

A Time-series Comparison and Drilldown Visualization of Economies Worldwide

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Abstract – *A Time-series Comparison Visualization*

This project involves providing a variety of users how the economy goes between countries through time. The goal is to provide users tools to better understand and interpret the overall economy status around the world and then make better decisions.

This has been done by fully using the D3 library, HTML, SVG web creation tools. Data collection and cleaning use excel and JMP to join data table and export needed format.

Glyph chart has six dimensions which represent six economy indicators of one country. Stacked area chart shows how the different sectors contribute to the GDP. Timeline slider could animate the glyph chart and show economy indicators change over time.

Based on this application tool, users could take it into consideration when making decisions related to getting a job, investing and so on and so forth.

Keywords – *Economics, Indicators, Time-Series, Comparison, Visual Analytics.*

I. INTRODUCTION

The status of economy draws considerable attention from the public and the press. People care about the economy because it affects people's life in the way that they work, live and spend money every day.

There is a general question that general public could get fragmented information everywhere but hardly to form an overall picture of the whole economy status, let alone for the world economy. Overwhelming news just confused people and it lacks tools to help the public to understand and interpret the economy better.

Therefore, we bring up this application which obtained the data from the World Bank and visualize 7 economy indicators to show the economy status and compare between countries through time.

II. MOTIVATION AND OBJECTIVES

Our research and development efforts were motivated by the lack of tools comparing a set of economic indicators of countries. Individuals modules are integrated in a single brand new app, ECO. Our tool is providing to the users the following functionalities and analysis requirements:

- (1) Time-series comparisons of different indicators;
- (2) On a diversified scale comparison offer by regions, countries or industries;
- (3) Intuitive and interactive charts to interpret macro trends and their impacts

Our tool is then useful for a variety of users such as retail investors, economists as well as job seekers and migrants.

III. DATA TRANSFORMATION

In our actual society, data is everywhere. A big source of information; but data need to be modified sometimes to be able to highlight this information. The scope of the project needs to be well defined to know what data to collect and where. Once, they are collected, a cleaning, a numerical transformation or a format conversion will be necessary to have an effective implementation on the D3.js library.

i. Source of Data

The purpose of the tool is to compare different indicators during time and different spaces. The first important step was to know which indicators to compare. These indicators needed to be relevant of a growth or decline stage of the economy. They have been selected thanks to our business knowledge and researches. The indicators are the following one; GDP, inflation, unemployment (Labor Market), Deposit Interest Rate, Lending Interest Rate and Central Government Debt. The different values have been collected from World Bank.

ii. *Preparation of Data*

Numerical transformation, expecting of a dates format change, was not needed since all the indicators were in percentage. But a format conversion from CSV to JSON was necessary to implement our data in the D3.js library and can compare them by countries and over time.

EXCEL has been used to compile all the different indicators sheets selecting the years 2005-2015. An online tool has been used to be able to convert the CSV format to JSON one.

The value-added to GDP is concentrated on a specific graph all the data related to it have been compiled and cleaned on JMP and have been left to the CSV file format.

IV. USER INTERFACE DESIGN

Our user interface design mainly focuses on easily accessible, interactive and visualized design. It allows the user to gain different insights and views. Elements on the user interface are cautiously chosen and best practices are well-rounded considered into design as well. Simplicity and interactively let users to enjoy using Economic Analysis of Indicators (EAI) tool.

i. *Elements*

Interface elements act in a certain way which users are more familiar with. Thus, a variety of elements are chosen to represent certain content in this tool. For example, input controls like buttons and dropdown list are used following the certain way users are familiar with. Navigational and informational are used to display content as well. Slider is used to show the economy indicator value change in time series. Search field is provided to search specific country.

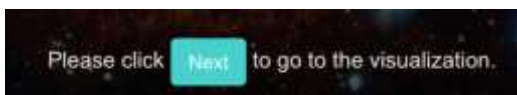


Figure 4.1 Next Button



Figure 4.2 Animated Slider

ii. *Best Practices*

A. *Simplicity:*

The interface of the tool avoids unnecessary elements to distract users and keep messages on labels clear to understand.

B. *Interactivity*

Several functions such as search , select and hover let users to communicate and interact which increases the level of involvement and draw attention of the user consistently.

C. *Meaningful page layout*

Timeline slider is shown on the top of page. Upon selection, visualized graph will be showed below side by side in one page.

Scrollbar is disabled to show overall graph in time series in one page. In this way, users could get each piece of information from one page instead of scrolling all the way back.

D. *Color and Texture*

Color and texture for each element are mostly in the same pattern. Consistent element design makes user more comfortable with this tool and facilitate efficiency to get the work done.

In addition, specific color is used to represent specific country in the legend which helps users to generate insights and compare with other countries much more easily.

V. THE APPLICATION

i. *Select and Search Function*

Users can compare economic indicators by searching or selecting from the dropdown list on our application up to 3 selections at a time.

Visualization will be generated below upon selection. When multiple selection boxes are filled, the application will trigger comparison mode to compare between countries on the same graph.

For example, comparing how one country fares against their closest competitors by choosing or searching this country. Then using comparison mode, other countries can be analyzed in a similar way, to see if they are heading towards a similar trend in terms of indicator values changing, and whether their sectors follow the same pattern.



Figure 5.1 Select and Search Field

ii. *Data Visualization*

Here are the charts displayed in our application. These graphs are linked together by time. Our tool is focusing on time-series comparison.

A. *Glyph Chart*

It gives an insight of the economic indicators and how they perform over time. The indicators are respectively the rates of Inflation, Unemployment, GDP growth, Central Government Debt, Lending Interest Rate and Deposit Interest Rates (aka savings rate). The selected area will be filled with specific color to represent the country.

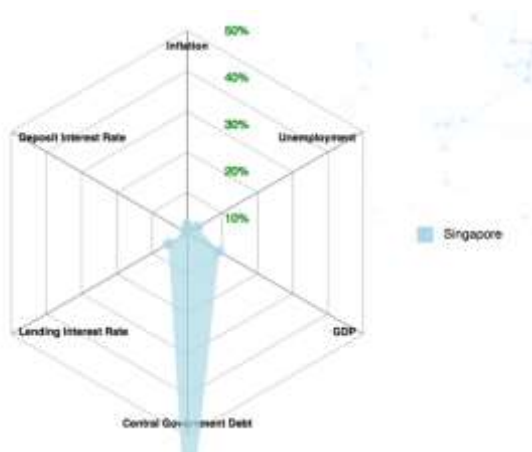


Figure 5.2.1 Glyph Chart

B. *Stacked Area Chart*

This stacked area chart plots the overarching sectors contributing to GDP of a country. The x axis represents the year, and y axis for cumulative percentage of GDP. Note that some countries or regions do not have a sector contributing to their GDP.

The legend appears next to its corresponding stacked area chart, representing your selection. Each color on the stacked area chart is representing a sector, either Agriculture, Industry or Services

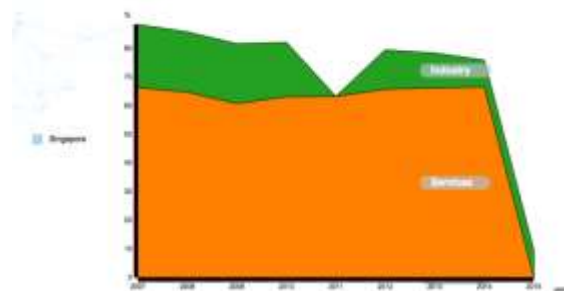


Figure 5.2.2 Stacked Area Chart

III. *Time-series function*

Time-series function provides a play button and a timeline to show the visualization of the selected year. Changes will be made on the animated radar chart. Each year represents a 'snapshot' of the economic profile of the countries or regions, allowing you to see the changes over time.

By doing so, one can see the evolution of these economic indicators over time and compare them to how the industries fared, revealing some insights on how well or bad the performance is, and in which sector.

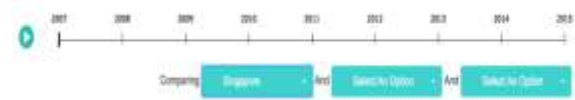


Figure 5.3.1 Initial Timeline



Figure 5.3.2 Animated Timeline

IV. Hover function

Hovering over both charts, details of the indicators on a tooltip will be shown beside the cursor. Other than overall picture of the economy profile, users could drill down the exact values as well.

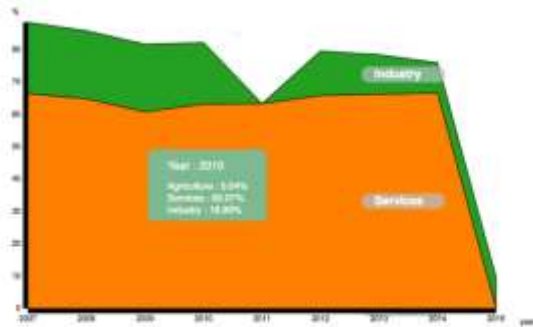


Figure 5.41 Hover over Stacked Area Chart

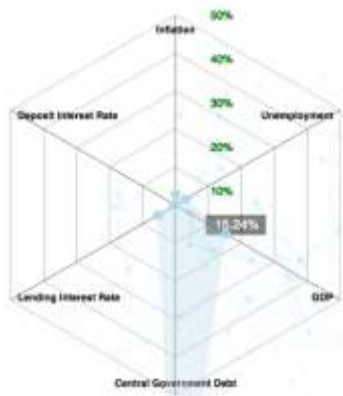


Figure 5.4.2 Hover over Glyph Chart

VI. ANALYSIS

Our application generate visualization based on World Bank database and provide rich information to users. A set of data can be obtained and interpreted from graphs. When the user select one country and enter single view mode, 6 economy indicators will be shown on the radar chart and how three sectors made contribution to the overall GPA will be shown on the stacked area chart. Hovering over either chart, the exact value will give accurate information to users. Playing the button, how the indicators change along the time will be animated on the radar chart. Same to the comparison mode, other than all the information users can get from single view mode, comparison among countries will be visualized on the radar chart and stacked area chart.

All the information on both charts provide a wide range of users to easily make decisions and interpret in various ways. Variety questions could be answered according to the application, such as buying power of the currency, supply and demand on the employment market or the country's growth. Comparison questions like "Which country could let me invest in the service sector?" or "Which country has a more positive state of employment market". Users could make decisions, like investment, moving to another country or currency exchange based on our application.

Because of friendly user interface and rich information behind the vivid graph, the application would involve users in and facilitates users to make better decisions. Not only the overall picture, but exact values could be drilled down using this application related to the economy for countries around the world.

VII. LIMITATIONS

i. Data availability

Because of regulations or the development stage of a country or region, its data cannot be found or obtained. For example, we initially wanted to analyze the number of worked hours or the wages in different countries, but our search gave us only data for OECD countries.

Even for the indicators we have selected, the data are sometimes not filled for some countries, appearing is blanks, or even as zeroes, which affects the data integrity and thus visualization. Additionally, regional data for each industry could not be obtained.

ii. Monthly and quarterly indicator snapshots

Having monthly and quarterly periods can allow much more insight on how a country or region is doing. Our sources may not be able to consistently update their data on time, thus affecting this visualization from being used frequently, thereby limiting its analysis to an annual one.

VIII. FUTURE WORK

i. Detailing the industries

An improvement of our application would be to detail the industries. Not display “primary”, “secondary” and “tertiary sectors. We would like to integrate specific sectors to allow more accurate analysis, and allow the users to derive more insights. For a job seeker, it would be good to know that manufacturing is doing well but which precise industry such as glass or technology would lend more interesting insights and decision making capabilities to a job seeker or economist.

ii. Time-series bar for the stacked area chart

Currently, hovering over the stacked area chart will show you a small box which is tooltip containing with all values at that specific year. For the future work, we can present a bar along the axis to cut the specific year and to show each value respectively.

iii. Inner circle for negative values

In our radar chart, we currently mark negative change in red. Further work could include an additional inner circle to denote negative change up to -10%. Additionally, coloring the area and circles in red can be more intuitive to denote negative values to users by making use of color and position change in the animation to know something drastic has happened if one year was positive, showing the colored areas expanding outwards, and another year had turned negative, with the areas collapsing inwards.

iv. Grouping economic indicators

The six economic indicators used now may be difficult to follow all at once. We propose future work to study the correlation of one indicator to another, perhaps forming boom or bust stages of an economic cycle, after each has reached a certain threshold. This would make the chart more intuitive to interpret.

IX. CONCLUSION

Our EAI tool is an application that allows the user to find economic information and compare them in one and only place. Regarding what the market offers, EAI is innovative and way more interactive for users to make their own decisions, well informed. It enables them to see the past trends in the economy regarding time space and geographic space. Of course, there is still a lot of way to improve the application as well as the utilization and gain of information for the users.

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