

FIT3179 DATA VISUALISATION

Week 1 Lab Activity: Introduction to Tableau

Semester 2, 2023

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Activity 1: Overview of Tableau

[Tableau](#) is advanced visualisation software that enables visualisations to be created with little to no programming. We have chosen this as the focus for the first half of this class as there is a wide range of programming skills amongst the students we are teaching, and we would like to focus on theory and creation of visualisations rather than programming.

A limitation in using Tableau is that we are restricted in terms of the visualisation choices we can make. We are limited to the visualisation types offered by Tableau. However, Tableau is used across multiple industries, and the practical content that we are covering is just scratching the surface. It is worth looking at building your skills in this software, even beyond what you are doing for the assignment. [There are Tableau specific jobs out there!](#)

One benefit of using a widely respected and well-established product is that there are also many online resources you can draw on. An example can be found [here](#).

This document includes a series of questions to think about inside grey boxes. Discuss the answer to each question during the Week 1 Studio with your tutor.

Activity 2: Practice with Tableau

You can download the free public version of Tableau (so you can build your assignments at home) [here](#).

Creating a visualisation in Tableau has several steps:

1. Connecting to a data source.
2. Building visualisation sheets.
3. Creating a dashboard and putting the visualisations into it.

In this tutorial, you will learn some of Tableau's basic workflow. Our first step in making meaningful data visualisation would be *designing the visualisation* because you do not want just to jump in and build something without a plan. Before creating any visualisation, you need to ask **three basic questions: what, why, and how**.

As an example, we want to find a way to visualise the world population by country. We located our data source from [a population dataset](#) from the World Bank. The data covers a lot. It has:

- Country Name
- Country Code
- Total Country Population from 1960 to 2017

For this, let's make a stacked bar chart with *filters* for *country* and *year*. This will allow an overview, then filtering to get details. We will create this visualisation with Tableau.

2.1 Importing the Dataset

Let's start to import the dataset and have a look at it in Tableau.

2.1.1 Get Started

Step 1. Open Tableau.

We need to provide the project with a **data source**. Let's start a new project and import the Excel data from the World Bank: **FIT3179_World_Population.xlsx** (available on Moodle). To do this, on the welcome page, click "Microsoft Excel" under "Connect: To a File" (Figure 1), then select the Excel file in your local disc. Please note that if your data file is in a .csv format, you will need to click on "Text file".

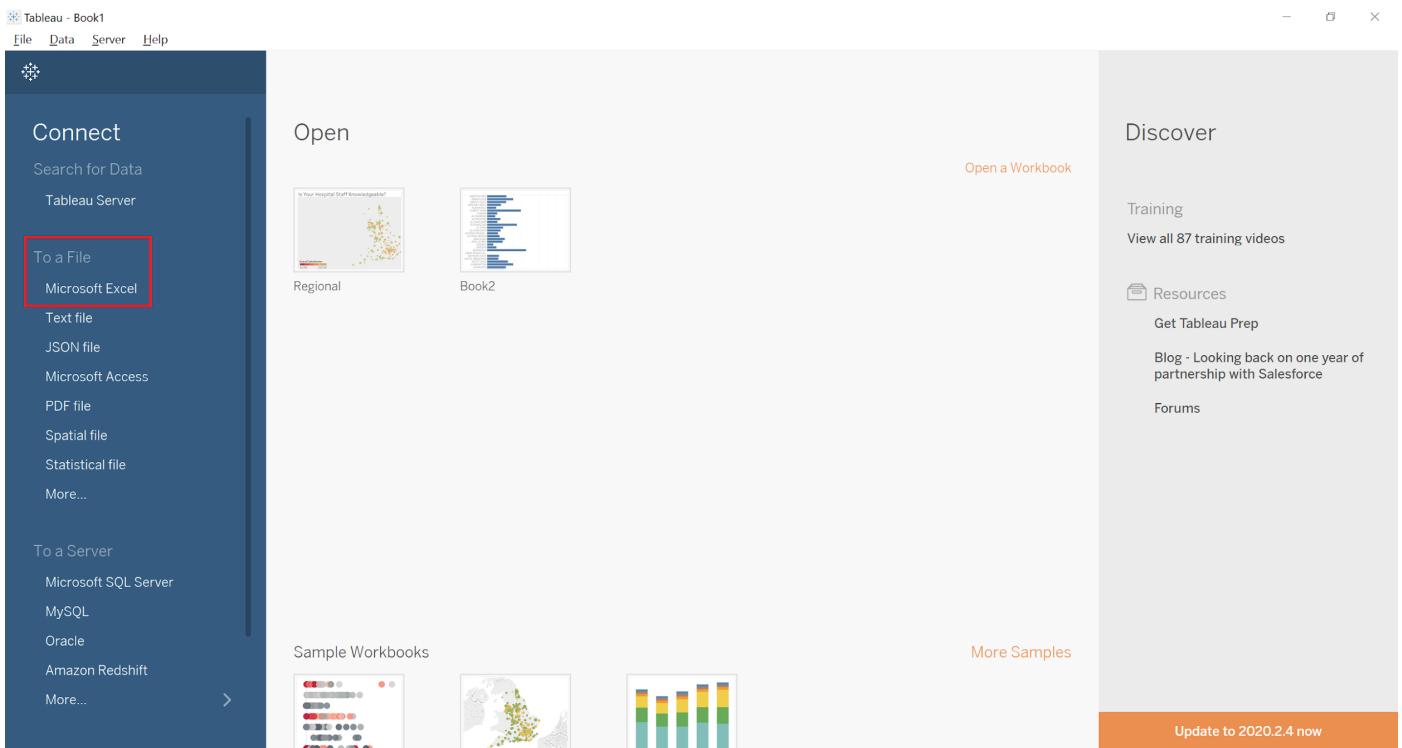


FIGURE 1. OPEN AN EXCEL DATA FILE

After Step 1, you should be able to see the Excel data imported into Tableau, and the first Excel sheet has been automatically activated (Figure 2). If so, please skip Step 2 and go to Step 3. If your sheet is not activated (Figure 3), then go to Step 2.

Data Source	World Development Indicators	Null	Null	Null	Null	Null	Null	Null	Null	Null
Last Updated Date	28/6/2018	Null	Null	Null	Null	Null	Null	Null	Null	Null
Country Name	Country Code	Indicator Name	Indicator Code	1,960	1,961	1,962	1,963	1,964	1,965	
Aruba	ABW	Population, total	SP.POP.TOTL	54,211	55,438	56,225	56,695	57,032	57,360	5
Afghanistan	AFG	Population, total	SP.POP.TOTL	8,996,351	9,166,764	9,345,868	9,533,954	9,731,361	9,938,414	10,15
Angola	AGO	Population, total	SP.POP.TOTL	5,643,182	5,753,024	5,866,061	5,980,417	6,093,321	6,203,299	6,30
Albania	ALB	Population, total	SP.POP.TOTL	1,608,800	1,659,800	1,711,319	1,762,621	1,814,135	1,864,791	1,91

FIGURE 2

Step 2. Select sheet from the available ones: to do so, just simply drag the sheet from the Sheets view to the Data Source view (Figure 3).

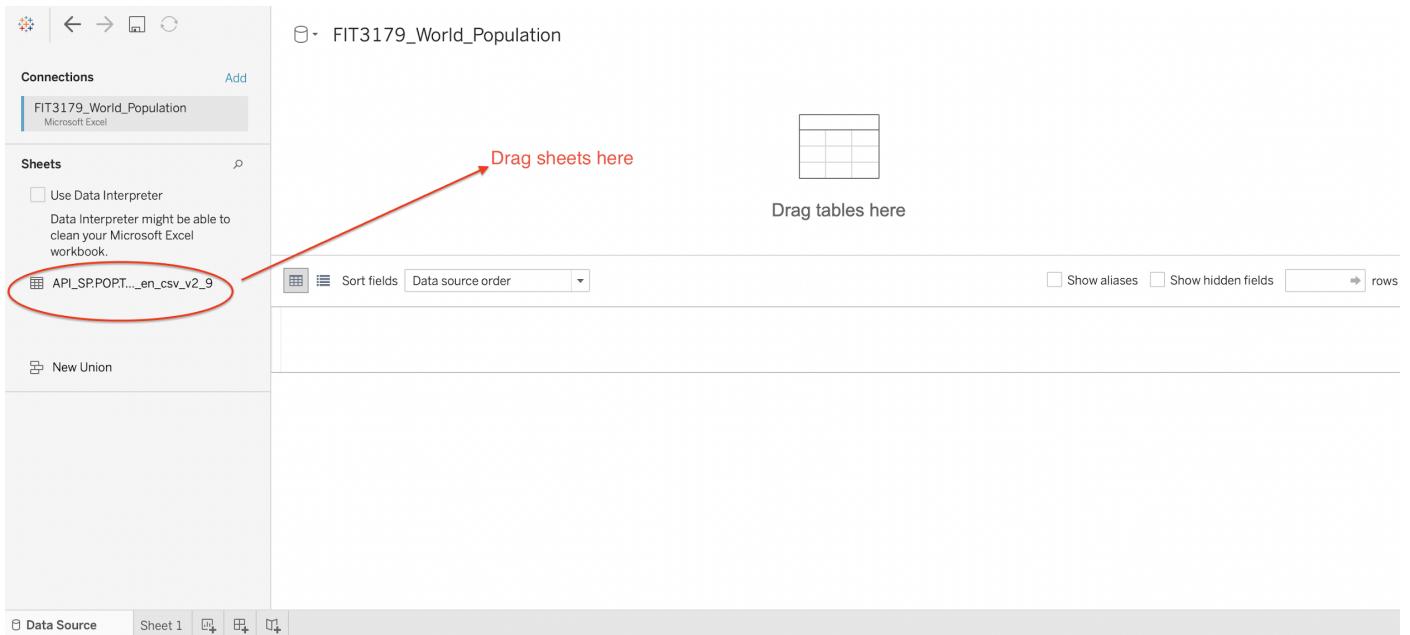


FIGURE 3

Step 3. Check the data:

You should be able to see that there is a problem with the way Tableau interpreted the dataset. The column of your data is not recognised (F1, F2, F3, etc.). Because you might not be able to edit the original Excel data on Tableau, you need to make sure your data is clean before importing it.

Abc API!SP.POP.TOTL!DS2!en!csv!v... F1	Abc API!SP.POP.TOTL!DS2!en!csv!v2!9 F2	Abc API!SP.POP.TOTL!DS2!en!csv!v2!9 F3	Abc API!SP.POP.TOTL!... F4	# API!SP.POP.T... F5	# API!SP.POP.T... F6	# API!SP.POP.T... F7	# API!SP.POP.T... F8	# API!SP.POP.T... F9	# API!SP.POP.T... F10	# API!SP.POP.T... F11
Data Source	World Development Indi...	null	null	null	null	null	null	null	null	null
Last Updated Date	6/28/2018	null	null	null	null	null	null	null	null	null
Country Name	Country Code	Indicator Name	Indicator Code	1,960	1,961	1,962	1,963	1,964	1,965	
Aruba	ABW	Population, total	SP.POP.TOTL	54,211	55,438	56,225	56,695	57,032	57,360	
Afghanistan	AFG	Population, total	SP.POP.TOTL	8,996,351	9,166,764	9,345,868	9,533,954	9,731,361	9,938,414	10
Angola	AGO	Population, total	SP.POP.TOTL	5,643,182	5,753,024	5,866,061	5,980,417	6,093,321	6,203,299	6
Albania	ALB	Population, total	SP.POP.TOTL	1,608,800	1,659,800	1,711,319	1,762,621	1,814,135	1,864,791	1
Andorra	AND	Population, total	SP.POP.TOTL	13,411	14,375	15,370	16,412	17,469	18,549	
...

FIGURE 4

Step 4. Clean the data.

Let's open the data with Microsoft Excel and clean this up. We just need to delete the first four rows of the first sheet. Press "Ctrl + S" to save the Excel data.

B18 ffx BEN

	A	B	C	D	E	F
1	Country Name	Country Code	Indicator Name	Indicator Code	1960	1961
2	Aruba	ABW	Population, total	SP.POP.TOTL	54208	554
3	Andorra	AND	Population, total	SP.POP.TOTL	13414	143
4	Afghanistan	AFG	Population, total	SP.POP.TOTL	8994793	91649
5	Angola	AGO	Population, total	SP.POP.TOTL	5270844	53672
6	Albania	ALB	Population, total	SP.POP.TOTL	1608000	16580

FIGURE 5

Step 5. Re-import the data to Tableau.

Tableau will not refresh our data source even after we have saved the changes in the Excel file. We will need to close the connection, then reattach the data source to Tableau. To do so, open your Tableau, click on “Data” -> “Close Data Source” -> “Data” -> “New Data Source” -> “MS Excel” (Figure 6). The result is shown in Figure 7.

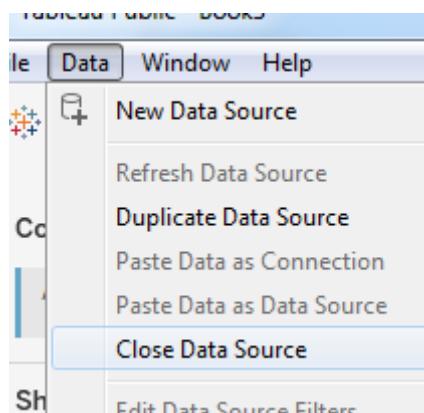


FIGURE 6

Tableau - BOOK1

File Data Server Window Help

Connections Add

FIT3179_Tutorial...rld_Population Microsoft Excel

Sheets API_SP.POP.TOTL_DS2_en_csv_v2_9 (FIT3179_Tutorial...)

Connections

Connections

API_SP.POP.TOTL_DS2_en...

Field names are in first row

Generate field names automatically

Convert to Union...

Duplicate

Remove

Sort fields Data source order

Show aliases Show hidden fields 265 row

Abc API_SP.POP.TOTL/DS2/en/csvv...	Abc API_SP.POP.TOTL/DS2/en/csvv...	Abc API_SP.POP.TOTL/DS2/en/csvv...	Abc API_SP.POP.TOTL/DS2/en/csvv...	# API_SP.POP.TOTL/DS2/en/csvv...						
F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11
Country Name	Country Code	Indicator Name	Indicator Code	1,960	1,961	1,962	1,963	1,964	1,965	1,966
Aruba	ABW	Population, total	SP.POP.TOTL	54,211	55,438	56,225	56,695	57,032	57,360	57,715
Afghanistan	AFG	Population, total	SP.POP.TOTL	8,996,351	9,166,764	9,345,868	9,533,954	9,731,361	9,938,414	10,152,331
Angola	AGO	Population, total	SP.POP.TOTL	5,643,182	5,753,024	5,866,061	5,980,417	6,093,321	6,203,299	6,309,770
Albania	ALB	Population, total	SP.POP.TOTL	1,608,800	1,659,800	1,711,319	1,762,621	1,814,135	1,864,791	1,914,573
Andorra	AND	Population, total	SP.POP.TOTL	13,411	14,375	15,370	16,412	17,469	18,549	19,647
Arab World	ARB	Population, total	SP.POP.TOTL	92,490,932	95,044,497	97,682,294	100,411,076	103,239,902	106,174,988	109,230,593
United Arab Emirates	ARE	Population, total	SP.POP.TOTL	92,634	101,078	112,472	125,566	138,529	150,362	160,481

Data Source Sheet 1

FIGURE 7

Step 6.

If the first row is not recognised as column names, you can manually specify it by clicking on the small triangle icon on the data source. And then select “Field names are in the first row” (Figure 7). After that, the result is shown in Figure 8.

The screenshot shows the Tableau interface with the following details:

- Connections:** FIT3179_Tutorial.rld_Population (Microsoft Excel)
- Sheets:** API_SP.POP.TOTL_DS2_en_csv_v2_9
- Data Source Order:** API_SP.POP.TOTL_DS2_en_csv_v2_9 (highlighted with a red box)
- Columns:** The data is displayed in a grid with the following headers:

Country Name	Country Code	Indicator Name	Indicator Code	1960	1961	1962	1963	1964	1965
Aruba	ABW	Population, total	SP.POP.TOTL	54,211	55,438	56,225	56,695	57,032	
Afghanistan	AFG	Population, total	SP.POP.TOTL	8,996,351	9,166,764	9,345,868	9,533,954	9,731,361	9,9
Angola	AGO	Population, total	SP.POP.TOTL	5,643,182	5,753,024	5,866,061	5,980,417	6,093,321	6,2
Albania	ALB	Population, total	SP.POP.TOTL	1,608,800	1,659,800	1,711,319	1,762,621	1,814,135	1,8
Andorra	AND	Population, total	SP.POP.TOTL	13,411	14,375	15,370	16,412	17,469	
Arab World	ARB	Population, total	SP.POP.TOTL	92,490,932	95,044,497	97,682,294	100,411,076	103,239,902	106,1
United Arab Emirates	ARE	Population, total	SP.POP.TOTL	92,634	101,078	112,472	125,566	138,529	1
Argentina	ARG	Population, total	SP.POP.TOTL	20,619,075	20,953,077	21,287,682	21,621,840	21,953,929	22,2
- Bottom Navigation:** Data Source, Sheet 1, etc.

FIGURE 8

This is much better! All columns in your data are recognised by Tableau!

Is there any faster way to clean up this dataset in Tableau?

2.1.2 Importance of the Dataset Shape

Step 1.

Once we have imported the dataset, we can start making visualisations! We can make multiple visualisations with a single dataset. Tableau has already made a sheet for us, as highlighted with red frame in Figure 8. Click on it, and let's use this sheet and start from here (Figure 9).

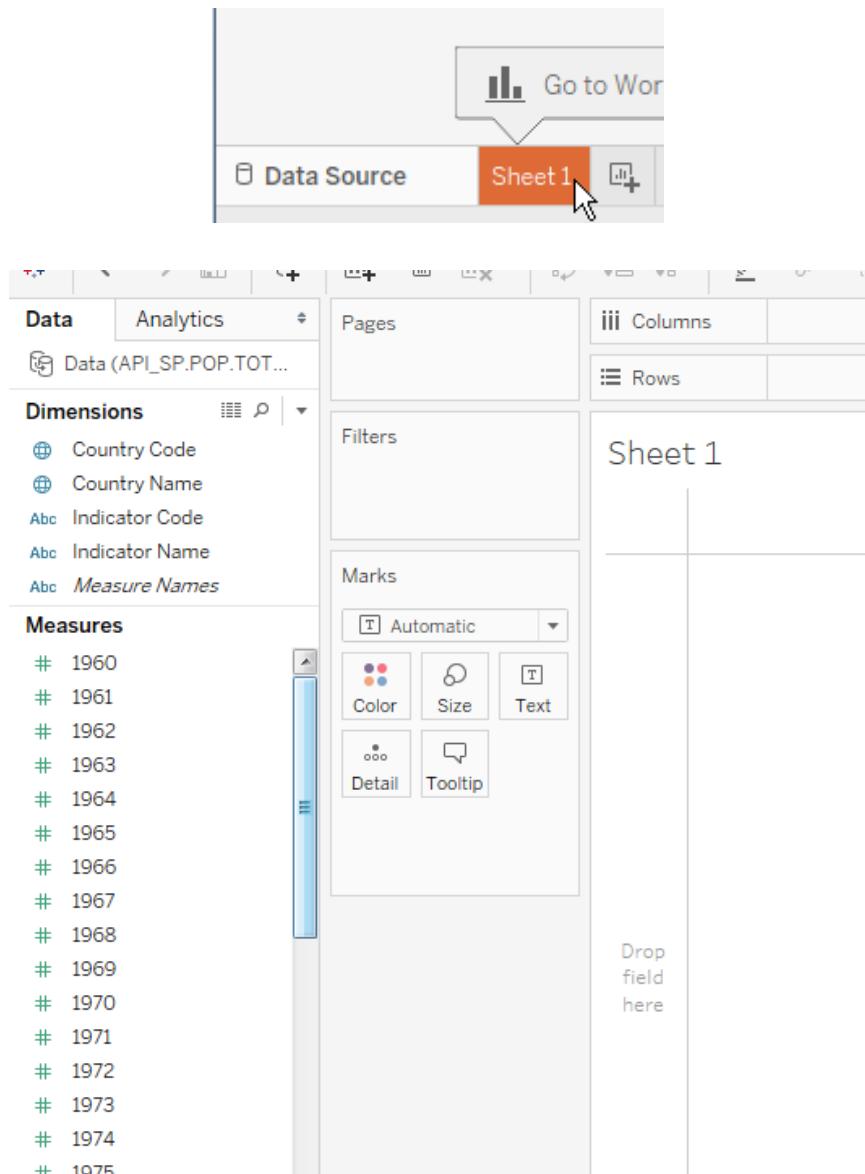


FIGURE 9

Look at the Data panel. You can see that the fields of the table are categorised into Dimensions and Measures.

What are the differences between these two categories?

Some important interfaces (panels) that you need to pay attention to are: *Dimensions*, *Measures*, *Filters*, *Marks*, *Columns* and *Rows*. Try to think/discuss/discover the functionality of each panel.

Step 2.

To create our first visualisation, what we want is to have **country names** as the **columns (x-axis)**, and the **year data** as Rows (y-axis). Let's put that together.

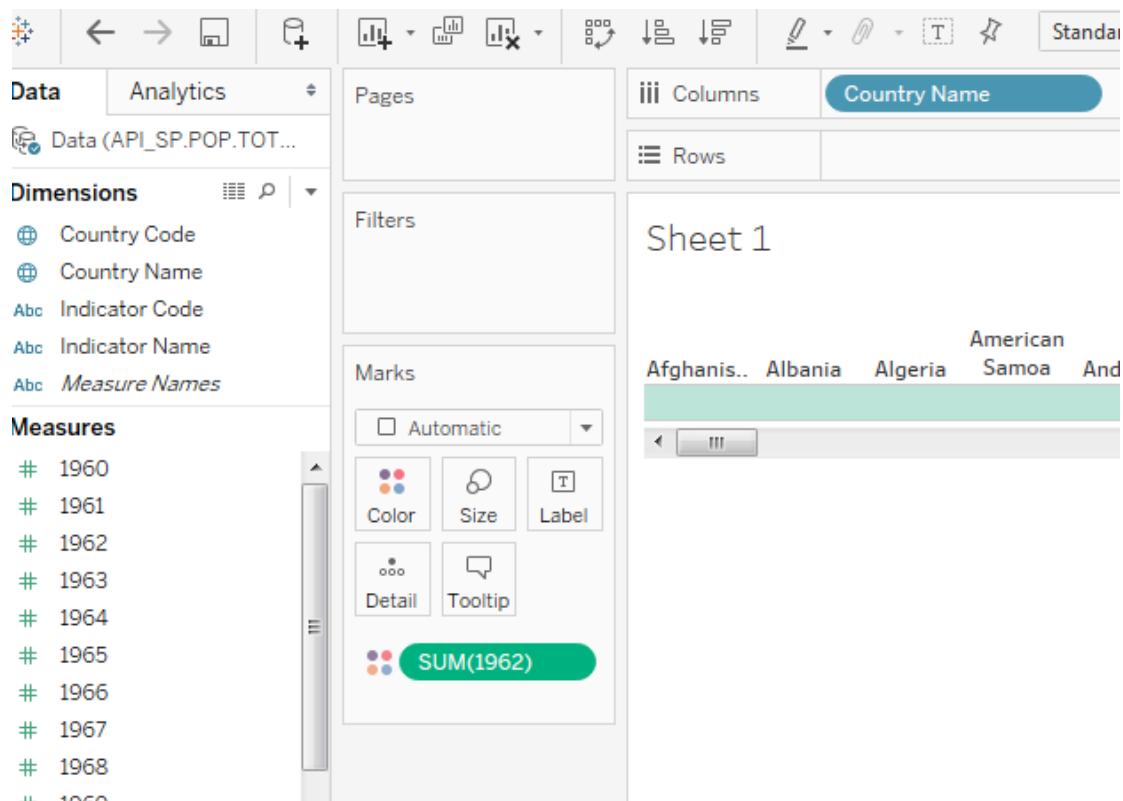


FIGURE 10

We can easily get the country name into the columns (Figure 10). However, when we try to add multiple years to the Marks, unfortunately, Tableau does not allow us to do it.

Before moving on to the next step, can you explain why the shape of this dataset is not suitable for analysis?

Step 3.

We MUST **RESHAPE** our data! In fact, a good rule-of-thumb is that each piece of data should be in a separate column, i.e., what we want is: from a wide format (Figure 11) to a long format (Figure 12).

BEFORE

Country Name	Country Code	Indicator Name	Indicator Code	# Data 1960	# Data 1961	# Data 1962	# Data 1963	# Data 1964	# Data 1965
Aruba	ABW	Population, total	SP.POP.TOTL	54,208	55,435	56,226	56,697	57,029	
Andorra	AND	Population, total	SP.POP.TOTL	13,414	14,376	15,376	16,410	17,470	
Afghanistan	AFG	Population, total	SP.POP.TOTL	8,994,793	9,164,945	9,343,772	9,531,555	9,728,645	9,
Angola	AGO	Population, total	SP.POP.TOTL	5,270,844	5,367,287	5,465,905	5,565,808	5,665,701	5,
Albania	ALB	Population, total	SP.POP.TOTL	1,608,800	1,659,800	1,711,319	1,762,621	1,814,135	1,
Arab World	ARB	Population, total	SP.POP.TOTL	92,540,534	95,077,992	97,711,191	100,439,395	103,263,656	106,
United Arab Emirates	ARE	Population, total	SP.POP.TOTL	92,612	100,985	112,240	125,216	138,220	
Argentina	ARG	Population, total	SP.POP.TOTL	20,619,075	20,953,079	21,287,682	21,621,845	21,953,926	22,
Armenia	ARM	Population, total	SP.POP.TOTL	1,867,396	1,934,239	2,002,170	2,070,427	2,138,133	2,
American Samoa	ASM	Population, total	SP.POP.TOTL	20,012	20,478	21,118	21,883	22,701	
Antigua and Barbuda	ATG	Population, total	SP.POP.TOTL	54,681	55,403	56,311	57,368	58,500	

FIGURE 11. WIDE-FORMAT

AFTER

Country Name	Country Code	Year	Population
Aruba	ABW	1960	54208
Aruba	ABW	1961	55435
Aruba	ABW	1962	56226
Aruba	ABW	1963	56697
Aruba	ABW	1964	57029
Aruba	ABW	1965	57360
Aruba	ABW	1966	57712
Aruba	ABW	1967	58049
Aruba	ABW	1968	58385
Aruba	ABW	1969	58724
Aruba	ABW	1970	59065
Aruba	ABW	1971	59438
Aruba	ABW	1972	59849
Aruba	ABW	1973	60239
Aruba	ABW	1974	60525
Aruba	ABW	1975	60655
Aruba	ABW	1976	60589
Aruba	ABW	1977	60366

FIGURE 12. LONG FORMAT

You can read a lot more about [cleaning and reshaping data for Tableau here](#).

NOTE: We *strongly* recommend that you read this! It will make your assignment a lot easier to put together.

It would be quite painful to fix this manually.

There is a good online resource for it [Pivot Data from Columns to Rows](#). We suggest you look at that online tutorial on your own time. For the purpose of this tutorial, we provide you with a reshaped dataset.

You could also use other data analysis tools in R or Python to reshape your data. However, that is beyond the scope of our tutorial. For now, let's start again with this reshaped dataset (long format).

2.2 Creating a Stacked Bar Chart

Our data is now cleaned and well-structured. It's time to make the visualisation that can deliver the message we want in the WHY step of our design process. In this activity, we will try to create a stacked bar chart and add basic interactive filtering.

Step 1.

Import the **FIT3179_World_Population_Clean.csv** file into Tableau. Since .csv files are text files, you need to open a **Text file** instead of a **Microsoft Excel** file. Once you do that, you can see a new data structure similar to the figure below.

The screenshot shows the Tableau Data Source interface. On the left, under 'Connections', there is a single entry: 'FIT3179_World_Population_Clean' (Text file). Under 'Files', there is also a single entry: 'FIT3179_World_Population_Clean.csv'. A note says 'Data Interpreter might be able to clean your Text file workbook.' Below these, there is a 'New Union' section. The main area displays the data in a table:

Country Code	Country Name	Year	Population
ABW	Aruba	1960	54,211
AFG	Afghanistan	1960	8,996,351
AGO	Angola	1960	5,643,182
ALB	Albania	1960	1,608,800
AND	Andorra	1960	13,411
ARB	Arab World	1960	92,490,932
ARE	United Arab Emirates	1960	92,634
ARG	Argentina	1960	20,619,075

At the bottom, there are tabs for 'Data Source' (selected), 'Sheet 1', and other sheet icons.

FIGURE 13

Step 2. Now we can start the worksheet and try to add the country as columns and year as the marks - colour.

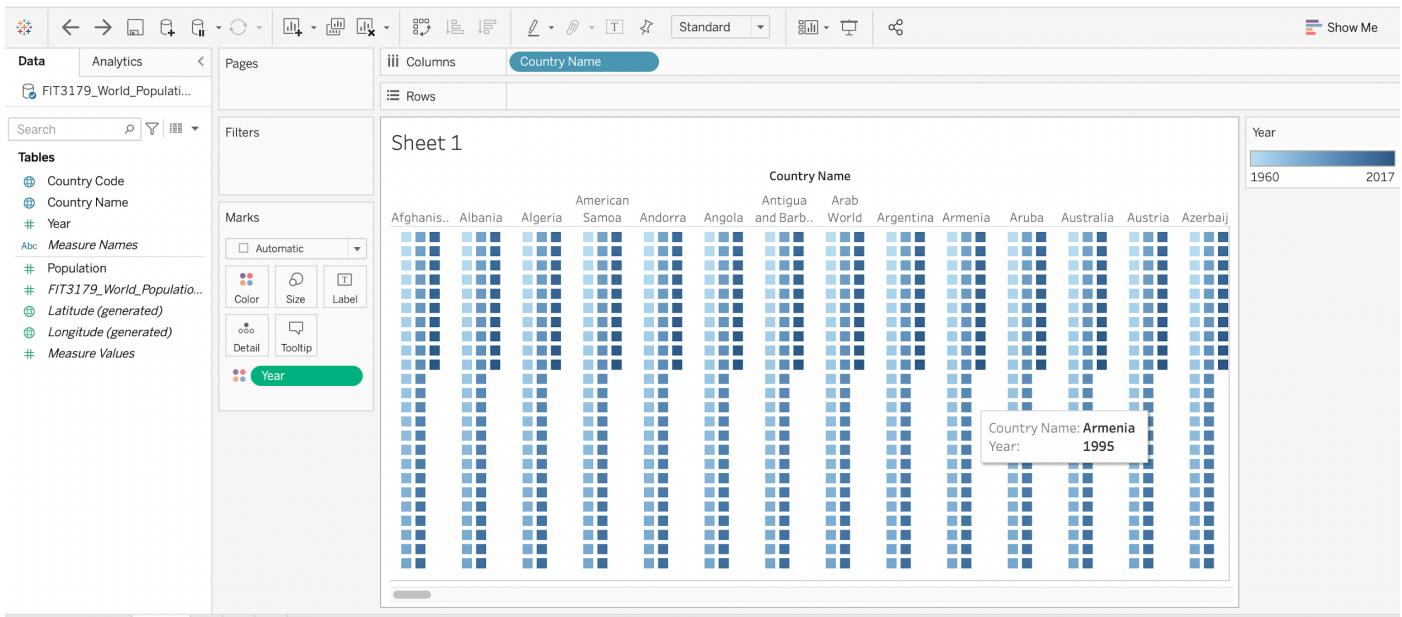


FIGURE 14

Much nicer! We will want to easily compare different years. At the moment, everything is in a shade of blue that starts very pale and gets darker.

Step 3.

The green colour of the mark interprets Year as a **continuous variable**. Since year is a **discrete variable**, we need to change it. To do so, right-click on “Year” under “Marks”, and select “Discrete”.

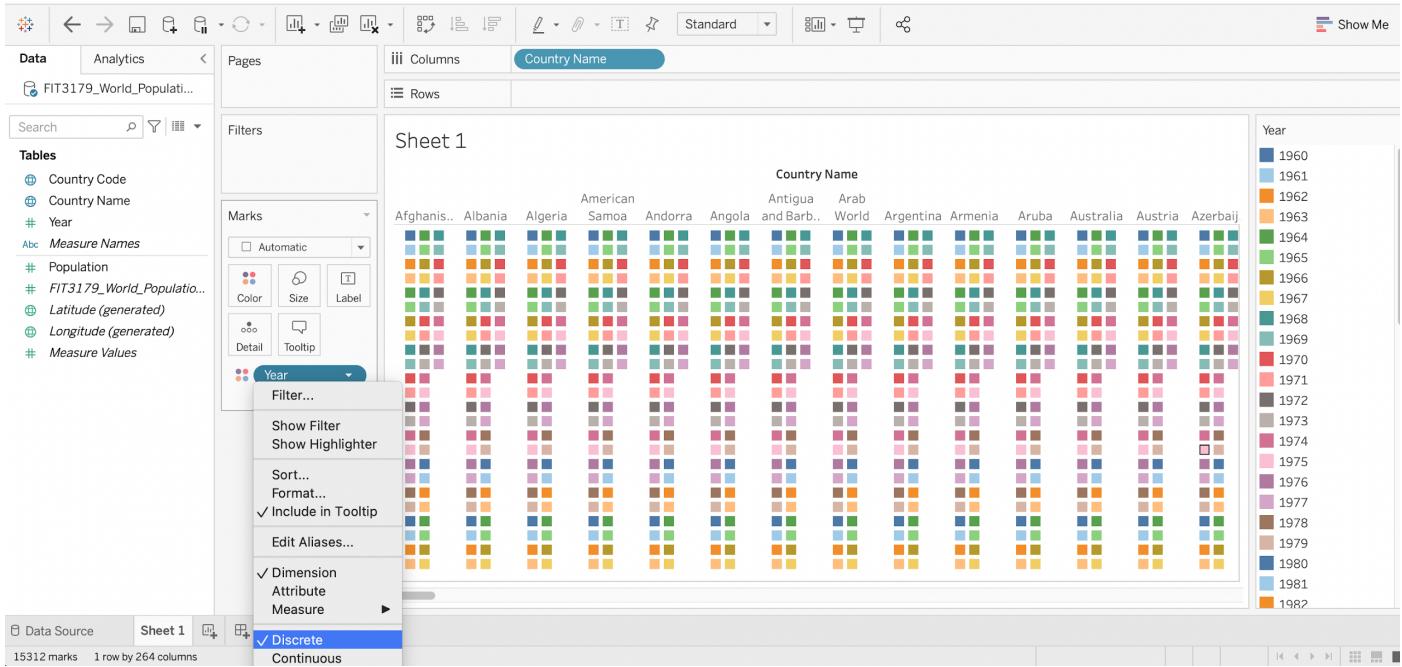


FIGURE 15

Now each year has a separate colour. Much easier to see! However, we still do not have what we want, that is, a stacked bar graph that looks like Figure 16.

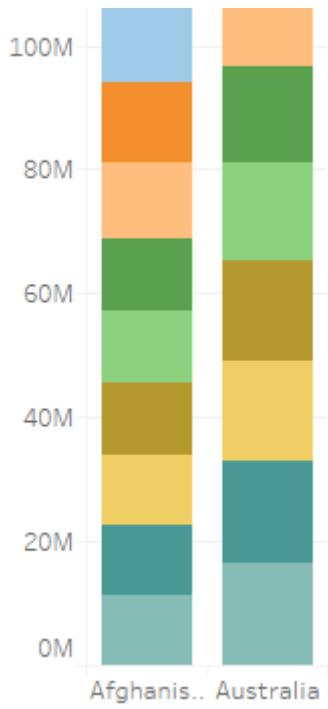


FIGURE 16

Step 4. Let's try to make this happen. We want to add something to the rows. We need to find data that represents the amount of population in each year. Luckily, Tableau automatically generates this for us.

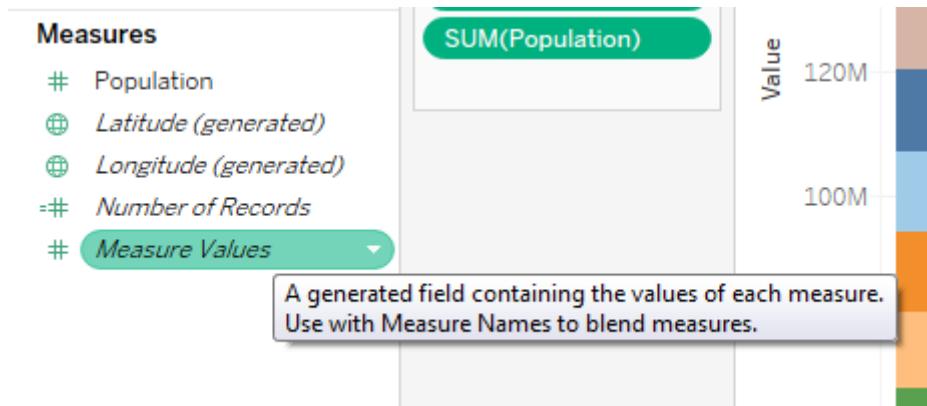


FIGURE 17

Step 5.

This is the value of each measure (in our case, each year). Perfect! Let's add that to the rows.

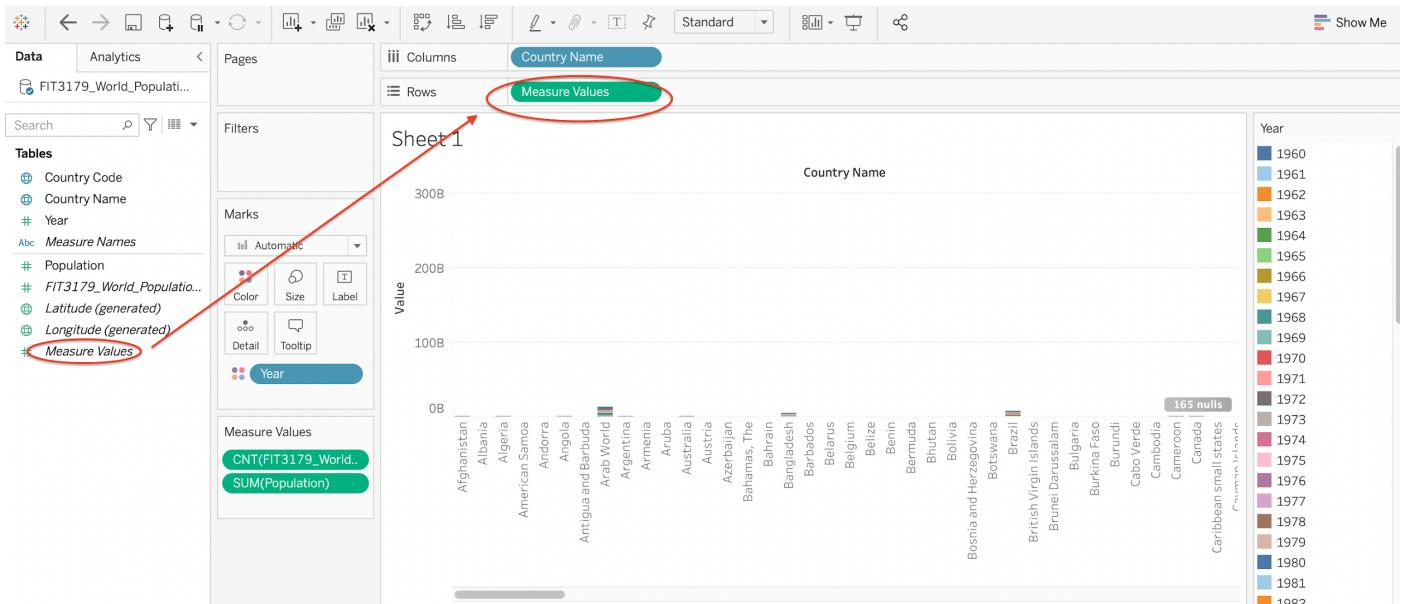


FIGURE 18

Step 6.

It's a bit hard to see what is going on here. The total world population is moving the scale so much that everything else looks small. We can add a filter to hide some of the data and improve the scale. For now, let's hide everything but the first few countries.

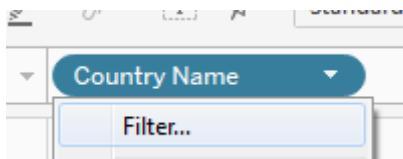




FIGURE 19

Step 7.

Much better. You will notice that when we move the mouse over these values, there is a popup. That is enough data for us; we can remove the legend. Let us also add a manual country filter, so the user can select whichever countries they want to see.

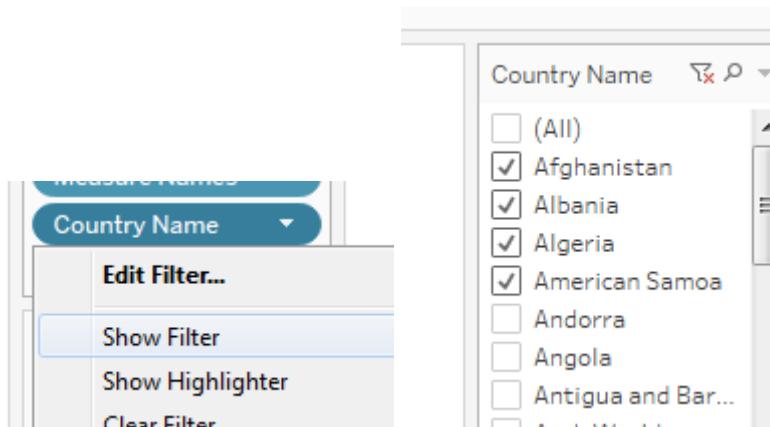


FIGURE 20

Step 8.

We are almost done. The last thing we want to do is add a way to limit the years. This allows the user to select only the years of their interest. Right-click “Year” under “Marks” and select “Show Filter”.

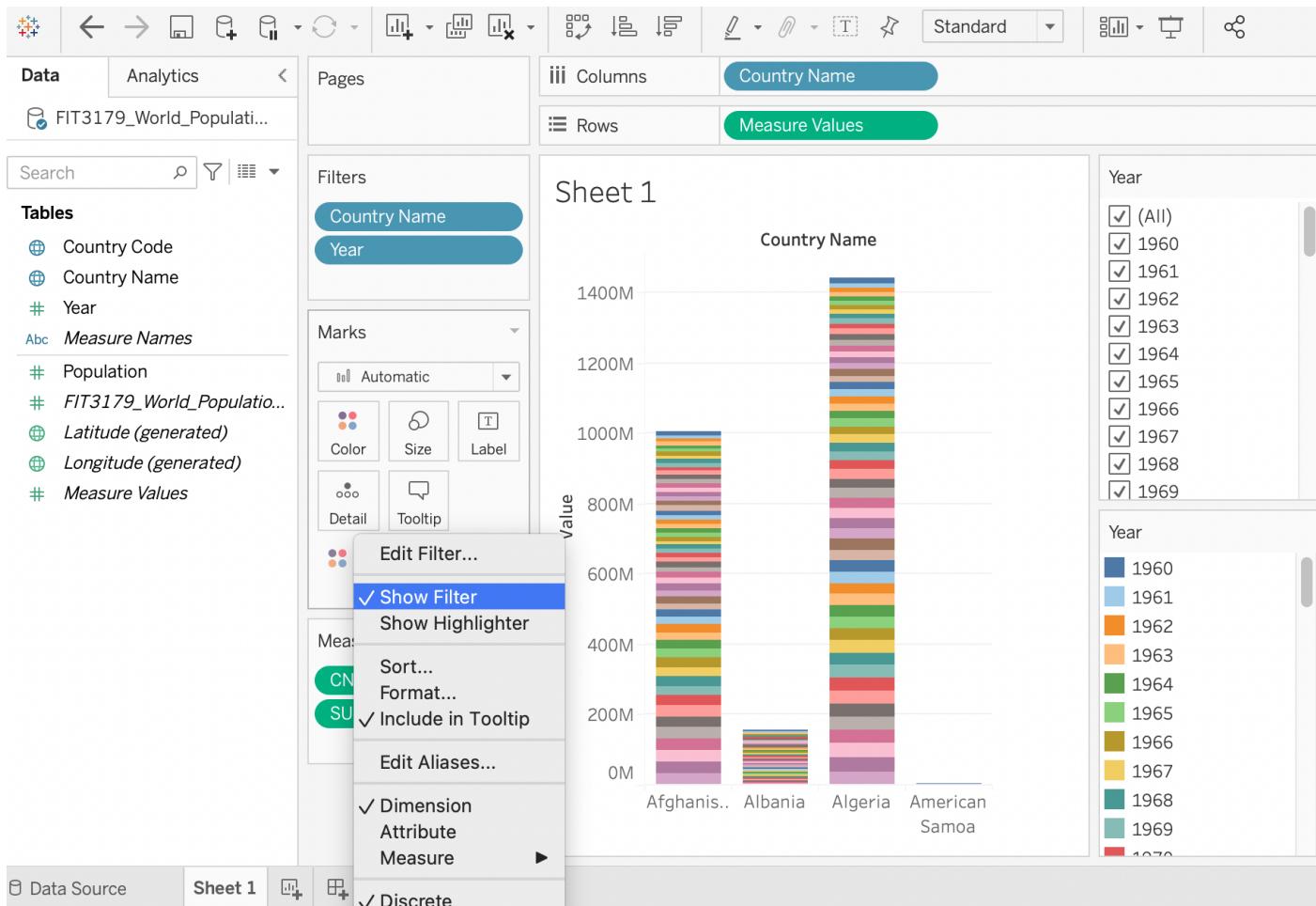


FIGURE 21

Step 9.

The choice of filter is driven by the kind of narrative we are telling. If we want the user to compare two different years (e.g., 1960 and 1980) then a list that can be ticked is best.

What will be a better interface to have if you want to filter the year by a certain range?

If your answer to the previous question is a **slider**, you are right!

In order to have a slider, we need to set the **year** as a *continuous* dataset again. We can just change this on the year filter: right-click “Year” under “Filters”, and select “Continuous”.

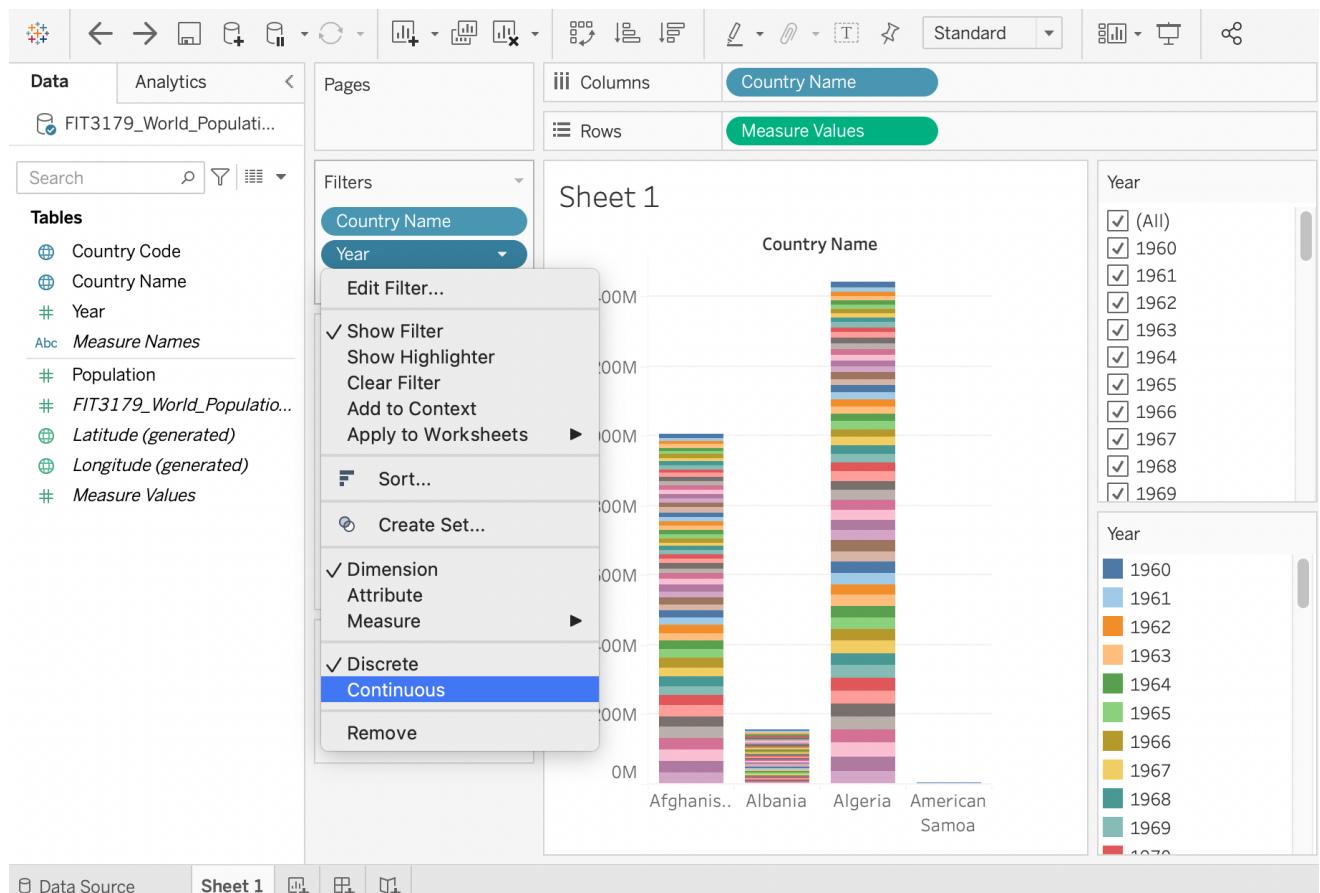


FIGURE 22

Then, a filter window will pop up (shown below).

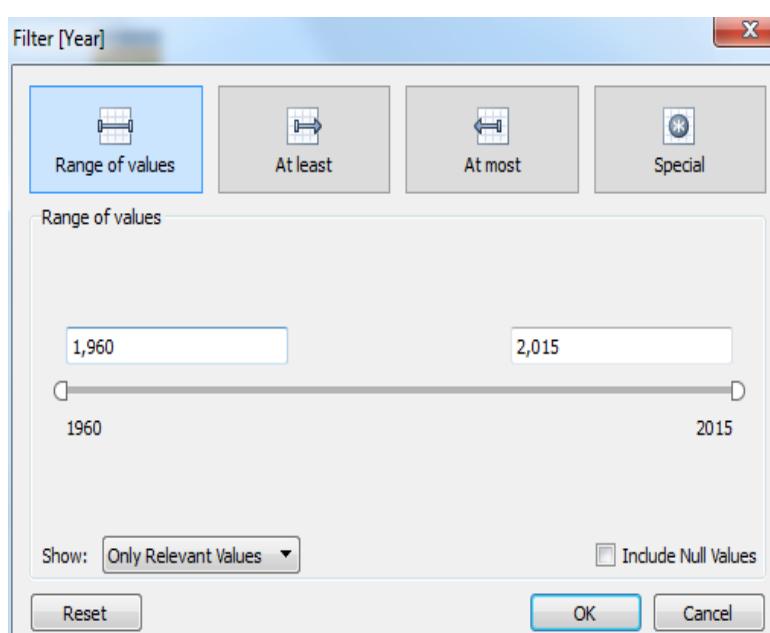


FIGURE 23

This window asks how you want this continuous dataset to function. Here we are happy with the default settings. We just need to tell Tableau to show the filter. To do so, right-click on “Year” under “Filters”, and select “Show Filter”.

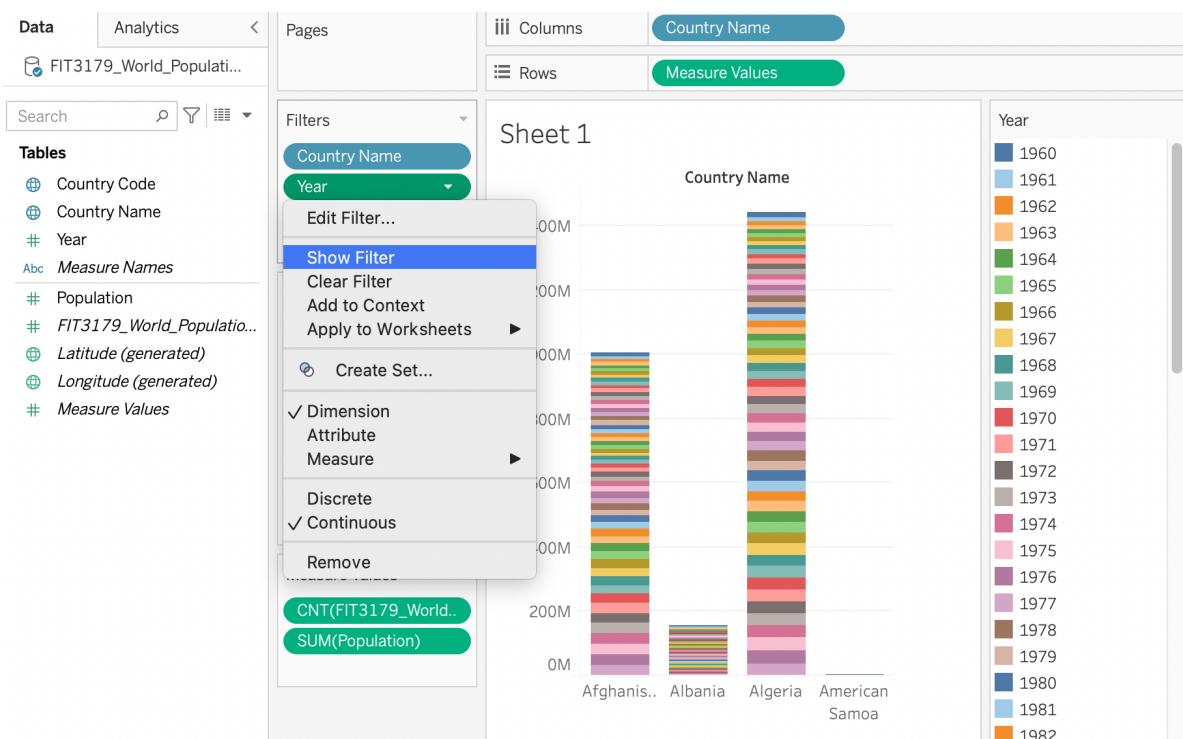


FIGURE 24

The result is shown below.

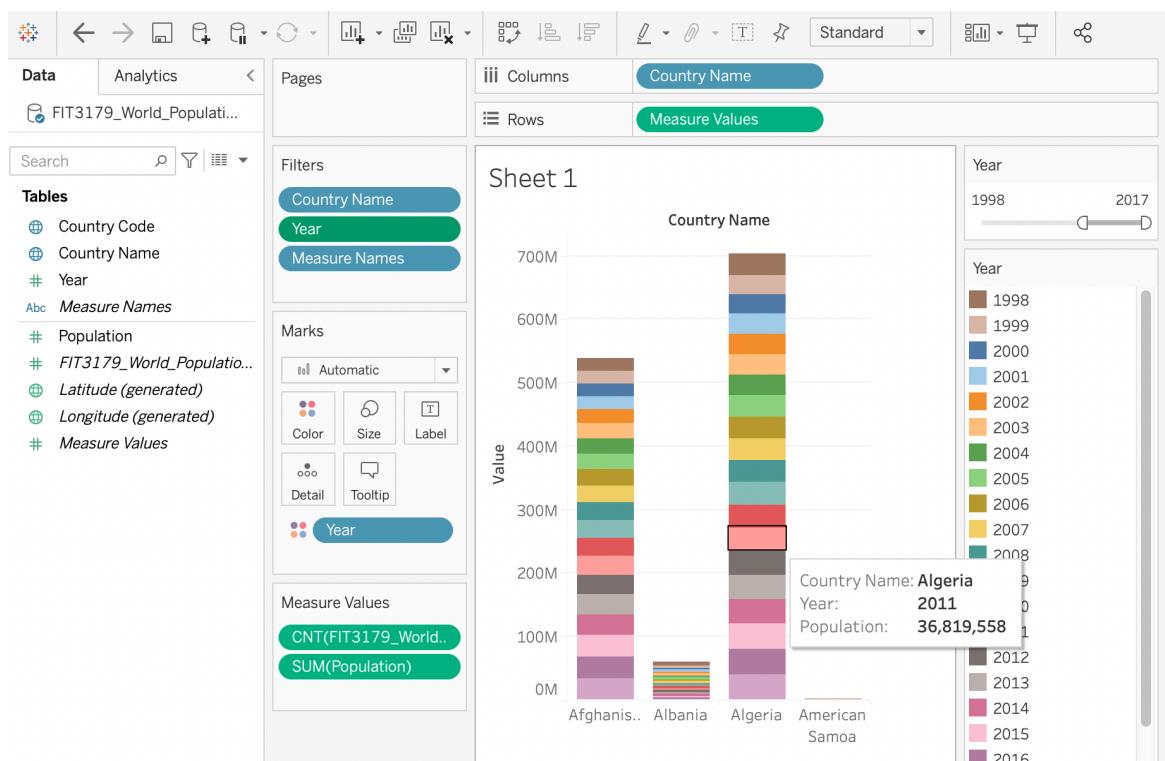


FIGURE 25

We now have a visualisation that allows direct comparison of a few selected countries by filtering, allows a range of years to be shown and provides details with a popup. However, please note that this part of the tutorial is designed to demonstrate Tableau functionalities. The result of the visualisation is, indeed, not a perfect visualisation.

- 1. What are the advantages of using a stacked bar chart in this case? Support your argument with examples.**

- 2. What are the disadvantages of using a stacked bar chart in this case? Support your argument with examples.**

2.3 Improving Our Time-Series Data Visualisation

In this section, we will investigate some other ways of communicating our narrative visualisations. Let's start fresh by creating a new sheet.

2.3.1 Creating Multiple Line Charts

Step 1. We want to compare the population over the years. Let's plot Year and Population. Put *year* in the columns, and *population* in the rows (Figure 26).

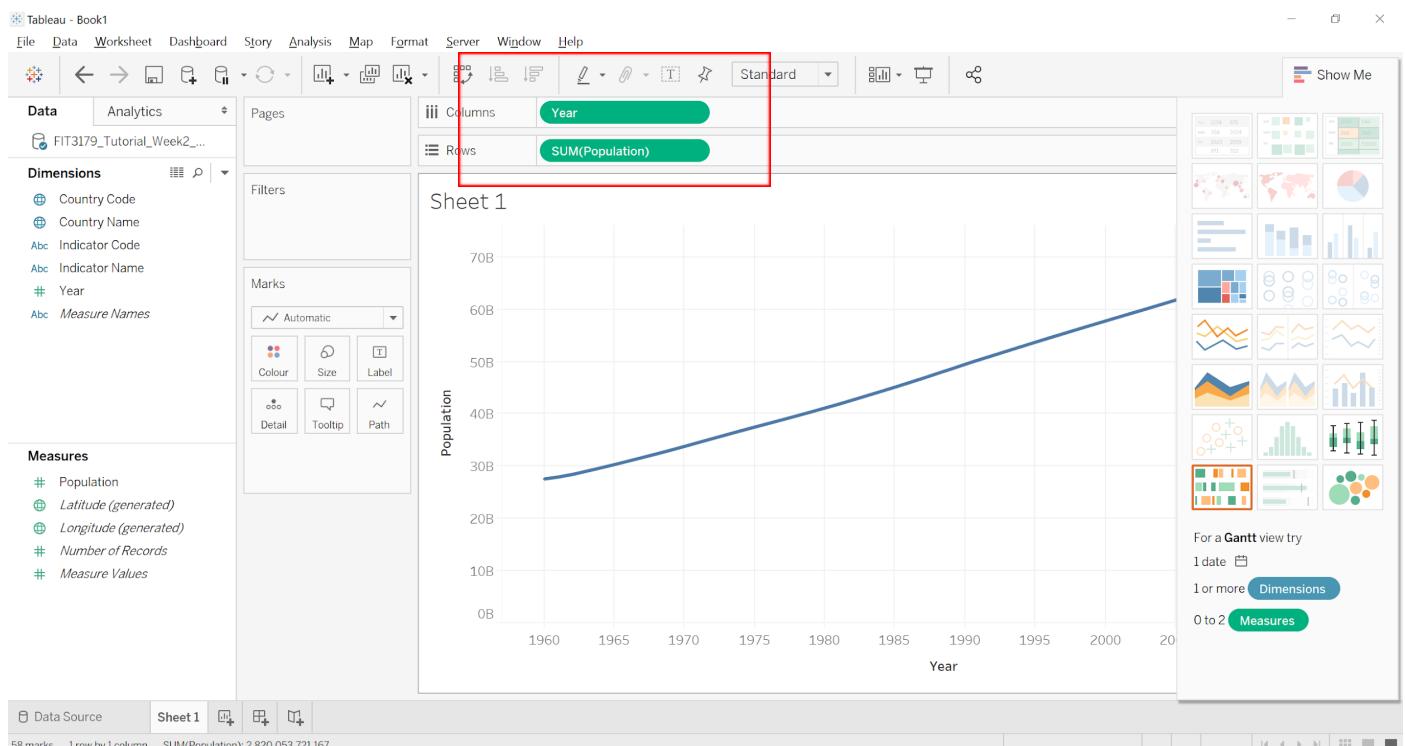


FIGURE 26

Step 2.

By default, Tableau will sum up the populations of all countries, and present that as a single line chart. Now, we would like to add the *country* dimension, and use *colour* to encode it. To do so, let's drag "Country Name" from "Dimensions" to "Marks: Colour".

Step 3.

It will trigger a warning pop up menu. For now, let's ignore it and click on **Add all members** (Figure 27).

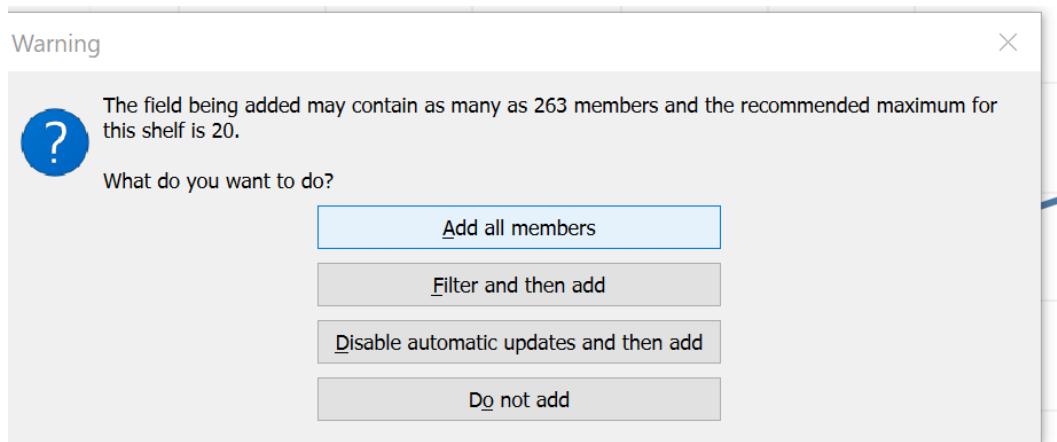


FIGURE 27



After step 3, you will see multiple lines that represent **all** countries in your dataset (Figure 28). You can hover over the individual line to check the population changes of that country/region.

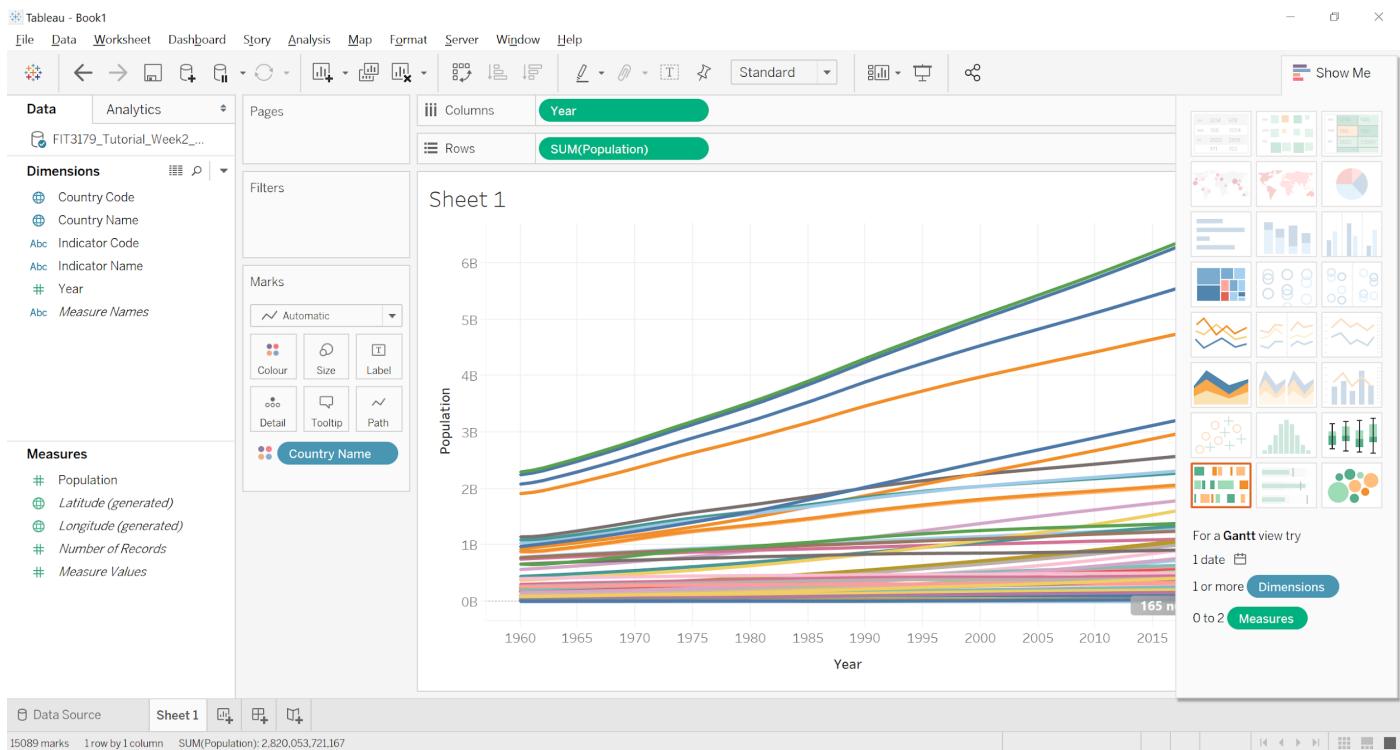


FIGURE 28

Step 4.

Apparently, this is too cluttered since there are more than 200 countries/regions presented. Let's filter out those countries. To do so, drag "Country name" from the Dimensions to "Filters" > click on "None" > and then select some countries of interest, e.g., "Australia", "China", "India", "United Kingdom", "United States". The result is shown in Figure 30.

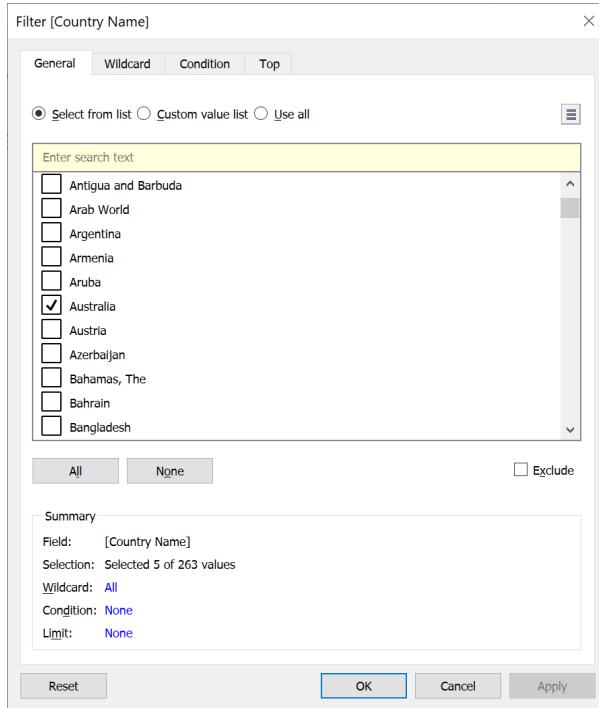


FIGURE 29

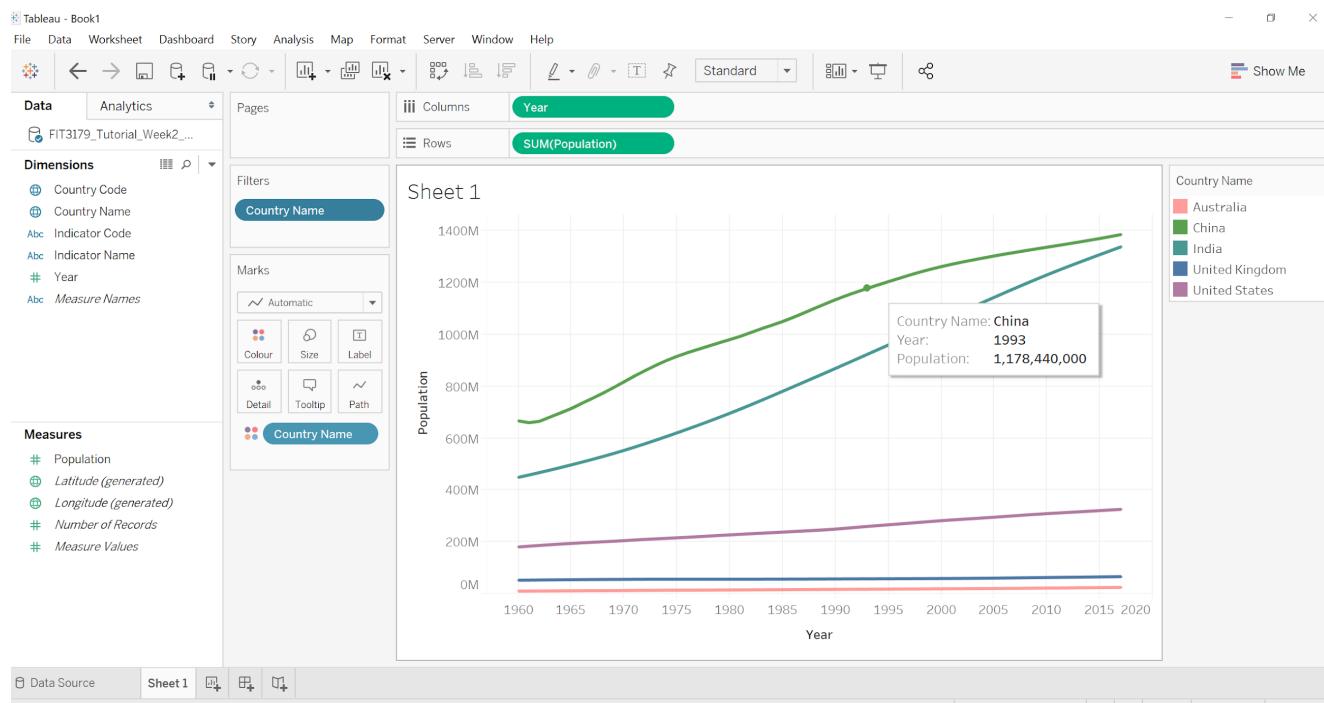


FIGURE 30

Much nicer! We now can easily compare the population of the selected countries.

Step 5.

You can also click on Colour > Edit Colours > Change the colours for different countries.

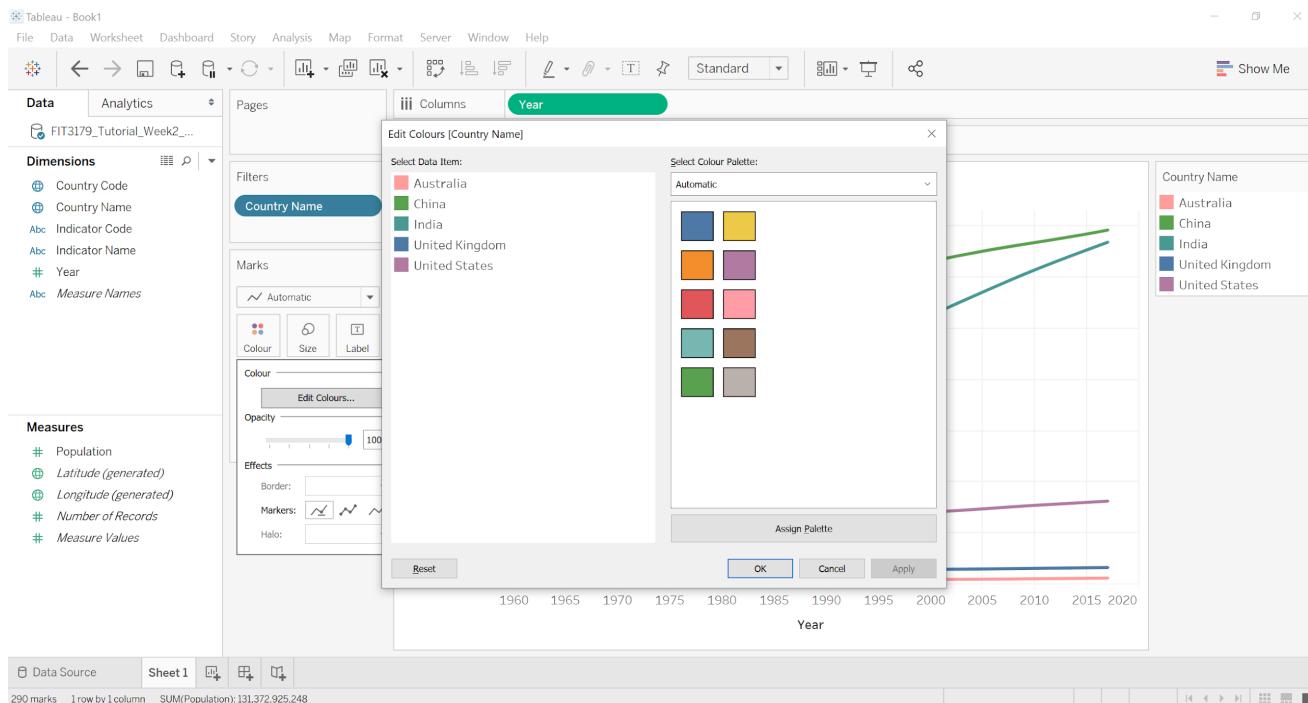


FIGURE 31

Step 6.

It is still missing the year slider and country checkboxes. Add those filters!

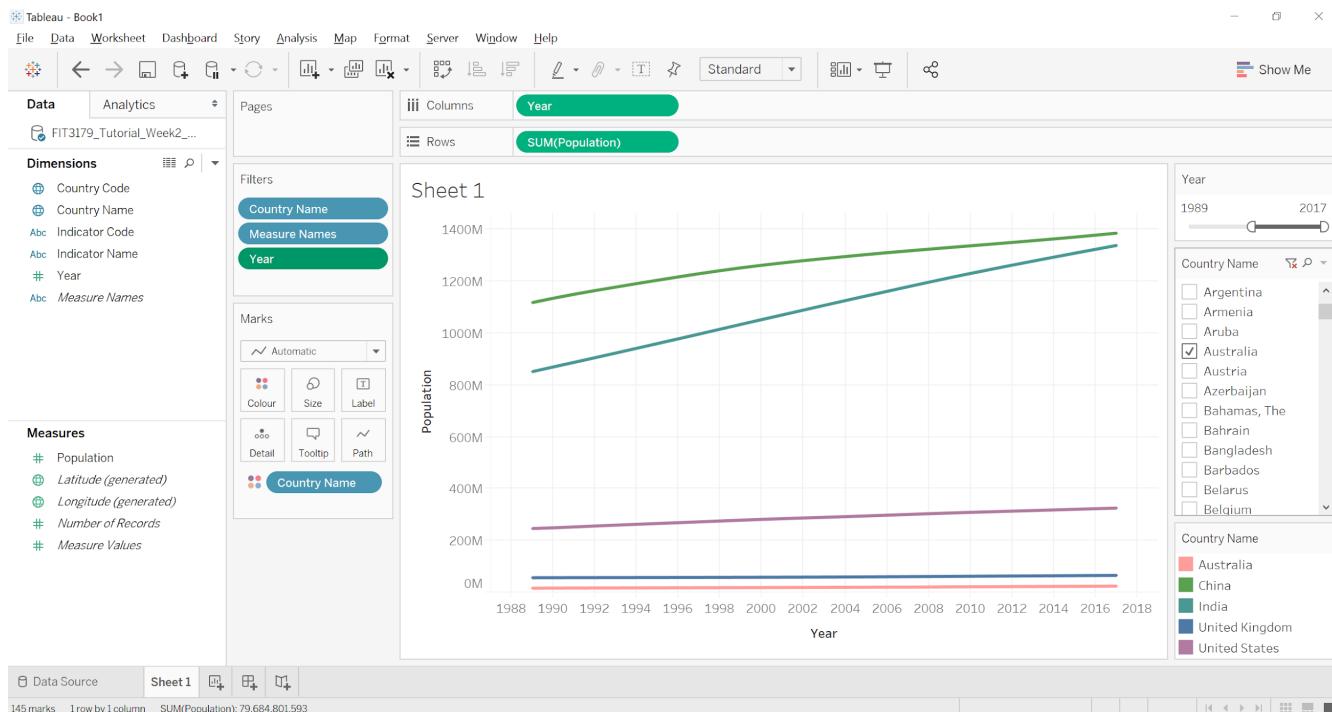


FIGURE 32

Well done! You have finished your interactive line charts.

2.3.2 Exploring the Marks

Lines look like a nice fit for this visualisation. Nevertheless, do you think it is a bit difficult to compare the population of multiple countries in a single year? Can we easily switch to a stacked bar chart to show the population ratio among countries in a single year? Yes, we can!

Look at the Marks panel. Try to change the Line to Bar. You should see this visualisation!

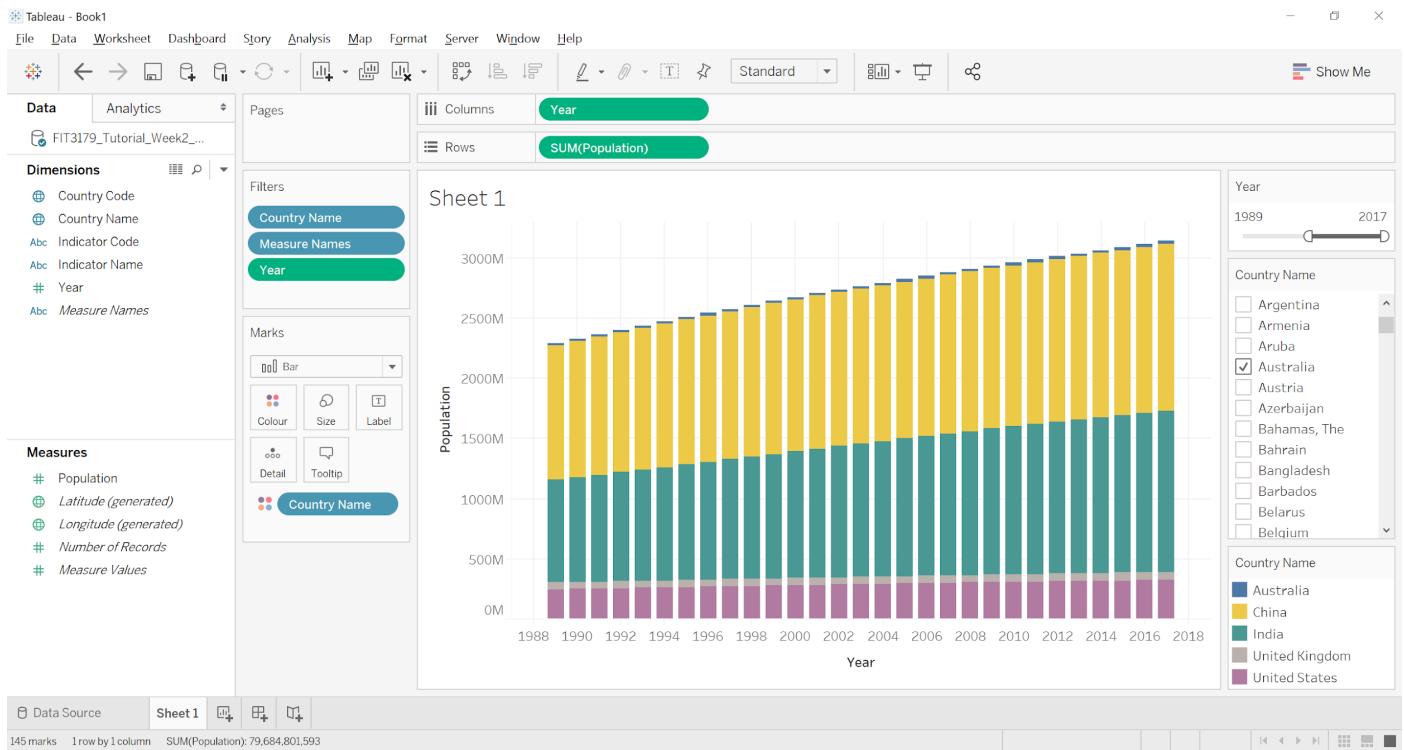


FIGURE 33.

Explore other mark types. You might discover something interesting!

In this activity, you have learned how to create interactive stacked bar charts and line charts in Tableau. You also learned the characteristics of each visualisation. Line charts are more effective to show the trend of an interval or ratio (population) data from an ordinal variable (year). We could also use colour channels to map other variables such as country (a categorical variable). Bar charts are suitable to compare the trend of discrete data across an ordinal (year) or categorical variable (country).

The visualisation cluttering can be reduced by introducing interactivity to your visualisation. In this case, we provided an interactive filter for both year and country.

In the next tutorial, you will learn more exciting features that Tableau provides to support you in making your visualisation meaningful as well as beautiful.

Activity 3: Using Visualisation Templates

You might have or might not have noticed that Tableau provides you with some basic templates under the **Show Me** button.



FIGURE 34

If you hover your cursor on one of the templates, you will see the data type requirement to create a visualisation. For example, a bar chart requires **0 or more Dimensions** and **1 or more Measures**.



FIGURE 35

Next, you will explore other ways of visualising your data and think about the character of each chart type. Create a new sheet and explore various charts provided in the templates!

3.1 Creating Tree Maps

Try to create a tree map and discuss what it is good for!

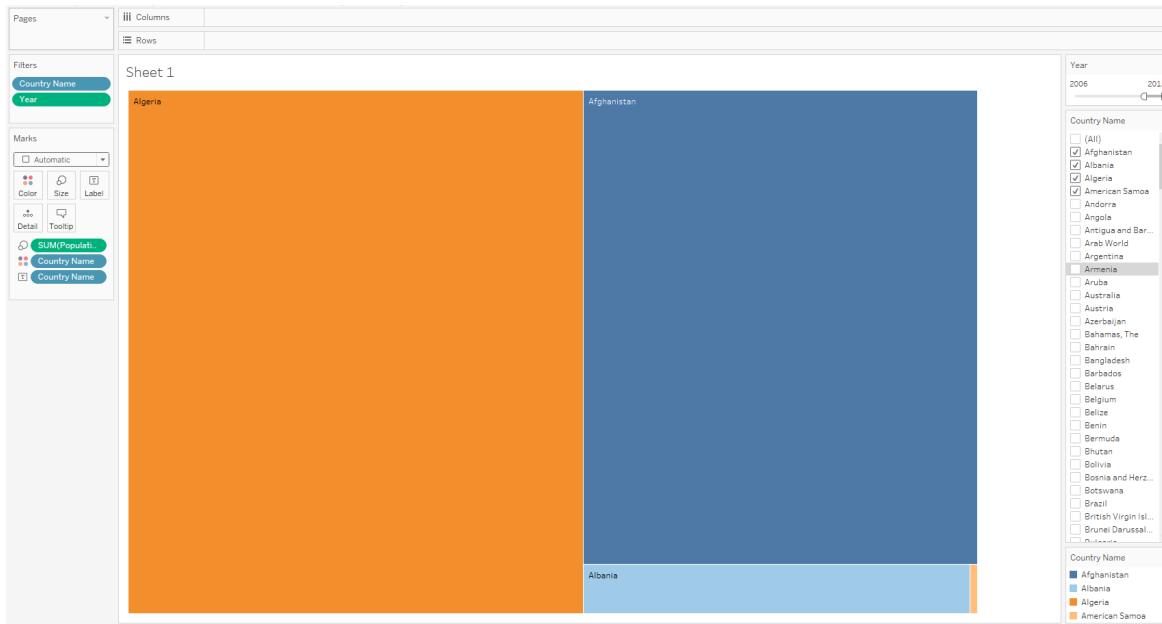


FIGURE 36

3.2 Creating Pie Charts

Try to create a pie chart and discuss what it is good for!

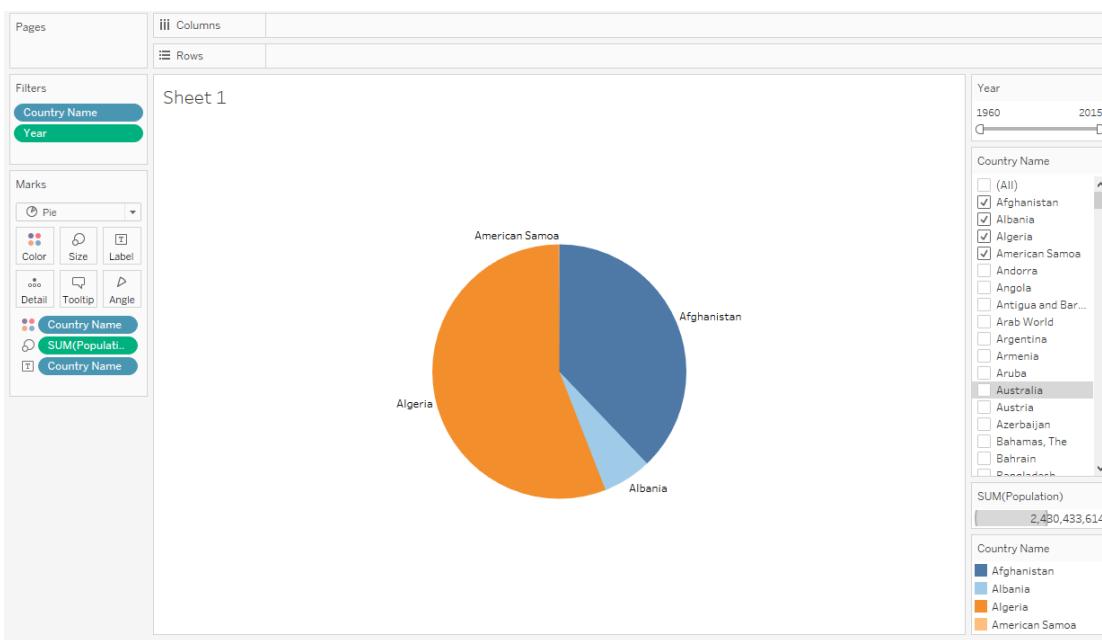


FIGURE 37

3.3 Creating Maps

You can also create maps! We will learn more about maps in another tutorial.

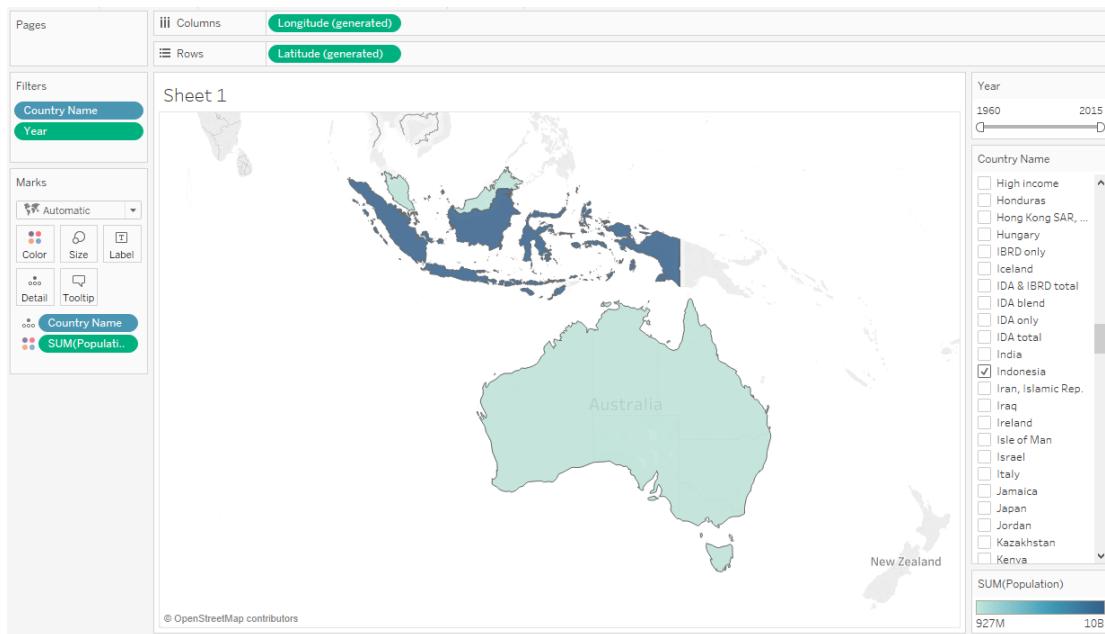


FIGURE 38

Once you finish exploring different marks, save your work so that you can open it up later.

3.4 Saving Your Work

Unfortunately, we can't save our work offline in Tableau Public. We can only save our project to our online Tableau profile.

You will be able to open this again (using the online version) if you need to edit it further.

1. To save your work on Tableau Public, click File -> Save to Tableau Public
2. Name your workbook
3. Done. Your web browser will open and show your visualisation online.

If you are using Tableau Desktop, you can save the workbook file offline by clicking File -> Save.