Singapore Trade: Partners through the Pandemic

SingTrade Compass, an interactive app for you to explore Singapore trade (2018 – 2022)

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Introduction

The World merchandise trade volume sank below 2015 levels in Q1 & Q2 2020 due to the closure of borders to curb the spread of COVID-19. Singapore, as a comparatively small and open economy, movements in demand and supply critically impact the imports, exports and trade balance that it has established for itself as a major trading hub, It is essential we monitor the impact of Covid on trade balances during this time period.

The period in this study, Jan 2018 to Jan 2022, encompasses pre-COVID, the lock down in late 2019 and the gradual opening of world economies at different times.

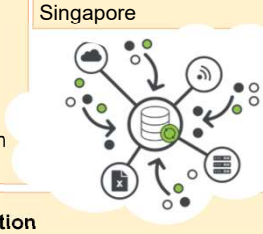
Motivation

This project aims to provide an application to assist users to visually explore and analyze the merchandise trading patterns of Singapore with various countries for the time period Jan 2018 to Jan 2022.

Data Cleaning & Prep

Data Cleaning
- Removed non-data rows e.g., Summary data
- Combined Export and Import data
- Standardized all numbers to thousands
- Removed rows with missing data

Data Source
- 2018 – 2022 Exports and Imports file from Department of Statistics, Singapore

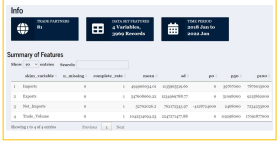


Data set for Time series clustering
- Data was spread to reflect month-year in columns Values were summed by type Import and export

Prepared Data set Jan 2018 to Jan 2022

81 countries
3969 records
4 new variables

Data set summary is available for user exploration in the app



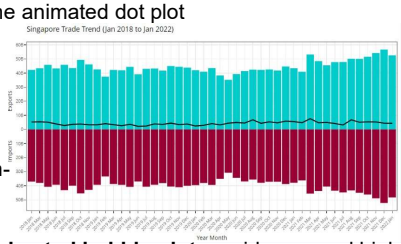
Trend Data Preparation
- 8 Country names were standardized with the geo listing.
- 10 Country names were identified as regions
- 4 new variables created: Year, Month, Trade Volume (sum of import and export), and Net imports (value of import – value of export)

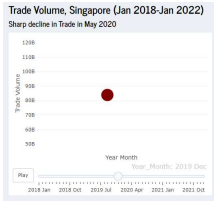
Main Tools and packages used

R, Shiny, ggplot2, dplyr, plotly, tidyverse, gganimate, Leaflet

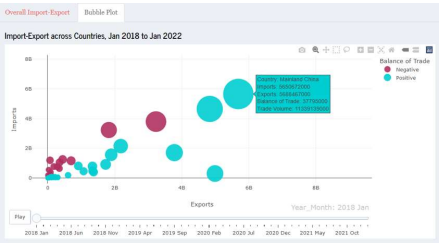
Descriptive Analysis

The **horizontal export-import pyramid chart** shows the import and export values across all trading partners, for Jan 2018 to Jan 2022. It visualizes similar patterns between the import and export trend e.g., the dip in May 2020 and sudden rise in Mar 2021, also revealing that there is an upwards trend that started from Aug 2021 and would go on to exceed pre-covid levels. The animated dot plot would explicitly indicate the trade volume for month-year





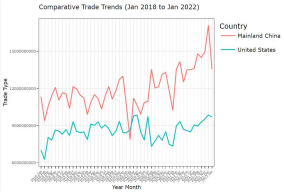
A time animated bubble plot provides a good high-level view of the changes in balance of trade across time frames with breakdown details of country. Users can stop at specific time and mouse over the bubbles to know the country partner contributing and the exact value.



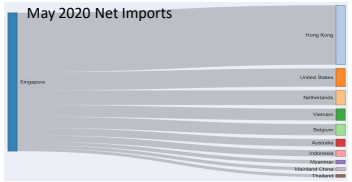
Comparative Analysis

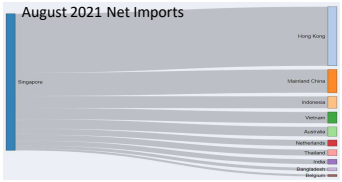
For comparison usage, the app allows users to select the countries desired, and 4 type of trade measures (import, export, net imports, trade variance). **Multi-select line plot allows u**sers to drill down to compare selected countries.

China's absolute trade value with Singapore remains higher than that with the United States, except for Jan 20 to Mar 20 did China dip below United Status



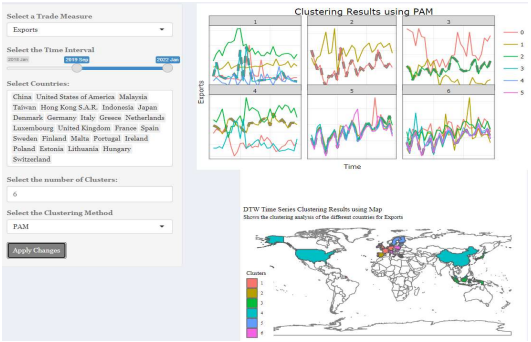
The Sankey Chart visualizes trade flow with arrows proportional to the flow quantity. Users can investigate by months to observe the top 10 partners by 4 measures (import, export, net imports, trade variance). Comparing May 2020 and Aug 2021, we see that United states and Netherlands have dropped off and China and Indonesia have taken 2nd and 3rd place respectively



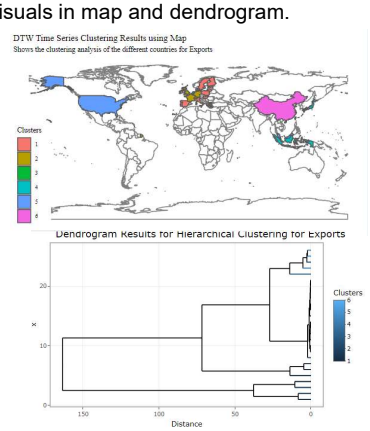


DTW Times Series Clustering

We use clustering to discover if there are hidden patterns among the data of many countries. Users are able to select the trade type, date range, number of clusters, clustering method and number of countries (min 5) to analyze. The results are presented in line graphs and geo-mapped out for clear visualization of clustering results, if PAM clustering method is selected.



Alternatively, selecting Hierarchical method for clustering also allows user to specify the control method (complete, single, average, ward.D, ward.D2) with corresponding visuals in map and dendrogram.



Conclusion & Future Works

- ✓ Singapore's Balance of trade has the worst results in May 2020, dipping to about 70B from 85B in Dec 2019, approx. 17.6%.
- ✓ Clustering Analysis reveals that United states, China, Malaysia and Indonesia are clustered in the same group, while Japan is not in the same.
- ✓ Trade volumes are bettering pre-pandamic levels. With the app, we can identify who are key trading partners with Singapore, and also possible key concentration risks if there is too much focus with 1 partner.

Future works:
- Analyze trading patterns post covid, as borders re-open and livelihoods normalize.
- Include forecasting feature
- Analyse trade for specific sectors

App Link – SingTrade Compass

SMU Singapore Management University