

# Observing the Recent Frictions Between China and United States of America

A Transnational Perspective Based on Google Trend Data

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## Introduction

With the tension between China and U.S. escalated recently, it obtained ubiquitous attention all over the world. This massive attention is probably caused by the tangible impact of the dispute on the global economy. According to a survey conducting by Fox Business which including health care, technology, automotive, energy and retail industries, more than two-thirds respondents reported that their business have been influenced by the recent friction (Fordham,2019) However, the dispute does not only influence the economy, but it also extends to other aspects. For example, three bills had passed unanimously in the House of Representative on Oct 16 this year(2,3,4), all aimed to the Hong Kong. Moreover, there was also another bill passed on the same day about Meng Wanzhou, the CFO of Huawei(5,7). The four acts passed while there was an ongoing negotiation about trade war between China and America which the chance of agreement is very low (Zengerle,2019). Under this circumstance, the unanimously passing of the four acts does not seem like a separate event, rather we can consider it as related to the trade war. We are interested in the global reaction on these three topics. More specifically, in this project, we want to explore the amount of attention people paid to the trade war and Huawei and Hong Kong protest based on the assumption that when people intend to know something, they will google it.

## Data

It may be viable to utilize Google trend data to constructed a database for further analysis. Initiailly, by web sraping, we obtain a list of countries and areas from International Organization for Standardization (ISO),and the list includes the geocodes for the countries and areas. Therefore, we combine the geocodes (e.g. US,CN) with ‘gtrends’ function, checking whether there are searching freqencies of interested keywords for the countries and areas.

Then, based on the geocodes of the ISO list, we carry out the data collection about transnational searching frquencies of the keywords about the trade war between China and the United States, which is the first topic in this study. We start our data gathering by using a more general keyword, ‘trade war’. By writing a new function (geocode\_1\_exist) and inserting this function into apply function, we can filter the countries and areas where there are searching records of ‘trade war’. Next, through apply function, we can find the searching frequencies of ‘trade war’ of the filtered countries and areas from March 1st, 2018 to November 1st,2019. Meanwhile, since google trend demontrate the related queries of ‘trade war’, we choose the related

keywords ‘us china trade war’ and ‘china trade war’ for further data gathering, since the numbers of the filtered countries and areas recording searching frequencies of the two keywords are highest, and the missing values about the searching frequencies of ‘us china trade war’ and ‘china trade war’ are fewer than the missing values of other related keywords of ‘trade war’. In addition, we attempt to collect searching frequencies of another keyword ‘US trade war’ among the filtered countries and areas, for amplifying database. Finally, we combine the searching frequencies of the four different keywords about the trade war between China and the United States and create a new database by data cleaning.

```
#asp_1 selecting countries#
geocode_1<-as.matrix(geocode_country[,1])
geocode_1_exist<-function(x){
  Country<-gtrends("trade war",time="2018-03-01 2019-11-01",geo=x)
  overtime<-Country$interest_over_time
  if (is.null(overtime)==FALSE) {return (x)}
  if (is.null(overtime)==TRUE) {return (NA)}
}
geocode_1_list<-apply(geocode_1,1,geocode_1_exist)
geocode_1<-as.data.frame(geocode_1_list)
geocode_1<-geocode_1 %>% drop_na(.)
colnames(geocode_1)<-"geo_code"
#finding overtime in aspect1#
over_time_1<-function(x){
  Country<-gtrends("trade war",time="2018-03-01 2019-11-01",geo=x)
  return (Country)
}
data_lists_1<-apply(geocode_1,1,over_time_1)
database_asp_1<-data.frame()
for (i in 1:length(data_lists_1)) {
  overtime<-data_lists_1[[i]][[1]]
  database_asp_1<-rbind(database_asp_1,overtime)
}

database_asp_1 %<>%
  mutate(date_geo=paste0(date,",",geo)) %>%
  select(date_geo,geo,keyword,hits)

#finding related topics#
related_query_database_1<-data.frame()
for (i in 1:length(data_lists_1)) {
  country<-data_lists_1[[i]]
  related_query<-country[[7]]
  related_query_database_1<-rbind(related_query_database_1,related_query)
}
query_freq_1<-related_query_database_1 %>%
  drop_na(.) %>%
  select(value,geo) %>%
  group_by(value) %>%
  summarize(freq=n()) %>%
  arrange(desc(freq)) %>%
  filter(freq>=15) %>%
  filter(value %in% c("us china trade war","china trade war"))

#finding hits for related queries
finding_hits_1<-list()
```

```

for (i in 1:length(query_freq_1$value)) {
  cn<-function(x) {
    Country<-gtrends(query_freq_1$value[i],time="2018-03-01 2019-11-01",geo=x)
    return (Country)
  }
  data_lists_1_1<-apply(geocode_1,1,cn)
  finding_hits_1<-c(finding_hits_1,data_lists_1_1)
}
#finding other keyword#
over_time_1_2<-function(x){
  Country<-gtrends("US trade war",time="2018-03-01 2019-11-01",geo=x)
  return (Country)
}
data_lists_1_2<-apply(geocode_1,1,over_time_1_2)
finding_hits_1<-c(finding_hits_1,data_lists_1_2)
data_related_1<-data.frame()
for (i in 1:length(finding_hits_1)) {
  country<-finding_hits_1[[i]]
  overtime<-country[[1]]
  if (is.null(overtime)==FALSE) {data_related_1<-rbind(data_related_1,overtime)}
}
data_related_trade_war<-data_related_1 %>%
  mutate(date_geo=paste0(date,",",geo)) %>%
  select(keyword,hits,date_geo)
data_related_kw_1<-database_asp_1
keywords<-c(query_freq_1$value,"US trade war")
for (i in 1:length(keywords)) {
  kw<-data_related_trade_war %>% filter(keyword==keywords[i])
  data_related_kw_1<-data_related_kw_1 %>% left_join(kw,by="date_geo")
  i<-i+1
}
#combining#
database_asp_1<-data_related_kw_1 %>%
  rename(trade_war=hits.x,us_china_trade_war=hits.y,china_trade_war=hits.x.x,US_trade_war=hits.y.y) %>%
  select(date_geo,geo,trade_war,us_china_trade_war,china_trade_war,US_trade_war)

```

The procedures of collecting searching frequencies of keywords about Huawei (a Chinese high-tech giant in the frictions between China and the United States) are similar as the process of collecting searching frequencies of keywords about the trade war Between China and the United States. In this topic, we attempt to two different initial keywords, 'Meng Wanzhou' and 'huawei ban'. Then we further filter related keywords of the two keywords and obtaining the searching frequencies of the related keywords. After integrating the searching frequencies of the keywords about huawei and data cleaning, we obtain another database.

For the third topic, hong kong protest, we only obtain searching frequencies of the keyword 'Hong Kong protests', which does not possess useful related words.

After establishing the database for searching frequencies of keywords in the third topic, we further combine the database for each topic (the trade war between China and the United States, huawei, hong kong protest), creating a new database by adding continent name for each filtered country and area. Consequently, the combined database has 7569 observations of 87 candidate countries and 15 variables, which is used for further analysis.

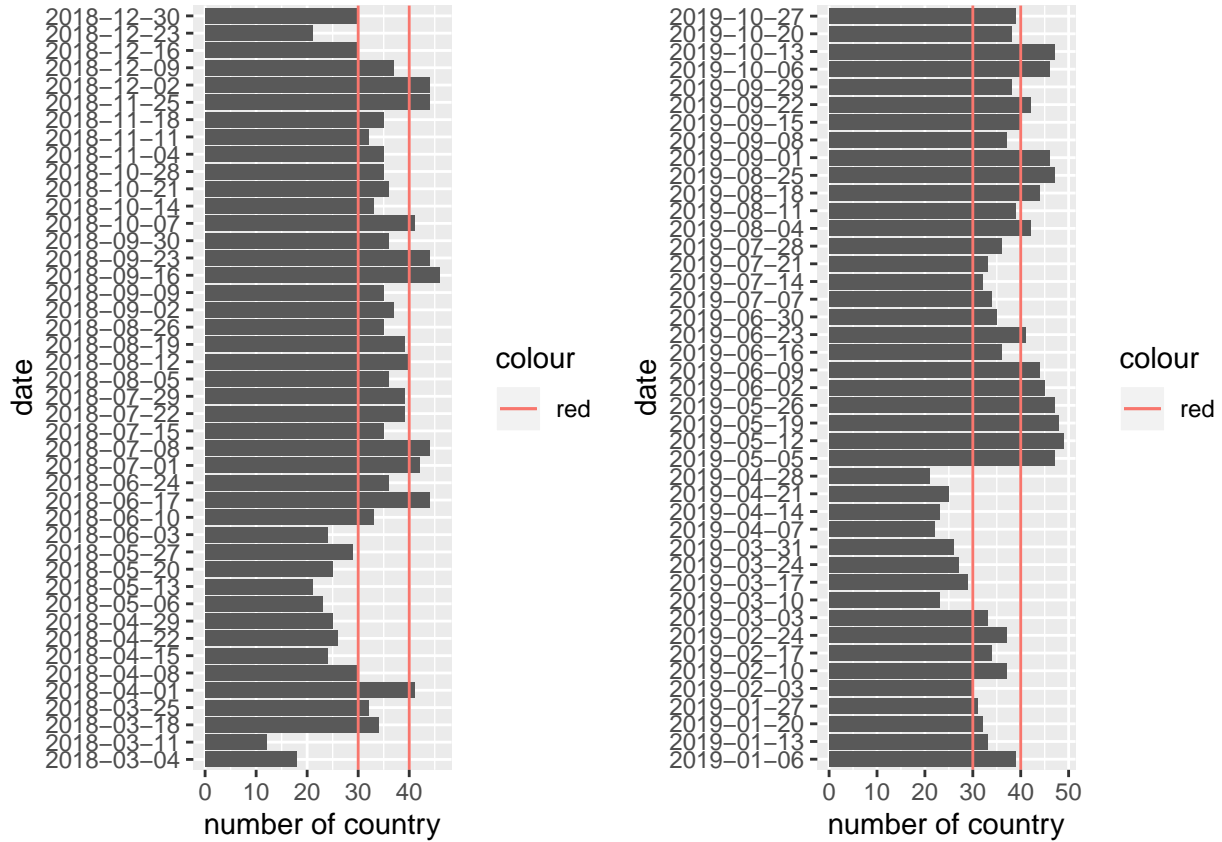
## Results

### Analysis and Data Exploration

This section presents the main results, such as (for example) stats and graphs that show relationships, model results and/or clustering, PCA, etc.

Firstly, we carry out the analysis of searching frequencies of keywords about the trade war between China and the United States. Compared with ‘trade war’, we find that the searching frequencies of ‘us china trade war’ can better reflect the attention of the candidate countries to the trade war between China and United States, excuding the the attention to trade wars among other countries. Then, we further attempt to filter searching records of ‘us china trade war’. Sepefically, based on the hierarchical clustering with keywords ‘US trade war’ and ‘china trade war’, it is reasonable to classify searching records of ‘us china trade war’ into four clusters. For each cluster, we firstly test whether searching frequencies of ‘us china trade war’ corralted with those of ‘US trade war’, which is a weakly related keyword of ‘us china trade war’ in topic. Next,we check if there are correlations between searching frequencies of ‘us china trade war’ and interation of searching frequencies of ‘US trade war’ and ‘china trade war’. Since people paying attention the trade war between China and US may choose different keywords about this topic,choosing searching frequencies of ‘us china trade war’ which are collectively contributed by ‘china trade war’ and ‘US trade war’ may reflect the attention of people more accurately.

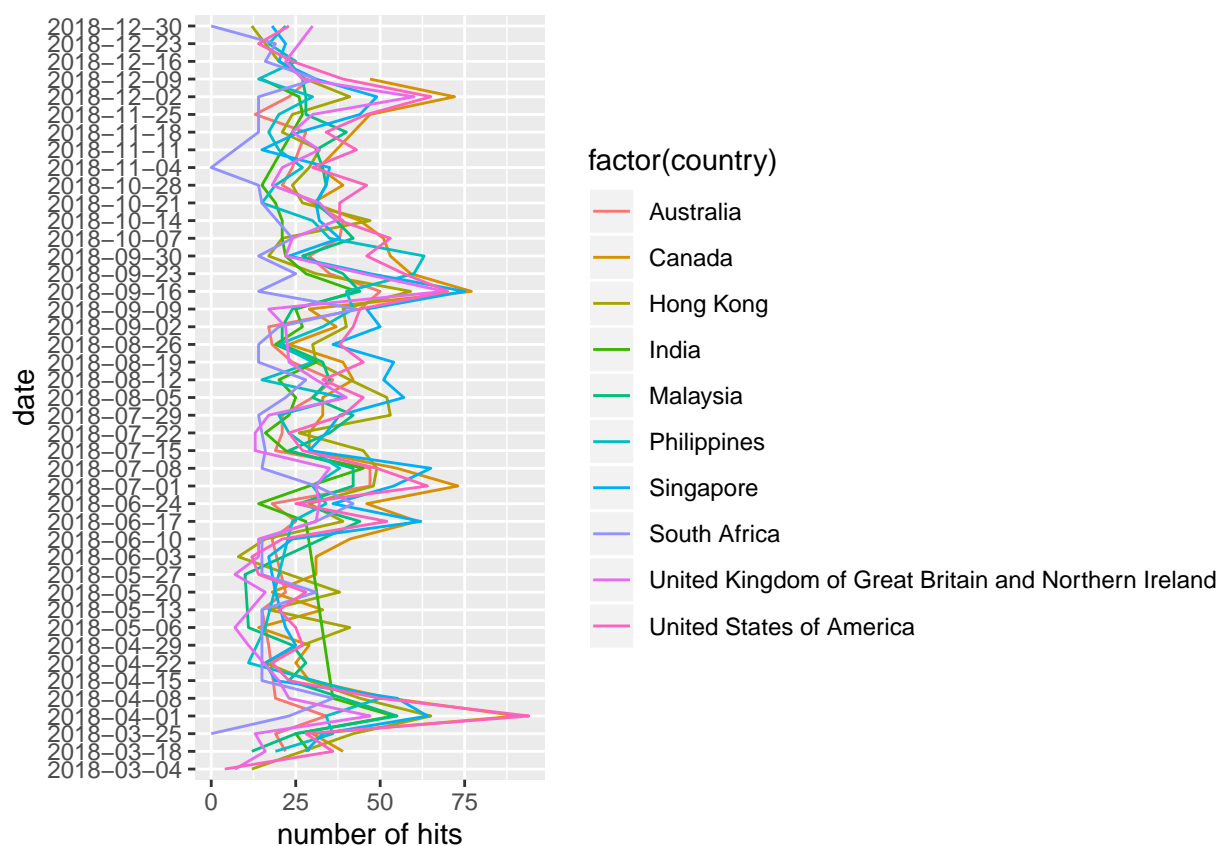
After clustering and filtering, we extract two clusters of searching records of ‘us china trade war’ for 53 countries and areas. By visualization, we can find that along the timeline from March 1st,2018 to November 1st 2019, in some weeks which is sinified by one day of the weeks, the numbers of countries with searching records of ‘us china trade war’ are over 40. In contrast, the numbers of countries are between 30 and 40 or lower than 30 in other weeks.



Thus, we argue that the countries where people keep longest attention to the trade war between China and US should have searching records of ‘us china trade war’ along the whole timeline. Meanwhile, the countries where people pay shortest attention should have searching records only at the weeks when the numbers

of countries with searching records of ‘us china trade war’ are over 40. The reason may be that people in these countries pay attention to US-China trade war when some important news of this trade emerge in the weeks. Thus, according to the length of attention people pay to ‘us china trade war’ in each country, we adopt k-means cluster and classify the 53 countries and areas into 3 groups based on the outcome of clustering. In the first group of countries and areas, the searching records of ‘us china trade war’ always exist along the timeline, demonstrating the people in the countries and areas pay longest attention to the US-China trade war. Accordingly, the length of people’s attention in the second group is shorter and the third group hold shortest attention.

For instance, visualizing the searching frequencies of the first group of the countries and areas, it can be found that searching records of ‘us china trade war’ in these countries and areas exist in almost all of interested weeks of 2018, and the variations of searching frequencies among this group members are similar. The outcomes in weeks of 2019 also follow this pattern. This means that this group of countries and areas pay continuously attention to the US-China trade war, and the peaks of searching frequencies of ‘us china trade war’ show that when important news about US-China trade emerge, people of all of the countries and areas strengthen their attention.



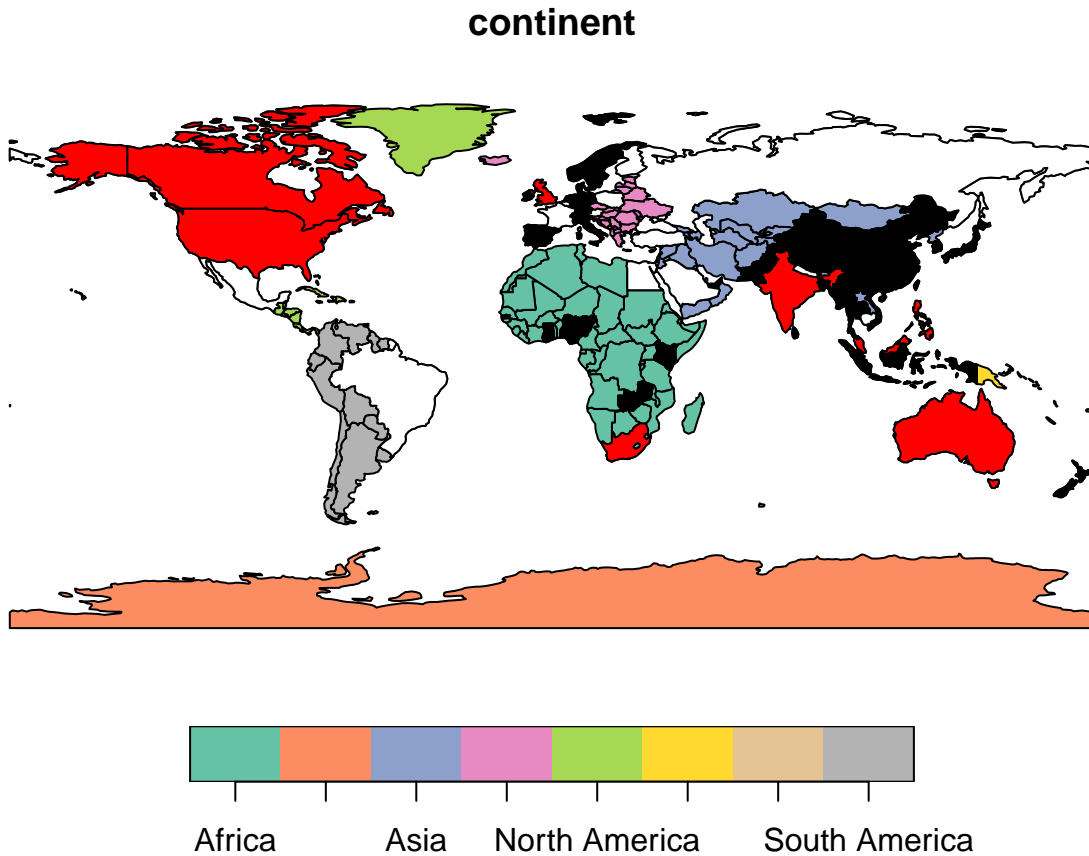
Then, we fill the three categories of countries and areas into a world map, identifying the geographical distribution of these countries. Since Singapore, Hong Kong and Saint Helena, Ascension and Tristan da Cunha do not have corresponding geocodes in the world map database, they won’t emerge in the filled map. In this map, red countries represent the countries where people pay longest attention to the US-China trade war; black countries represent the countries where people pay shorter attention; white countries represent the countries with shortest attention.

```
#Using map to show the countries#
world_geo<-as.data.frame(world$iso_a2)
colnames(world_geo)<-"geo"
world_geo$geo<-as.character(world_geo$geo)
world_map<-rbind(most_paid,next_most_paid,least_paid)
```

```

maps_data<-world_map %>%
  inner_join(geocode_country,by="country") %>%
  inner_join(world_geo,by="geo")
plot(world["continent"],reset=FALSE)
for (i in 1:nrow(maps_data)) {
  cn = world[world$iso_a2 == maps_data$geo[i], ]
  cn_1=st_union(cn)
  if (maps_data$kind[i]==1) {plot(cn_1,add=TRUE,col="red")}
  if (maps_data$kind[i]==2) {plot(cn_1,add=TRUE,col="black")}
  if (maps_data$kind[i]==3) {plot(cn_1,add=TRUE,col="white")}
}

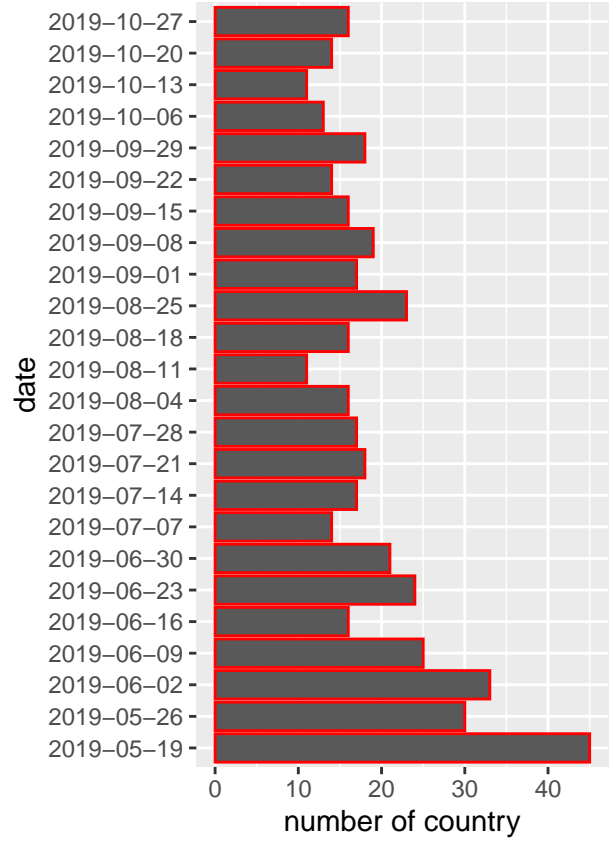
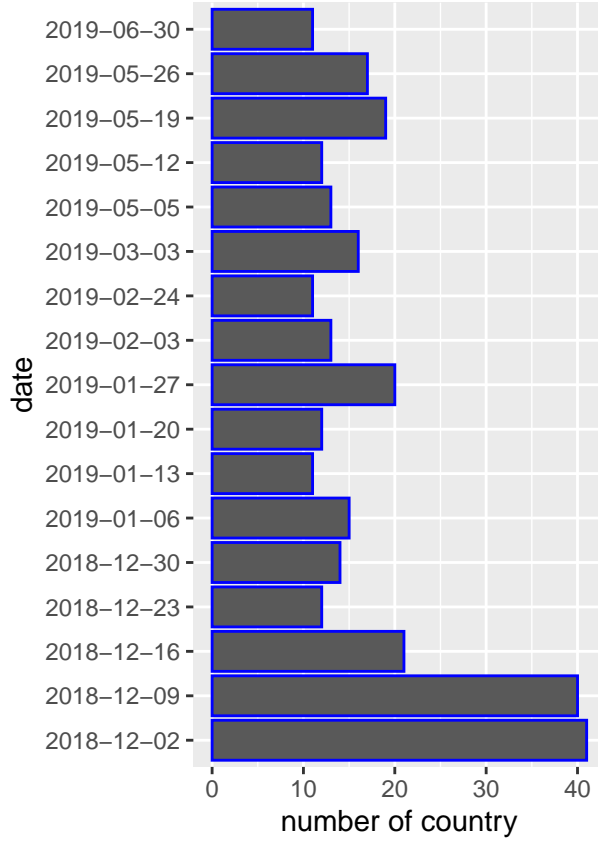
```



From the above map, it can be found that people in countries with mother language of English pay longest attention to the US-China trade war by searching the keyword 'us china trade war'. Then it can be found that countries in east asia have similar length of attention as countries in western parts of Europe and Africa. The countries with shortest attention are mainly distributed in middle east, eastern Europe and Latin America.

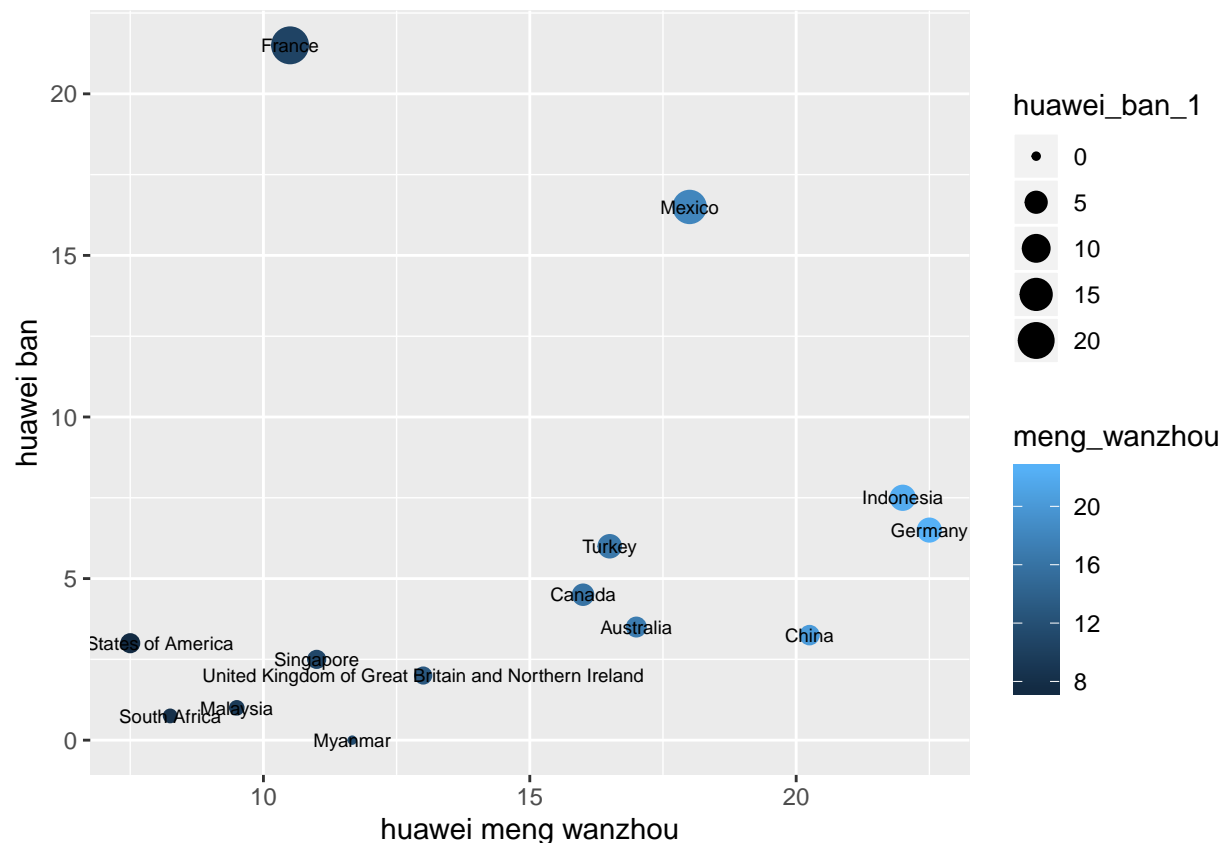
Now we start the analysis of the keywords about Huawei. In data collection, we find two seemingly separate key words 'meng wanzhou huawei' and 'huawei ban', so we would like to explore whether the attention to Meng Wanzhou (CFO of huawei, being confined in Canada) is correlated with attention to bans about Huawei. Meanwhile, although another keyword 'huawei google ban' is a related keyword of 'huawei ban', we also would like to know whether there is relation between the attention to bans about Huawei and the attention to the ban initiated by Google to Huawei. In other words, we would like to explore whether the ban from google contribute to searching frequencies of 'huawei ban'.

Firstly, we respectively filtered the weeks when more than 10 countries show searching records of 'meng wanzhou huawei' and 'huawei google ban', since important news of the two keywords occur in different time periods, we can concentrate on the periods when the keywords acquire sufficiently wide attention among the countries.



It can be found that relatively general searching records of ‘meng wanzhou huawei’ start from the first week of December 2018 and end at June 2019 (left side bars), while relatively general searching records of ‘huawei google ban’ are from May 2019 to October 2019 (right side bars). Then, by visualizing searching records of ‘huawei ban’ along the whole timeline, we find that the number of countries with searching records of ‘huawei ban’ is higher in the periods when ‘meng wanzhou huawei’ or ‘huawei google ban’ obtain attention from more countries. Thus, we filter searching frequencies of the three keywords by removing the dates before December 2018 and carry out k-means clustering of three keywords.

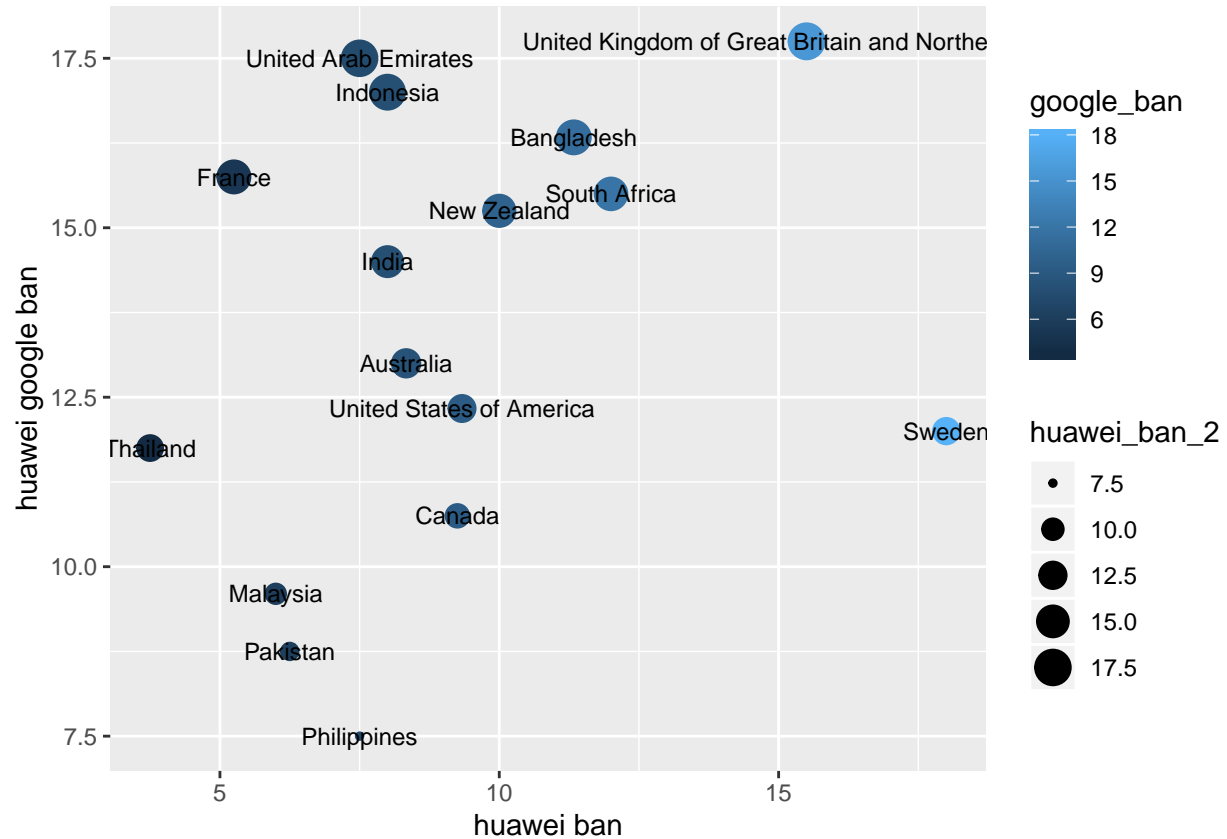
Based on the k-means clustering, we choose a one of the four clusters where there is a linear relation between the searching frequencies of ‘huawei ban’ and those of ‘meng wanzhou huawei’ from December 2018 to June 2019, and there is also a linear relation between the searching frequencies of ‘huawei ban’ and those of ‘huawei google ban’ from May 2019 to October 2019. Within this cluster, we would like further shorten our focus period to one month or two months. For ‘huawei ban’ and ‘men wanzhou huawei’, we contrate on searching frequencies of the two keywords in December 2018, when the event about arrest of Meng wanzhou occurs. Through visualization, we demonstrate the relations of searching frequencies of ‘huawei ban’ and searching frequencies of ‘meng wanzhou huawei’ among the available countries.



From the above plot, we can find that there are 14 available countries demonstrating relations between frequencies of 'huawei ban' and 'meng wanzhou huawei'. The degrees of color for each point in this plot show the different searching frequencies of 'meng wanzhou huawei', and the sizes for each point in the plot show the different search frequencies of 'huawei ban'. Thus, there appear to be diverse modes of relations of the two keywords among some available countries. For example, although France and Mexico commonly hold high searching frequencies of 'huawei ban', the searching frequencies of 'mengwan zhou huawei' in France is obviously lower than the searching frequencies in Mexico. This difference may reflect that in Mexico, people's attention to the event of Meng Wanzhou strengthen their attention to bans about Huawei, while in France, the event of Meng Wanzhou should not be a factor contributing the high attention of people to bans of Huawei. On the other hand, while the 12 other available countries demonstrate diverse searching frequencies of the two keywords, there seems to be a linear relations of searching frequencies of the two keywords. Specifically, points with light colors tend to be bigger, meaning that in these countries such as Indonesia and Germany, more attention of people to the event of Meng Wanzhou contribute to more attention to bans about Huawei. In contrast, points with dark colors tend to be smaller, meaning that in these countries such as Singapore and South Africa, less attention to the event of Meng Wanzhou contribute less to attention of bans about Huawei.

Similarly, through visualization, we demonstrate the relations of searching frequencies of 'huawei ban' and searching frequencies of 'huawei google ban' among the available countries, from late May, 2019 to late June, 2019.





From the above plot, we can find that there are 15 available countries demonstrating relations between frequencies of 'huawei ban' and 'huawei google ban'. The degrees of color for each point in this plot show the different searching frequencies of 'huawei google ban', and the sizes for each point in the plot show the different search frequencies of 'huawei ban'. In this plot, we can find that points with dark colors tend to be small size, while points with light colors tend to be large size. This means that for countries such as Malaysia and Philippines, low searching frequencies of 'huawei ban' are accompanied with low searching frequencies of 'huawei google ban'. In contrast, for the countries such as the United Kingdom, high searching frequencies of 'huawei ban' are accompanied with high searching frequencies of 'huawei google ban'. In sum, in the period from late May 2019 to late June 2019, there should be a linear relationship of searching frequencies of 'huawei ban' and 'huawei google ban', which means that attention of people to the bans between initiated by Google to Huawei partly explain the attention of people to bans about Huawei.

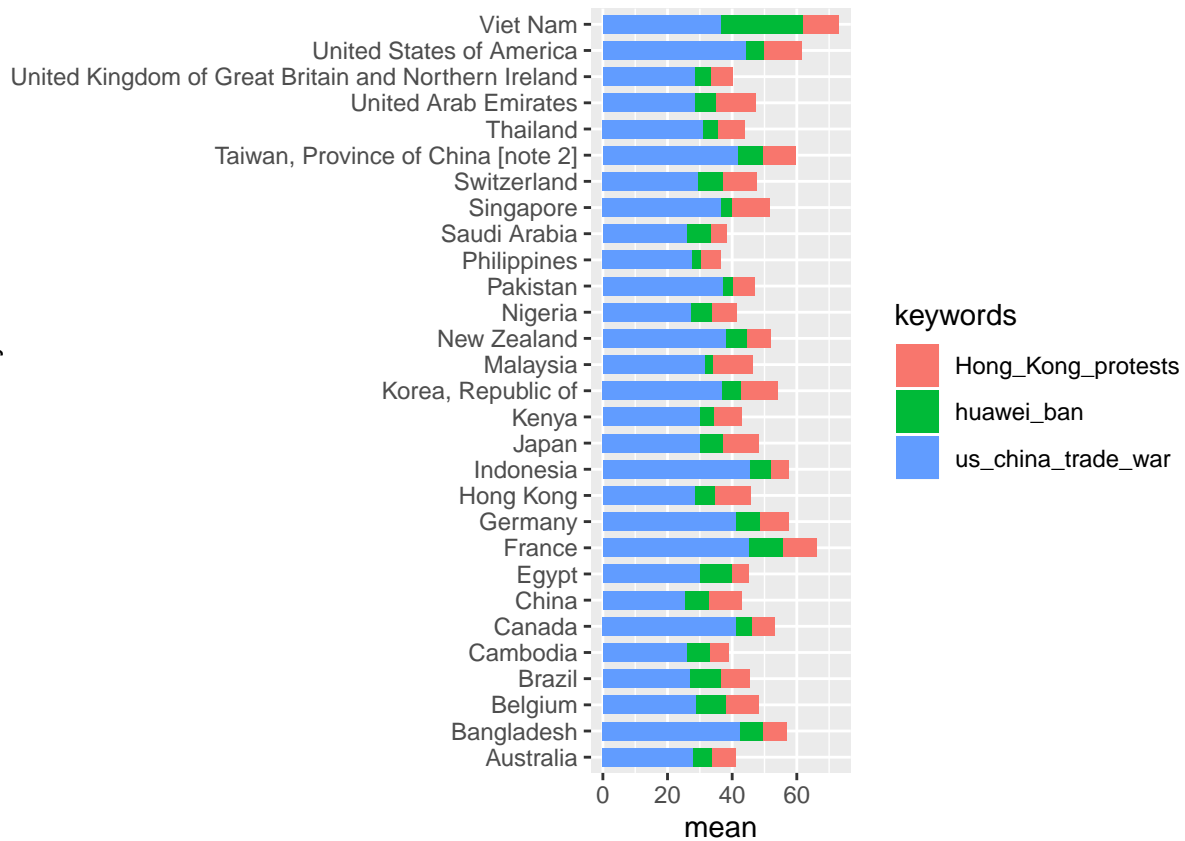
Now we come to searching frequencies of the keyword of Hong Kong protest.

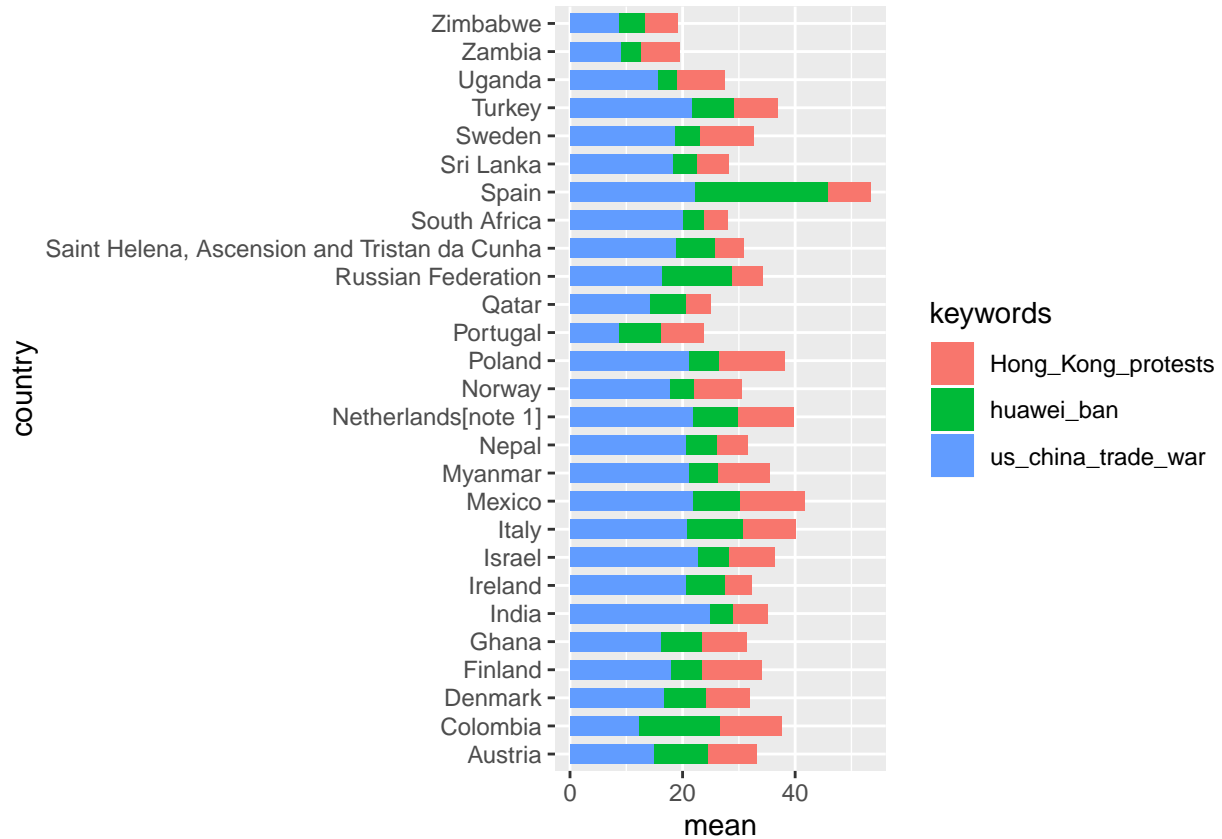
We use interactive graph to visualize searching frequencies of the keyword 'Hong Kong protests', which can reflect different combinations of countries about the searching frequencies of 'Hong Kong protests'.

In the final part of the analysis, we combine searching frequencies of the typical keywords of three topics: 'us china trade war', 'huawei ban' and 'Hong Kong protests', and we compute the means of searching frequencies for each keyword in each available country, which can be used for comparing degrees of people's attention to the three topics (US-China trade war, Huawei and HongKong protests).

Then, we visualize the mean searching frequencies of the three keywords ('us china trade war', 'huawei ban' and 'Hong Kong protests') for each available country, which is beneficial to further comparison among the available countries. In the process of visualization, we find that the around half of the available countries have the mean of over 25 for searching frequencies of 'us china trade war', so we classify these countries into one group and classify the other available countries into the other group, which is beneficial to create graphs.

country





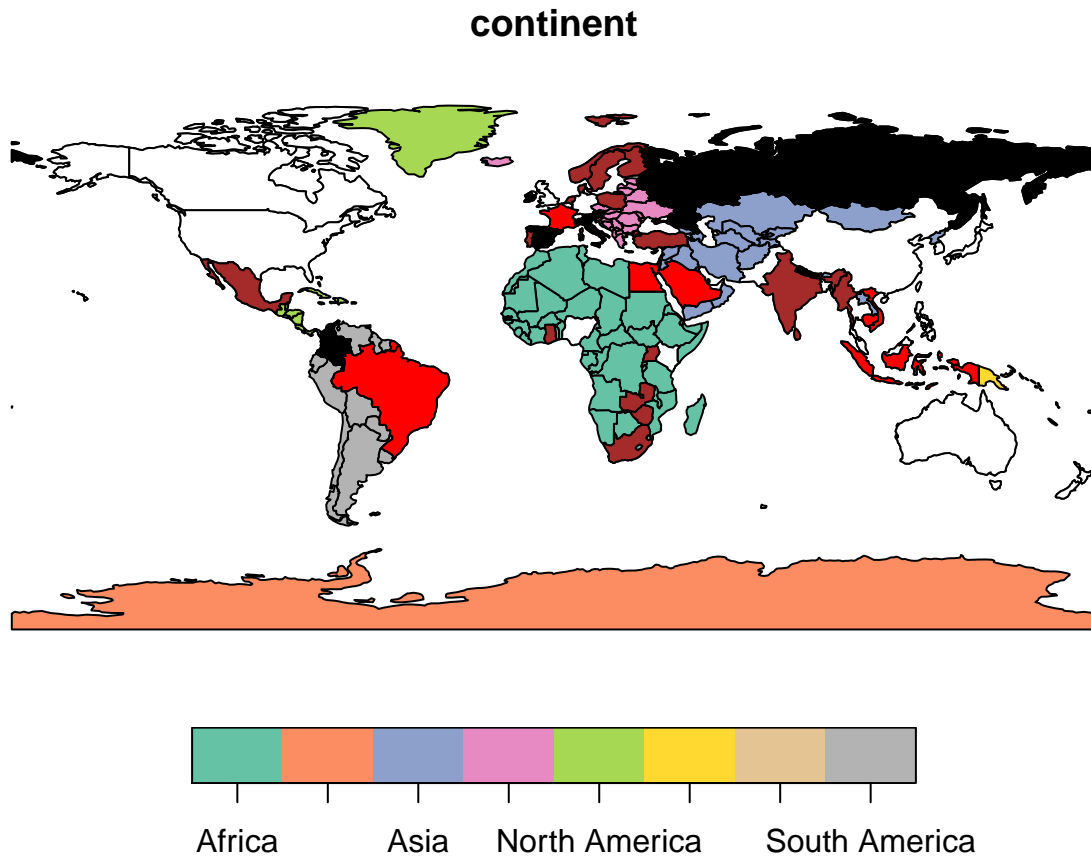
Based on the two graphs, we can find that compared with mean searching frequencies of ‘huawei ban’ and ‘Hong Kong protests’, mean of searching frequencies of ‘us china trade war’ is higher universally among the 56 available countries. This difference demonstrates that along the timeline from March 2018 to October 2019, US-China trade war generally receives more attention than other two topics about the frictions between China and the United States. In addition, in some countries, mean searching frequencies of ‘huawei ban’ is higher than that of ‘Hong Kong protests’, while in other countries, the outcome is different. Thus, although the time period of attention to Hong Kong protests is shorter than that of attention to Huawei, people in the countries with mean searching frequencies of ‘Hong Kong protests’ higher than mean searching frequencies of ‘huawei ban’ may reflect that in the eruption of Hong Kong protest, these people pay much more attention to Hong Kong protest than Huawei.

Thus, we combine the standard of whether mean searching frequencies of ‘huawei ban’ are greater than mean searching frequencies of ‘Hong Kong protests’ or not, with the previous standard of whether mean searching frequencies of ‘us china trade war’ is greater than 25 or not, separating the 53 available countries (excluding Singapore, Hong Kong and Saint Helena, Ascension and Tristan da Cunha) into four groups.

Finally, we fill the four groups of available countries into another world map.

```
#Using map to show the countries#
asp3_1$group<-0
for (i in 1:nrow(asp3_1)) {
  if (asp3_1$us_china_trade_war[i]>25 & asp3_1$huawei_ban[i]>asp3_1$Hong_Kong_protests[i])
  {asp3_1$group[i]<-1}
  if (asp3_1$us_china_trade_war[i]<=25 & asp3_1$huawei_ban[i]>asp3_1$Hong_Kong_protests[i])
  {asp3_1$group[i]<-2}
  if (asp3_1$us_china_trade_war[i]>25 & asp3_1$huawei_ban[i]<asp3_1$Hong_Kong_protests[i])
  {asp3_1$group[i]<-3}
  if (asp3_1$us_china_trade_war[i]<=25 & asp3_1$huawei_ban[i]<asp3_1$Hong_Kong_protests[i])
  {asp3_1$group[i]<-4}
```

```
{asp3_1$group[i]<~-4}
}
```



In this map, red countries represent the countries where mean searching frequencies of 'us china trade war' is over 25, and simultaneously mean searching frequencies of 'huawei ban' is higher than mean searching frequencies of 'Hong Kong protests'. Black countries represent the countries where mean searching frequencies of 'us china trade war' is lower than or equal to 25, and simultaneously mean searching frequencies of 'huawei ban' is higher than mean searching frequencies of 'Hong Kong protests'. White countries represent the countries where mean searching frequencies of 'us china trade war' is over 25, and simultaneously mean searching frequencies of 'huawei ban' is lower than mean searching frequencies of 'Hong Kong protests'. Brown countries represent the countries where mean searching frequencies of 'us china trade war' is lower than or equal to 25, and simultaneously mean searching frequencies of 'huawei ban' is lower than mean searching frequencies of 'Hong Kong protests'.

## Discussion

In this part, we would further discuss main results from previous visualization and analysis.

### Results about trade war between China and the United States

From the first filled map, it can be found that from March 2018 to October 2019, there are diverse modes about length of attention to the US-China trade war among western European countries. The reasons behind the difference may be involved with the frequency of using English. The United Kingdom, where people's main language is English, possesses the longest period of recorded searching frequencies about 'us china trade war', and therefore is classified into the countries where people successively pay attention to the trade war between China and the United States. For Germany, Scandinavian countries and Spain, although people's mother language is not English, they are also accustomed to adopting English search engines like Google, learning

about this trade war through English keywords search. Thus, from searching records of Google trend, these countries still demonstrate relatively long period of attention to US-China trade war. For France, where native people are reluctant to use English, searching records of English records are corresponding lower than that of other western countries, so France is classified as the category of countries where people pay shortest attention US-China trade war. In sum, transnational comparison of time length of people's attention the US-China trade war should sufficiently consider people's habits of language among different countries, and English keywords from searching engines can only partially explain the different length of attention of different countries.

### **Results of cross-topic comparison**

In the second filled map, we compare the red countries and white countries, both of which belong to the group of available countries with more attention to US-China trade war than other available countries. In red countries, represented by France, Brazil and Egypt, people pay more attention to issues about Huawei than to Hong Kong protest from March 2018 to October 2019, while in white countries including Germany, America, Japan and China, people pay more attention to Hong Kong protest than to issues about Huawei. Therefore, it seems interesting compared to economically weaker countries (red countries), where people pay more attention to economic frictions between China and the United States, most of white countries demonstrate better economic conditions and correspondingly pay more attention political friction between China and United States. In other words, economic conditions of a country may affect the weight of people's attention to economic frictions and political frictions. Then, we pay specific attention to white countries, which includes two subgroup countries: English-speaking countries and Eastern Asian countries. While most Eastern Asian countries are not English-speaking countries, since the protest erupts in Hong Kong, the English keywords searching about Hong Kong protest in these countries also rise, which reflect the strong attention of the people in these Eastern Asian countries. Finally, compared to red countries and white countries, people in both black countries and brown countries take on less attention to the trade war of China and the United States. We can find countries with black color and brown color either suffer smaller assault from US-China trade or become beneficiary of the trade war. In other words, since these countries are immune from negative economic effects of US-China trade war, people in these countries relatively pay less attention to the trade issue than that of red countries and white countries. This section summarizes the results and may briefly outline advantages and limitations of the work presented.

### **Advantages and Limits of the study.**

This study has attempted to compare the people's attention of different countries about topics of frictions between China and the United State in 2018 and 2019. By collecting searching frequencies from google trend data, this study has demonstrated the similarities and differences of available countries about the people's attention to various topics. However, there are some limits within this study. Firstly, because of the missing values in searching frequencies of interested keywords, the number of countries which can be used for comparison is limited. In particular, missing values causes significant decrease of number of available countries, and only around 15 countries possess available data for analyzing the relations of searching frequencies about keywords in issues about Huawei. The analysis based on the limited data may be biased. Furthermore, since keyword searching can only partially explain people's attention to certain public issues, it is necessary to collect data from other media, which may contribute to more comprehensive understanding about people's attention. Finally, because of limited economic level or official confinement, people in many countries have no access to Google search, which limited the searching frequencies of keywords in Google trend.

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