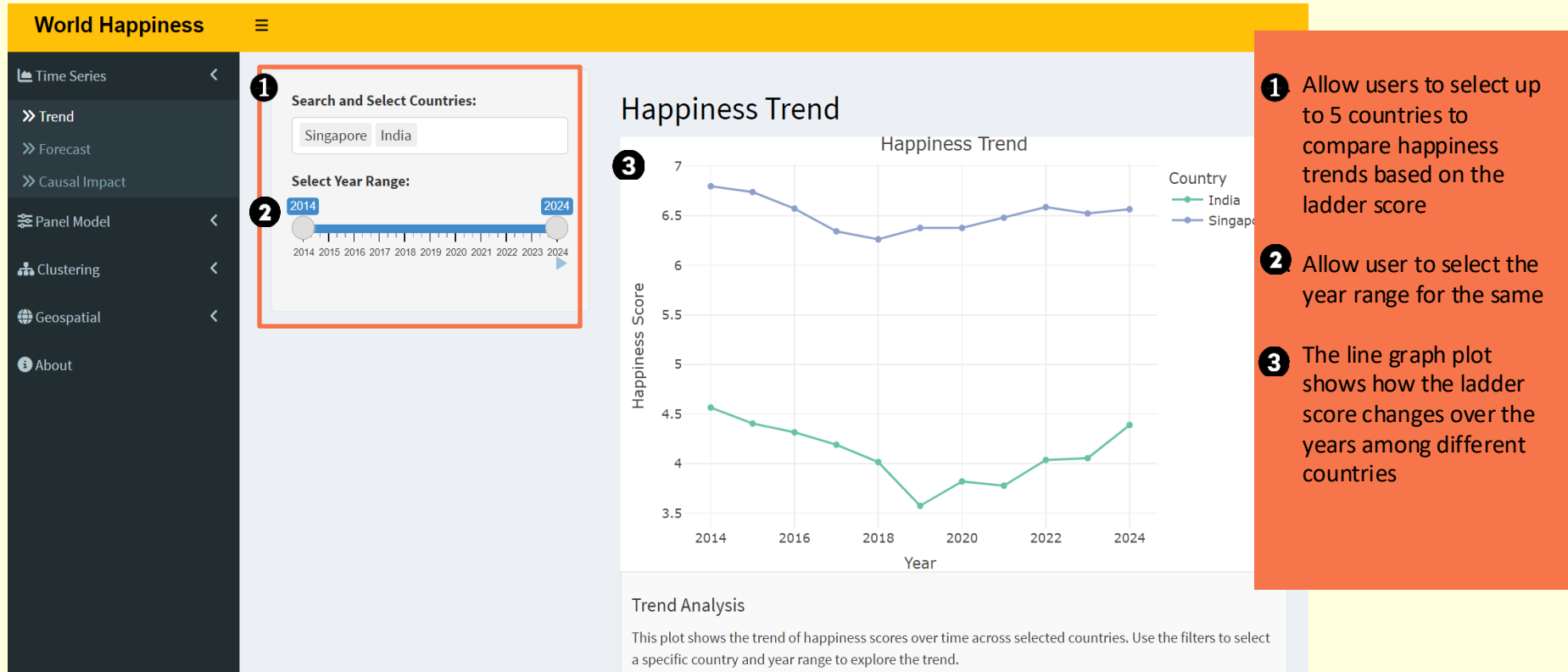


# World Happiness Visualization

User Guide for Group 14



# TIME SERIES: HAPPINESS TREND



# TIME SERIES: HAPPINESS FORECAST

## World Happiness



Time Series <

>> Trend

>> Forecast

>> Causal Impact

Panel Model <

Clustering <

Geospatial <

About

**1** Search and Select Countries:

United States of America Japan

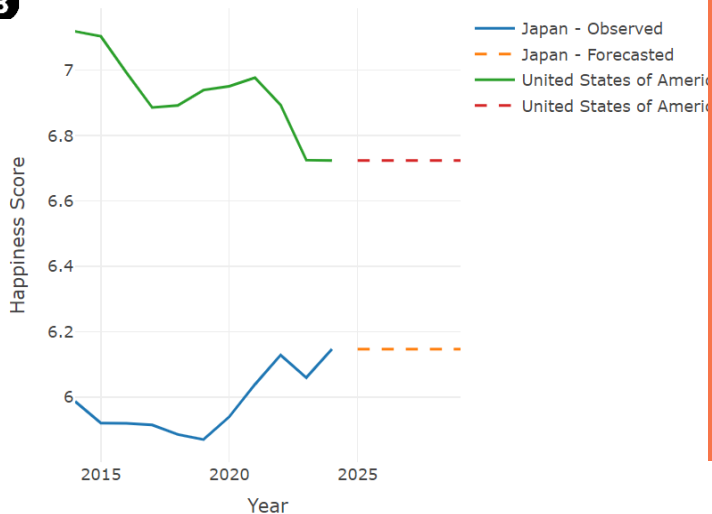
**2** Select Year Range:

2014 2024

2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024

## Happiness Forecast

### Happiness Forecast Comparison



### Forecasting Happiness

This plot provides a forecast of future happiness scores based on past trends. Adjust the year range to explore potential future outcomes.

**1.** Allow users to select up to 5 countries to compare happiness trends based on the ladder score

**2.** Allow user to select the year range for the same

**3.** The line graph plots the happiness forecast for next 5 years using exponential smoothing.

# TIME SERIES: COVID'19 HAPPINESS LEVELS

## World Happiness



### Time Series

>> Trend

>> Forecast

>> Causal Impact

Panel Model

Clustering

Geospatial

About

1

#### Search and Select Countries:

Singapore Japan

#### Select Year Range:

2014

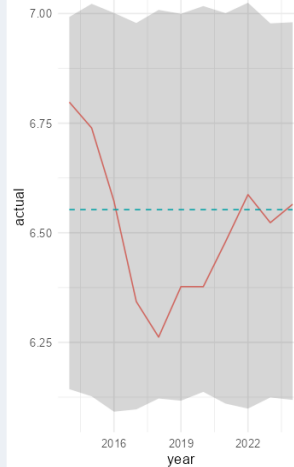
2024

2

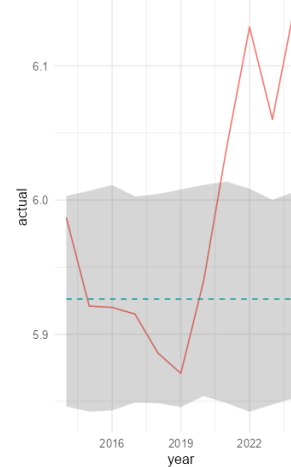
## Causal Impact Analysis

3

### Causal Impact - Singapore



### Causal Impact - Japan



### Causal Impact Analysis

This plot shows the causal impact of events (e.g., COVID-19, economic crises) on happiness scores. Use this to understand how external factors may have influenced the happiness trends.

- 1 Allow users to select up to 5 countries to compare happiness trends based on the ladder score
- 2 Allow user to select the year range for the same
- 3 Casual Impact Plot compares countries and their happiness level before and after covid.

# PANEL MODEL: FEATURE IMPORTANCE

World Happiness



Time Series <

Panel Model <

>> Feature Importance

>> Happiness Trend

>> Panel Data Insights

Clustering <

Geospatial <

About

## Feature Importance

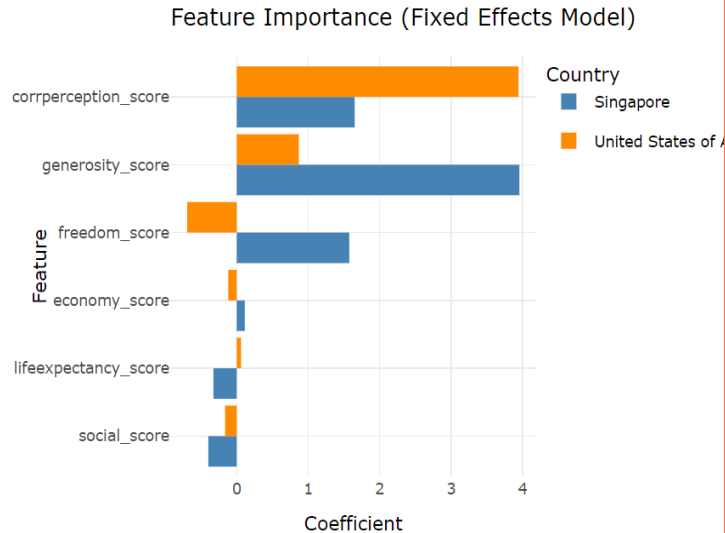
1

Select Up to 2 Countries:

Singapore

United States of America

2



1 This allows users to select 2 countries from the list

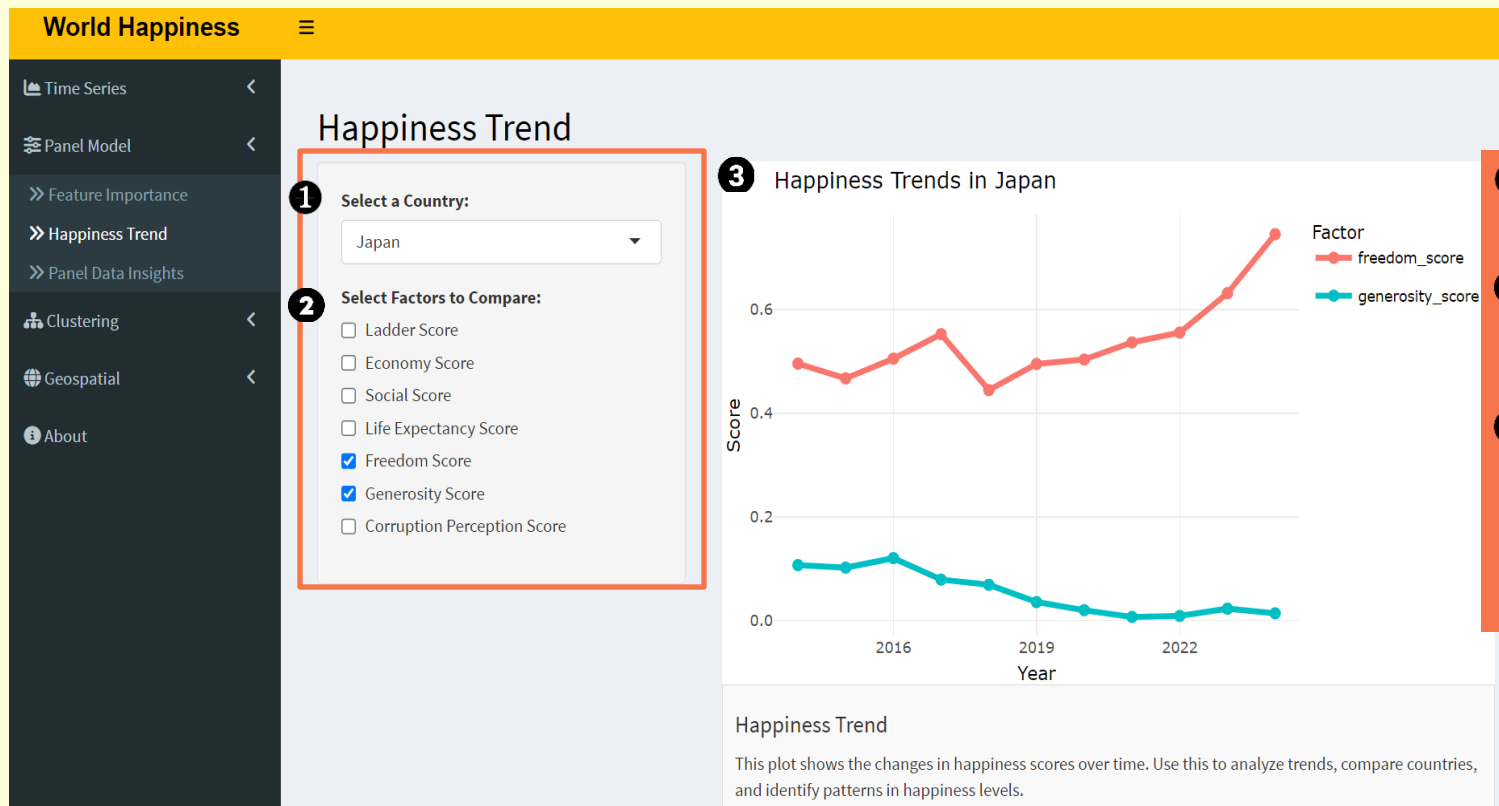
2 The feature importance comparison plot, shows how the 2 countries vary in their scores based on the different factors.

[Note : this helps understand how the factors in developing countries differ from developed countries]

### Feature Importance

This plot highlights the most significant factors influencing happiness scores. Larger bars indicate greater importance in predicting happiness levels.

# PANEL MODEL: HAPPINESS TREND (using factor)



- 1 Allows user to select a country
- 2 Allows user to select at least 1 or more factors to compare
- 3 Allows user to compare different factors over time

# PANEL MODEL: DATA TABLE

## World Happiness

- Time Series
- Panel Model
  - Feature Importance
  - Happiness Trend
  - Panel Data Insights
- Clustering
- Geospatial
- About

### Panel Data Insights

1 Do you want to save the data?  
[Download Data as CSV](#)

Panel Data Table

Top Improvement

What-If Analysis

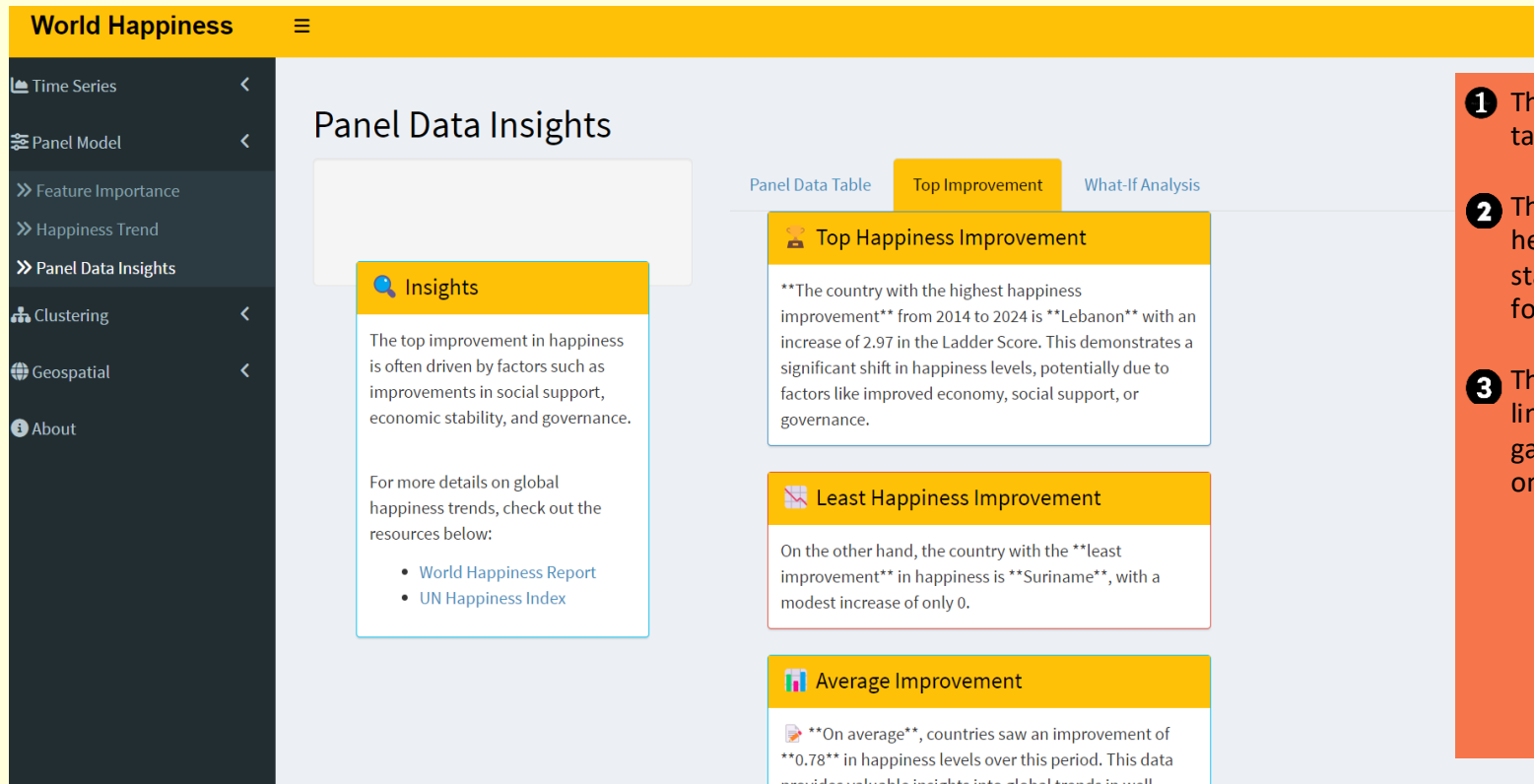
Show 10 entries

Search: saudi

year	country	ladder_score	economy_score	social_score	lifeexp
2014	Saudi Arabia	6.411	1.39541	1.08393	
2015	Saudi Arabia	6.379	1.48953	0.84829	
2016	Saudi Arabia	6.344	1.53062	1.28668	
2017	Saudi Arabia	6.371	1.379	1.331	
2018	Saudi Arabia	6.375	1.403	1.357	
2019	Saudi Arabia	6.4065	1.33433	1.30995	
2020	Saudi Arabia	6.494	1.435	0.964	

1 This sub tab under panel data insights allows user to filter the data table based on country of choice and save that data as a csv file

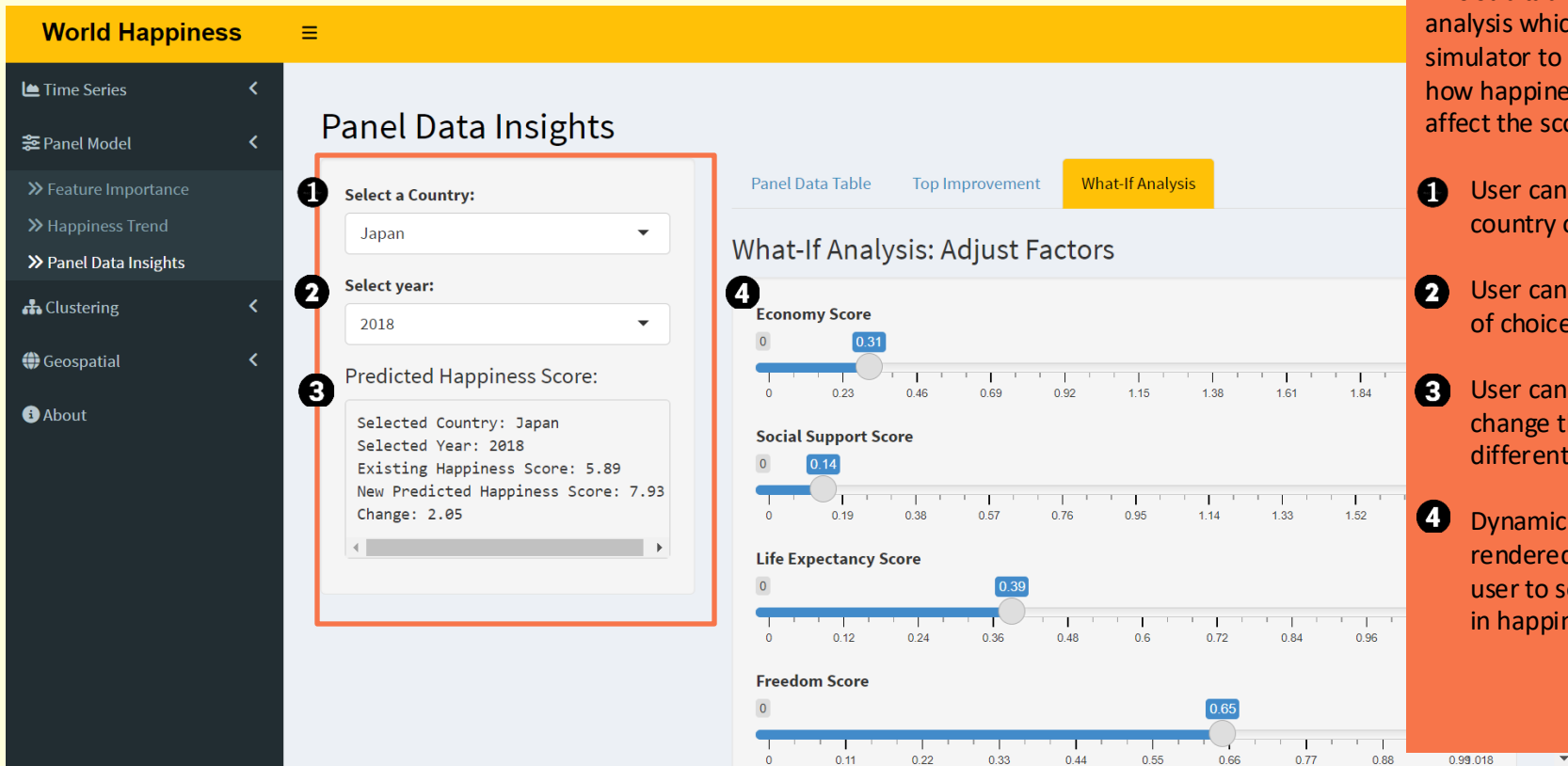
# PANEL MODEL: DATA INSIGHTS



- 1 This is the insights sub tab.
- 2 There is no interactivity here, but important statistics are summarized for users.
- 3 There are also external links if the user wishes to gain more information on happiness data/index



# PANEL MODEL: WHAT IF ANALYSIS SIMULATOR



This sub tab is What-if analysis which is kind of a simulator to understand how happiness factors affect the score

- 1 User can select a country of choice
- 2 User can select a year of choice
- 3 User can update and change the value of the different factors
- 4 Dynamic text is rendered which allows user to see the change in happiness score.

## CLUSTERING: YEARLY CLUSTER EXPLORATION

## World Happiness



Time Series

Panel Model

## Clustering

» Multivariate

 Geospatial

**About**

## World Happiness Clustering Analysis

## 1 Clustering Parameters

Select Year

2014

### Clustering Method

## K-Means

Number of Clusters

3

## 2 PCA Variables Selection

Variable 1

economy\_score

### Variable 2

social\_score

### Variable 3

lifeexpectancy\_score

Note: For optimal PCA visualization, select 2 different variables the 2D plot and 3 different variables for the 3D plot

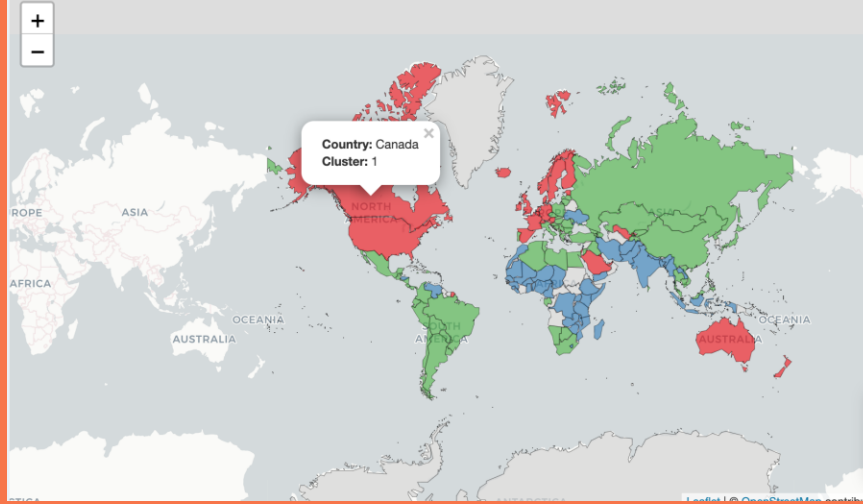
### 3 Yearly Cluster Exploration

## PCA Analysis 2D

### PCA Analysis 3D

## PCA Full Analysis

## Clustering Over Time



#### 4 Clustering Validation Statistics

### Silhouette Score

0.284

Higher is better

Dunn Index

0.093

Higher is better

CH Index

68.8

Higher is better

Davies-Bould

1.325

Lower is better

- 1 Allow for the selection of the "Year" [2014-2024]
  - Allow for the selection of "Clustering Method" [K-means, Hierarchical]
  - Allow for the selection of "Number of Clusters" [1-8]
- 2 All for selection of Variables for PCA Analysis  
[economy\_score, social\_score, lifeexpectancy\_score, freedom\_score, generosity\_score, corrperception\_score]
- 3 Plot showing the Geographical Map with different colors for different clusters
- 4 Clustering Validation Statistics

# CLUSTERING: PCA ANALYSIS 2D

World Happiness



Time Series

Panel Model

Clustering

Multivariate

Time-Series

Geospatial

About

## World Happiness Clustering Analysis

### Clustering Parameters

Select Year

2014

Clustering Method

K-Means

Number of Clusters

3

### PCA Variables Selection

Variable 1

economy\_score

Variable 2

social\_score

Variable 3

lifeexpectancy\_score

Note: For optimal PCA visualization, select 2 different variables the 2D plot and 3 different variables for the 3D plot

1

Yearly Cluster Exploration

PCA Analysis 2D

PCA Analysis 3D

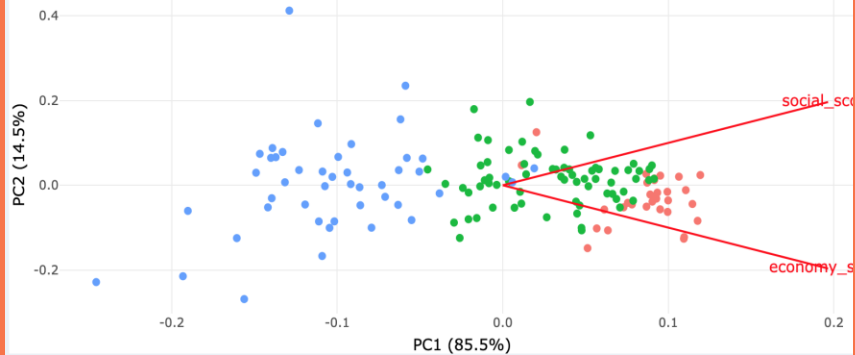
PCA Full Analysis

Clustering Over Time

### What is PCA (Principal Component Analysis)?

PCA is a technique that reduces the number of variables while preserving most of the important information (variance) in the data. It creates variables, called Principal Components, which are combinations of the original variables. The first few components usually capture most of the variation. PCA is used here to project the clustered data into a 2D space, making it easier to visualize how well-separated the clusters are.

Think of PCA as finding the best viewing angle to observe patterns in complex data.



2

Loadings Matrix

Interpretation

PC1 ( 85.5% variance explained )

- positively driven by **economy\_score**
- positively driven by **social\_score**

PC2 ( 14.5% variance explained )

- positively driven by **social\_score**
- negatively driven by **economy\_score**

### 1 Explanation of PCA Analysis

- Plot showing the 2D PCA Analysis

### 2 Loading Matrix

- Interpretation of results

# CLUSTERING: PCA ANALYSIS 3D

World Happiness

Time Series

Panel Model

Clustering

Multivariate

Time-Series

Geospatial

About

## World Happiness Clustering Analysis

1

Yearly Cluster Exploration

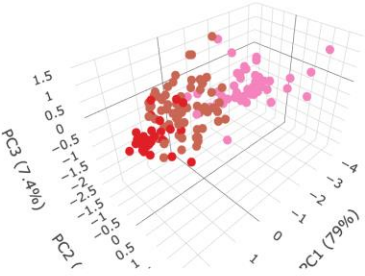
PCA Analysis 2D

PCA Analysis 3D

PCA Full Analysis

Clustering Over Time

Food for thought: Is the separation between clusters apparent?



2

Loadings Matrix

Interpretation

PCA Loadings Matrix (Selected 3 Variables)

Variable	PC1	PC2	PC3
economy_score	0.601	0.09	0.794
social_score	0.559	-0.757	-0.337
lifeexpectancy_score	0.571	0.647	-0.506

Note: For optimal PCA visualization, select 2 different variables the 2D plot and 3 different variables for the 3D plot

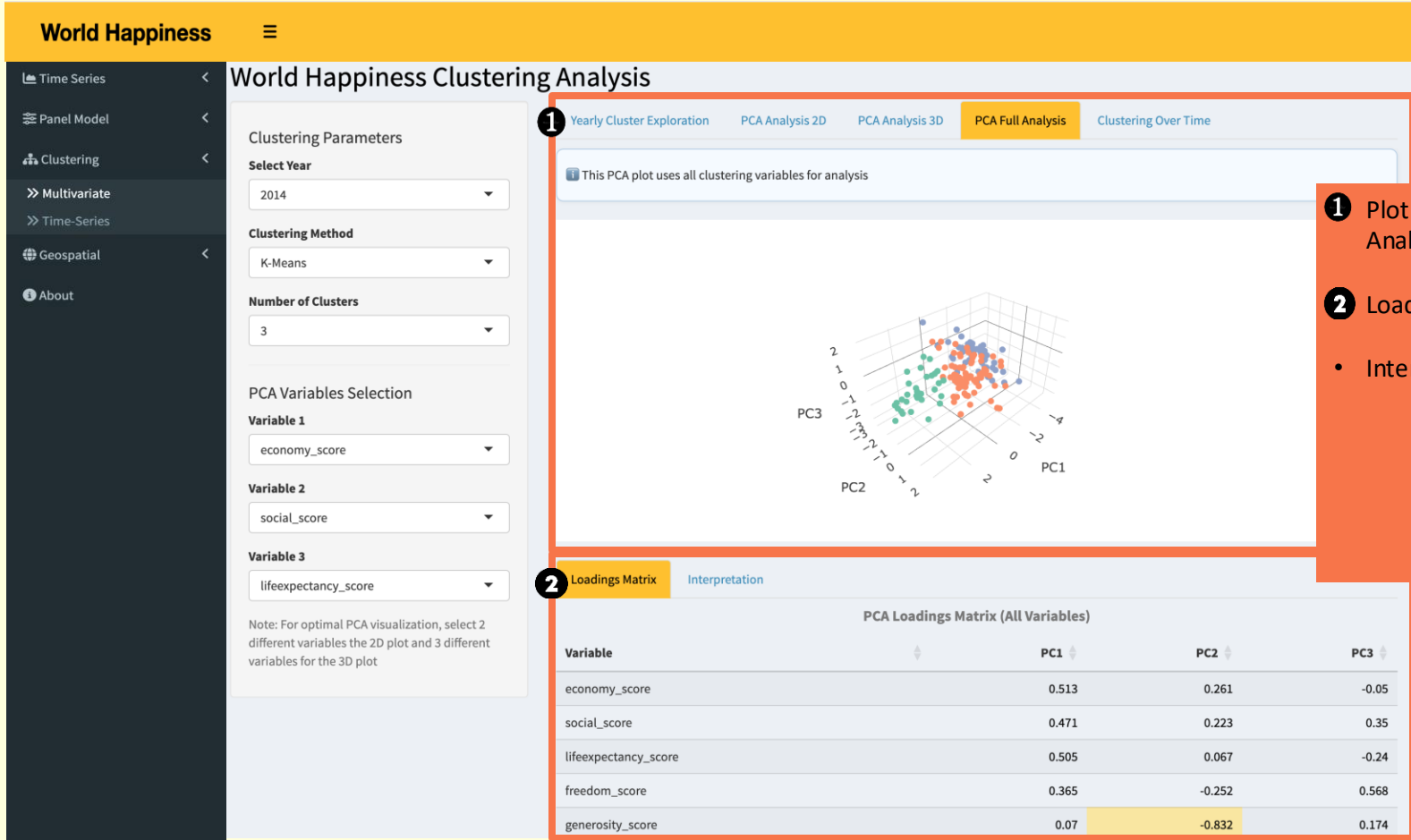
Food for Thought – Is the separation between clusters approved?

1 Plot showing the 3D PCA Analysis

2 Loading Matrix

- Interpretation of Results

# CLUSTERING: PCA FULL ANALYSIS

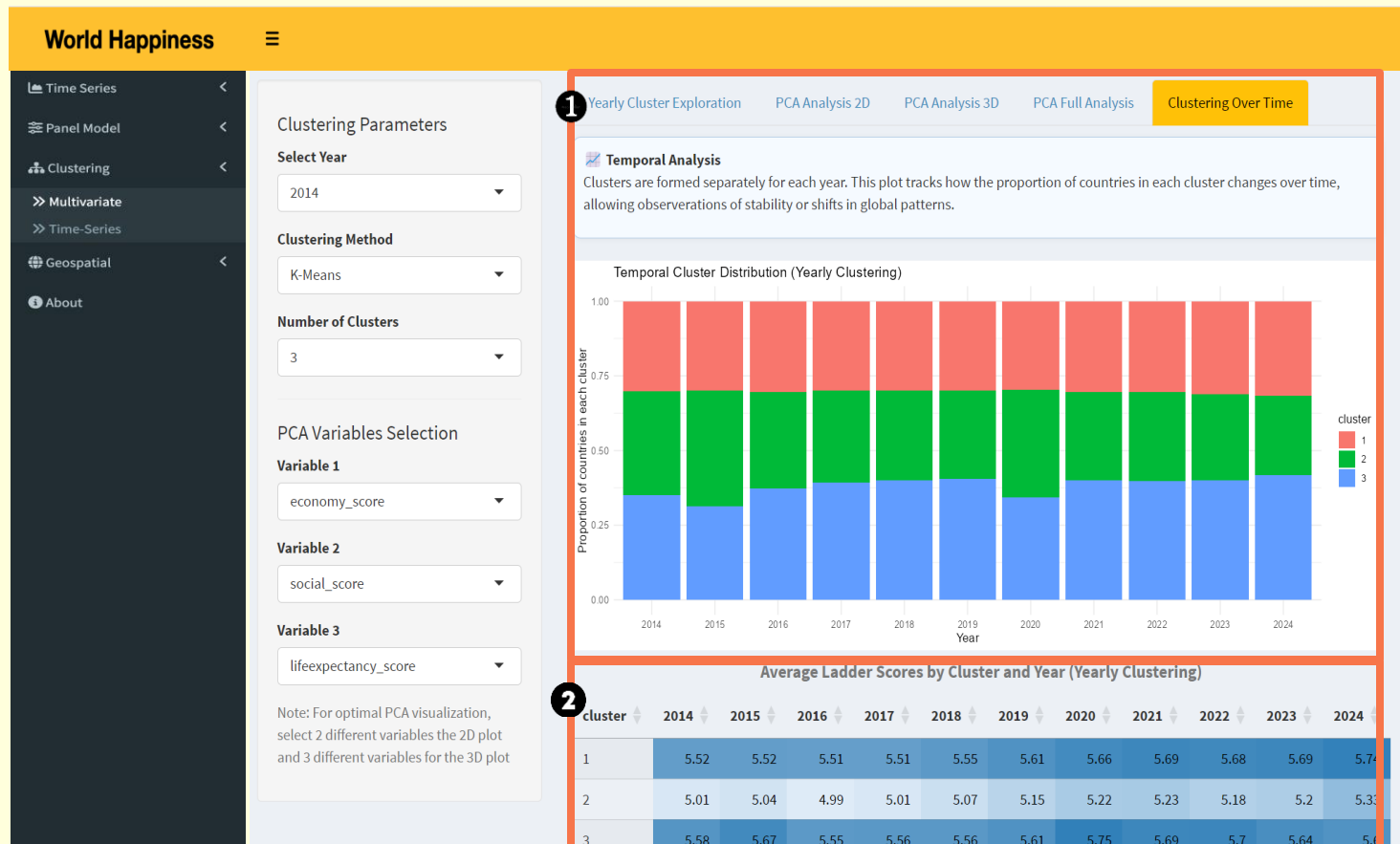


**1** Plot showing the 3D PCA Analysis

**2** Loading Matrix

- Interpretation of Results

# CLUSTERING: CLUSTERING OVER TIME



1 100% Stacked Bar Plot showing the Temporal Cluster Distribution

2 Clustering Statistics by Year (ladder score)

# CLUSTERING: OPTIMAL CLUSTERS

## World Happiness

Time Series

Panel Model

Clustering

Multivariate

Time-Series

Geospatial

About

1. Feature based clustering
2. DTW based clustering
3. Shape clustering

Clustering Method:

Feature-based Clustering

Number of Clusters:



Select Features:

- ☒ Mean
- ☐ Variance
- ☒ Trend
- ☐ Autocorrelation

Run Clustering

Method Info:

Feature-based clustering summarizes each time series into statistical features such as mean, variance, trend, and autocorrelation, then applies k-means clustering on these features.

## Series Clustering

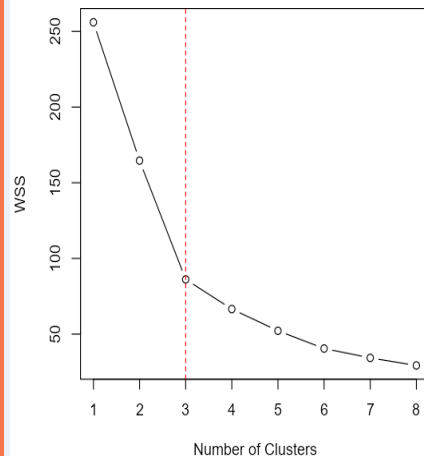
Optimal Clusters

Cluster Results

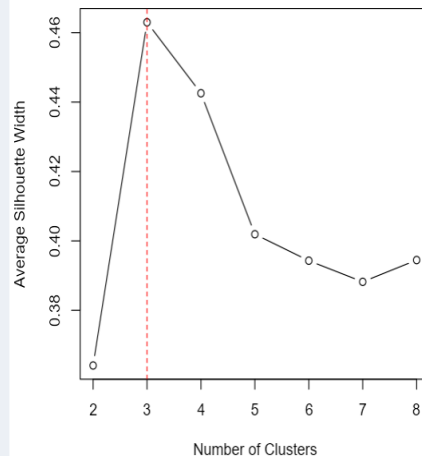
Geographical Distribution

Statistical Analysis

Elbow Method



Silhouette Plot

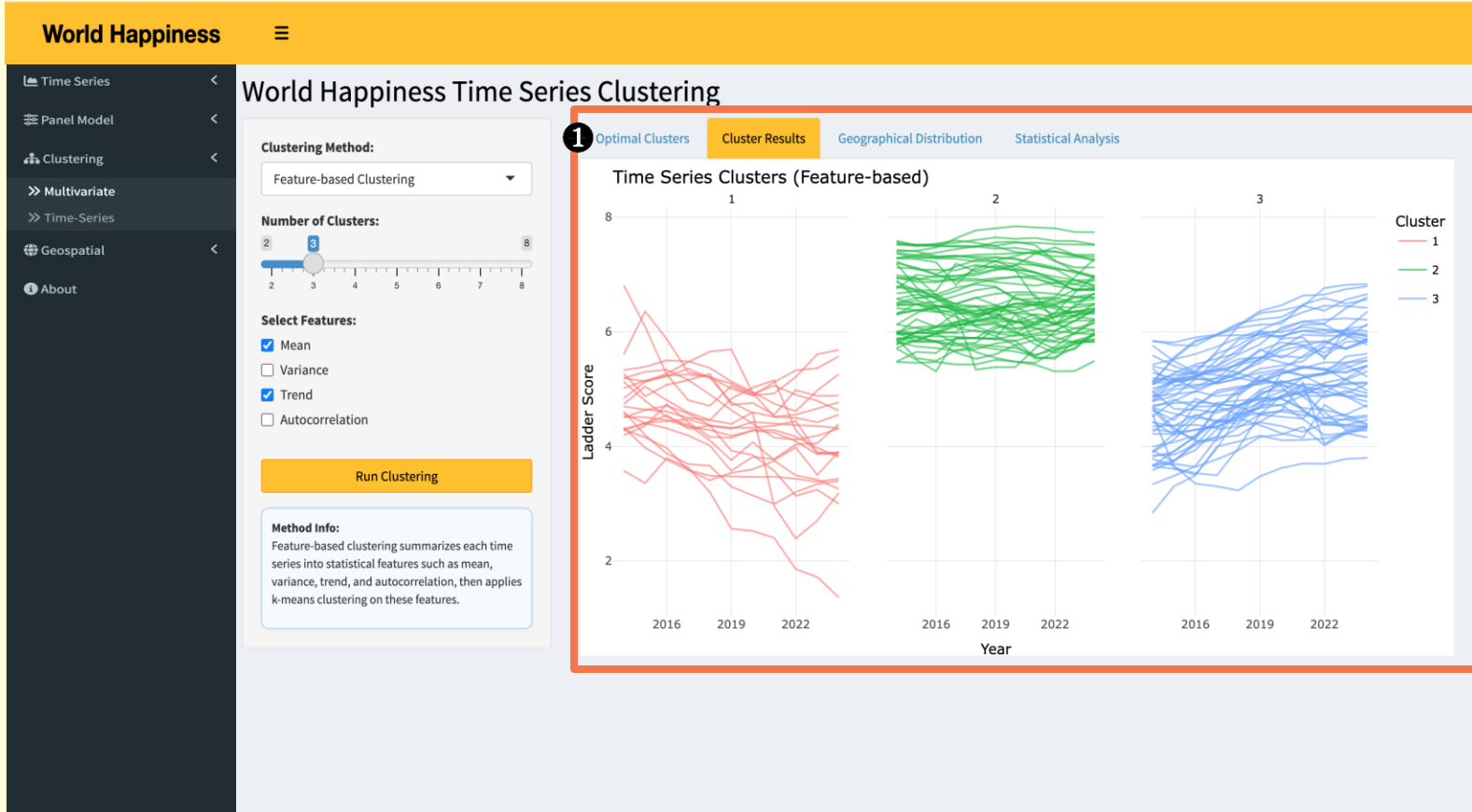


- 1 Allow for the selection of the Clustering Method – “Feature-based clustering, DTW-based clustering, Shape clustering”

- Allow for the selection of the no. of clusters
- Allow for the selection of the features.

- 2 Graph showing the clusters based on Elbow Method/ Silhouette Plot

# CLUSTERING: CLUSTER RESULTS



1 The line graph plots the ladder score for all the years for visual comparison of the different clusters.



# CLUSTERING: GEOGRAPHICAL DISTRIBUTION

World Happiness



- Time Series
- Panel Model
- Clustering
- Multivariate
- Time-Series
- Geospatial
- About

## World Happiness Time Series Clustering

Clustering Method:

Feature-based Clustering

Number of Clusters:



Select Features:

- ☒ Mean
- ☐ Variance
- ☒ Trend
- ☐ Autocorrelation

Run Clustering

Method Info:

Feature-based clustering summarizes each time series into statistical features such as mean, variance, trend, and autocorrelation, then applies k-means clustering on these features.

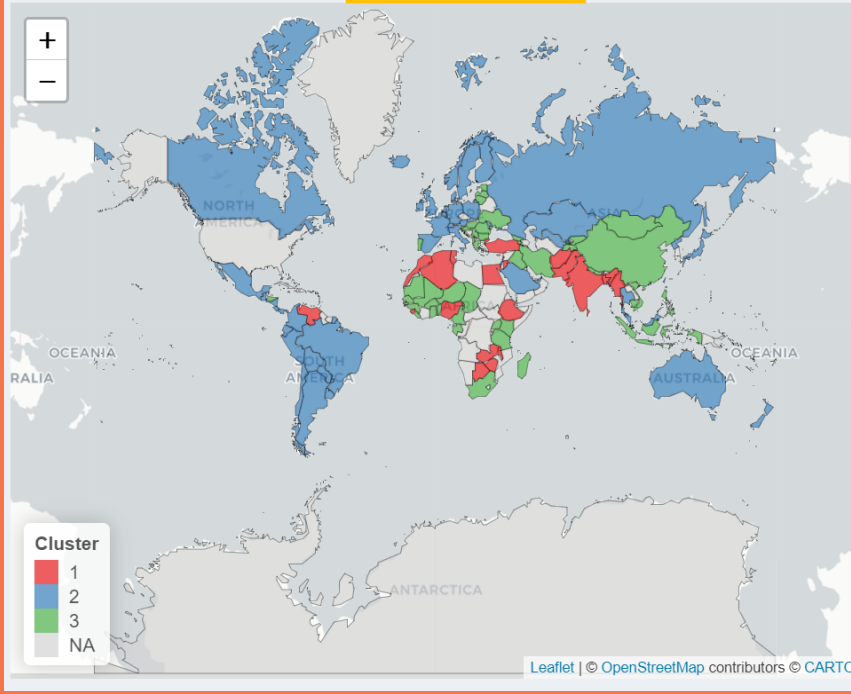
1

Optimal Clusters

Cluster Results

Geographical Distribution

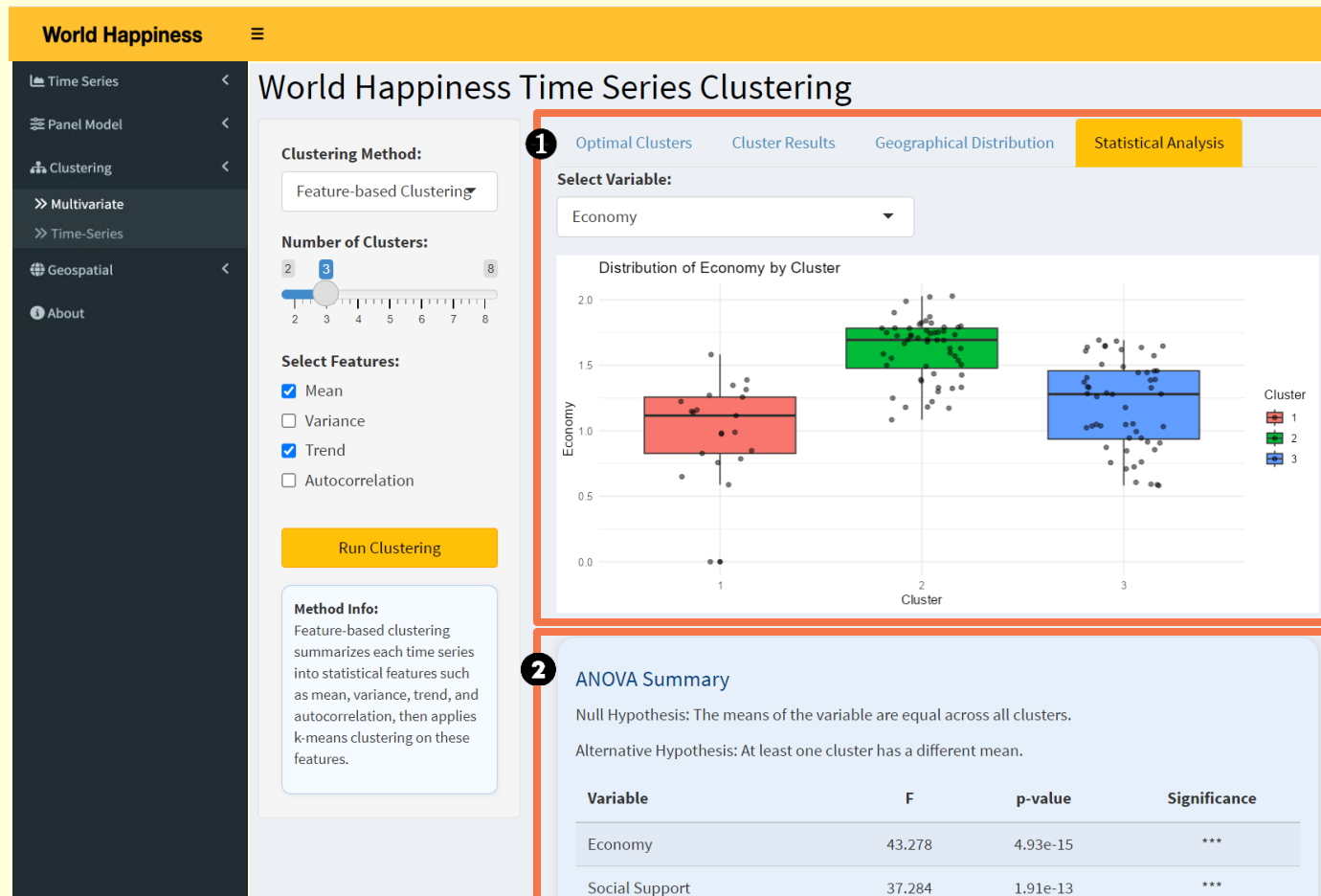
Statistical Analysis



1

Plot showing the countries by clusters based on the selection of the users

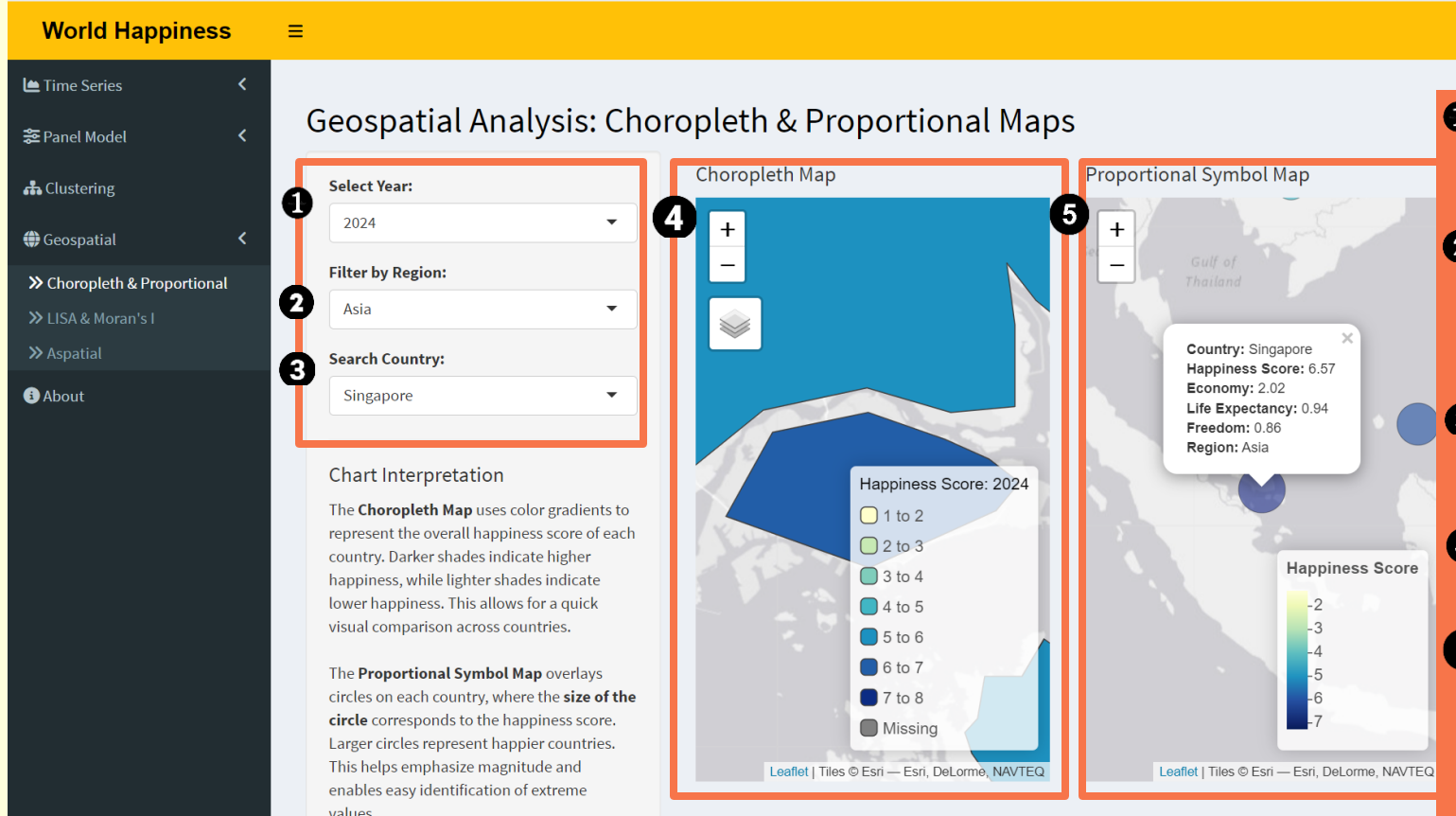
# CLUSTERING: STATISTICAL ANALYSIS



**1** Boxplots showing the statistics of the different clusters based on the user's selection

**2** ANNOVA Test Result Summary at a glance

# GEOSPATIAL ANALYSIS: CHOROPLETH & PROPORTIONAL MAPS



- 1** Allow for the selection of the “Year” [2014 to 2024]
- 2** Allow for the selection of “Region” [All, Africa, Americas, Asia, Europe, Oceania]
- 3** Allow for selection of “Country” [173 countries]
- 4** Plot showing the Choropleth Map
- 5** Plot showing the proportional symbol map

[Auto-zoom in features for both maps to allow for easy referencing]

# GEOSPATIAL ANALYSIS: LISA & MORAN'S I

World Happiness



Time Series

Panel Model

Clustering

Geospatial

>> Choropleth & Proportional

>> LISA & Moran's I

>> Aspatial

About

## Geospatial Analysis: LISA & Moran's I

1 Select Year:

2023

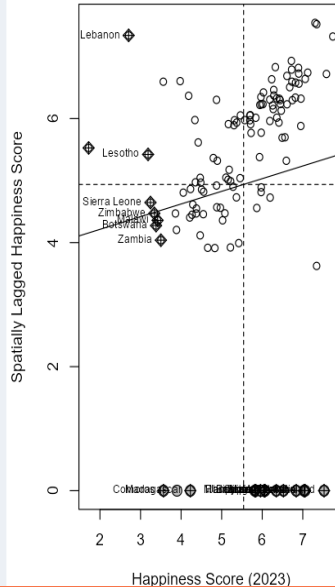
### Chart Interpretation

The Moran scatterplot shows how each country's happiness score correlates with its neighbors'.

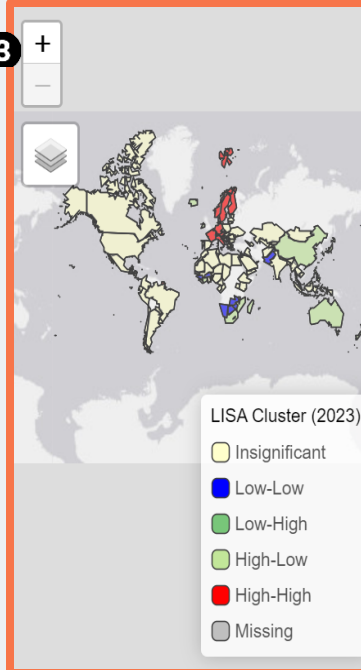
The LISA Cluster map highlights statistically significant spatial clusters:

- **High-High**: Top right quadrant - Happy countries near other happy countries
- **Low-Low**: Bottom left quadrant - Unhappy countries near unhappy neighbors
- **Low-High**: Top left quadrant - Potential outliers
- **High-Low**: Bottom right quadrant - Potential outliers
- **Insignificant**: No strong spatial pattern

2



3

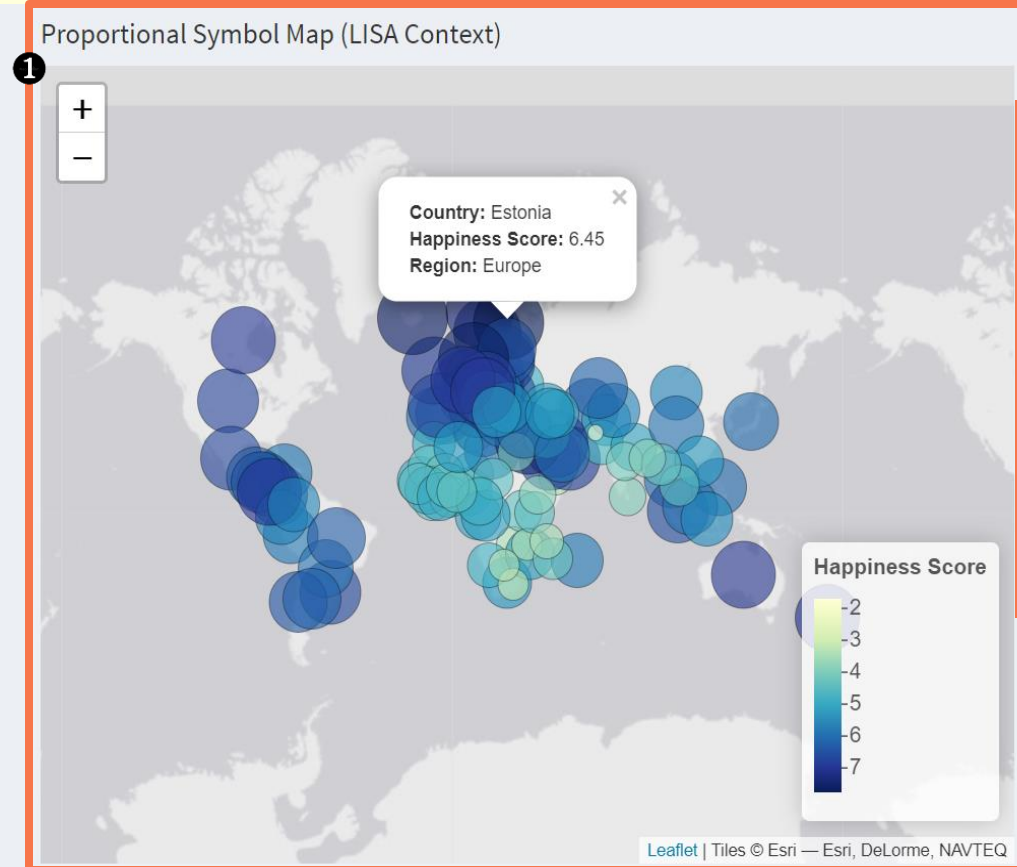


1 Allow for the selection of the "Year" [2014 to 2024]

2 Moran scatterplot – shows the spatial lag of happiness score (y axis) against country's own happiness score (x axis)

3 LISA cluster map – highlights the statistically significant spatial clusters based on local spatial autocorrelation with neighbouring nations.

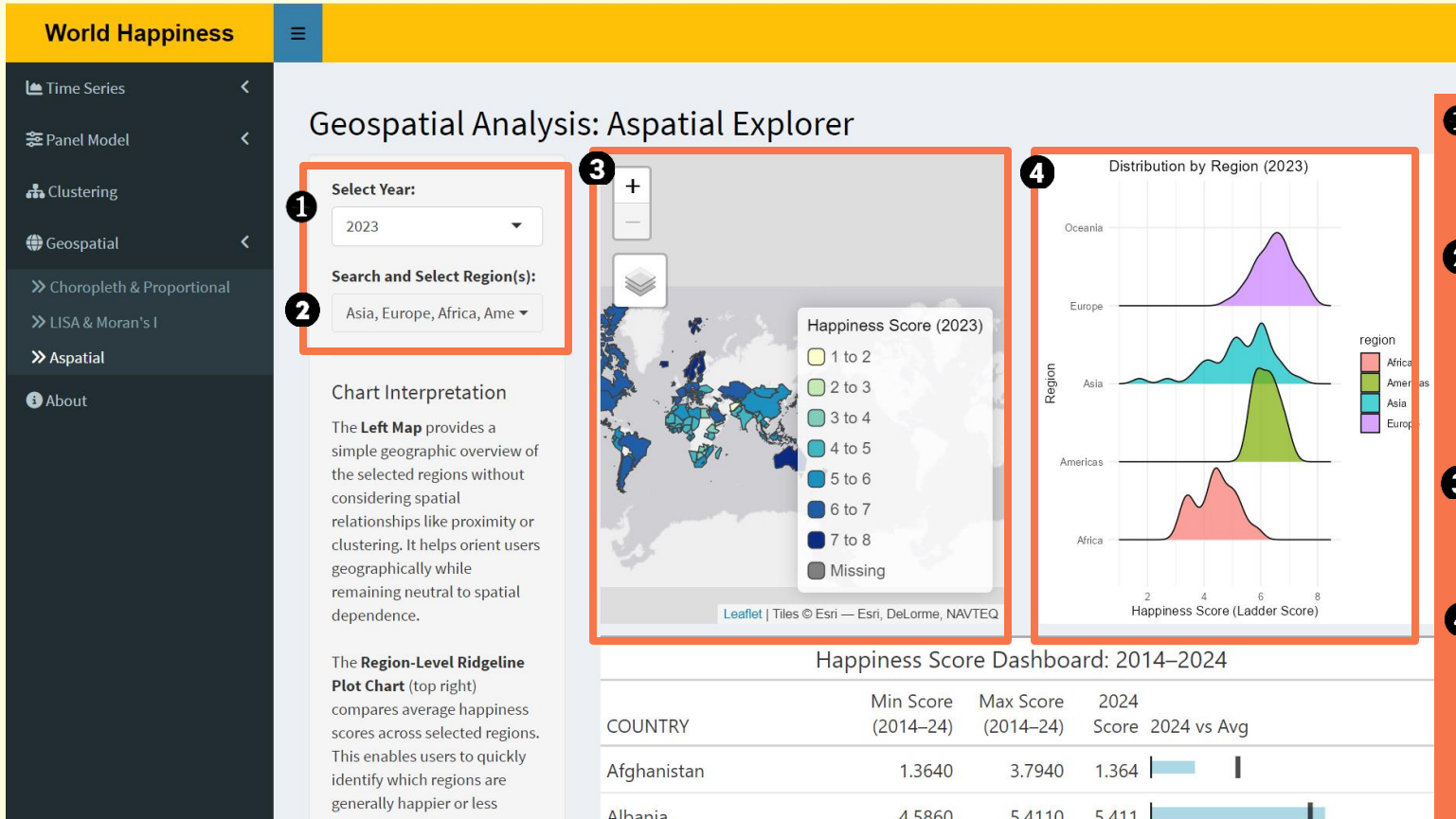
# GEOSPATIAL ANALYSIS: LISA & MORAN'S I



1 Proportional symbol map provides an intuitive overview of each country's happiness score using bubble size and color.

- Visually confirms patterns observed in the Moran scatterplot and LISA cluster map.

# GEOSPATIAL ANALYSIS: ASPATIAL EXPLORER



- 1** Allow for the selection of the “Year” [2014 to 2024]
- 2** Allow for multiple filtering by region (e.g.: Asia, Europe, Africa etc.) to compare and explore regional happiness trends.
- 3** Visualizes each country’s happiness score using bubble size and color.
- 4** Displays the distribution of happiness scores by region using region-wise ridgeline plot.

# GEOSPATIAL ANALYSIS: ASPATIAL EXPLORER

1

The **Region-Level Ridgeline Plot Chart** (top right)

compares average happiness scores across selected regions. This enables users to quickly identify which regions are generally happier or less happy.

The **Summary Table**

complements the visuals by providing exact happiness values, averages, and rankings, allowing for precise data inspection.

Happiness Score Dashboard: 2014–2024

COUNTRY	Min Score (2014–24)	Max Score (2014–24)	2024 Score	2024 vs Avg
Afghanistan	1.3640	3.7940	1.364	
Albania	4.5860	5.4110	5.411	
Algeria	4.8870	6.3550	5.571	
Angola	3.7950	4.0330	NA	
Argentina	5.9290	6.6500	6.397	
Armenia	4.3210	5.4940	5.494	
Australia	6.9740	7.3130	6.974	
Austria	6.8100	7.2942	6.810	
Azerbaijan	4.8750	5.2910	4.875	
Bahrain	5.9590	6.6470	6.030	
Bangladesh	3.8510	5.1550	3.851	
Belarus	5.3230	5.8210	NA	
Belgium	6.8050	6.9370	6.910	
Belize	5.9560	6.7110	6.711	
Benin	3.3400	5.2160	4.357	

1

Summary table that provides detailed happiness statistics (min, max, average, 2024 score) for each country to support precise comparisons.

# ABOUT:

World Happiness

Time Series

Panel Model

Clustering

Geospatial

>> Choropleth & Proportional

>> LISA & Moran's I

>> Aspatial

About

## About This Dashboard

Project Overview

- This interactive dashboard visualizes global happiness trends from **2014 to 2024**.
- It enables users to explore country-level happiness scores, compare across regions, and identify key drivers using modeling and spatial analysis.

Features

- Time Series: Explore happiness trends, forecasts, and causal impacts
- Panel Model: Fixed effects regression to assess feature importance
- What-If Analysis: Simulate changes to happiness factors
- Clustering: Group similar countries based on happiness indicators
- Geospatial: View Choropleth, Proportional, LISA, and Aspatial maps

Data Source

- The data is sourced from the [World Happiness Report](#), which evaluates well-being across countries using metrics like GDP per capita, social support, healthy life expectancy, freedom, generosity, and corruption perception.

Developer Info

- Created by **Andrea Yeo, Dhreeti Shah, and Ou Yi Ming** as part of the **ISSS608 Visual Analytics Applications (VAA)** subject in the Master of Information Technology program (MITB) at SMU.
- This project combines statistical modeling, data visualization, and geospatial techniques using **R Shiny**.



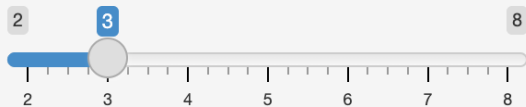
END

# CLUSTERING: CLUSTERING CHOICES

## Clustering Method:

DTW-based Clustering ▼

## Number of Clusters:



## DTW Distance Method:

Euclidean ▼

Run Clustering

### Method Info:

DTW-based clustering compares the shape of time series directly by aligning them in time (even if shifted or warped), then groups them based on similarity.

# CLUSTERING: CLUSTERING CHOICES

## Clustering Method:

Shape-based Clustering ▼

## Number of Clusters:



Run Clustering

### Method Info:

Shape-based clustering uses correlation-based distances to compare overall patterns and shapes of time series, grouping series with similar profiles.