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Visualization 2 – Design Dashboards using Tableau

Introduction

For the second visualization assignment, I chose to expand on the first visualization assignment by focusing on different demographics - young population, elderly population, and foreign-born population - within several countries around the world and seeing how they relate to the percentage of 25-64 year-olds who have attained tertiary education. Once again, tertiary education includes any education after secondary education; this can include undergraduate education or postgraduate education, and can culminate in the attainment of certificates, diplomas, or academic degrees. The young population includes anyone under 15 years old. The population of the elderly includes anyone 65 years old or older. Foreign-born population includes all people who ever moved from their country of birth to their current country of residency. Also included in this analysis are fertility rates, population, and GDP.

The Data

The data set for this visualization assignment includes the following (as well as any applicable units):

- Country
- Year
- Young (% of Population)
- Elderly (% of Population)
- Foreign-Born Migrants (% of Population)
- Fertility Rate
- Population of the country (Million Persons)
- GDP (Million USD)
- Continent of the country in question
- Percentage of men who have attained tertiary education (% 25-64 year-olds)

● Percentage of women who have attained tertiary education (% 25-64 year-olds)

For the countries, the same twenty-five countries from the first visualization assignment were selected. These countries were originally selected from the Organization for Economic Co-operation and Development (OECD) based off of the availability of their data. The countries are as follows:

1. Australia
2. Belgium
3. Canada
4. Czech Republic
5. Denmark
6. France
7. Germany
8. Greece
9. Hungary
10. Ireland
11. Italy
12. Japan
13. Korea
14. Mexico
15. Netherlands
16. Poland
17. Portugal
18. Spain
19. Sweden
20. Switzerland
21. Turkey
22. Great Britain
23. United States of America
24. Estonia
25. Latvia

For the years, focus was once again placed on 2001 through 2012 inclusive - twelve years in total - in order to limit the scope to just the 21st century. The percentage of young was included to observe any trends among the younger people in relation to tertiary education. In particular, this is to contrast against the percentage of the population who are elderly which was included in the first visualization assignment. Foreign-born migrants and fertility rate were included to determine additional trends among the demographics for each country. Population values were included once again to see if there were any patterns over time. Continent was included to see the distribution of countries included in the visualization. The percentages of tertiary education was among men and women was carried over from the first visualization assignment.

Note: For the revision, the percentages of tertiary education among men and women replace the combined percentages of the two groups for the sake of creating some visualizations.

Data Acquisition and Processing

Majority of the data sets were downloaded once again from the OECD website as separate .csv files. The data contained in these .csv file were then copied into separate sheets within one Excel spreadsheet file dedicated to data wrangling. From there, the data was consolidated into a new sheet in the same Excel file before undergoing an iterative process to generate a final data set that includes the twelve years of data for the twenty-six countries. Each step of the process was performed on a new sheet within the Excel file in order to keep track of the steps taken when processing the data.

Note: For the first submission, all data was collected into one tab within an Microsoft Excel. For the revision, more data was combined with the previous data in another tab within the same Excel file. However, in order to use the new data, Tableau utilized data from both tabs and linked them together through the "Continent", "Country", and "Year" dimensions.

The .csv files for population, percentage of population who are young, percentage of population who are elderly only included data from 2001 to 2014 inclusive. The .csv file for foreign-born population only covered 2001 to 2013 inclusive. The .csv files for tertiary education and GDP included data from 2001 to 2017 inclusive. The .csv file for fertility rates covered 2001 to 2016 inclusive.

Not all countries had data for each of the years covered by the .csv files, and countries with large amounts of data missing were excluded the final data set. Unlike before where extrapolation was avoided since estimated values could be grossly incorrect, gaps in the data here were filled when there was sufficient data to estimate trends. This was because the countries used in this assignment needed to be the same as those featured in the first assignment. When no data was OECD available at all for some of the twenty-five countries, additional sources were utilized. Some countries had breaks in the OECD time series associated with population and percentage of population who
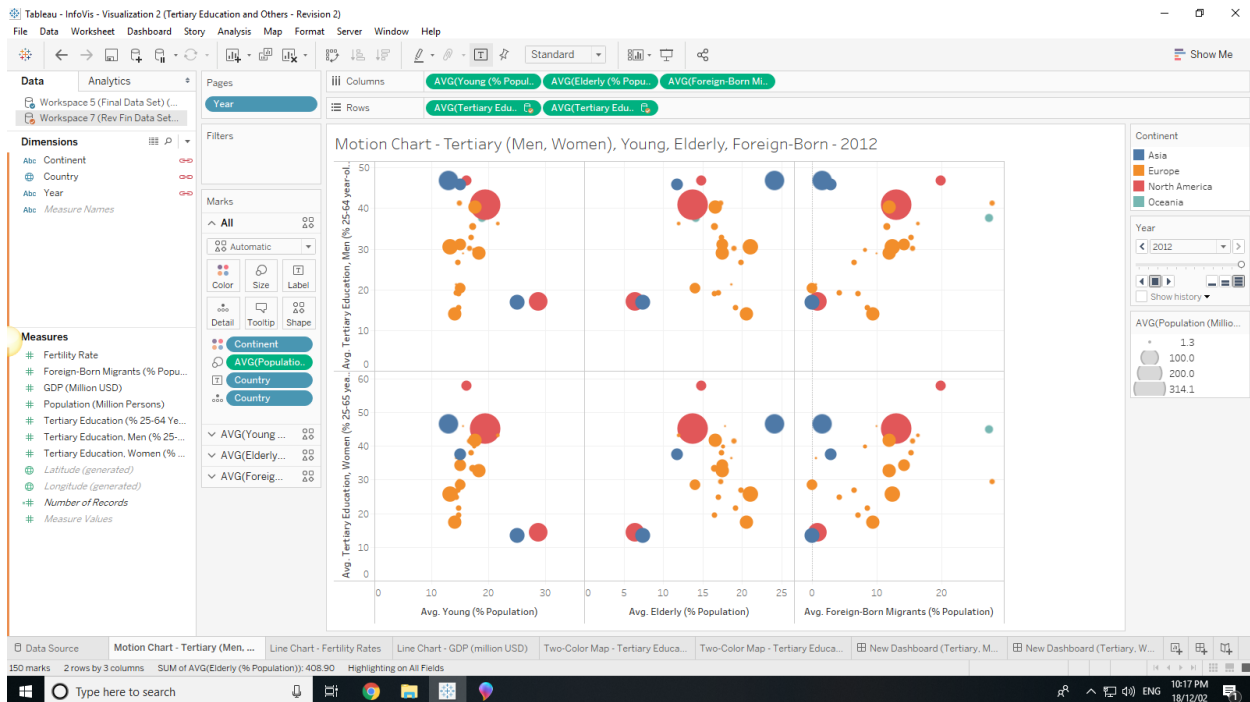
are elderly. This was because the methods for measuring this statistic had changed; however, care was taken by statisticians to maintain the integrity of the time series.

Observations and Analysis

Below are the motion charts for 2001:
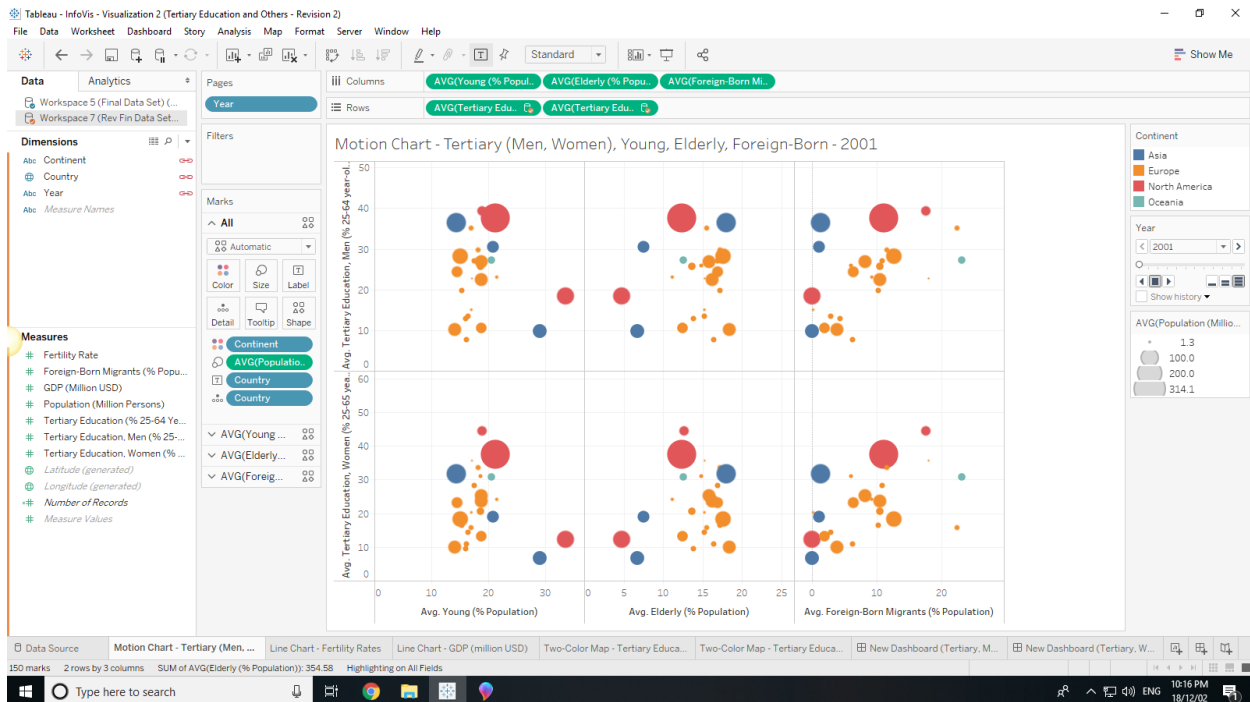
And below are the motion charts for 2012:

In all six cases, the circles exhibit a general shift upward over time, thus indicating an increase in tertiary education. This was observed in the first visualization assignment. In the leftmost column of charts which features the young population, the circles exhibit a clustering towards the left. This would indicate a reduction in the percentage of the young among the total population. In the center column of charts which features the elderly population, the circles exhibit a general shift to the right. This would indicate an increase in the percentage of the elderly among the total population. This was also observed in the first visualization assignment. In the rightmost column of charts which features the foreign-born population, the circles generally shift to the right. This would indicate an increase the percentage of foreign-born among the population.

A possible explanation of these relationships could be that the level of economic development for these countries could be such that they attract migrants in search for a better life, which would include access to tertiary education. Another possible explanation could be that the migrants could already have attained tertiary education in their their birth countries, and the countries featured in this analysis are in demand for

their skillset. In either case, the migrant group could be 15 years or older, thus shrinking the size of the young population. Moreover, the same migrant group could include older adults, thus increasing the size of the elderly population as time progresses and these people reach the 65-years-and-older demographic.

Below is a line chart of each country's fertility rates over the twelve-year period:
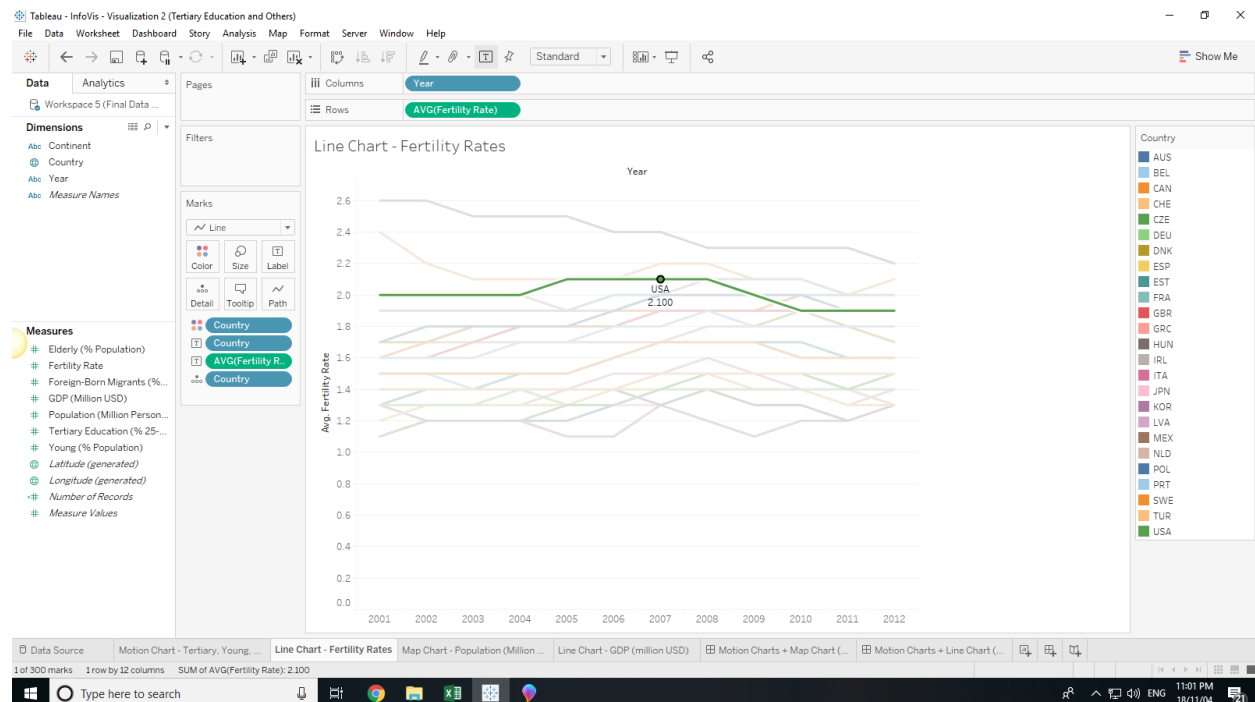
Fertility rates are measured as ratio of children per woman, with many of the lines appearing below the number 2.1 This number is important because 2.1 is considered to be the ratio for maintaining a stable population, assuming no migration and unchanged mortality. Ratios less than 2.1 mean that fewer children are being born, thus contributing to the shrinking of the young population. Explanations for this reduced ratio include postponement of family formation and a desire for smaller family sizes.

Here is a map chart for the populations of the countries in 2001:
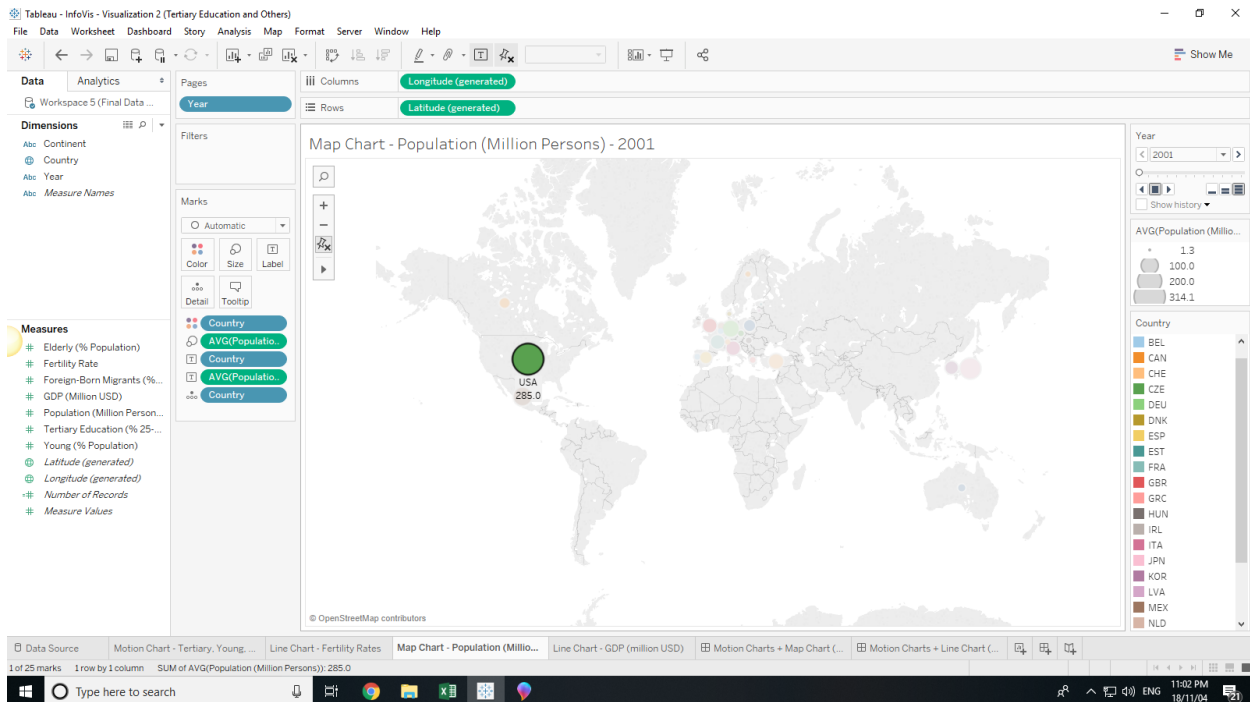
And here is a map chart for the populations of the countries in 2012:
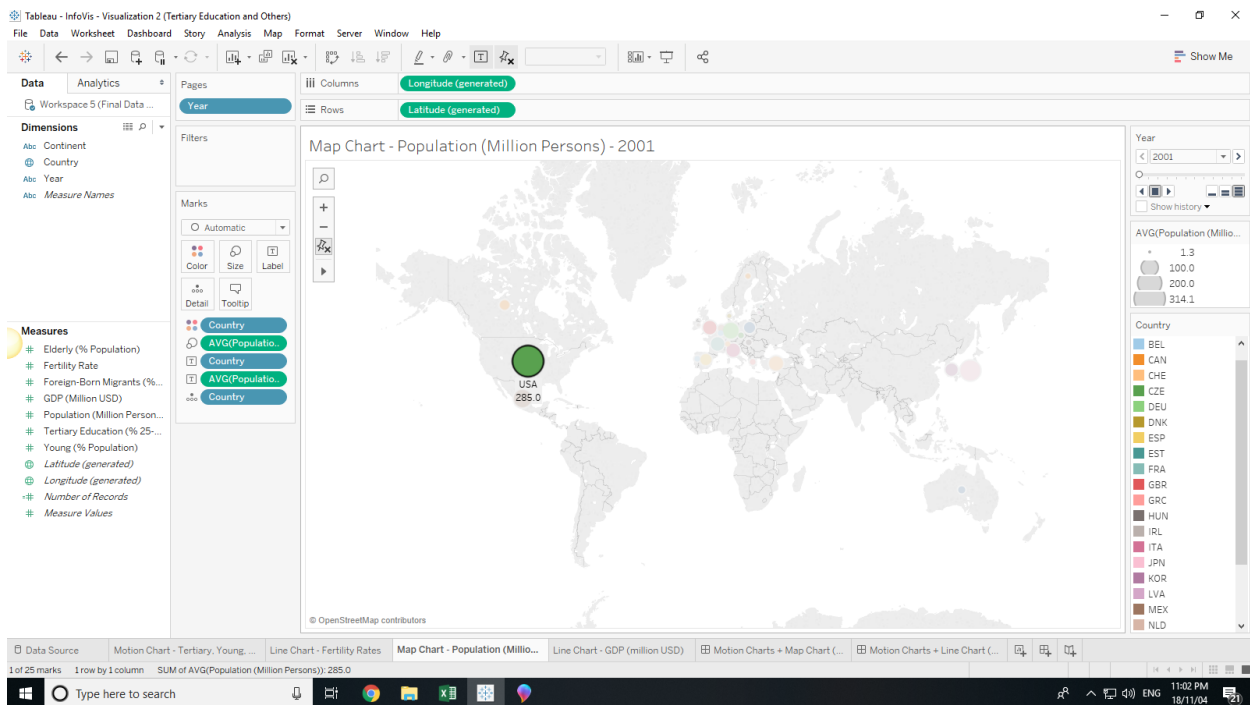
While not every number is visible on the map, the general trend is that the populations are increasing. Now given that the young population is shrinking overall and that the fertility rates are mostly below 2.1, this increase in population can be attributed to migration into the countries.
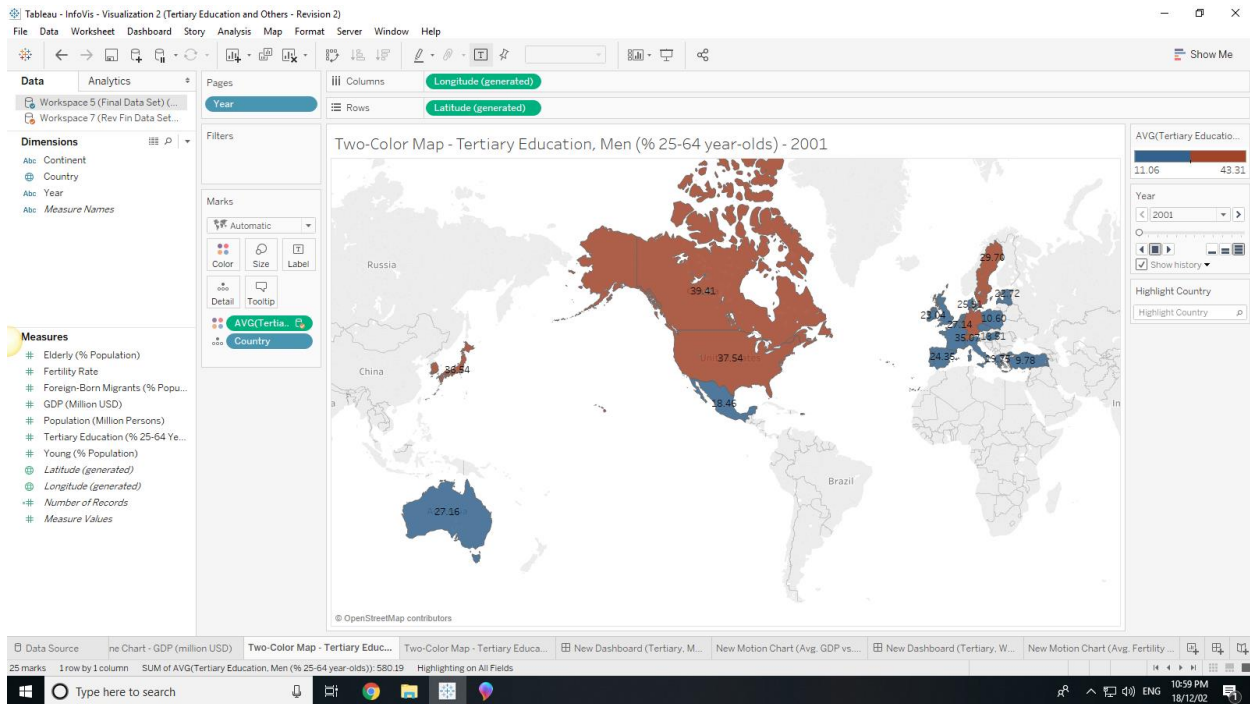
Here is a line chart of the GDPs for each of the countries over the twelve years:
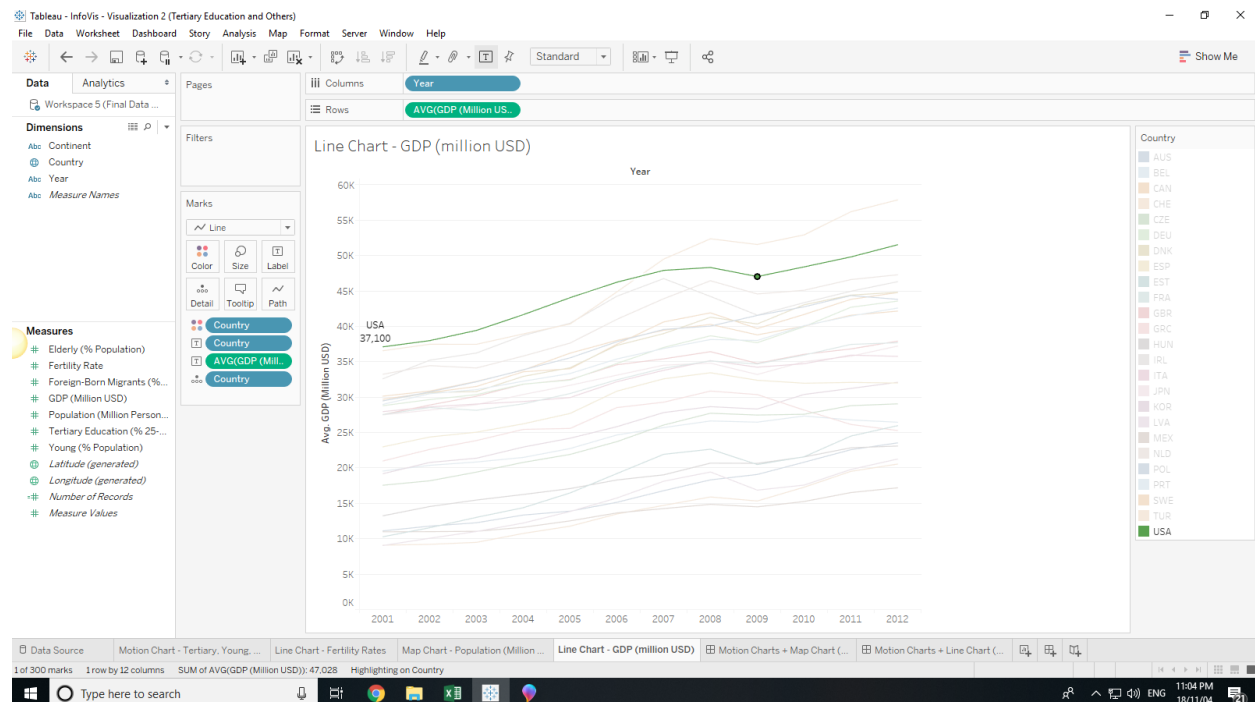
The overall trend here is that GDP increased from 2001 to 2012 with a dip around 2008 and 2009 which corresponds to the financial crisis during the same time period. Some countries though, such as GRC (Greece) and ESP (Spain), exhibit even more severe downturns than other countries like CHE (Switzerland) and USA (United States of America). A possible explanation this trend in relation to the other data in this analysis could be that tertiary education enables improved productivity over the long term.

Here is a two-color map for the percentage of men with tertiary education for each of the countries for 2001 with values included:

And here is a two-color map for the percentage of men with tertiary education for each of the countries for 2012, also with values included:

The countries in red are the ones with a relatively high percentage of men with tertiary education. The displayed values increase from 2001 to 2012; however, worth noting is that the number of red countries also increases, especially in Europe. This would indicate a striking increase in education attainment among the male population.
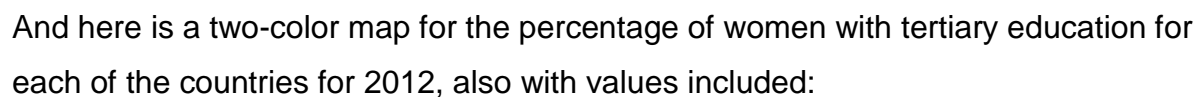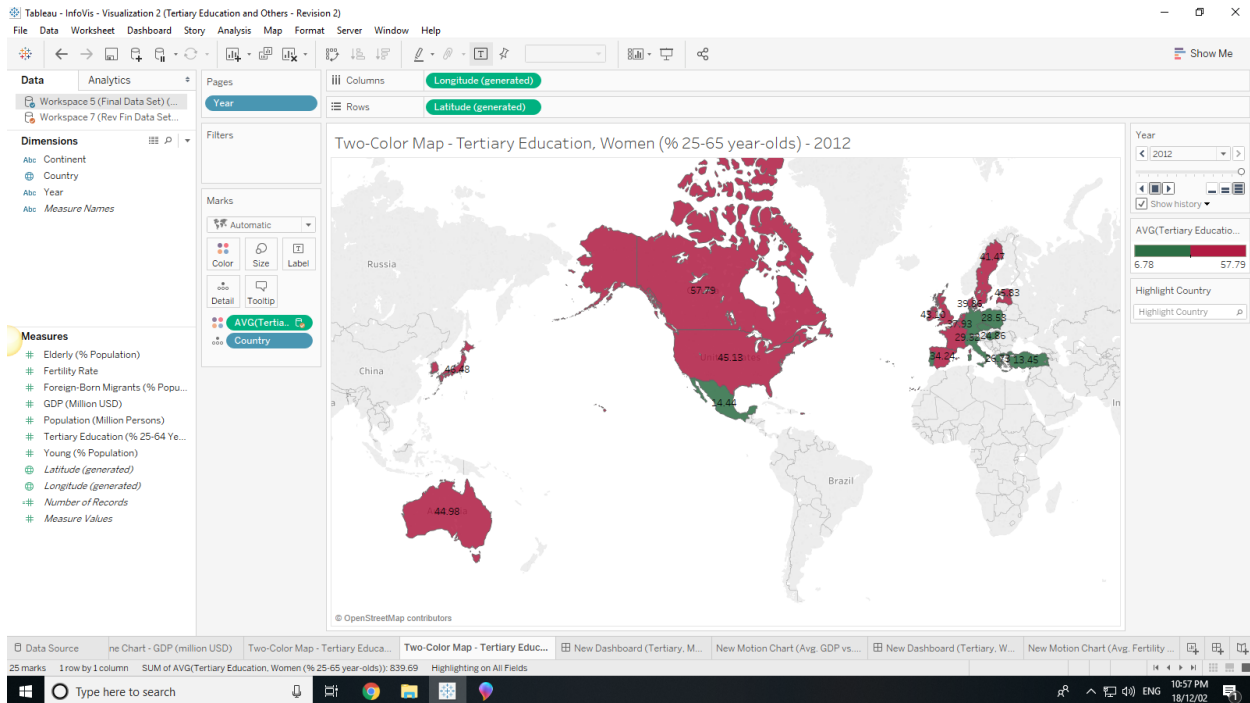
Here is a two-color map for the percentage of women with tertiary education for each of the countries for 2001 with values included:
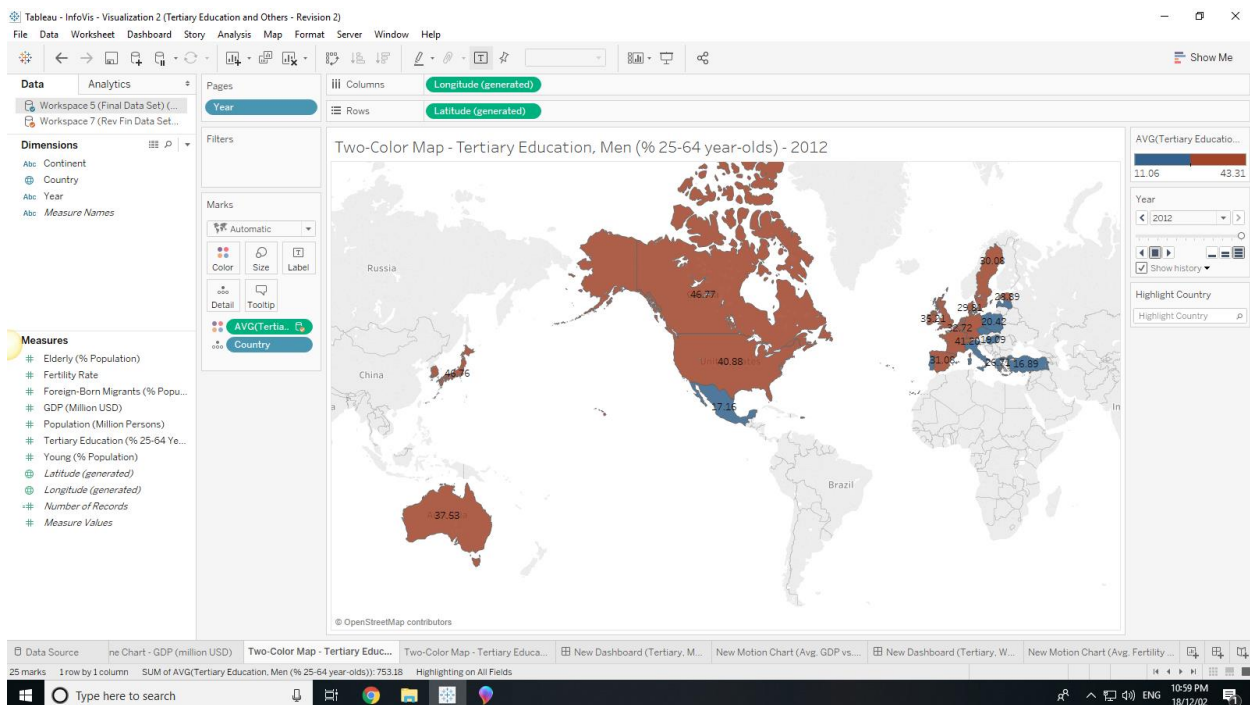
And here is a two-color map for the percentage of women with tertiary education for each of the countries for 2012, also with values included:

Similar to the case for the men, the countries in red are the ones with a relatively high percentage of women with tertiary education. The displayed values here also increase from 2001 to 2012, and the number of red countries increases as well, notably in Europe. This would indicate a striking increase in education attainment among the female population, too.

Here is a dashboard that features the two-color map for the men:
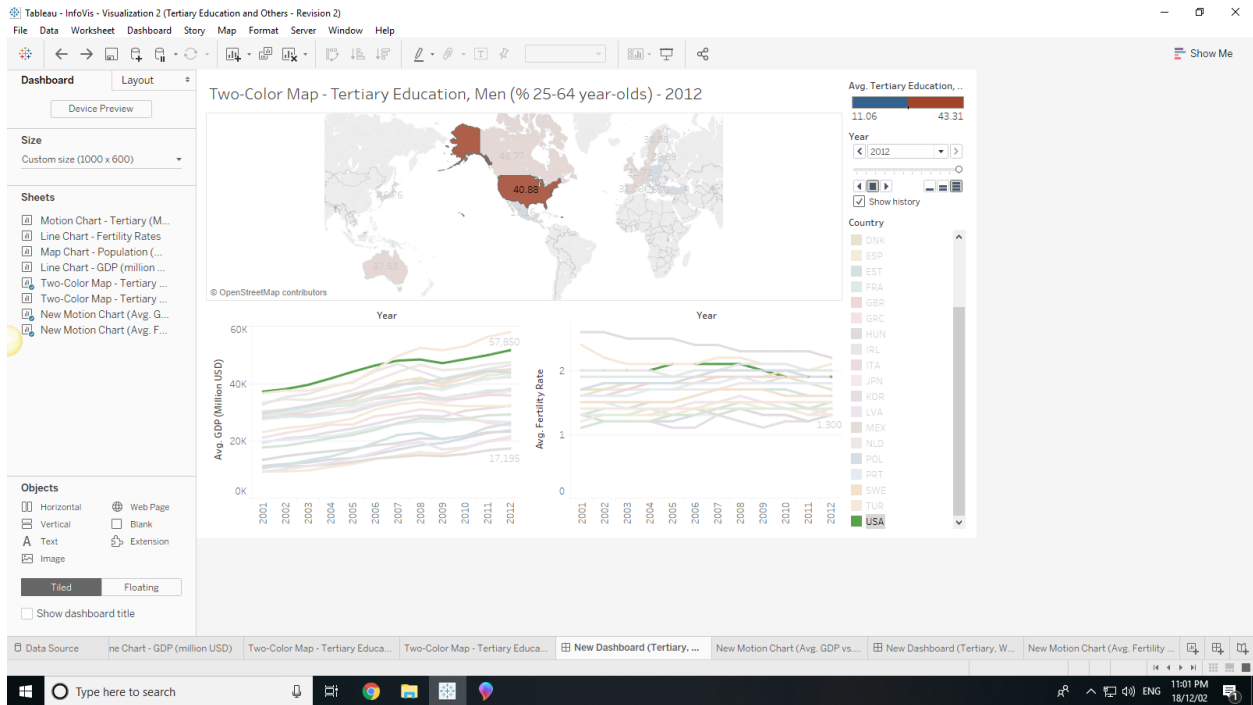
Here is a dashboard that features the two-color map for the women:
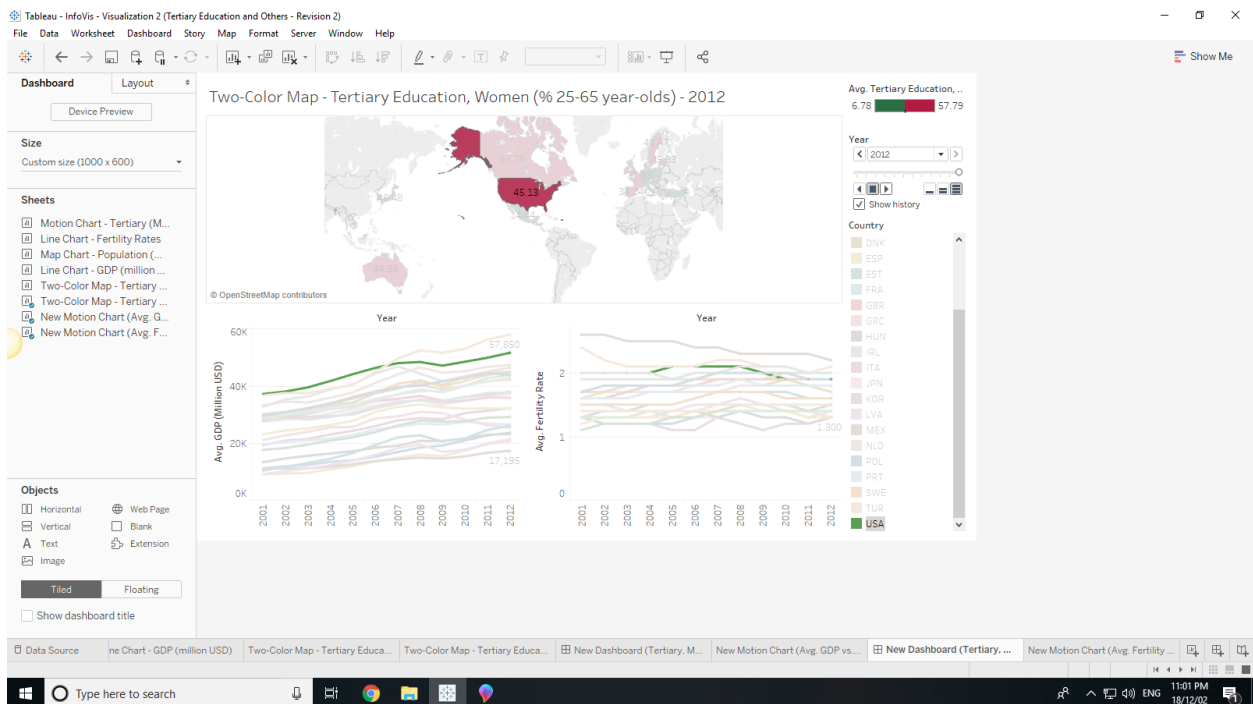
In terms of global distribution of these twenty-five countries, like in the first visualization assignment many of them are part of Europe. Three are part of North America -

Canada, United States, and Mexico. Turkey was designated an Asian country because 95% of the country is located on the Asian continent; therefore, a total of three countries are part of Asia (Japan and Korea being the other two). Only one country, Australia, is part of Oceania. There may be other countries that exhibit similar trends as these twenty-five - or maybe even completely different trends - but due to a lack of available data, those countries could not be included in this analysis.

Conclusion

It appears from the motion charts that as more men and women attain tertiary education, the young population shrinks, the elderly population increases, and the foreign-born population increases as well. Fertility rates are lower than the 2.1 mark due to the postponement of family formation and the desire for smaller family sizes; however, populations seems to increase nonetheless as a function of migration. Moreover, GDP increases over the twelve-year period, perhaps in part as a function of tertiary education attained which can enable higher productivity. Given these correlations, and perhaps with some additional data and analysis, an argument can be made in favor of greater access to tertiary education and more openness for immigration for the sake of overall economic prosperity.

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