Business Activity Trends For Disaster Recovery

Analysis Report

Email:ha562@exeter.ac.uk

Department of computer science , Exeter university

ECMM443 : Introduction to Data Science

1. Introduction

In this assignment, I will analyze the impact of COVID-19 on businesses worldwide. By applying a time-series analysis of the posting rate for each business using Facebook Business Activity Trends datasets and other relevant sources. I aim to understand how different businesses have been affected and how they adjusted and transformed their operations in response to the unprecedented challenges brought by the pandemic.

1.1 Dataset

The analysis was conducted using the public version of the Business Activity Trends dataset provided by Facebook through their Data for Good at Meta program. This dataset examines the impact of COVID-19 on businesses by analyzing their posting activity on the Facebook platform. it aims to provide timely estimates of global business activity without the common limitations of traditional data collection methods, such as scale, speed and no standardization. The dataset consists of approximately 2,396,577 rows of data collected from 221 countries across 11 business sectors. The data covers a period from March 1st, 2020 to November 29th, 2022.[1]

1.2 Features

The data set contain the following features:[1][2]

Field	Description
GADM ID (gadm_id)	The GADM ID of the polygon.
GADM name (gadm_name)	The GADM name of the polygon.
GADM level (gadm_level)	The GADM level of the polygon.
GADM level 0 name (gadm0_name)	The name of the polygon at GADM level 0 (country name). Equivalent to GADM name if GADM level is 0.
GADM level 1 name (gadm1_name)	The name of the polygon at GADM level 1 (US state name). Equivalent to GADM name if GADM level is 1.
GADM level 2 name (gadm2_name)	The name of the polygon at GADM level 2 (US county name). Equivalent to GADM name if GADM level is 2.
Country (country)	2-character (ISO alpha-2) country code.
Business vertical (business_vertical)	Internally defined categories within Facebook, representing local economic sectors.
Activity quantile (activity_quantile)	The level of activity as a quantile relative to the baseline period.
Activity percentage (activity_percentage)	The 7-day rolling sum of total activity as a percent of the average weekly baseline average.
Crisis start (crisis_ds)	The crisis start date in YYYY-MM-DD format. The baseline period used is the 365 days prior to this date.
Date (ds)	The date of the activity provided in YYYY-MM-DD format, defined by Pacific Time.

1.3 Libraries used

In this analysis project the following libraries are used ：

- **numpy as np**: Used for efficient numerical operations and array manipulations in data analysis.
- **pandas as pd**: Employed for handling and analyzing structured data through data frames.
- **os**: Used for interaction with the operating system, facilitating file and directory operations.
- **matplotlib.pyplot as plt**: Utilized for creating static, interactive, and dynamic visualizations of data.
- **seaborn as sns**: Used for enhancing the aesthetic appeal of visualizations and providing additional plotting functionalities.
- **geopandas as gpd**: Employed for handling geospatial data, extending Pandas functionalities to geographic datasets.

2 Basic Stats & Metrics

2.1 ***Data Summary:*** Describing the basic properties of the dataset, including statistics such as ,mean, median, and standard deviation.

activity quantile		**activity percentage**	
count	2.396549e+06	**count**	2.396549e+06
mean	4.333909e-01	**mean**	1.158843e+02
std	2.134659e-01	**std**	5.706403e+01
min	0.000000e+00	**min**	0.000000e+00
25%	2.789940e-01	**25%**	8.965291e+01
50%	4.345785e-01	**50%**	1.094090e+02
75%	5.814944e-01	**75%**	1.314520e+02
max	1.000000e+00	**max**	3.215491e+03

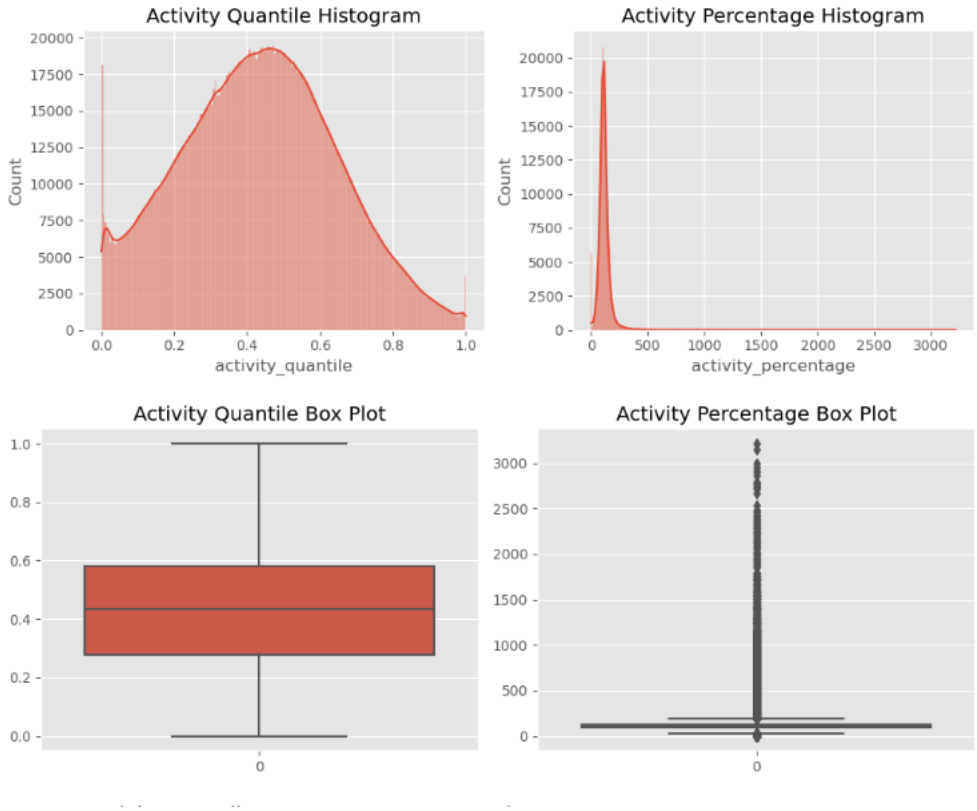


Figure 1 histogram and boxplot for both metrics

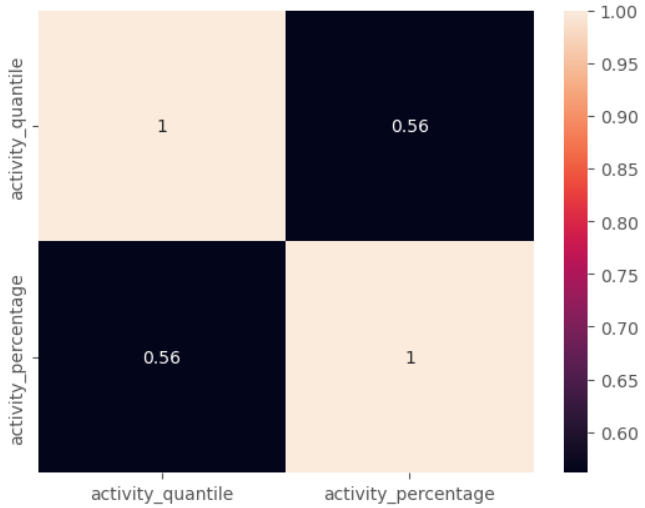
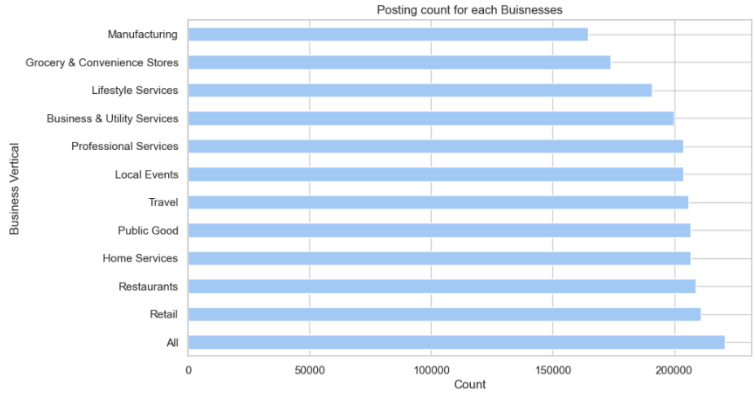


Figure 2 Correlation matrix for activity percentage and activity quantile



2.2 Count the number of countries/regions being mentioned in the dataset.

There are about 221 countries mentioned in this dataset based on the 'gadm_name' column. However, when using the 'country' column, there are only 216 countries listed. This suggests that there are some missing values in the latter column.

2.3 Count the total number of dates available for each country/state (or equivalent geo-area), in terms of the type of business. Describe missing values/duplicates (if there are any), and how you deal with anomalies (if there are any).

In terms of dates all businesses verticals share the same number of dates (1004), which represent the duration of the data collecting in this dataset between (1/3/2020 to 29/11/2022).

Missing values:

After conducting several tests, it was discovered that the dataset contains missing data as shown in **Fig.3**. Specifically, columns [gadm name1 and gadm name2] do not have any values and can be considered as additional indexes for the countries column. To reduce noise in the dataset during data analysis, I would delete these columns and use [gadm name] instead. Similarly, columns [Field , Label ,Value] dropped from the dataset, because they have missing values that represent more than 80% of the data and they give additional information which would not be used in the analysis stage.

However, Interpolation will be used to fill missing rows in [ds] columns, which is time-series data as we know that the data are collected for each business daily. On the other hand, missing data in the [activity quintiles and activity percentage] columns represent a small percentage of the data (28 rows), therefore it would be better to ignore them to avoid bise introduction .

Duplicate values:

In terms of duplication, the data set did not have any duplication as **Fig.2** represent the outcomes of the duplication test.

Outliners:

Based on the boxplot shows in **Fig1**, it can be observed that the activity quantile does not have any outlier values. While, the activity percentage shows a significant bias with numerous outliers. These outliers in the activity percentage column could potentially skew the analysis results and should be carefully addressed or removed before proceeding with further analysis.

```
gadm_id                   28
gadm_name                 28
gadm_level                28
gadm0_name                28
gadm1_name           2396577
gadm2_name           2396577
country                38180
business_vertical         28
activity_quantile         28
activity_percentage       28
crisis_ds                 28
ds                        28
Field                2396549
Label                2396549
Value                2396549
dtype: int64
```

Figure 4 Missing data test result

```
#Dublication
duplicate_rows = cdf[cdf.duplicated()].sum()
print(duplicate_rows)
```

```
gadm_id                0.0
gadm_name              0.0
gadm_level             0.0
gadm0_name             0.0
gadm1_name             0.0
gadm2_name             0.0
country                0.0
business_vertical      0.0
activity_quantile      0.0
activity_percentage    0.0
crisis_ds              0.0
ds                     0.0
Field                  0.0
Label                  0.0
Value                  0.0
```

Figure 3 :Duplication test result

2.4 Understanding of Activity Quantile (activity_quantile):

Activity quantile is a metric designed to measure the level of activity for a business relative to a baseline period, providing insights into deviations from normal behavior. The calculation involves several steps:

1. **Quantile Calculation**: Calculate the approximate quantiles (midquantiles) of each Page's daily activity relative to their baseline activity. These quantiles represent the business's activity compared to its usual baseline.

$$\text{Quantile}_i = \frac{X_i - \text{Baseline}_i}{\text{Baseline}_i}$$

2. **Summation:** Sum the quantiles obtained from step 1. This sum represents the cumulative deviation of the business's daily activity from its baseline.

3. **Shift, Rescale, and Variance-Adjust**: Apply transformations to the sum to shift, rescale, and variance-adjust it. This is done to make the sum follow a standard normal distribution.

$$\text{Adjusted Sum} = \frac{\text{Sum} - \text{Mean(Sum)}}{\text{Std(Sum)}}$$

4. **Probability Transformation**: Use the standard normal cumulative distribution function to probability transform the adjusted sum. This results in a value between 0 and 1.

$$\text{Transformed Value} = \Phi(\text{Adjusted Sum})$$

Where Φ is the standard normal cumulative distribution function.

5. **Averaging:** Average the transformed value over the last 7 days to smooth out daily fluctuations.

$$\text{Smoothed Value} = \frac{1}{7} \sum_{j=i-6}^{i} \text{Transformed Value}_j$$

The interpretation of this metric is as a quantile, where a value around 0.5 signifies normal activity. The quantile interpretation allows comparison of daily activity to the distribution of daily activity within the baseline period. This metric provides a balanced view, giving equal weight to all businesses and being less influenced by businesses that post a lot. It is recommended,

especially for situations where robustness to outliers and numerical stability are crucial considerations.[2][3]

2.5 Understanding of Activity Percentage (activity_percentage):

Activity percentage is a metric that measures the 7-day rolling sum of total activity (total posts) as a percentage of the average weekly baseline. The calculation involves the following steps:

1. **Baseline Calculation:** Calculate the average of the 7-day sum of total activity every Monday within the baseline period. This baseline average represents the expected weekly activity.

2. **Daily Calculation:** For each day during the crisis, calculate the 7-day rolling sum of total posts. Divide this sum by the weekly baseline average and multiply by 100 to obtain the activity percentage.

This metric is easily interpretable, with a value around 100 considered normal activity. However, it is influenced by businesses that post a lot, potentially leading to misleading results. The metric may also be less stable numerically when the number of posts is relatively low. It is recommended for situations where interpretability is the primary criterion. [4]

Both metrics provide valuable insights into business activity during the crisis, with the choice between them depending on the specific analysis requirements and considerations such as interpretability, robustness to outliers, and numerical stability.

In the real-world context of analyzing mobility and activity data, the terms "Activity Quantile" and "Activity Percentage" offer insights into how businesses or regions deviate from their normal patterns during a crisis. Let's explore the practical meaning of these terms:

1. **Activity Quantile:**

    - **Real-World Interpretation**: Activity quantile provides a normalized measure of a business's or region's activity relative to a baseline period. The quantile interpretation allows businesses to understand their position in comparison to their usual level of activity.

    - **Application:** A value around 0.5 signifies normal activity, with deviations indicating higher or lower activity levels. Businesses can use this metric to identify whether their current activity patterns align with historical norms. For instance, during a crisis, a quantile significantly below 0.5 might suggest reduced activity, while a quantile above 0.5 could indicate increased activity.

    - **Benefits:** The quantile approach makes this metric robust to outliers and ensures equal weight to all businesses, providing a more balanced perspective on activity changes during a crisis.

2. **Activity Percentage:**

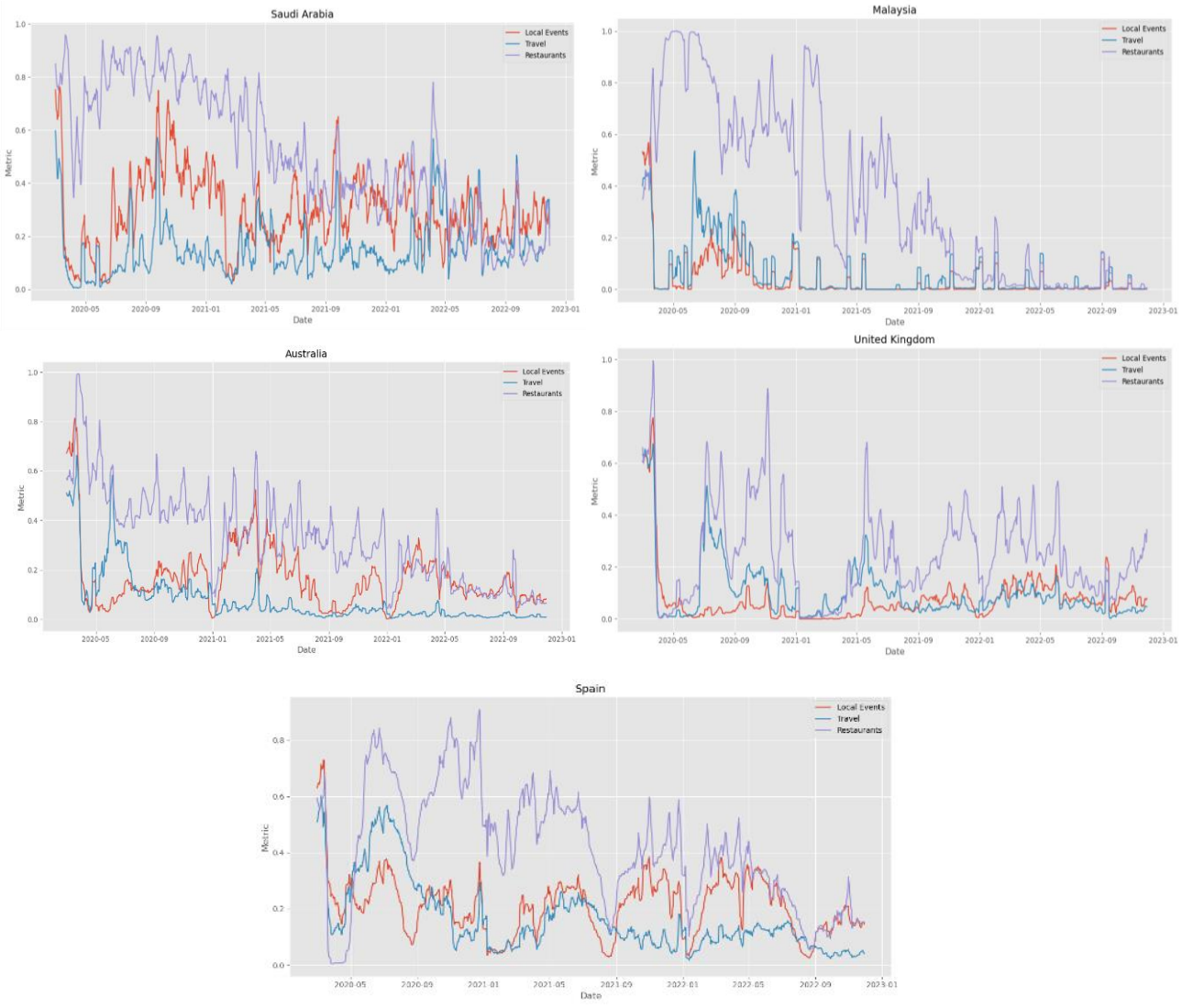
    - **Real-World Interpretation:** Activity percentage represents the relative change in total activity (such as posts or mobility) compared to a baseline. It is presented as a percentage, making it easily interpretable in terms of the degree of change from the expected baseline activity.

- **Application**: A value around 100 indicates normal activity, and deviations reflect changes in activity levels. Businesses can use this metric to quickly assess whether their overall activity has increased or decreased during a crisis. It is particularly useful for straightforward interpretations.

- **Considerations:** the activity percentage may be influenced by businesses that post a lot, potentially skewing the results. Additionally, it might be less stable when the number of posts is low.

Both metrics are valuable for assessing the impact of a crisis on business or regional activity, offering different perspectives. Activity quantile provides a more nuanced understanding by comparing businesses to their baseline distribution, while activity percentage offers a straightforward percentage change from the expected baseline. Depending on the specific needs of an analysis, businesses can choose the metric that aligns with their priorities, whether it be robustness, interpretability, or simplicity. These metrics empower businesses to adapt their strategies based on real-time data during challenging periods.

2.6 Choose 5 different countries (preferably from different continents), and plot time-series figures for your chosen type(s) of business. Comment on what you see.



The chosen countries = [Saudi Arabia ,Malaysia ,Australia ,United kingdom, Spain]

Business types = ['Local Events', 'Travel', 'Restaurants']

During the first months of the pandemic, starting from mid-March 2020 when many countries implemented lockdown policies to control the spread of the virus, there was a significant decrease in posting activity in the travel sector across all five countries. This can be attributed to travel restrictions put in place during that time. Similarly, the local events sector also experienced a decline in posting activity during this period, likely due to social distancing measures and restrictions on public gatherings.

On the other hand, trends in posting activity for restaurants varied across the five countries. Some countries initially saw a decrease in posting activity but then observed an increase after shifting towards offering takeout and delivery services.

2.7 Are there any other patterns you could find from the data - e.g., weekdays vs. weekends? You could propose other discoveries. Comment on what you see.

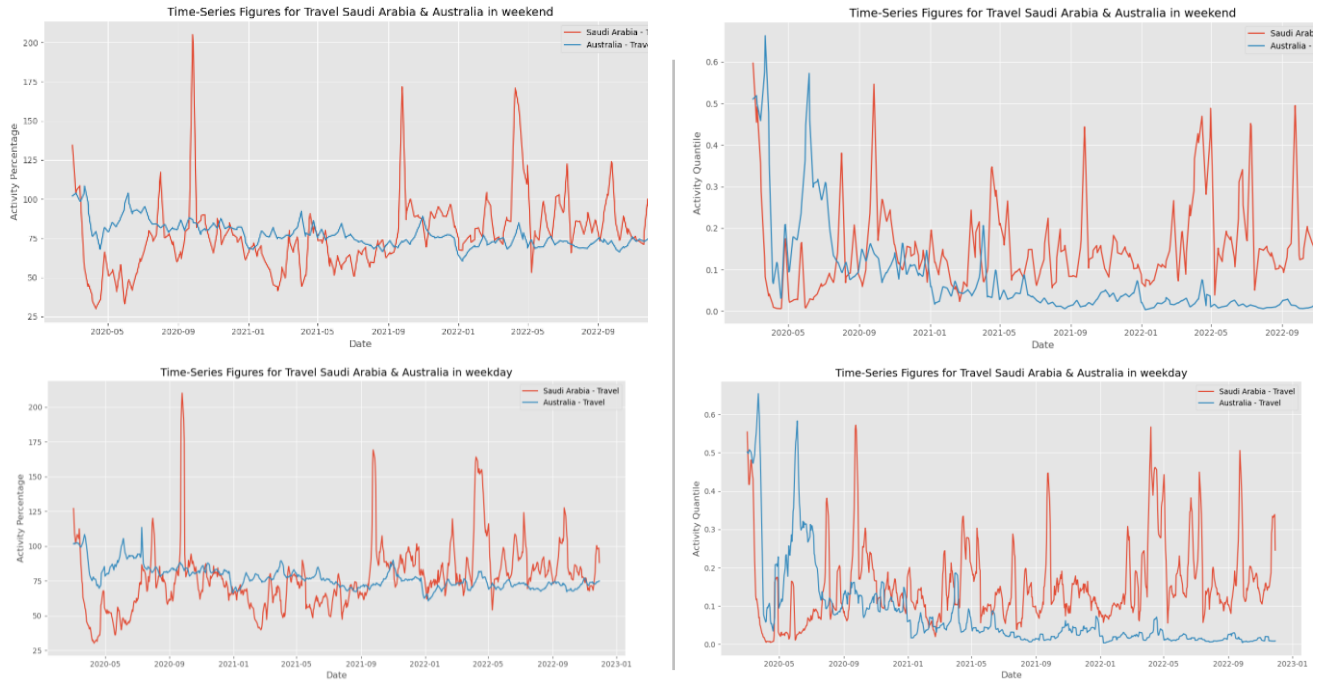


Figure5 Travel sector Activity quantile and percentage in Saudi Arabia and Australia (weekday and weekend)

By observing the data from Saudi Arabia and Australia in the travel sector at different weekdays it seems that despite the significant decline in travel activities in both countries between March and May 2020 when the pandemic start there are interesting trend observed in both countries Initially, travel activity in Australia started at a higher level compared to Saudi Arabia until the end of 2020. However, starting from that point onward, travel activities in Saudi Arabia began to increase and remained consistently higher than those in Australia until the end of 2022. This indicates that despite travel restrictions, the travel sector in Saudi Arabia has been able to adapt and develop new strategies aligned with government regulations . **In terms of Weekend effect**, activity quantiles is generally lower on

Saturday and Sunday for most countries and activities, indicating that people tend to stay at home more on weekends.

2.8 Visualisation. Please choose two days and visualise different countries/states (depending on the gadm_level of the dataset) with the business level (preferably using colormaps), in those two days. Please refer to https://gadm.org/ for more information.

Fig.6 shows a very low level of business activity less than the baseline level at (25-04-2020) when lockdown hold worldwide.

Figure 6

Fig.7 shows a relatively high level of business activity at (27-03-2021) when most countries start return to normal life activities with less restrictions.

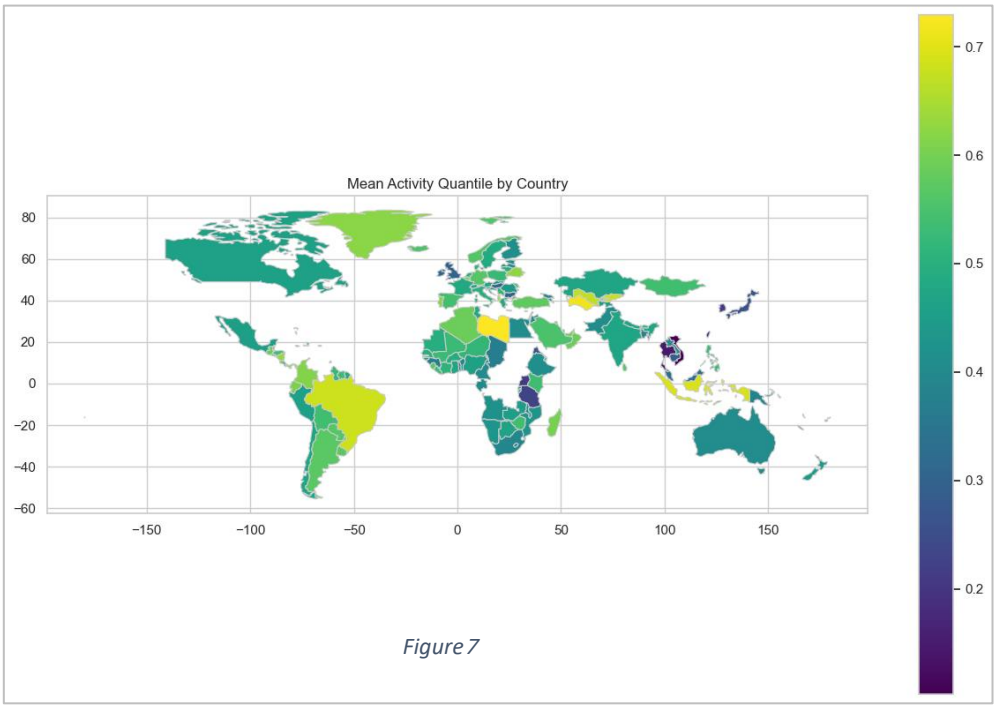


Figure 7

3 Analyzing Events

3.1 Identify changes. Choose 5-6 different countries.

Here's a brief overview of the average size, location, population, and income of the mentioned countries:

Denmark

Size: Approximately 42,924 square kilometers (16,573 square miles)
Location: Northern Europe
Population: Around 5.8 million (as of 2021)
Income: High-income country with a strong welfare system and high GDP per capita.

Mauritania

Size: Approximately 1,030,700 square kilometers (397,955 square miles)
Location: Northwest Africa
Population: Around 4.7 million (as of 2021)
Income: Considered a lower-middle-income country with varying economic disparities.

Argentina

Size: Approximately 2,780,400 square kilometers (1,073,500 square miles)
Location: South America
Population: Approximately 45.7 million (as of 2021)
Income: Considered an upper-middle-income country with varied economic condition.

Philippines

Size: Approximately 300,000 square kilometers (115,831 square miles)
Location: Southeast Asia
Population: Around 111 million (as of 2021)
Income: Considered a lower-middle-income country with a growing economy and diver se industries.

Mexico

Size: Approximately 1,964,375 square kilometers (758,449 square miles)
Location: North America
Population: Approximately 130.3 million (as of 2021)
Income: Considered an upper-middle-income country with varied economic conditions a cross regions.

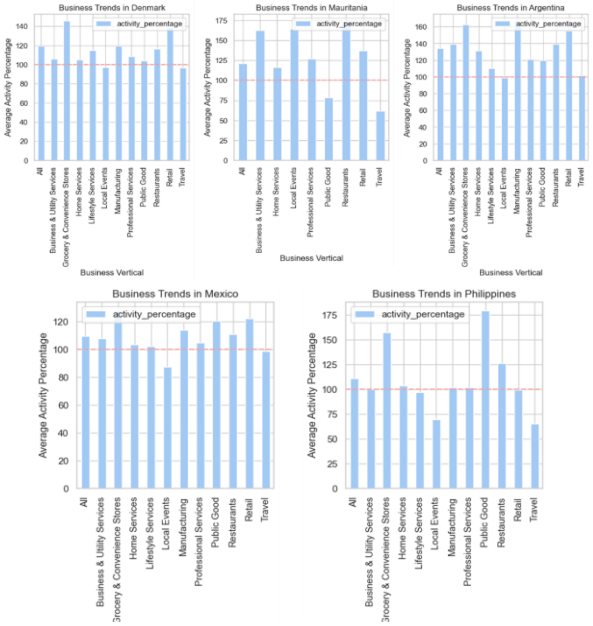


Figure 8 Business verticals for each countries (Business percentage)

Identify the obvious changes in the business trends across different types of business. You could work in more countries if you want to!

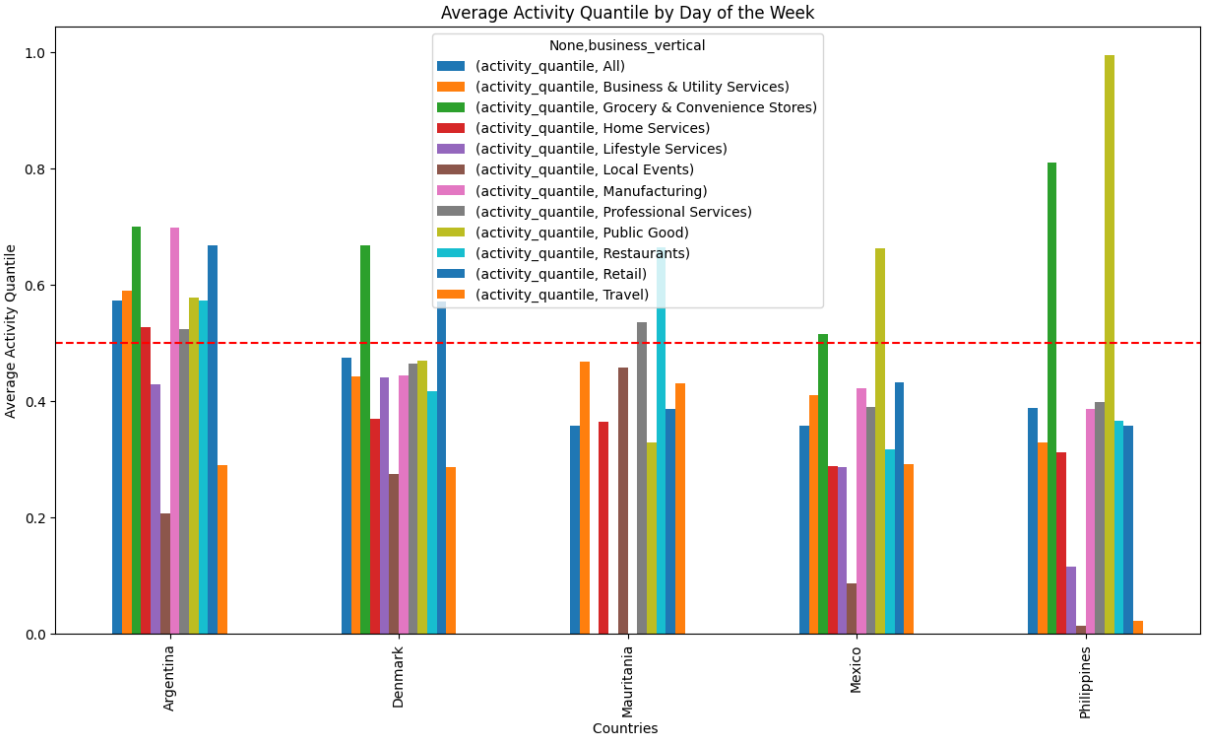


Figure 10

Fig. 9 describes the activity quantile for the chosen countries. It shows that **Philippine** and **Mexican** business quantiles are mostly below 0.5, indicating that they have lower activity than the regional average in all business verticals.

Because they were able to adapt to the pandemic, the data indicates that the least affected sectors in the **Philippines**, **Mexico**, **Argentina**, and **Denmark** are groceries and public goods. In these countries, the majority of grocery stores switched to delivery services and began utilizing digital platforms, which offer a variety of services and encourage customers to gradually use online services. However, in Mauritania, these industries suffer the most from a lack of adequate technical and financial support from the government .

Figure 11

Figure .10 shows Retail sector has a high activity level in both **Denmark** and **Argentina**. According to the International Trade Administration, Denmark entered the global COVID-19 pandemic from a position of strength, as evidenced by the Danish economy's low fiscal deficit of 2.3 percent of GDP in 2021. Wage subsidies, tax deferrals, and loan guarantees were all enacted by the government to assist firms and workers in dealing with the crisis. The retail sector likewise reacted fast to new regulations , expanding its online presence and delivery services [6]. In Argentina, the retail sector was one of the least affected by the pandemic. In comparison to other sectors such as tourism, hospitality, and entertainment.[7]

Finally, the local events and tourism sectors in each of the five countries have the lowest values. In the **Philippines**, they are virtually at zero, whereas in **Mauritania**, they are above 0.4. This suggests that the pandemic affected these industries differently , because they are tied to each country's economic and social characteristics as well as policy responses to the crisis. This trend can be explained by the following information :

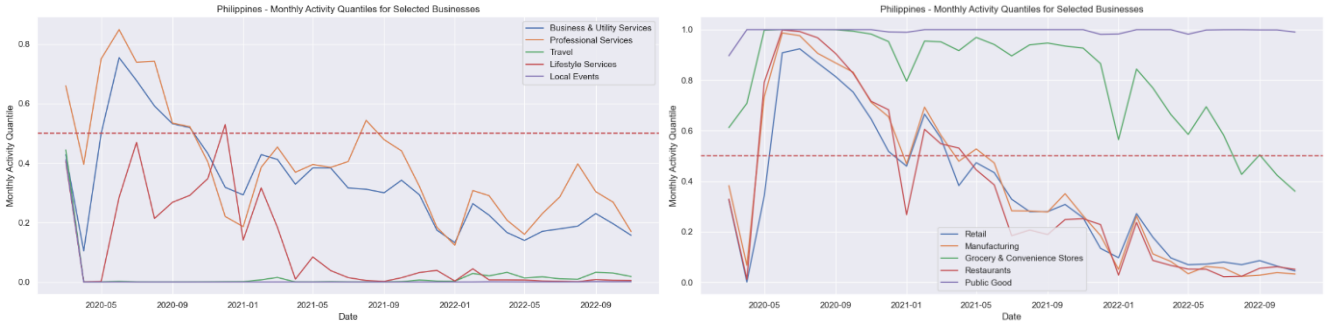


Figure 12

The Philippines is strongly reliant on tourism for revenue and employment**.** In 2019, tourism contributed 12.7% of the country's GDP and employed 5.7 million people [7]. However, the pandemic has had a severe impact on the tourism industry, with travel restrictions and lockdown measures reducing demand for air travel and hotel services. The country lost 190 billion dollars ($3.8 billion) in tourism profits in the first quarter of 2020 [8]. The government gave wage subsidies, tax incentives, and credit lines to support tourist firms and workers, but the sector's recovery remains uncertain as shows in **figure 11** [8].

Figure 13

Mauritania, on the other hand, does not rely heavily on tourism to support its economy. Tourism contributed only 0.2% of the country's GDP and 0.1% of its employment in 2019 [9]. The country has a limited domestic market as the majority of the population cannot afford to travel. Since the

country did not implement rigorous measures to contain the virus, the pandemic had little influence on local event sector **Fig.12**.

3.2 What do you discover when using different metrics? Please make comments.

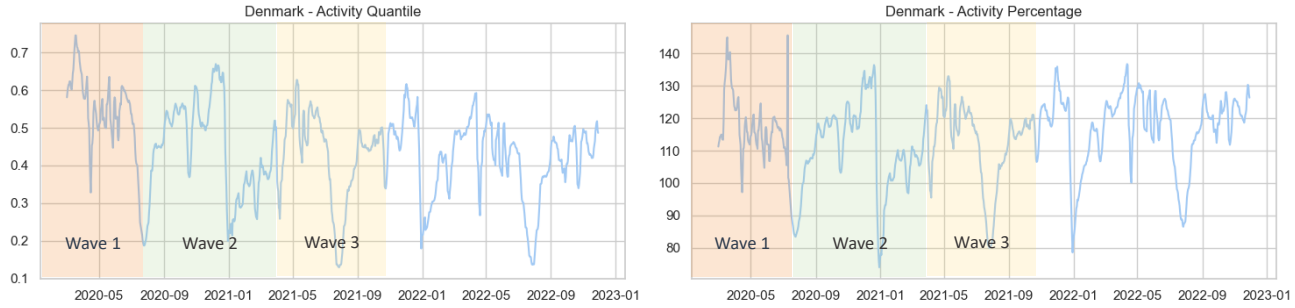


Figure 14

Fig. 14 shows how business level using two matrix(activity quantiles and activity percentage) highlighting the 3 waves of the pandemic **in Denmark.** We can see that the activity level decrease sharply between August and December 2020 to about 0.2 .followed by gradual increases until the second wave of Covid-19 start at January 2021.When the activity level decline to the lowest value near 0.1 at August 2021 then fluctuated across the rest of the year .Both matrix show that business verticals suffer a decrease in business activity after following restrictions .

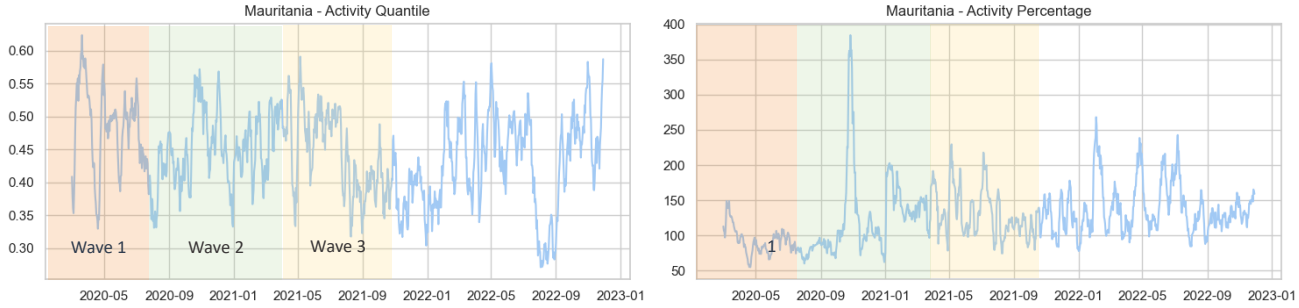


Figure 15

In **Mauritania** both matrices show that business activity experienced numerous challenges from the first wave of Covid-19 until the end of the third wave. **Fig. 15 shows** the weekly activity percentage fluctuated during the first months until December 2020, when UN assistance arrived Mauritania after the first wave and peak at 350[9].Business quantile generally has a fluctuated rat below 0.55 .

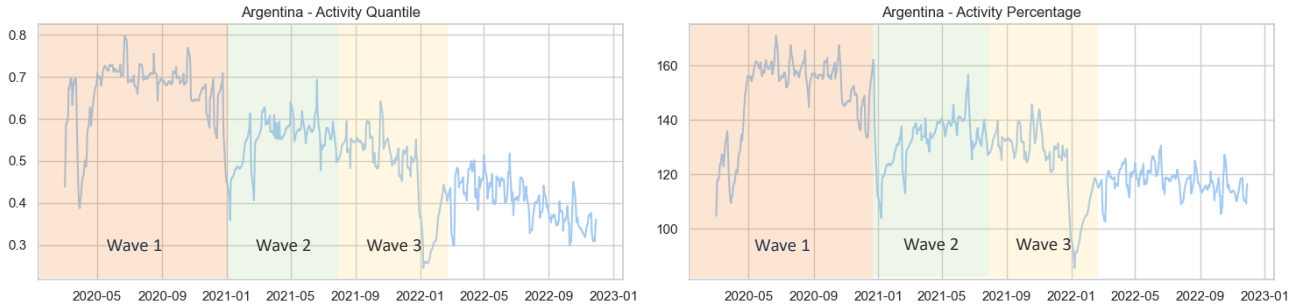


Figure 16

In Fig .16 , both matrices have similar trends. Since March 2020, **Argentina** has been under a legislated national lockdown. And By the end of 2020, the government had announced a partial

lockdown in **Buenos Aires**, which included limits on commerce and mobility, border closures, and school and educational institution closures. Consequentially, the quantile of business activity fell dramatically to under 0.5 and did not recover to pre-pandemic levels.[16]

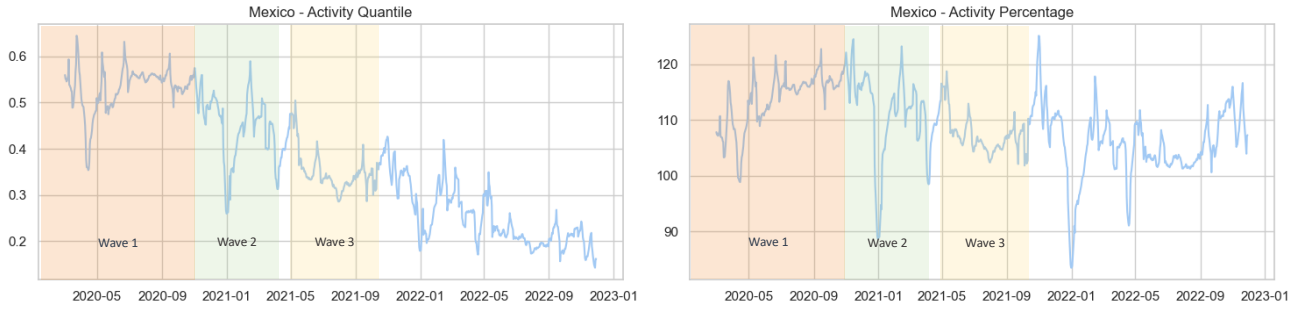


Figure 19

In Fig .17 When we use activity percentage in Mexico, we notice that it is at high levels above 100, while when we compare the activity quantiles, we find that since the beginning of the pandemic in Mexico, it has been gradually decreasing until it reached nearly 0.1. Even after containment measures In terms of activity quantiles, the Philippines has a low and unpredictable level of activity throughout the year.

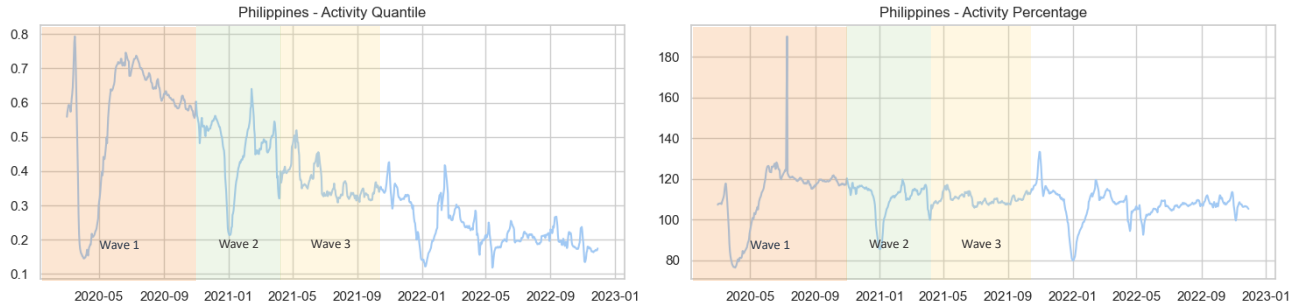


Figure 18

According to **Figure 18**, economic activity in the Philippines fell drastically to around 0.2 in March 2020 after the government declared a sanitary emergency. There will be a mandatory lockdown in place until May 2020, with stringent limits on commerce and movement. [14] Activity percentage, on the other hand, peaked in July 2020 and then ranged between 100 and 120 in the followed months.

4 Try to understand the causes of these changes - please look for relevant policies and other events that help you understand these changes. Or reversely, how the business trends have enabled/disabled some policies to some extent. Use online information wisely! Comment on what you discover.

By combining the result trend with **Covid-19** Government Response policy **,**number of factors can provide a potential explanation for the observed trends. [15]

1. **implementation of containment measures**: such as lockdowns, social distancing, travel restrictions, and closures of non-essential businesses. These measures had different impacts on different sectors and countries, depending on the nature and duration of the interventions, the structure of the economy, and the policy responses. **Denmark** and **Argentina** give an example of how travel policy change business activity quantiles during .

In the history of the COVID-19 Alert System, in travel sector in **Denmark** transitioned into different levels of restrictions highlighted as following :[11][16]

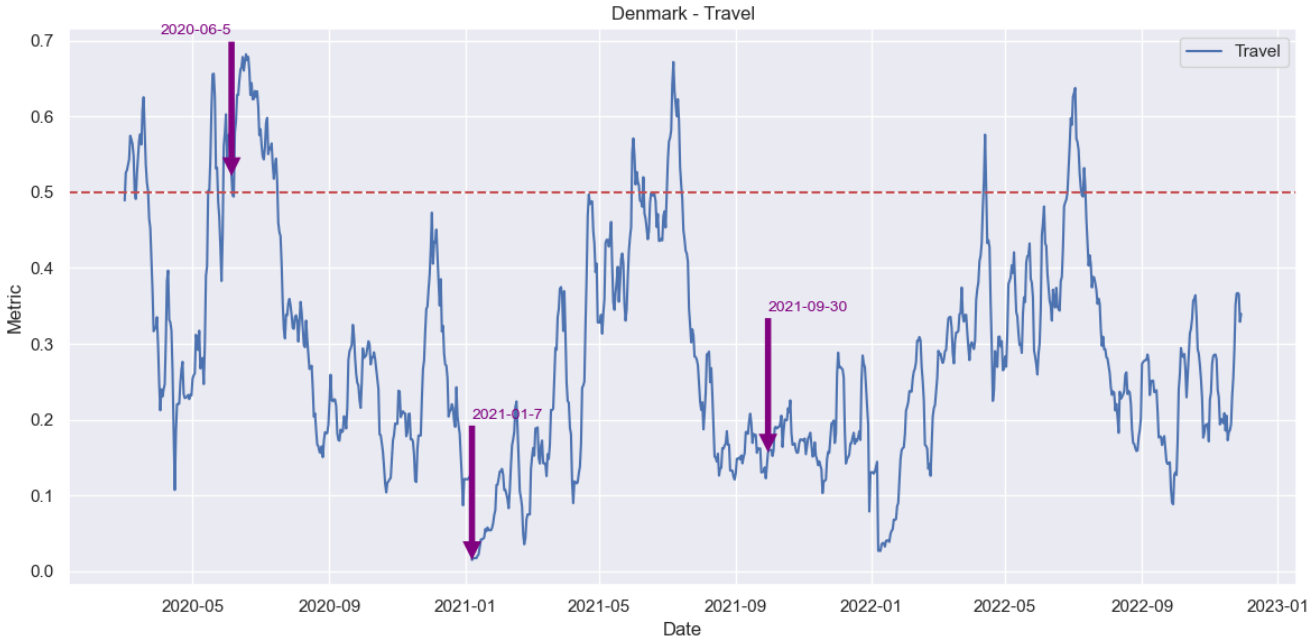


Figure 20

- On June 5, 2020 **Denmark** introduced a COVID-19 Alert System, which classified countries into three categories: open (green), banned (red), and restricted (orange), based on their infection rates and travel advice.
    - **Result** :Travel activities start adapting the new regulations and shows a small growth.
- On January 7, 2021, **Denmark** tightened travel restrictions for all countries due to the emergence of new variants of the virus.
    - **Result** : Gradual decline in travel activity rate to less than 0.2 quantiles in Jun2021 .
- On September 30, 2021, **Denmark** became the first EU country to lift all COVID-19 travel restrictions, allowing travelers to enter Denmark without any entry requirements. The same also applied to domestic travel within Denmark, where all preventive measures were also lifted.
    - **Result** : The rate of travel activity rose gradually to reach pre-pandemic level by the end of 2022.

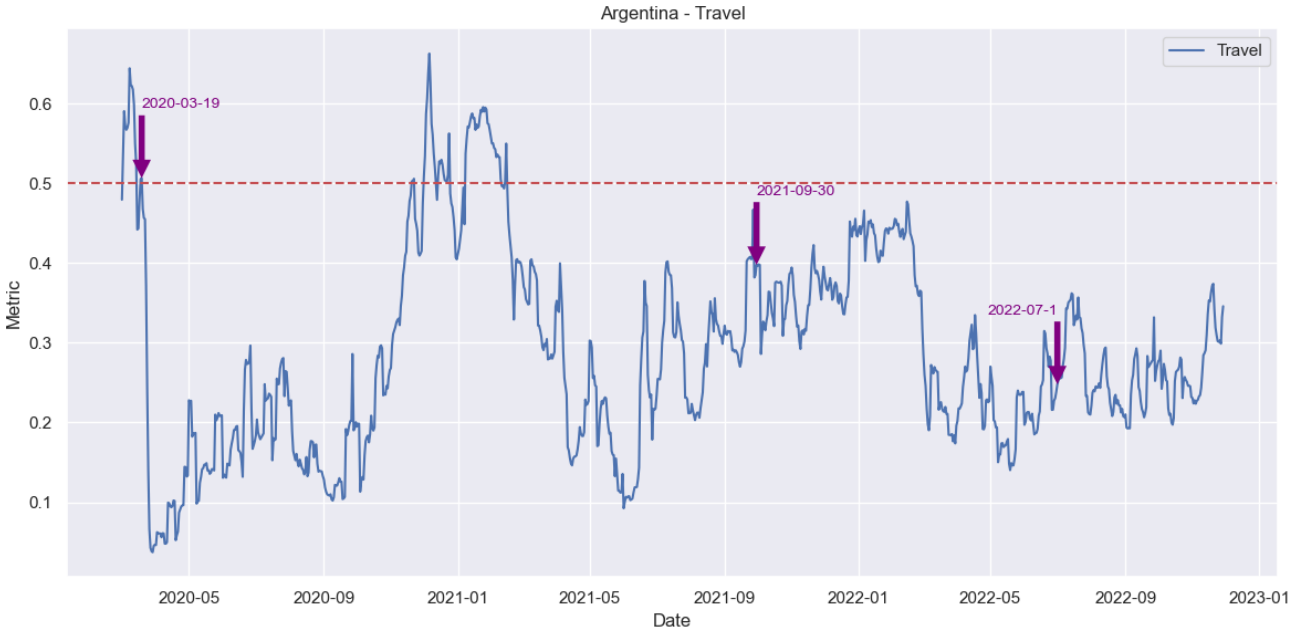


Figure 21

Similarly, **Argentina** introduced a COVID-19 Alert System on March 19, 2020, which declared a mandatory nationwide lockdown until March 31, 2020.[12][13]

- The lockdown extended several times until November 8, 2020. The lockdown included restrictions on commerce and movement, the closure of borders, and the closure of schools and educational institutions.
  - **Result** :sharp decline in travel activity to under 0.1.
- On September 30, 2021, **Argentina** lifted almost all COVID-19 travel restrictions, allowing travelers to enter Argentina without any entry requirements.
  - **Result** : travel activity start to recover and increase gradually to about 0.5 till the end of the year.
- On January 17, 2022, all preventive measures were lifted for domestic travel within Argentina.
  - **Result** : travel sector damaged after the third wave of Covid-19 and struggle to return to the pre-pandemic level , but it shows and upwards trends.

Generally, the decrease mostly occurs only when the government requires closing for all non-essential businesses. When the closing restriction is a recommended closing or open differently, Business sectors manage to maintain their ordinary levels of activity. But when the closing restriction is strict for some sectors, we see a decrease in activity only, likely due to the heterogeneity of the different policies**.**

2. **Policy responses** of governments and central banks to mitigate the economic and social consequences of the pandemic. These responses included fiscal measures, such as income support, tax relief, and public spending. [16]

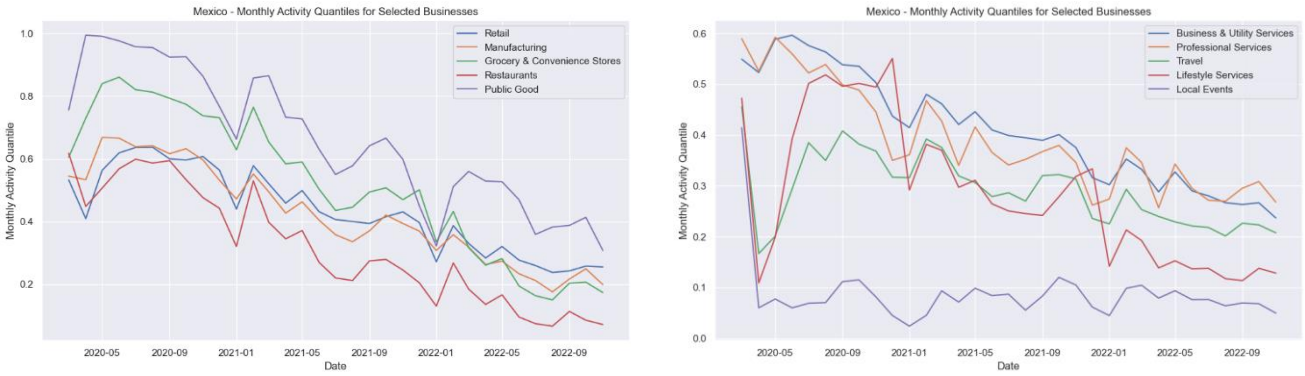


Figure 22

Retail sector in Mexico from the figure 23 we can observe how government and financial support affect the activity rate during Covid-19 :

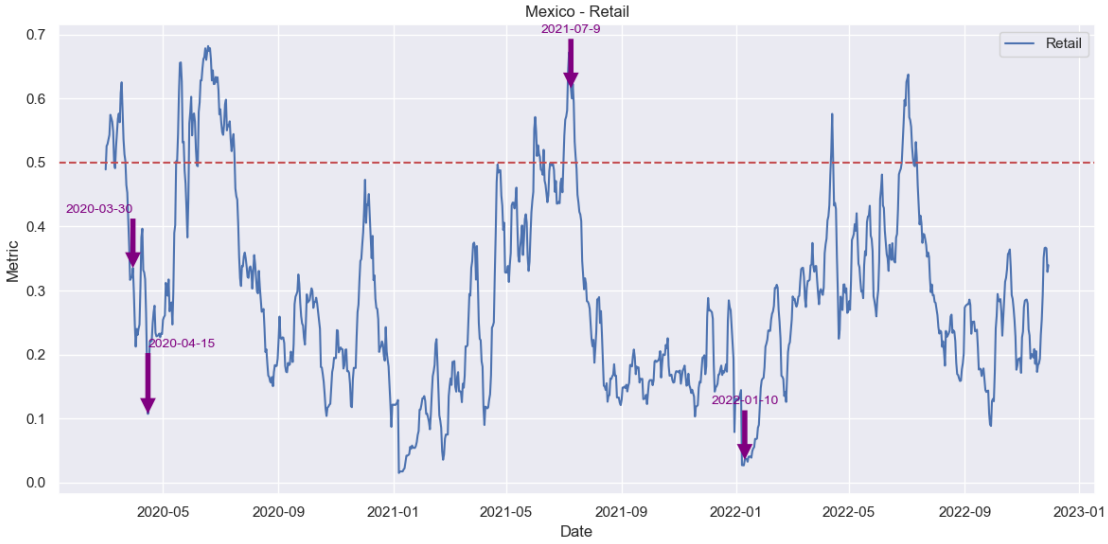


Figure 23

- On March 30, 2020 : The government declared a sanitary emergency due to force majeure on March 30, and implemented a mandatory, nationwide lockdown until May 30 .[15]
    - **Result**: retail sector severely affected, as consumer spending fell sharply and many stores had to close or reduce their operations.
- On April 15, 2020: President López Obrador announced a fiscal stimulus package of 3.3% of GDP, which included income support for vulnerable groups, tax relief for small businesses, public spending on infrastructure and social programs.[19]
    - **Result**: the retail sector progressively increased to above 0.5, the pre-pandemic level.
- On July 9, 2021: The government experienced a surge in cases due to the Delta variant, which was more transmissible and caused more severe symptoms than the previous variants. To prevent the spread of the Delta strain, the authorities enforced tighter quarantine restrictions

in some states. Curfews, travel restrictions, and capacity limits for public and private businesses were among them.
    - **Result:** activity quantile dropped to less than 0.2 .

- Mexico's retail sector began to recover in 2021, as COVID-19 infections and deaths decreased dramatically by November 2021.Furthermore, retail sector benefited from the acceleration of digital transformation, as consumers adopted online platforms and delivery services for their purchases which result in significant growth from January 2022.[20]

5 Reflection

Write no more than 500 words in total. Remember, this is an academic writing exercise. You should be citing sources and justifying your opinions with evidence/analysis.

Business activity trends are important indicators of the economic and social conditions of a region or sector. They provide insights into the opportunities and challenges faced by businesses and consumers, as well as the impact of the COVID-19 pandemic.

There are several benefits to using this dataset. To begin, the methods used to generate statistics on the level of activity in each business sector are simple to compute and interpret, as they are based on the counts of business actions. Second, the two matrixes used in this dataset provide a clear representation to detect changes and patterns across time as well as across different areas and industries. They represent the influence on commercial activity of the COVID-19 pandemic, lockdowns, and economic measures. For example, the data reveal a sharp decrease during the pandemic's peak in 2020, indicating a drop in business activity. and then it shows how the global market will begin to recover in 2021, with an increase in business investment and consumer confidence. The data also demonstrates that different regions and sectors had varied patterns of change in reaction to the pandemic, depending on their exposure and response. However, The two matrices used in this dataset have some limitations and disadvantages, as they may not reflect the actual performance or revenue of the businesses. Additionally , the two metrics only measure the online interactions but not the offline transactions. Which could be an external and important factor affect business interaction.

Despite their usefulness, these metrics struggle with inherent limitations. As they operate mainly in the online sphere and leave out important offline transactions, they may not accurately reflect the tangible performance or revenue of businesses. Furthermore, unrelated variables, such as the marketing strategies and substance of company pages, the complexities of marketing plans, and the algorithms built into the Facebook (now Meta) network, have an impact and may introduce prejudices unconnected to the main business operations. Moreover, these metrics in some countries face difficulties in capturing the complex and multifaceted diversity that exists within businesses; they frequently fail to account for differences in size, type, and category.

Therefore, even though these metrics provide priceless insights into trends in business activity, their interpretive range is not exhaustive. To provide an accurate representation, they require integration with additional data types. This data may include actual revenue, business performance, and customer demographics in detail, guaranteeing a comprehensive comprehension of the complex dynamics involved. This requires a multimodal approach to ensure a full and reliable evaluation of business activity patterns in a constantly changing environment.

6 Conclusion

In this report I tried to observe and analysis the main trends using business activity trends dataset .it is important to say that it is a useful source of information that can provide insight into the rate of business recovery in various countries. Nonetheless, I think it is important to acknowledged the dataset's limits. The dataset may not accurately reflect business performance, revenue, or the underlying variables of the data collection method. To improve these findings and attain more precise assessments, it is necessary to combine additional data sources, such as business marketing plans and actual performance statistics. Also some insight on Facebook algorithms and features that used to enhance business marketing plans. Therefore, we can create a thorough and accurate picture of activity trends to help businesses make better decisions and strategies during crisis events.

7 References

1. Data For Good at Meta. (n.d.). Business activity trends. Retrieved from : https://dataforgood.facebook.com/dfg/tools/business-activity-trends
2. Facebook. (2020). Facebook business activity trends during COVID19. Retrieved from : https://data.humdata.org/dataset/facebook-business-activity-trends-during-covid19.
3. Eyre, R., De Luca, F., & Simini, F. (2020). Social media usage reveals recovery of small businesses after natural hazard events. Nature communications, 11(1), 1-10. https://doi.org/10.1038/s41467-020-18827-5
4. Lam, P., Iyer, S., Giraudy, E., & Pompe, A. (2022). Facebook business activity trends for disaster recovery. A preprint, 4-11.
5. CDC Museum. (n.d.). COVID-19 timeline. Retrieved from : https://www.cdc.gov/museum/timeline/covid19.html
6. OECD. (2020). The impact of containment measures across sectors and countries during the COVID-19 crisis. Retrieved from : https://www.ecb.europa.eu/pub/economic-bulletin/focus/2021/html/ecb.ebbox202102_04~eef0a56145.en.html
7. World Bank. (2020). How COVID-19 is affecting companies around the world. Retrieved from : https://www.bbc.co.uk/news/business-51706225
8. Oxford Business Group. (2021),How does the Philippines envision tourism after the pandemic, Retrieved from :How does the Philippines envision tourism after the pandemic? - Asia 2021 - Oxford Business Group
9. UNICEF. (2020). Mauritania humanitarian situation report No.5.
10. Wikipedia contributors. (2021, November 17). Economy of Mauritania. In Wikipedia, The Free Encyclopedia. Retrieved from : https://en.wikipedia.org/wiki/Economy_of_Mauritania
11. International Trade Administration. (2020). Denmark - Market overview. Retrieved from : https://www.trade.gov/country-commercial-guides/denmark-market-overview
12. U.S. Department of State. (2021). Investment climate statements: Argentina 2021. Retrieved from : https://www.state.gov/reports/2021-investment-climate-statements/argentina/
13. International Monetary Fund. (2021). Policy tracker. Retrieved from : https://www.imf.org/en/Topics/imf-and-covid19/Policy-Responses-to-COVID-19
14. United Nations. (2020). Secretary-General examines the impact of COVID-19 on tourism. Retrieved from : https://philippines.un.org/en/88661-secretary-general-examines-impact-covid-19-tourism
15. World Health Organization. (2021). Coronavirus disease (COVID-19) dashboard with vaccination data. Retrieved from : https://covid19.who.int/
16. (2021). COVID-19 government response tracker. Retrieved from : https://www.bsg.ox.ac.uk/research/covid-19-government-response-tracker
17. Greer, S. L., King, E. J., Fonseca, E. M. D., & Peralta-Santos, A. (2021). Coronavirus politics. University of Michigan Press.

18. Mathieu, E., Ritchie, H., Rodés-Guirao, L., Appel, C., Giattino, C., Hasell, J., Macdonald, B., Dattani, S., Beltekian, D., Ortiz-Ospina, E., & Roser, M. (2020). Coronavirus pandemic (COVID-19). Our World in Data. Retrieved from : https://ourworldindata.org/coronavirus
19. Yale School of Management. (2020). The Mexican government's economic response to the COVID-19 pandemic. Retrieved from : https://som.yale.edu/blog/the-mexican-government-s-economic-response-to-the-covid-19-pandemic
20. Wikipedia contributors. (2021, November 17). COVID-19 pandemic in Mexico. In Wikipedia, The Free Encyclopedia. Retrieved from : https://en.wikipedia.org/wiki/COVID-19_pandemic_in_Mexico