Does Media Matter?

A Quantitative Analysis of Media Effects on Human Behavior Through The Case of Covid.

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Abstract

This paper aims to examine the impact of media on human behavior through a case study of the COVID-19 pandemic. The study employs a quantitative research method to analyze the relationship between media coverage and public behavior. The results of the analysis will provide insights into the role of media in shaping human behavior, and the implications of these findings for policymakers and practitioners in the media industry.

Contents

1 Introduction

1.1 Background

The COVID-19 pandemic has had a profound impact on human mobility, as governments around the world have imposed restrictions on travel and public gatherings in an effort to slow the spread of the virus. At the same time, news reports have played a critical role in shaping public understanding of the pandemic and guiding decisions about personal behavior. This study aims to examine the relationship between news reports and human mobility during the COVID-19 pandemic, exploring the ways in which news coverage has influenced patterns of travel and mobility in communities in Japan. Through careful analysis of Japanese news publications' coverage of COVID-19 and a comprehensive examination of mobile phone location data, we hope to gain a deeper understanding of the complex interplay between news, public perception, and human behavior in times of crisis.

During the height of the COVID-19 pandemic, there was a pronounced decrease in human mobility as a result of restrictive measures imposed on the public to contain the spread of the virus. Governments across the globe implemented stringent guidelines and regulations aimed at limiting public gatherings and non-essential travel. Media outlets and news sources complemented these efforts by reporting the urgency of the pandemic, prompting many to heed warnings to stay at home and limit travel. This is especially so in the case of Japan, where strict restrictions on civil liberties are difficult for the government to impose due to legal complications. Unlike many Western nations, Japan did not impose strict curfews or lockdowns on its citizens to prevent infections (Thakur, 2021). Instead, it opted for strongly worded press releases, behavioral guidelines, and recommendations for the public to willfully follow. Much of the relative success Japan has had in curbing COVID-19 infections is attributed to this (self-restraint) exercised by the public.

There is hardly any denying that news and media outlets played a role in expediting such responses among the public. Even under the assumption that the public were merely forming rational responses to the risks of leaving their homes during a pandemic, they need information regarding the spread of the disease and the urgency of the situation in order to reach such decisions. In this paper, I argue that Japanese news outlets did more than just passively relay objective information about the current spread of COVID-19 but also actively influenced Japanese people's pandemic responses by shaping their understanding of the urgency of the situation.

1.2 Literature Review

This research contributes to roughly three areas in the academic literature.

First, this paper contributes to the study of the relationship between media and human behavior. This research has focused on several key areas, including the effects of framing and agenda setting. The framing effect refers to how the subtle ways in which

a media outlet presents an issue, or framing, can have significant impacts on people's perceptions, attitudes, and behaviors. For example, Entman (1993) found that different frames used by the media can influence the public's understanding of political events and can lead to different policy preferences. Another study by Nisbet and Scheufele (2009) found that framing can impact people's attitudes towards health issues, such as vaccination, and can shape public opinion on social and environmental issues. Similarly, research on agenda setting has demonstrated that media play a key role in determining which issues are considered important by the public. This is because the media set the "agenda" for what is considered newsworthy and worthy of public attention. A classic study by McCombs and Shaw (1972) found that the media's agenda can influence people's perceptions of the importance of certain issues, as well as their opinions on those issues. More recent research has further confirmed the importance of media agenda setting, with studies finding that the media's agenda can impact government policies and disaster prevention/response in the case of natural disasters (Barnes et al., 2008).

Second, the paper adds to the emerging academic literature utilizing large-scale geospatial mesh data. Traditional methods for measuring human mobility include using census and tax record data, which only offer data at annual intervals and are not fit for research like ours that relies on high frequency data. Questionnaires and surveys are also common in travel demand analytics, but this type of data can face problems with high bias and questionable accuracy. Furthermore, they can be costly to acquire and difficult to process. Un-aggregated GPS probe data and call detail records (CDR) data address the issue of frequency and accuracy by providing precise, continuous data on an individual's location. However, the former is rife with computational difficulties as the data often requires complex preprocessing such as map-matching and can quickly become too large to process in a resource-constrained environment, while the latter evokes privacy concerns as it can identify private information about the cellphone owners such as their address (von Mörner, 2017). Anonymized geospatial mesh data circumvents the above hurdles by providing high frequency, high granularity, reliable data that by the use of Standard Grid Squares. The data aggregates mobile phone GPS data into grids (a.k.a., "meshes") based on locations of cellphone towers, and records the number of people in a given mesh at a given hour. An increasing number of new studies have used this data in ways such as to measure differences in mobility patterns of people based on socioeconomic factors (Chen & Pope, 2020), estimate evacuation patterns in the case of an earthquake (Hayano, 2013), and empirically validate theoretical spatial econometric models (Miyauchi, 2021). My research follows in these efforts by utilizing the accuracy and high frequency of mesh data as a robust measurement of mobility that allows for inferring impulse responses in the data.

Third, the use of text analytic methods in order to process and utilize text data for quantitative analysis employed in this paper are part of a bigger trend of text analytics in economics. The introduction of text analytics and sophisticated natural language processing (NLP) methods to economics has considerably expanded the scope of data available for use in economic analysis. One example of using text analytics in economic research is the use of sentiment analysis in stock market prediction. Researchers have

used NLP techniques to analyze large volumes of financial news articles and social media posts to identify trends and predict stock market movements. For example, in a study by Bollen, Mao, and Zeng (2011), researchers used NLP techniques to analyze blog posts and found a significant correlation between changes in blog sentiment and stock market movements. Another example of NLP in economic research is the use of topic modeling to analyze text data in macroeconomics. Topic modeling, which is also employed in this paper, is a machine learning technique that uses NLP algorithms to identify patterns and themes in large volumes of text data. In a study by Muchnik et al. (2013), researchers used topic modeling to analyze news articles and found that changes in the media's coverage of certain topics were correlated with changes in the economy.

2 Methodology

2.1 Data

2.1.1 Mobility Data

The mobile location data analyzed in this study was collected from NTT Docomo Inc, the largest mobile carrier in Japan. The data records the number of people in a given square grid ("mesh"), centered around a mobile base station, at a given hour. Standard Grid Squares are defined by Japan's Statistics Bureau and shown in the table below. It counts one user residing within the grid for 15 minutes as 0.25 people, and aggregates the number of NTT mobile carriers according to that formula. One notable feature about mesh data is that since it relies on phones' connections to base stations to derive its records, it can even measure the location of users who do not have GPS enabled or are not currently using the GPS probing service. Thus, it provides a less biased and more accurate alternative to GPS probe data. At the time this mesh data was collected, NTT Docomo Inc had over 80 million users.

Partition	Interval of Latitude	Interval of Longitude	Length of Side
Primary Area Partition	40 minutes	1 degree	about 80 km
Secondary Area Partition	5 minutes	7 minutes 30 seconds	about 10 km
Basic Grid Square	30 seconds	45 seconds	about 1 km
Half Grid Square	15 seconds	22.5 seconds	about 500 m

The grids selected in this study are described in the table below. The choice of the grids depends on the characteristics of the location. The first grid extracts areas around Shibuya station, a busy hub of entertainment and leisure facilities. The second grid extracts areas in and around Ootemachi station, a major business hub. The third grid is the smallest of all of them and is located in the remote suburbs of Tokyo, in a city called Kiyose. This grid was selected for being a primarily residential area (a bed town) containing residences and a housing complex, and for being the author's home. The grid representation of Shibuya Station is included in the appendix as Figure 1.

Name	Basic Grid	Half Grid	Area	Description
Shibuya	5339-35-95, 5339-35-96, 5339-35-85, 5339-35-86		4 km^2	Leisure
Ootemachi	5339-46-11, 5339-46-21		2km^2	Business
Kiyose		5339-54-41-2	0.25 km^2	Residential

In this study, I use population data of the above grids from 2020-01-01 to 2021-12-31 to focus on population responses to news reports on the pandemic. I aggregate the population data over grid so that each location (Shibuya, Ootemachi, Kiyose) has one population parameter (the sum of population in each grid contained in the area). Further, instead of dealing with hourly population information, I divide the data into 3 bins: Daytime (8:00-17:00, or work hours), Evening (17:00-24:00), and Night (24:00-8:00). For this analysis, I focus on Daytime population, and take the mean population per area per day within the Daytime hours. The resultant data set looks like the following:

Table 3: Population data

date	area	population	time_bin
2020-01-01	Shibuya	61660.25	0-700
2020-01-01	Shibuya	58693.56	800-1700
2020-01-01	Shibuya	53289.29	1700-2400
2020-01-02	Shibuya	41514.62	0-700
2020-01-02	Shibuya	89257.33	800-1700
2020-01-02	Shibuya	79501.71	1700-2400

Some descriptive statistics about daytime population per area are provided below.

Table 4: Descriptive Statistics of Daytime Population Data

	shibuya	ootemachi	kiyose
Min.	32504.0	10308.67	912.3333
1st Qu.	124667.8	73226.67	1079.1111
Median	162552.0	185209.67	1113.4444
Mean	152350.7	152554.04	1132.9352
3rd Qu.	180865.8	207857.28	1193.8889
Max.	221899.4	306337.33	1338.6000

3 Methodology

In this section, describe the methods and techniques you used to conduct your research. If applicable, include any statistical models or econometric techniques you used.

4 Results

In this section, present your findings and results from your research. This can include tables, graphs, and other visual representations of your data.

5 Conclusion

In this section, provide a summary of your findings and draw conclusions about your research. Discuss any implications of your results for future research and policy.

6 References

Barnes, M. D., Hanson, C. L., Novilla, L. M. B., Meacham, A. T., McIntyre, E., & Erickson, B. C. (2008). Analysis of media agenda setting during and after hurricane katrina: Implications for emergency preparedness, disaster response, and disaster policy. *American Journal of Public Health*, *98*(4), 604–610. https://doi.org/10.2105/AJPH.2007.112235

Bollen, J., Mao, H., & Zeng, X. (2011). Twitter mood predicts the stock market. *Journal of Computational Science*, *2*(1), 1–8.

Chen, M. K., & Pope, D. G. (2020). *Geographic mobility in america: Evidence from cell phone data* (Working Paper No. 27072; Working Paper Series). National Bureau of Economic Research. https://doi.org/10.3386/w27072

Chong, D., & Druckman, J. N. (2007). Framing theory. *Annu. Rev. Polit. Sci.*, *10*, 103–126.

Entman, R. M. (1993). Framing: Toward clarification of a fractured paradigm. *Journal of Communication*, *43*(4), 51–58.

Hayano, &. A., R. S. (2013). Estimation of the total population moving into and out of the 20 km evacuation zone during the fukushima NPP accident as calculated using 'auto-GPS' mobile phone data. *Proceedings of the Japan Academy. Series B, Physical and Biological Sciences*, *89*(5), 196–199. https://doi.org/10.2183/pjab.89.196

McCombs, M. E., & Shaw, D. L. (1972). The agenda-setting function of mass media. *Public Opinion Quarterly*, *36*(2), 176–187.

Miyauchi, N., Y. (2021). The economics of spatial mobility: Theory and evidence using smartphone data. In *Proceedings of the Japan Academy. Series B, Physical and biological sciences* (Working Paper No. 28497; Working Paper Series). National Bureau of Economic Research. https://ssrn.com/abstract=3795016

Muchnik, L., Aral, S., & Taylor, S. J. (2013). Social influence bias: A randomized experiment. *Science*, *341*(6146), 647–651.

Nisbet, M. C., & Scheufele, D. A. (2009). What's next for science communication? Promising directions and lingering distractions. *American Journal of Botany*, *96*(10), 1767–1778.

Thakur, R. (2021). *The west should envy japan's COVID-19 response*. The Japan Times.

von Mörner, M. (2017). Application of call detail records - chances and obstacles. *Transportation Research Procedia*, *25*, 2233–2241. https://doi.org/https://doi.org/10.1016/j.trpro.2017.05.429

7 Appendix

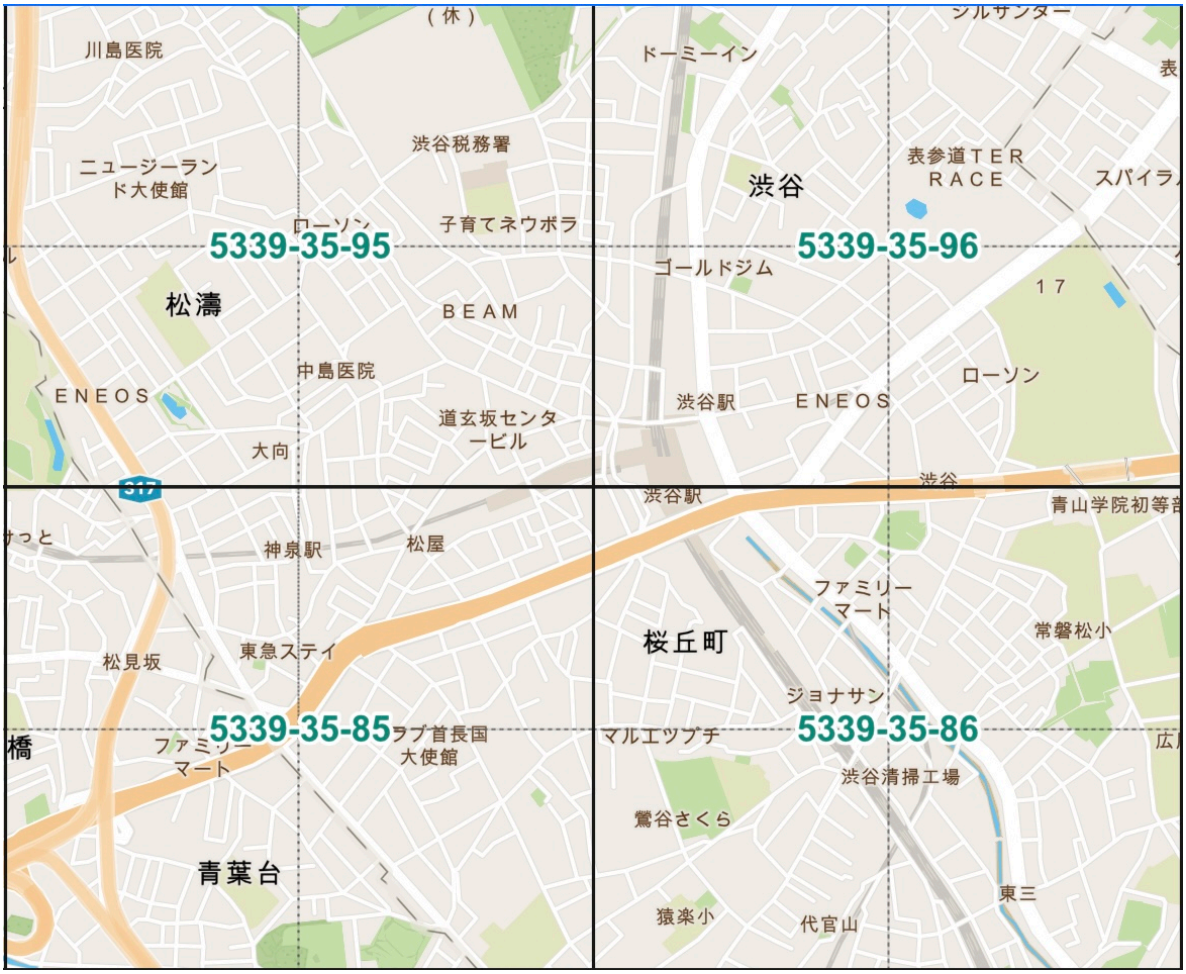

Figure 1: Shibuya station in grids. Source: https://www.arcgis.com/