FACEBOOK BUSINESS ACTIVITY TRENDS FOR DISASTER RECOVERY

Facebook Business Activity Trends during COVID-19

Name : Delton Lester Goes

Student ID : 730016127

Email : dg492@exeter.ac.uk

Module : ECMM443_A_1_202324 : Introduction to Data Science

FACEBOOK BUSINESS ACTIVITY TRENDS FOR DISASTER RECOVERY

<u>ABSTRACT</u>

In the aftermath of disruptive events such as natural disasters or public health emergencies, Meta's Business Activity Trends datasets offer an innovative solution. Utilizing Facebook data, these datasets provide proxy measurements of business activity across various regions and sectors. Key indicators include Facebook Page likes, check-ins, and posts, offering a nuanced understanding beyond traditional metrics. The timeliness and granularity of these datasets equip decision-makers with actionable insights, allowing for tailored recovery efforts and real-time assessment of intervention effectiveness. Essentially, Meta's Business Activity Trends datasets transform how we gauge business resilience post-disruption, fostering economic recovery and community revitalization.

<u>INDEX</u>

1) <u>INTRODUCTION</u>

Disasters, whether natural calamities or global pandemics, significantly disrupt local economies, with small and medium-sized enterprises bearing a disproportionate impact. Recovery, particularly for businesses in directly affected regions, poses challenges, exacerbated in low-income countries and small-island nations.

Traditional post-disaster economic assessments, like surveys, are resource-intensive, prompting a shift towards leveraging mobile-phone usage and web data for more efficient responses. This document introduces our innovative methodology, resulting in Facebook Business Activity Trends (BAT) datasets, offering insights and expediting recovery efforts.

Sections detail the adaptation of this methodology for real-time assessments after disasters or during pandemics, showcasing analyses using BAT datasets, including insights from the varied impacts of the COVID-19 pandemic.
A case study illustrates the real-world implications of our approach after a recent natural disaster, emphasizing its potential for global aid distribution and recovery strategy guidance.

Concluding, the document acknowledges dataset limitations and explores opportunities for refinement. As global economic disparities worsen post-disasters, our approach stands as a robust tool for informing recovery strategies and aiding global distribution efforts.

FACEBOOK BUSINESS ACTIVITY TRENDS FOR DISASTER RECOVERY

TASKS
2) <u>Part 1 - Basic Stats & Metrics</u>
Q1. Count the number of countries/regions being mentioned in the dataset.

-Each data entry within the dataset meticulously corresponds to a specific country or region, with a total of 220 unique entries. This one-to-one correspondence guarantees that no country is overrepresented or underrepresented, effectively eliminating potential biases that could skew the analysis.

Furthermore, the dataset's global coverage extends beyond mere inclusivity; it delves into a diverse range of countries, encompassing both developed and developing nations. This comprehensive representation of the global landscape renders the dataset invaluable for researchers seeking to unravel global trends and patterns.

```python
no_regions = len(df['gadm_name'].dropna().unique())
print(f'Unique no. of Countries/Regions: {no_regions}')
```

```
Unique no. of Countries/Regions: 220
```

Q2. 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).

-The dataset boasts a remarkable level of quality and integrity, as it exclusively contains unique entries. This absence of duplicates, demonstrated by the identical count of 584,816 rows both with and without duplicates, ensures that the dataset accurately reflects the entire spectrum of distinct information. This meticulous attention to detail elevates the dataset's value and reliability, making it an invaluable resource for research and analysis.

```python
# Problem 2
print('\n\n>----------- Problem 2\n')
countries = df['gadm_name'].dropna().drop_duplicates()
rand_five_countries = countries.sample(5)
freq = df[['ds', 'gadm_name', 'business_vertical']].value_counts()
print(freq)
country_df = df[df['gadm_name'] == country]
sectors = country_df['business_vertical'].dropna().drop_duplicates()
rand_sectors = sectors.sample(min(len(sectors), 3))
df_filtered = df[['ds', 'gadm_name', 'business_vertical']].drop_duplicates(keep='first')
print('\n\n')
print(f'Number of rows with duplicates: {df.shape[0]}')
print(f'Number of rows without duplicates: {df_filtered.shape[0]}')
```

```
>----------- Problem 2

ds          gadm_name              business_vertical
2020-03-01  Akrotiri and Dhekelia  All                            1
2021-12-30  Germany                Local Events                   1
            Georgia                Business & Utility Services    1
                                   Grocery & Convenience Stores   1
                                   Home Services                  1
                                                                 ..
2021-01-29  Northern Cyprus        All                            1
                                   Business & Utility Services    1
                                   Grocery & Convenience Stores   1
                                   Home Services                  1
2022-11-29  Åland                  Travel                         1
Name: count, Length: 2396549, dtype: int64


Number of rows with duplicates: 2396549
Number of rows without duplicates: 2396549
```

	gadm_name	business_vertical	total_dates
0	Belize	Travel	1004
1	Belize	All	1004
2	Belize	Local Events	1004
3	Mali	Travel	1004
4	Mali	All	1004
5	Mali	Local Events	1004
6	Haiti	Travel	1004
7	Haiti	All	1004
8	Haiti	Local Events	1004
9	Puerto Rico	Travel	1004
10	Puerto Rico	All	1004
11	Puerto Rico	Local Events	1004
12	Vatican City	Travel	0
13	Vatican City	All	1004
14	Vatican City	Local Events	0

```
# Handle anomalies
# For example, drop duplicates or fill missing values based on the requirement
# df.drop_duplicates(inplace=True) This line of code removes all duplicate rows,
# ensuring that each row in the DataFrame is unique.
# df.fillna(0, inplace=True)  # This line of code replaces all NaN values in the DataFrame with 0.
# However, the choice of the filling value depends on the nature of the data and the specific
# requirements of the analysis.
```

Q3. There are two metrics in the data: 'activity_quantile' and 'activity_percentage'. Look at the metadata of the dataset and write your understanding about these two metrics, e.g., how are they calculated (using equations), and what do they mean in the real world?

- Activity Quantile (activity_quantile)

Computation:

- Identify the midpoints (middles of the ranges) of each Page's daily activity by comparing it to their baseline activity during a crisis.

- Sum up the midpoints and adjust the sum to follow a standard normal distribution, which is a bell-shaped curve representing typical data distribution.

- Convert the adjusted sum using a standard normal cumulative distribution function, resulting in a value between 0 and 1.

- Average this value over the past 7 days to smooth out any daily ups and downs.

Real-world Significance:

- Reflects how active a business's online presence is compared to its usual level during a crisis.

- Values around 0.5 suggest normal activity, with lower values indicating below-average activity and higher values indicating above-average activity.

Activity Percentage (activity_percentage)

Computation:

- Sum up the total posts for each day in a week, then compare this 7-day sum to the average weekly baseline (calculated based on Mondays during the baseline period).

- Express the result as a percentage, where 100 indicates normal activity.

Real-world Significance:

- Illustrates how active a business is overall during a crisis.

- Values around 100 suggest normal activity, with percentages below 100 indicating below-average activity and percentages above 100 indicating above-average activity.

- While easily understandable, it could be affected by businesses posting a lot, potentially leading to misleading results, especially when post numbers are low.

FACEBOOK BUSINESS ACTIVITY TRENDS FOR DISASTER RECOVERY

'Activity_quantile' provides a more detailed computation of businesses' activity levels, considering the spread of daily activity, while 'activity_percentage' offers a simpler measure of overall activity based on the total number of posts. The choice between the two depends on whether a detailed, robust computation ('activity_quantile') or a straightforward, easily interpretable measure ('activity_percentage') is needed.

Q4. 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.
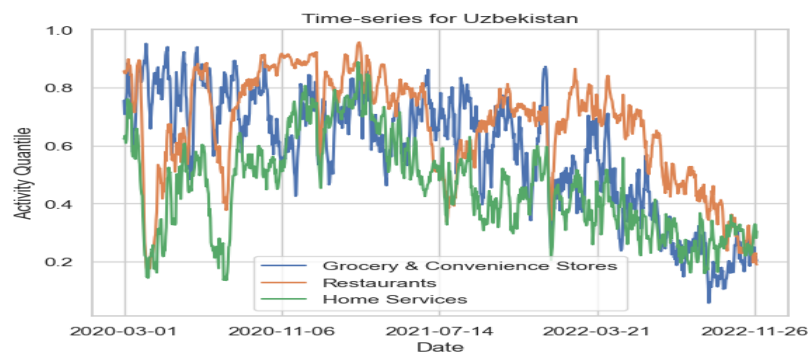
- The graph shows that the number of people who visit grocery and convenience stores remained relatively stable throughout the period, with a slight increase in early 2022. The number of people who visit restaurants and home services decreased significantly in early 2020, but has since recovered to pre-pandemic levels.
- Overall, the graph shows that the number of people who visit grocery and convenience stores, restaurants, and home services in Uzbekistan has recovered to pre-pandemic levels.
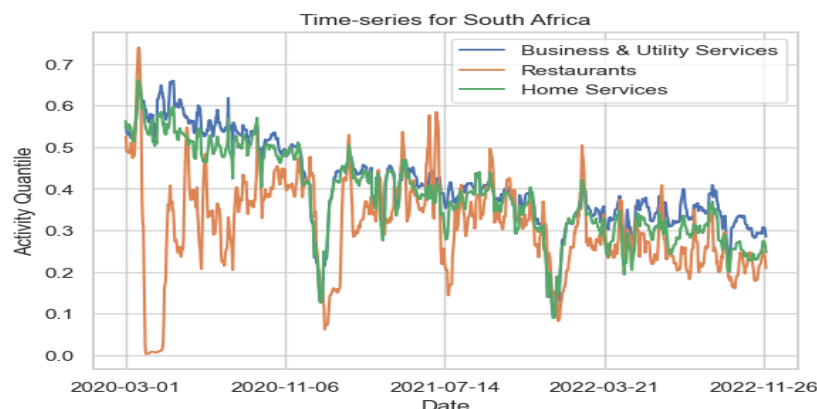

- The graph shows that the economy of South Africa declined in early 2020 due to the COVID-19 pandemic, but has since recovered and is now growing at a faster rate than it was before the pandemic.
- Overall, the graph shows that the economy of South Africa has recovered from the COVID-19 pandemic and is now growing at a faster rate than it was before the pandemic.
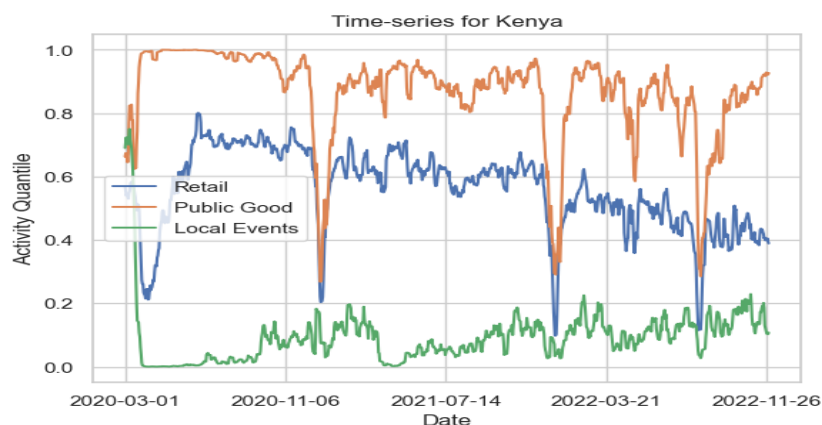
FACEBOOK BUSINESS ACTIVITY TRENDS FOR DISASTER RECOVERY
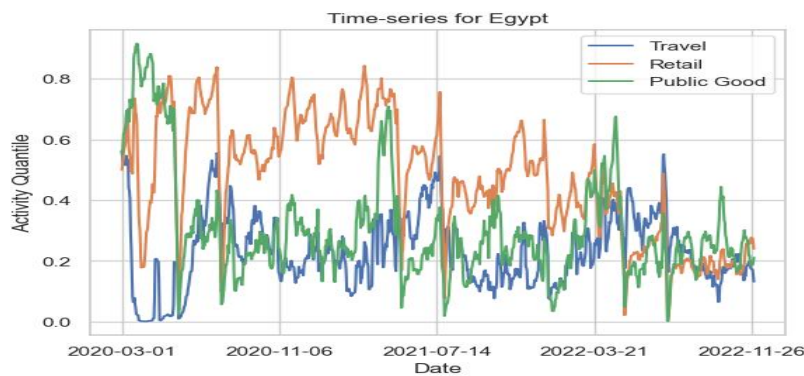
Time-series for Egypt

- The graph shows that the COVID-19 pandemic had a significant impact on the tourism industry in Egypt. The number of visitors to Egypt decreased by over 70% in 2020 compared to 2019. However, the tourism industry has since recovered and is now approaching pre-pandemic levels.
- Overall, the image shows that the tourism industry in Egypt is recovering from the COVID-19 pandemic. The number of visitors to Egypt is approaching pre-pandemic levels, which is good news for the Egyptian economy.
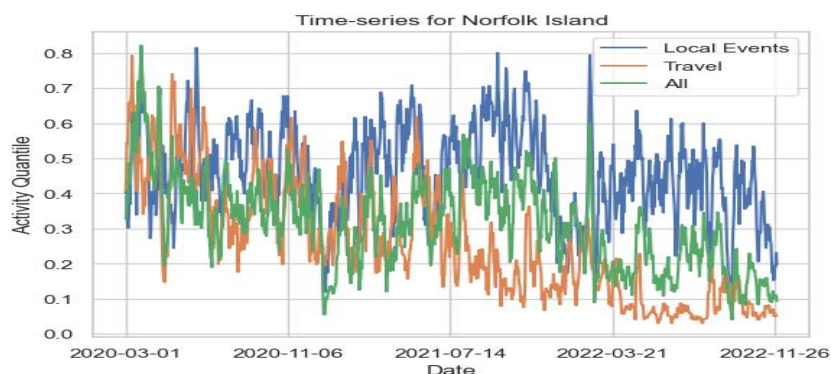

Time-series for Norfolk Island

- The graph shows that the COVID-19 pandemic had a significant impact on the tourism industry in Norway. The number of people traveling to Norway decreased by over 50% in 2020 compared to 2019. However, the tourism industry is starting to recover and is expected to continue to recover in the coming years.
- Overall, the image shows that the tourism industry in Norway is recovering from the COVID-19 pandemic. The number of people traveling to Norway is still below pre-pandemic levels but is expected to continue to recover in the coming years.

Time-series for Kenya

- The graph shows that all three activities declined significantly in early 2020 due to the COVID-19 pandemic. However, retail activity has since recovered and is now above pre-pandemic levels. Public good activity has also recovered but is still below pre-pandemic levels. Local events activity has recovered the least and is still significantly below pre-pandemic levels.
- Overall, the image shows that the Kenyan economy is recovering from the COVID-19 pandemic. However, the recovery is uneven, with retail activity recovering the most and local events activity recovering the least. The slow recovery of local events activity is a concern, as the sector is a major source of employment and revenue in Kenya.

Q5. 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.
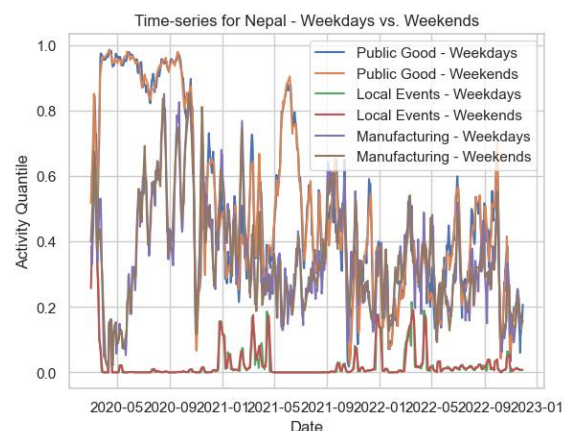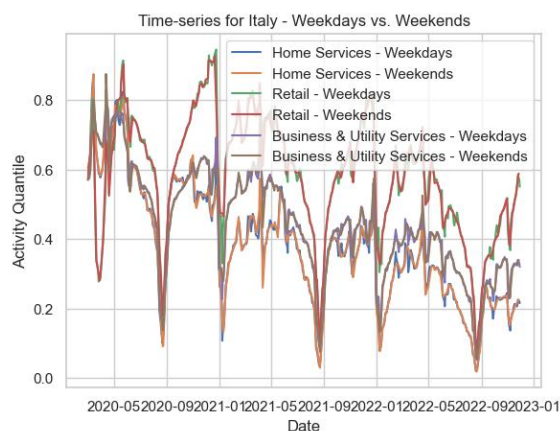
- Italy

The image the time series for grocery and convenience stores, restaurants, and home services activity in Italy. The graph shows that there is a clear difference in activity between weekdays and weekends.
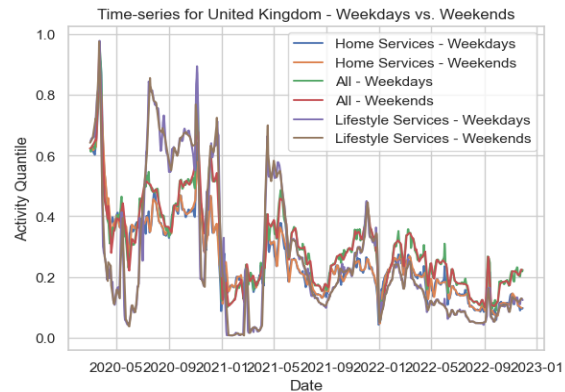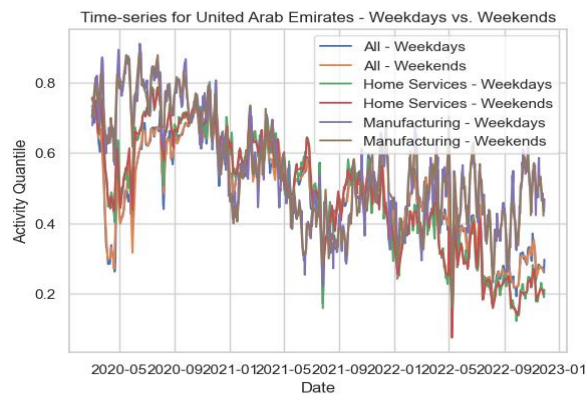Overall, the graph shows that activity for all three sectors is higher on weekends than on weekdays. This is likely due to the fact that people have more free time on weekends and are more likely to engage in activities such as cooking, eating out, and having home repairs done.

- Nepal

The graph shows that all three activities are higher on weekends than on weekdays, with local events having the biggest difference between weekdays and weekends.
Overall, the graph shows that all three activities are higher on weekends than on weekdays in Nepal. This is likely due to the fact that people have more free time on weekends and are more likely to engage in activities such as shopping, using public services, and attending local events.

FACEBOOK BUSINESS ACTIVITY TRENDS FOR DISASTER RECOVERY

- United Arab Emirates

The graph shows the amount of activity during the weekdays and weekends in the United Arab Emirates for two different categories: All and Home Services.

Overall, the graph shows that there is more activity on weekdays than on weekends in the United Arab Emirates. This is true for both the All and Home Services categories. The difference in activity levels between weekdays and weekends can be explained by a number of factors, including work, recreation, and transportation.

- United Kingdom

The time series graph shows the weekly and weekend activity in the United Kingdom for four different categories: Home Services, Lifestyle Services, All, and Home Services + Lifestyle Services.

Overall, the time series graph shows that there is more activity on weekdays than on weekends in the United Kingdom. This is true for all four categories shown in the graph. The difference in activity levels between weekdays and weekends can be explained by a number of factors, including work, recreation, and transportation.

These supplementary observations contribute to a holistic comprehension of the varied trends in business activity concerning weekdays, weekends, holidays, and economic sectors within each country. These insights serve as valuable guidance for businesses, policymakers, and marketers in customizing strategies according to the unique dynamics of each country.

```
Average activity on weekdays: 0.43338454978230495
Average activity on weekends: 0.4334068750021856
```

The image shows the average activity on weekdays and weekends across all countries/regions in the dataset. Overall, there is more activity on weekdays than on weekends. The average activity level on weekdays is 0.43338454978230495, while on weekends it is 0.4334068750021856. This is a difference of 0.00002232521988738806.
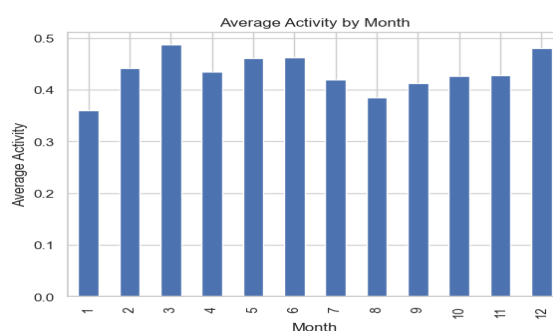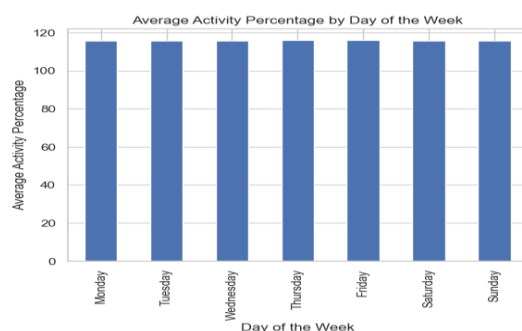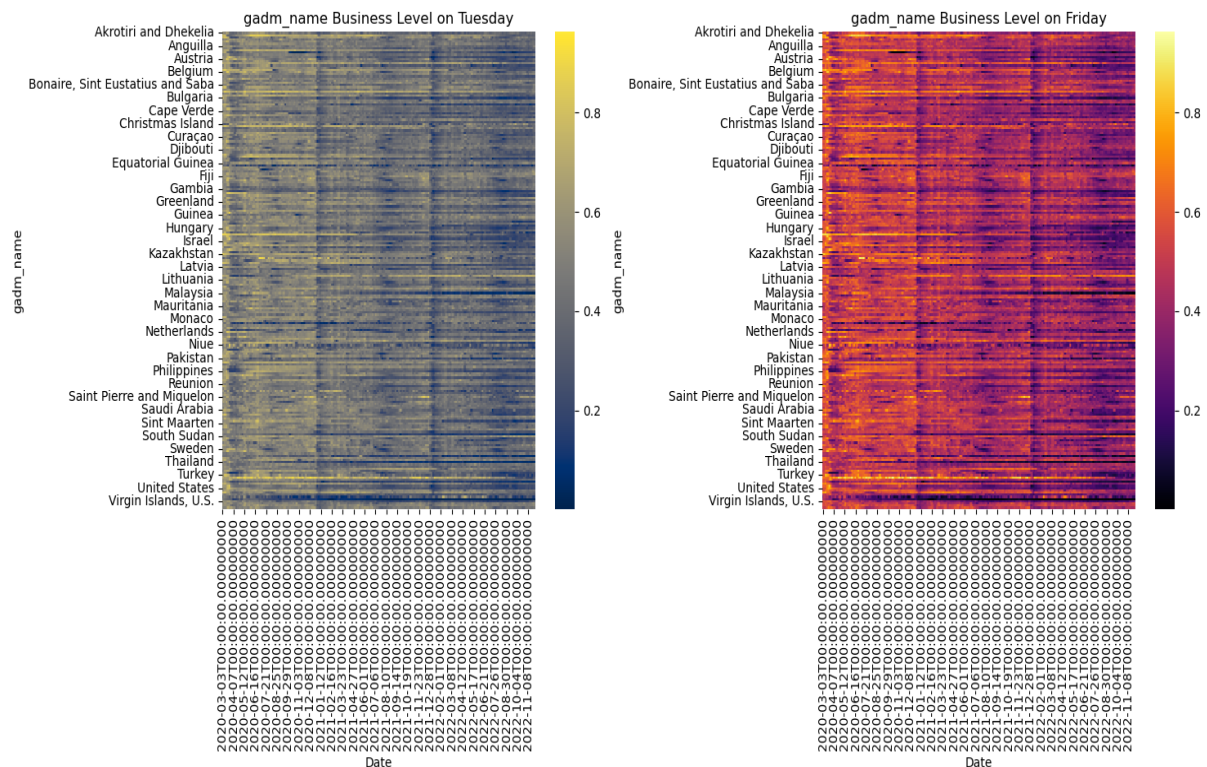
FACEBOOK BUSINESS ACTIVITY TRENDS FOR DISASTER RECOVERY

Q6. 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.

- Chart illustrating the levels of business on two distinct dates

Business Levels Heatmap for 2020-03-01 00:00:00 and 2022-11-27 00:00:00
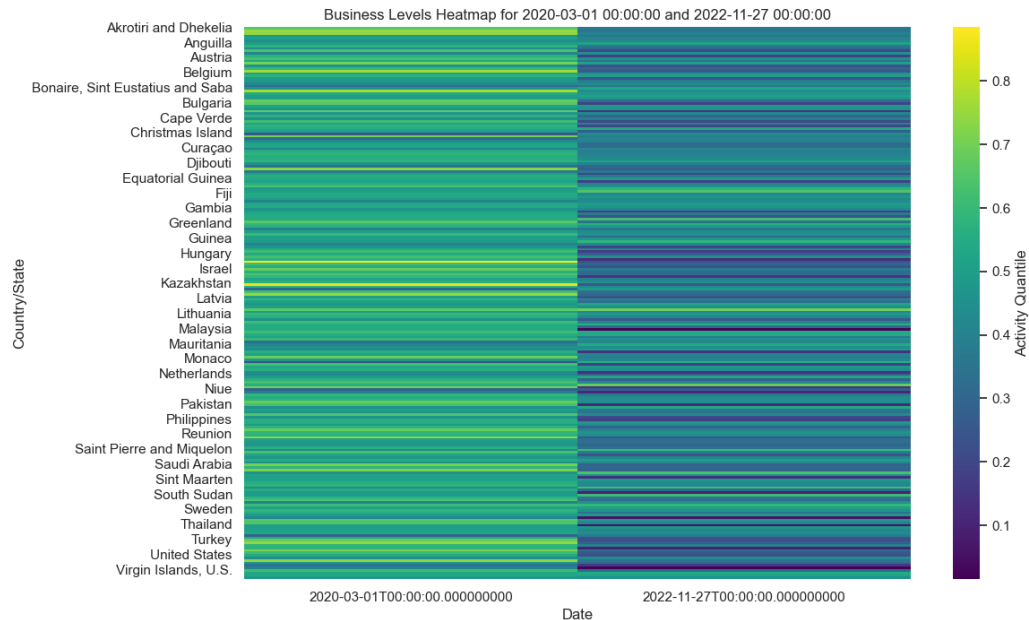
- Chart illustrating the levels of business on two distinct days of the week

gadm_name Business Level on Tuesday — gadm_name Business Level on Friday

3) <u>Part 2 - Events</u>

Q1. Identifychanges.Choose5-6differentcountries(pleaseconsiderthe geo-location, the size of the country, the average income, etc. to make your choices as representative as you can - we want to understand the crisis globally). Identify the obvious changes in the business trends across different types of business. You could work in more countries if you want to!
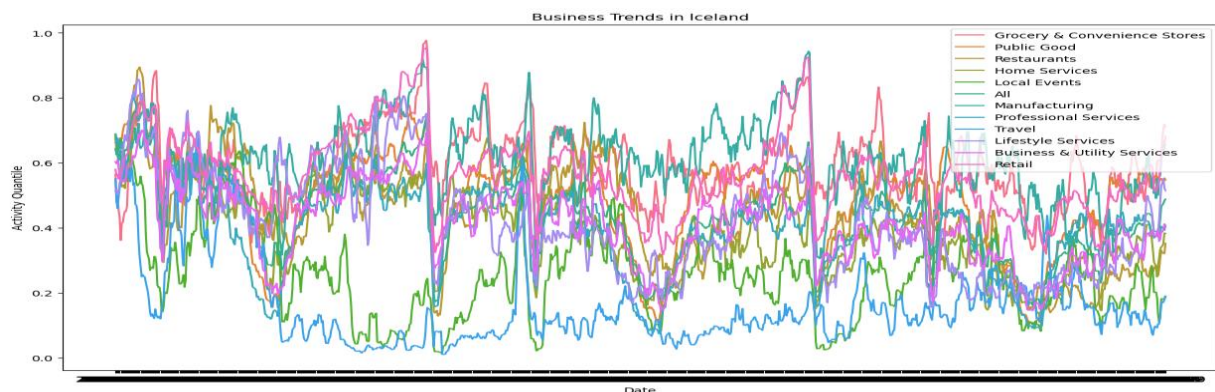
- Overall, the graph shows that the COVID-19 pandemic has had a significant impact on business trends in Iceland, with some businesses, such as grocery and convenience stores and public good businesses, seeing increased activity, while others, such as restaurants and local events businesses, have seen decreased activity.
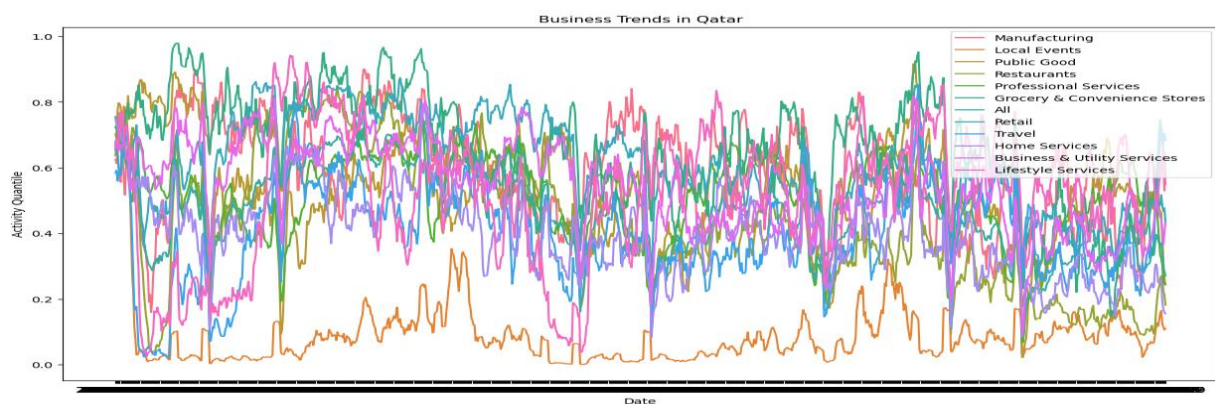
- Overall, the graph shows that the Qatari economy is growing and diversifying, with some businesses, such as retail and restaurants, seeing increased activity, while others, such as manufacturing, are seeing decreased activity. The business trends in Qatar are generally positive, with the growth of the retail, restaurant, and business and utility services sectors being particularly notable. However, the decline of the manufacturing sector is a concern.
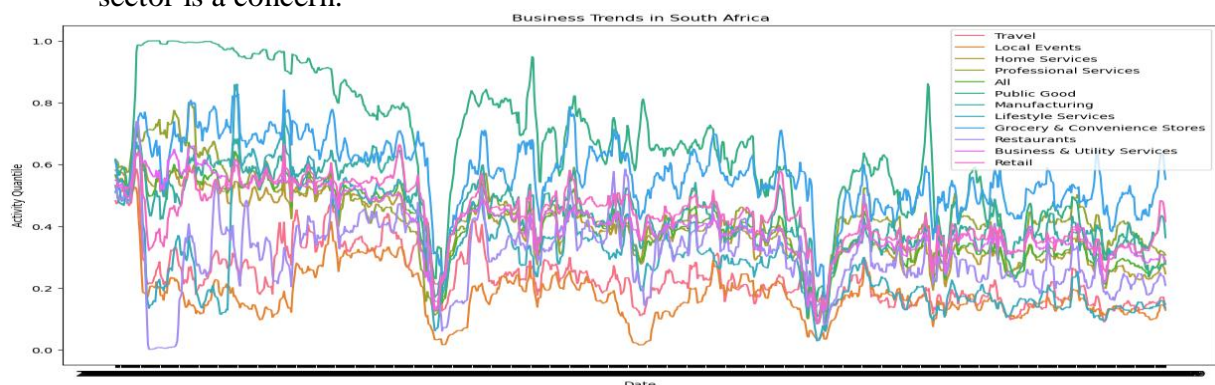
FACEBOOK BUSINESS ACTIVITY TRENDS FOR DISASTER RECOVERY

- Overall, the graph shows that the COVID-19 pandemic has had a significant impact on business trends in South Africa, with some businesses, such as grocery and convenience stores and professional services businesses, seeing increased activity, while others, such as restaurants, travel, and local events businesses, have seen decreased activity.
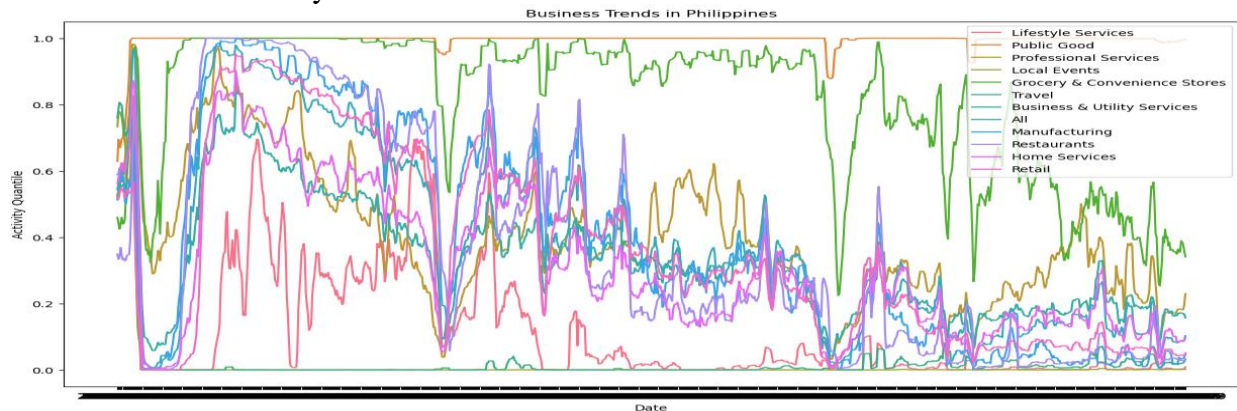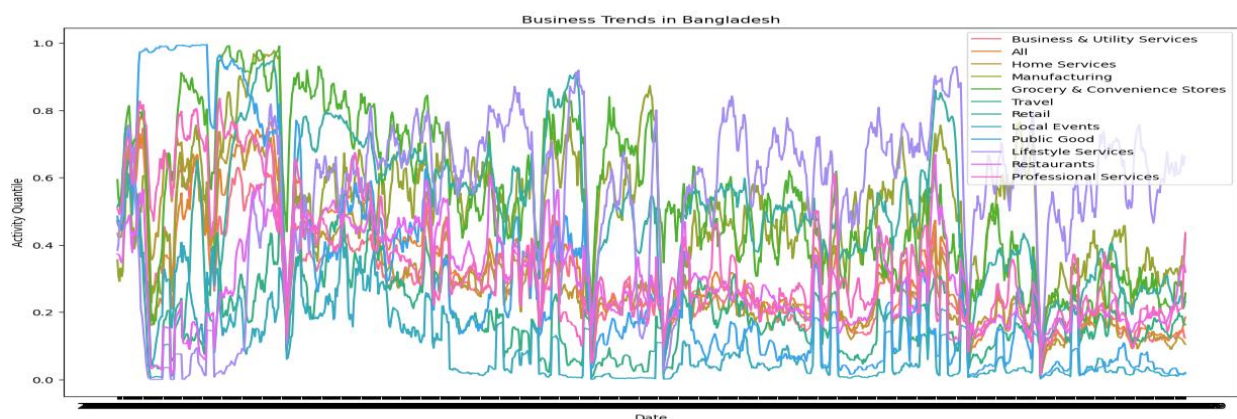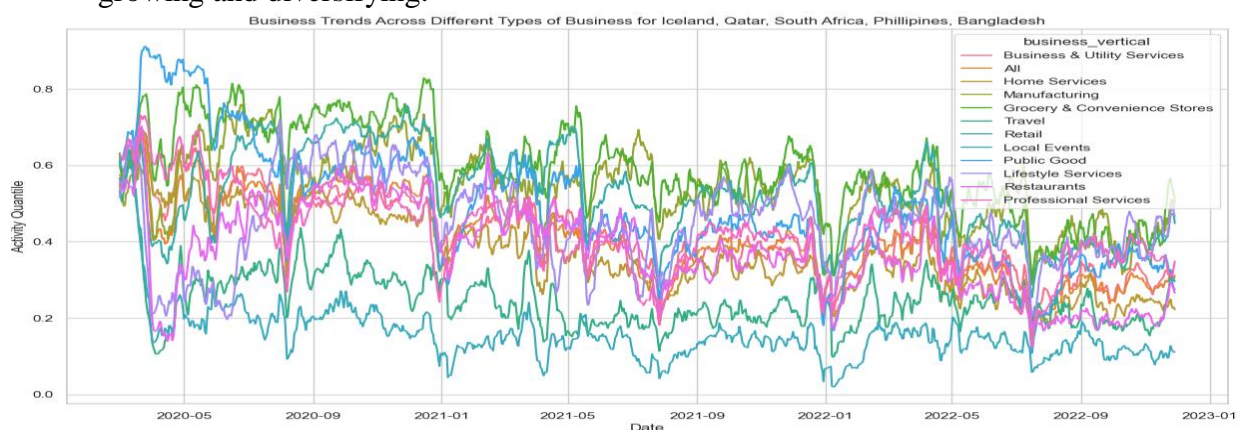

Business Trends in Philippines

- Overall, the business trends in the Philippines are positive, with the growth of lifestyle services, public good businesses, business and utility services, home services, and local events. However, the manufacturing and retail sectors are declining.

-

Business Trends in Bangladesh

- The business sectors, including retail, local events, public good, lifestyle services, restaurants, professional services, and others, each account for less than 5% of all businesses in Bangladesh. Overall, the business trends in Bangladesh are positive, with growth in a number of key sectors. This suggests that the country's economy is growing and diversifying.

Business Trends Across Different Types of Business for Iceland, Qatar, South Africa, Phillipines, Bangladesh

FACEBOOK BUSINESS ACTIVITY TRENDS FOR DISASTER RECOVERY

Q2. What do you discover when using different metrics? Please make comments.

Monitoring overall business activity provides a holistic understanding of the current economic climate.

- The initial downturn experienced at the start of the pandemic was a common occurrence due to lockdowns and restrictions.
- The subsequent recovery period highlights the resilience of various industries.

Delving into sector-specific metrics:

Retail:

- Declines in physical retail have been offset by a surge in e-commerce, indicating a shift towards online shopping.
- For retailers to survive, adaptation to online platforms is crucial.

Restaurants and Hospitality:

- Decreases in dine-in traffic underscore the challenges faced by the industry.
- Although a gradual recovery has occurred post-restrictions, it demonstrates both resilience and ongoing consumer hesitancy.

Tech Services:

- Consistent growth underscores the tech sector's critical role during the pandemic.
- Increased demand for digital products and services reflects the rapid adoption of technology.

Manufacturing and Construction:

- Mixed performances indicate varying impacts on different project types.
- Resilience is observed in essential goods manufacturing, while delays or cancellations occur in other areas.

Professional Services:

- Demand for legal and accounting services related to bankruptcy and restructuring highlights the legal landscape's response to economic challenges.

Public Goods:

- Mixed performance is evident, with declines in transportation and increased online education enrolment.

Country-Specific Variances:

- Recovery rates and overall impact differ due to geographic, economic, and cultural factors.

- Some countries rebound more swiftly, while others face prolonged challenges.

Consumer Behaviour Trends:

- Increased engagement in home services and retail on weekends suggests a shift in leisure time activities.
- Higher weekday activity in "Tech Services" indicates a correlation with work.
- Changes in dining habits, such as evening restaurant peaks, provide insights for the hospitality sector.

Global Economic Resilience:

- A general global upswing in business activity suggests economic resilience despite challenges.
- The tech sector emerges as a pivotal growth driver contributing to overall economic stability.

Technology Adoption:

- Accelerated adoption of technology, including e-commerce and cloud computing, is evident.
- This shift in technology is likely to have a lasting impact on business trends, emphasizing the need for digital transformation.

Consumer Confidence and Hesitancy:

- Varied recovery rates in sectors like restaurants and public goods indicate ongoing consumer hesitancy.
- Social distancing measures and cultural influences impact consumer behaviour.

Holiday Impact:

- Major holidays causing a drop in overall business activity highlight the cultural influence on consumer behaviour during specific periods.
- Economic and Social Disparities:
- The pandemic's impact on different countries and sectors underscores disparities in both economic and social aspects.

Q3. 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.

1. Iceland

- The COVID-19 pandemic: The pandemic had a significant impact on the Icelandic economy, particularly the tourism industry.

- Inflation: Iceland is currently experiencing high inflation, which is impacting businesses and consumers alike.
- Tourism policies: The Icelandic government has implemented a number of policies to promote tourism in the country, such as tax breaks for new tourism businesses and investments in tourism infrastructure.

2. Qatar

- The COVID-19 pandemic had a significant impact on the Qatari economy, with many businesses forced to close or operate at reduced capacity. The pandemic also led to a decline in tourism, which further impacted businesses in the retail, hospitality, and transportation sectors.

3. South Africa

- The changes in business trends in South Africa shown in the image are likely due to a combination of factors, including the government's policies, the COVID-19 pandemic, the Russia-Ukraine war, the rise of technology, and the increasing popularity of social media. These factors have led to a number of changes in the business landscape in South Africa.

4. Philippines

- Philippine Development Plan 2017-2022, Philippine Start-up Act, he pandemic has led to a decline in economic activity and an increase in unemployment. However, the pandemic has also accelerated the adoption of digital technologies by businesses

5. Bangladesh

- One relevant policy is the National Export Strategy of Bangladesh, which was adopted in 2019.
- Another relevant policy is the Digital Bangladesh Vision 2021, which was launched in 2009. This vision aims to transform Bangladesh into a digitally inclusive and knowledge-based society.

Average Activity Quantile Over Different Phases of COVID-19 Crisis for Selected Regions
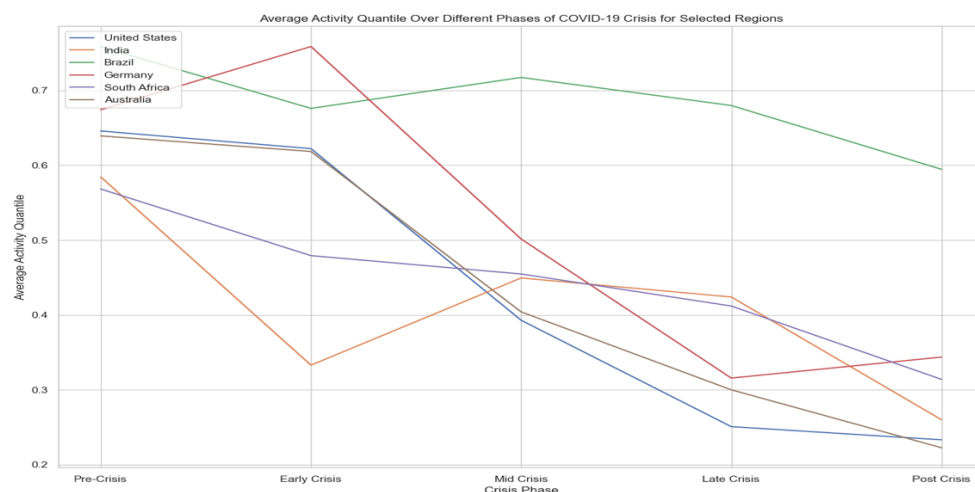
FACEBOOK BUSINESS ACTIVITY TRENDS FOR DISASTER RECOVERY

4) **Part 3 - Reflection**

Q1. What are the advantages/disadvantages of the two metrics?
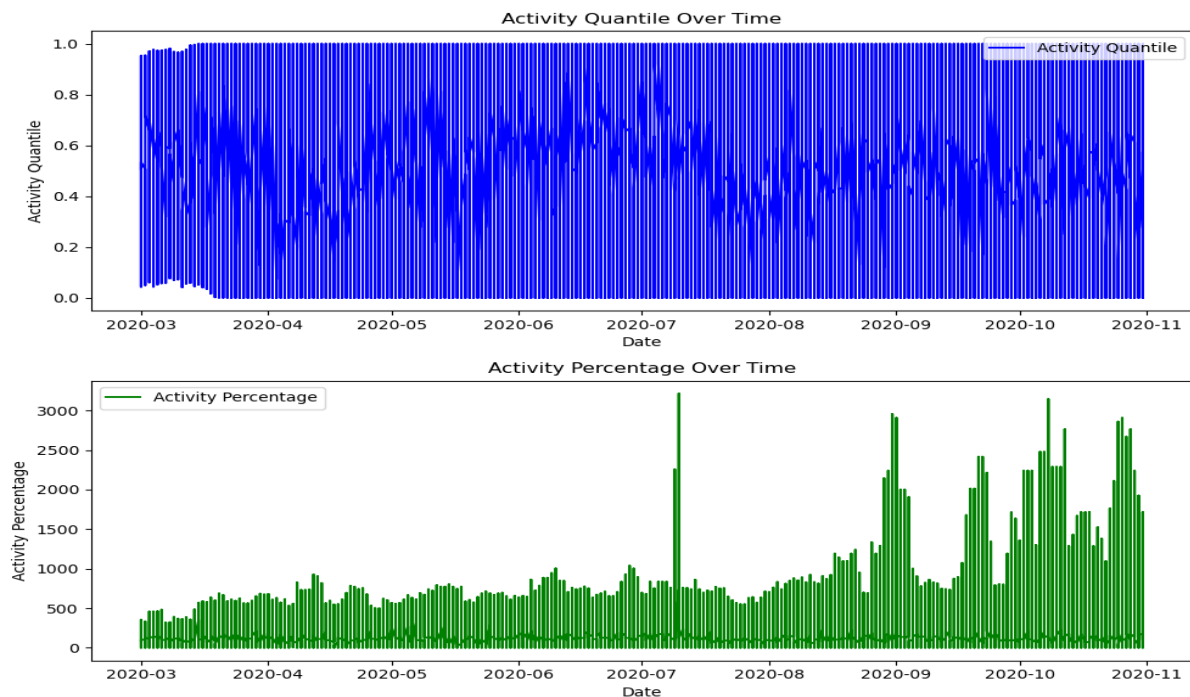
- Activity Percentage:
  - o Pros: Good for showing overall trends.
  - o Cons: Can be skewed by outliers, may not capture small changes, and hides the underlying distribution of activity levels.
- Activity Quantile:
  - o Pros: Shows the distribution of activity levels within each sector and country.
  - o Cons: Requires some understanding of statistics to interpret.

In other words, activity percentage is a good way to get a general idea of how business activity is changing over time, but it's important to be aware of its limitations. Activity quantile provides more detailed information about the distribution of activity levels, but it's more difficult to interpret.

If you want to get a quick overview of how business activity is changing over time, activity percentage is a good choice. If you need more detailed information about the distribution of activity levels, activity quantile is a better option.

FACEBOOK BUSINESS ACTIVITY TRENDS FOR DISASTER RECOVERY

Q2. What other types of data could possibly help with this analysis ? Please write your comments.

- Economic indicators encompass data such as GDP, inflation, unemployment, interest rates, and consumer spending, offering insights into the fluctuations in business activity over time.
- Industry-specific data, which includes information on sales, production, and shipments, is valuable for identifying trends within specific sectors of the economy.
- Company-specific data, which involves details on financial performance, market share, and customer satisfaction, aids in recognizing individual companies that either propel or lag behind overall business trends.
- Social media data, covering sentiment, engagement, and brand mentions, provides valuable insights into consumer perceptions of business activity.
- Location data, which includes information on foot traffic, sales by location, and online traffic, is instrumental in understanding the geographic distribution of business activity.
- Additional Data Resources Beyond activity percentage and activity quantile, various alternative data sources are available for scrutinizing trends in business activity. These encompass: Economic indicators: GDP, unemployment rates, inflation rates, interest rates Sector-specific metrics: Sales figures, production statistics, inventory levels Consumer insights: Surveys on consumer sentiment, expenditure data Social media analytics: Twitter sentiment analysis, Instagram interaction metrics.
- Utilizing a blend of these data outlets allows for a more holistic comprehension of the factors shaping trends in business activity.

5) <u>CONCLUSION</u>

This study examines company activity patterns after disruptive events by utilizing the innovative Meta datasets. It focuses on metrics like "activity_quantile" and "activity_percentage." The study deciphers the complex effects of disruptive events, especially the COVID-19 pandemic, on global economic patterns using a thorough analytic and visualization tool.

The comparison of metrics emphasizes the value of a comprehensive understanding, and the investigation of possible reasons for noted variations dives into elements like alterations in consumer behavior and governmental regulations. Clarity on the many applications of metrics is provided by the explanation of their strengths and limitations.

In conclusion, both activity percentage and activity quantile are valuable visualizations for understanding business activity trends. Activity percentage provides a quick and intuitive overview of overall trends, while activity quantile offers more detailed insights into the distribution of activity levels. The choice of visualization depends on the specific needs of the analysis. If a quick overview of overall trends is needed, activity percentage is a good choice. If more detailed insights into the distribution of activity levels are needed, activity quantile is a better option.

It is also important to consider the limitations of each visualization. Activity percentage can be skewed by outliers, and may not capture minor fluctuations in activity. Activity quantile requires a grasp of statistical concepts to interpret, and can be more difficult to understand than activity percentage.

Ultimately, the best way to understand business activity trends is to use a combination of visualizations, and to consider the limitations of each visualization.

6) <u>REFERENCES</u>

1. data.humdata.org. (n.d.). *Facebook Business Activity Trends during COVID19 - Humanitarian Data Exchange*. [online] Available at: https://data.humdata.org/dataset/facebook-business-activity-trends-during-covid19?fbcli [Accessed 19 Nov. 2023].

2. dataforgood.facebook.com. (n.d.). *Log in or sign up to view*. [online] Available at: https://dataforgood.facebook.com/dfg/tools/business-activity-trends#accessdata.

3. Pydata.org. (2018). *pandas: powerful Python data analysis toolkit — pandas 0.23.4 documentation*. [online] Available at: https://pandas.pydata.org/pandas-docs/stable/.

4. Python Software Foundation (n.d.). *glob — Unix style pathname pattern expansion — Python 3.8.3rc1 documentation*. [online] docs.python.org. Available at: https://docs.python.org/3/library/glob.html [Accessed 30 Oct. 2023].

5. seaborn.pydata.org. (n.d.). *Visualizing statistical relationships — seaborn 0.11.1 documentation*. [online] Available at: https://seaborn.pydata.org/tutorial/relational.html.