

OTDK-dolgozat

2025

Exploring Transportation-Related Online Media Thematization Through
The Study Of Congestion In Budapest

Közlekedéssel Kapcsolatos Online Médiatematizáció Vizsgálata
Budapesten Keresztül

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Kézirat lezárása: 2024.04.18.

Abstract

Is transportation-related thematization based on evidence? This paper explores the topic through the lens of Budapest, and the Hungarian media landscape. It starts by introducing the literature relevant to this theme. Then, it takes a look at the Hungarian media's evolution and role between 1990-2024. Afterward, the paper provides an overlook of the current transportation situation and plans in Budapest. The research question is whether there is a relationship between daily congestion and the number of articles written about it. Traffic data was obtained from [TrafficIndex.org](https://www.trafficindex.org), article data was collected by the author of the paper. The methodology used for analyzing this relationship is regression analysis, with the number of articles written as the dependent, and the traffic data as the independent variables. The result of the analysis is that there is a significant relationship between the two, however, one variable is not enough to fit a model properly, signaling that there are other variables that influence how much traffic gets mentioned.

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1 Introduction

We live in an age of comparative abundance. In Hungary, economic growth since the regime change has been staggering, with the country's GDP increasing over fivefold in thirty years (World Bank, 2023). This had several positive effects on the citizens' quality of life, including an increase in wages, infrastructure development, and access to automobiles.

Since the regime change, highway investment has been a priority of both Hungary and the European Union. Transporting goods via roads is seen as more versatile than rail freight. This is because the same roads that are used to transport cargo can also be used by personal and military vehicles. Establishing highway connections with other countries also helps foster political and economic ties between them by increasing trade and cooperation, while fueling the domestic construction sector with government spending. For these reasons, investment in any kind of infrastructure is often seen as a universal good by voters. This phenomenon leads governments to invest in highway development that is economically wasteful, too early or infeasible in some other way according to multiple metrics such as current usage, and predicted future usage (G7, 2022), while the capital's roads leading to and from the agglomeration remain heavily congested in the morning and evening rush hours (Hungary, 2019).

Nevertheless, for any analysis to be complete, we must consider that infrastructure development is a complicated matter. There are a multitude of different factors affecting which projects get approved other than their economic viability. Each project has its own political, social, and technical dimension as well. Some developments are not only easy to use for political gains, but it is necessary to figure a way out to do so, as these developments are not done in a vacuum. More often than not, the people carrying out the project are not the ones who are responsible for greenlighting it. This means that there are different incentives for each stakeholder.

Politicians want to support projects that are the most popular, even if not the most needed, because their goal first and foremost is to be reelected. If these projects are government-funded, which they are more often than not, there is also an incentive for potential cost overruns to happen, which would explain the obscenely high price tag of some road developments (HVG Kiadó, 2023). Voters, especially in Hungary, are not the most receptive when it comes to spending the state budget efficiently, they prefer to view these issues as a matter of personal benefits (Ügyészség, 2024). Contractors working for the government are also interested in gaining as much from each project as possible, which, combined with the lack of interest in the state budget, and warped incentives from politicians' side, creates a situation where any remotely

useful infrastructure projects get built. The development projects are then viewed as political tools to be used for or against achieving certain goals. These can include highlighting the success of a given project regardless of whether it makes sense in the grander context of the transportation picture, thematizing public discourse around perceived advancements in the local transportation network on the positive side, and criticizing political opponents for the perceived lack of high profile developments, thematizing public discourse around the inability of the opposing party to complete projects and to use these projects efficiently.

In the current media environment, it is difficult to form opinions based on unbiased information. Coverage is lacking on each side when it comes to certain issues. This paper aims to look into whether the intensity of media coverage on the topic of traffic is determined by the actual state of traffic by looking for the relationship between the severity of daily traffic congestion and the intensity of coverage on the topic. The null hypothesis is that there is no statistically significant relationship between traffic and the number of articles on traffic.

To evaluate the hypothesis, traffic congestion and media coverage data was gathered. Traffic data was obtained from trafficindex.org, which takes its data from analysing Google Maps every 30 minutes. This data is then aggregated into a single value every day: TCI, or traffic congestion index. This is calculated by looking at the different congestion levels that Google shows, giving more weight to higher congestion. While there are at least 48 data points for every day, daily maximum data was used because this paper is interested in the daily peak congestion.

Media coverage was obtained by scraping some of the most read news websites, looking for keywords such as congestion, traffic, *körút* (the road on which the tram 4-6 goes), bike lanes etc. Then the number of articles for each day was counted and aggregated into a single daily value. Afterward, this data was analyzed by linear, loglin and quantreg regressions, and conclusions were drawn: while media coverage of transportation increases along with maximum traffic over time, and this increase is significant, looking at traffic data alone does not sufficiently explain the change in the number of articles written on the topic. There are more variables at play, but that is outside the scope of this paper.

The relevancy of this paper is twofold: Its findings are relevant for policymakers who look to assess whether the respective projects are going to be covered how they would like them to be covered in different kinds of media, and whether readers can trust the motives behind the articles.

2 Literature Review

The most relevant paper on this topic is “Narratives in transport research: A thematic and functional analysis”(Loyola et al., 2023), which is a comprehensive literature analysis of over 100 papers made on this topic. They have reached the conclusion that narratives’ use are not prevalent in regards to transportation. Another important paper is “Mass Media and the Transformation of American Politics”(Oswald, 1994), which deals with how mass media – defined at the time as television and radio – have transformed how American politics works. In the paper, the author talks about the economic interests of giant conglomerates, the oversized influence they have over public opinion, and that their interests are aligned with shareholders above all. However, for the purposes of this paper, the most relevant part is the last chapter, where the author describes how the media is being manipulated by the government. Inotai (2020) gave a comprehensive overlook of the Hungarian media’s history from 1988 to 2010, while Vickrey’s (1969) paper on congestion theory was fundamental to this paper. Few if any studies were done on the thematization capabilities of the current Hungarian government, which could be because of the fact that the country’s current political system relies heavily on the media narratives pushed by the people close to the governing party(Reporters Without Borders, 2024).

3 Background

The paper touches on two different variables in policy-making regarding transportation, both of which are of equal importance: the political and policy dimensions. These two dimensions are closely intertwined. Within politics, there is a large variety of different incentives, priorities, and goals from every player in a given administration, from the prime ministers to even the aides of regional ministers (Sharkansky, 2002). The argument stemming from these differences in priorities not only makes politics exciting but also serves as one of the most important aspects of democracies, it is a way to reconstruct and reframe not only public discourse but the whole of society (Boyte, 2011). This process cannot be done without access to information, which can be provided by informing the voters – this is the role the media plays in politics (Strömberg, 2015).

Aside from these, the notion of media thematization is important as well. According to Mardani (2016) „Thematization is considered the mental act or process of selecting particular topics as themes in discourse or words as themes in sentences.”. Thematization intensity is used in this paper, which refers to the amount of coverage on a given topic.

3.1 Contemporary Media Landscape in Hungary

In recent decades, the media landscape has shifted dramatically. Printed media moved online (Quintype, 2022), the 24-hour news cycle became the new norm, and partisan media is gaining traction (Center, 2020). It is only understandable, that political entities seek to shape public discourse in a way that fits them. This has been true since the Watergate scandal in the US (Hollis, 2019), and the regime change in Hungary (Paál, 2013). In fact, employees, journalists and editors did not change between the communist and the democratic era. Networks and newspapers got privatized straight after the regime change, and started to serve the interests of its owners. This period is also known as “Médiaháború”, or “Media-war” in English. Around this time, political parties tried to divide the media landscape between each-other, rather than letting independent media do their work. For example, in the 1990s there were two new public service channels – one conservative, one liberal. Around the end of the decade, commercial channels started to appear, drawing in a large chunk of the country’s population. This meant that public channels were unable to support themselves from market operations and were reliant on government spending to keep themselves afloat. This situation was reinforced, when in 2002, public channels became free for everyone. In the 2000s, the media landscape became consolidated around the two large voting blocks. The public channels were under light government influence, opposition figures were allowed to appear in programs (Inotai, 2020). In fact, the speech that led to the end of Ferenc Gyurcsány’s tenure as Prime Minister was first revealed in a public radio broadcast.

After 2010, the country’s media landscape started changing rapidly. Over the 8 years they have spent in opposition, Fidesz focused on building up its media empire. After they won the 2010 elections, the governing party expanded its media reach and successfully thematized public discourse leading up to the 2014 parliamentary elections (Agenda, 2018). They enacted Act CLXXXV of 2010 on Media Services and Mass Communication, which defined the concept of a media service provider having a significant influence as having an audience share of at least 15 percent. These media service providers with significant influence are required by law to broadcast news programmes, of which a maximum of 20% could be criminal-themed. An additional quote was placed on these providers, over 50% of their programme had to be made up of European, over 30% of Hungarian media of origin. For public channels, these quotas were 60% and 50% respectively. Furthermore, the act also regulated the role of NMHH (Nemzeti Média- és Hírközlési Hatóság, or National Media and Communications Authority) and Médiatanács, who became responsible for overseeing whether the regulations are being

upheld (Wolters Kluwer Hungary, 2010). This law was criticized as promoting self-censorship(Bálint, 2020) and going against the fundamental values of the European Union(Hír24, 2010). Furthermore, in 2011, the government modified the regulations of the usage of advertising installations alongside public roads. This law especially hurt the joint Spanish-Hungarian-owned ESMA, which lost over 1 billion HUF as a result(Attila, 2012). The result of these changes is that the government had a larger influence over advertisements, both in the online and offline spaces. The same Médiatanács, or “Media Council” in English, played an instrumental role in closing Népszabadság, which was an anti-government news organization(24.hu, 2016).

In 2015, the Prime Minister and one of his most important allies, Lajos Simicska who has been managing Fidesz’s media empire got into a fight. This led to intensified measures to acquire new media channels, businessmen close to the government tried to buy out TV2, one of the largest TV channels, which was quite unsuccessful(Dániel, 2015a), they bought Origo, the then-largest online news site in Hungary(Dániel, 2015b), Lőrinc Mészáros, who is currently the richest man in Hungary, bought the organization that closed the aforementioned Népszabadság(Dániel, 2016). After the 2018 election, where Fidesz was once again elected with a supermajority, Simicska sold all his interests(HVG Kiadó, 2018), quit fighting the government and went into relative exile. What remained in the place of this fight is a more consolidated media environment in the country. Today, KESMA (Central European Press and Media Foundation, or CEPMF in English) owns a large share of the Hungarian media landscape. Valuable companies were gifted to the foundation, with an estimated total value of over 100 million USD, or 4 billion HUF(Gorondi, 2018).

In the 2022 election campaign, Fidesz used a variety of ways to discredit opposition figures, through their massive media ownership(Bódis, 2021), and the use of grey-zone media campaigns (Németh et al., 2022).

“The novelty of these campaigns was the extensive use of gray-zone media organs and campaigning within comment sections. Social media platforms, notably Facebook and YouTube, were flooded with targeted political ads, mostly in the form of short videos. Fidesz campaign messages were disseminated by sites such as the Megafon Center, Aktuális and Budapest Beszél, presumably consuming billions of Forints of taxpayers’ money. Like these large sites, dozens of smaller sites with a similar pro-government bias, anonymous or with opaque ownership and editorial structures, joined the campaign, diversifying the distribution of the governing party's positions.”(Political Capital, 2022).

While these tools were being used against Prime Minister candidate Péter Marki-Zay, for this paper, the 2019 local elections are more important. The main message of the governing party back then was that Gergely Karácsony, the then-candidate of the opposition for the post of mayor, is inadequate for leading the capital. In fact, in the 30 days preceding the election, media close to the government used this word around 500 times(plankog, 2019). While he won the election, the intensive campaign continued – in the past year, over 800 articles were written on the site Origo alone about the mayor. While some of these are about the renovation of the Chain Bridge (ORIGO, 2024), most of them focus on transportation-related themes, namely, congestion. The central point of these articles is that congestion has worsened in the city in the past years because of the mayor’s actions or inaction. Assessing whether this statement is correct, incorrect or is a half-truth requires taking a look at the transportation situation in Budapest and its agglomeration in the past years.

3.2 Transportation Policy Background

There are a multitude of variables that shape transportation policy. Thorough analyses have been made on the topic as transportation engineering has become a major discipline of its own. For the scope of this paper, understanding the basics of why congestion could happen is enough. While several theories exist to explain traffic jams, such as mathematical theories (Flynn et al., 2009), the Macroscopic Fundamental Diagram(Ortigosa et al., 2013), and the Three-phase traffic theory(Kerner, 1998), however, the focus will be on the economic theories behind it. Roads are a typical example of the tragedy of the commons(Mazurkeviciute, 2020). They are built and maintained using a common pool of resources (taxes), from which each of us benefits, or rather each of us exploits. They are an especially tricky “good” to control. There have been proposed demand-side pressures, even domestically in the form of a congestion charge(Lencsés, 2011). These plans however are often politically infeasible, because they would hurt a large and quite wealthy segment of the population who wield considerable political power, while also disproportionately hurting poorer households who thus get priced out of going to the city center. Supply-side measures such as expanding highways have their own downsides as well: demand will eventually reach the supply limit once again(Duranton & Turner, 2011). While the capacity of roads hardly changed in the case of Budapest, the number of vehicles has grown every year since 2012, while the share of commuters using public transportation declined(BKK, 2023).

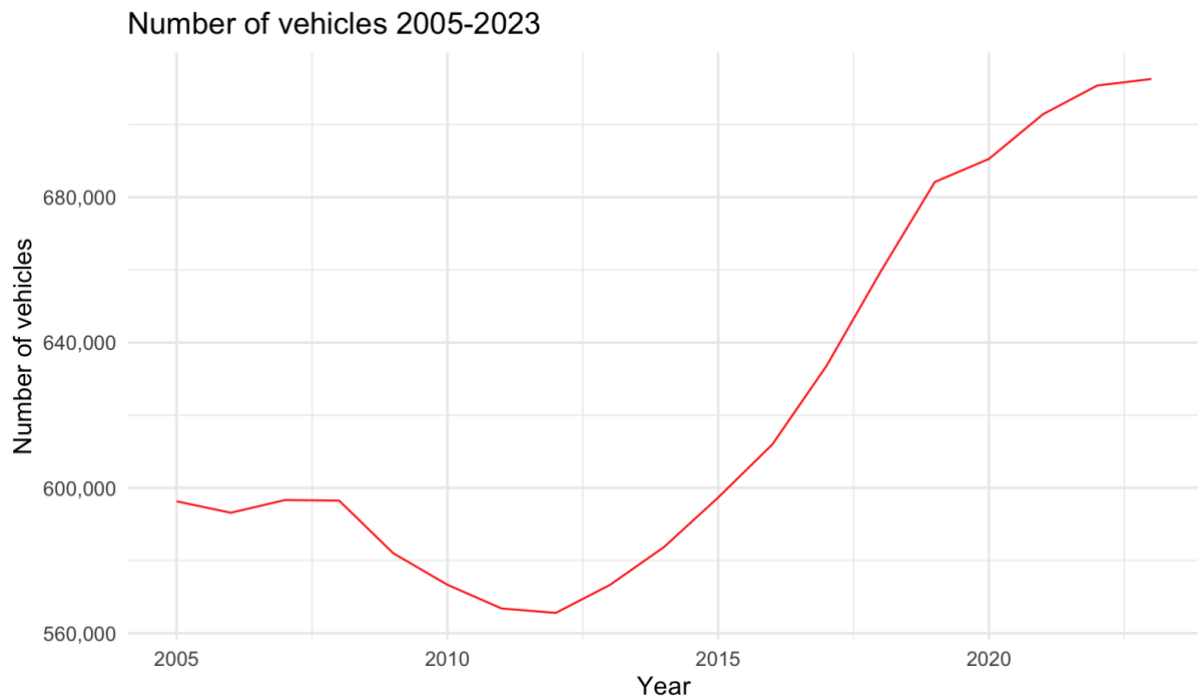


Figure 1: Number of passenger vehicles over time in Budapest (Own work)

In 2019, a paper was published by the city of Budapest by the name of BMT – Budapest Mobilitási Terv or Budapest Mobility Plan – which outlines the city’s medium-term strategy until 2030 (General Assembly of the Municipality of Budapest, 2019). In this paper, one of the main problems outlined is the through traffic that uses the centuries-old inner center to pass through the city (General Assembly of the Municipality of Budapest, 2019, p 8.). Furthermore, the current public transportation system was designed to carry passengers to and from metro lines. However, the current metro lines don’t reach the suburbs, which means that people from the suburbs have to use either busses or trains to get into the city center, which requires changing between transportation modes, thus practically necessitating using cars. The current road network to and from the suburbs was not designed to handle this amount of traffic, which results in a higher amount of congestion and near-constant capacity issues (Hungary, 2019). Instead of solving the core problems that cause traffic to be this bad, policymakers focus on extending road network capacity. This is a result of sectoral thinking, outlined in the aforementioned document (General Assembly of the Municipality of Budapest, 2019, p. 9). These issues cause labor shortages, pollution, and loss of economic activity.

4 Methodology

Understanding the scale and scope of traffic-related problems and their media coverage requires empirical analysis. There are multiple data sources used in this paper. For traffic, an

easy-to-understand and intuitive source was needed. Traffic data was provided by trafficindex.org. They gather data from Google Maps, using Google's own traffic classification system. They capture data from Google twice every hour and then get the weighted average of each class. The classes range from P0-P3. P0 means free-flowing traffic and has a weight of 0, as it signals no traffic slowdown. P1 refers to the orange color of maps, or light traffic, and has a weight of 1. P2 is heavy traffic, has a weight of 2, and P3 is a heavy traffic jam and has a weight of 3. P0+P1+P2+P3 adds up to 100%, as they refer to the percentage of road network covered by each type of traffic flow (Traffic Index, 2024). These combine and add up to a TCI, or Traffic Congestion Index, using the following formula:

$$TCI = (0 * P0) + (1 * P1) + (2 * P2) + (3 * P3)$$

Equation 1: TCI equation

Daily TCI is calculated the same way, by taking the % of each type of traffic flow over the day. Max TCI is calculated by taking the TCI for each period of a given day and then choosing the maximum value, usually rush hour, signaling the highest amount of congestion on a given day. Naturally, the maximum amount of TCI is 300.

Media thematization intensity was measured by the number of times a given keyword was used. The keywords varied from site to site, as they all have their own article tagging system. Articles were obtained by scraping each site's search engine results. From there, I obtained the article's date, title, and short description. Then, they were manually checked if they were about the given topic. Whether the articles were positive or negative in nature is irrelevant – congestion is hardly covered positively, and the few instances they were outliers and were subsequently removed. The sites checked are all Hungarian, widely read, and cover a wide range of ideologies. They were Telex, Origo, 24.hu, and Metropol. These websites were then scraped using various keywords until all the relevant articles were found, from which the article's title, date, lead, and URL were scraped. This data was aggregated into an Excel file, where the articles were then ordered by the dates, and the number of articles for each date was counted. A total of 2353 days worth of data was used. Then, to look at the relationship between the count of articles and TCI_max, linear regression, loglin model, SARIMA, and quantreg were used. Linear regression was used to estimate the R^2 of Article count~TCI_max, loglin to possibly account for outliers, quantreg to account for outliers in a different way, SARIMA to try and find a better fit.

5 Data

5.1 Traffic Data

Visualizing the gathered data helps fully understand and appreciate the findings. The visualized traffic data over time looks like the following, with both the daily average and daily maximums being plotted:

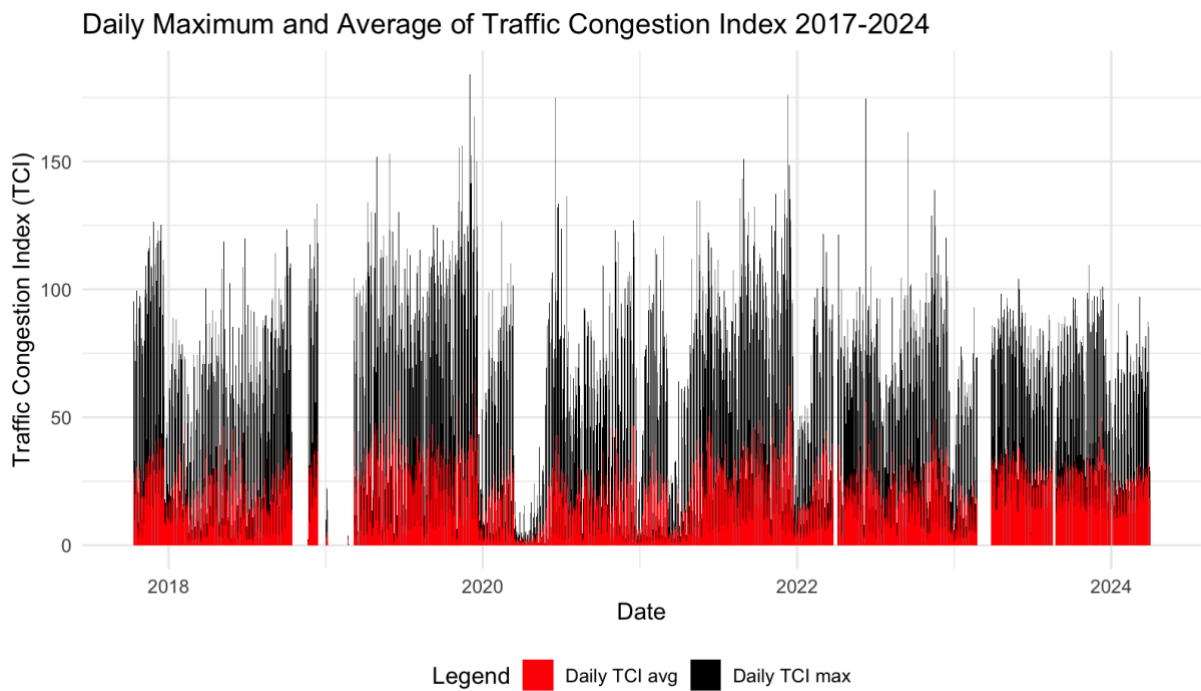


Figure 2: average and maximum daily TCI. (Own work)

Plotting the dataset allows us to examine some general behaviors of the data. The daily maxes are noticeably, up to 3-4 times higher than the averages, as daily traffic varies a lot depending on the time of day. Taking a quick look at the plot suggests that extremely high daily maxes are becoming rarer, while averages are roughly consistent over time. There are also some missing daily data in 2019, but this doesn't affect the data analysis itself.

Regression analysis $tci_max \sim tci_avg$ does not give any surprising results:

Estimate	Estimate	Std. Error	T value	P value	Significant?
Intercept	4.678	0.455	10.34	0.000	Yes (to 0)
Tci_avg	2.751	0.02	135.26	0.000	Yes (to 0)
RSE	12.44	Adj. R²	0.89	P value	0

Table 1: Regression analysis of $tci_max \sim tci_avg$. (Own work)

There is a strong relationship between the two variables, as expected. Each increase in TCI_avg increases TCI_max by 2.751.

5.2 Article data

Articles on the topic were gathered from Origo, 24.hu, Metropol, and telex. Then, the number of articles was counted for each day.

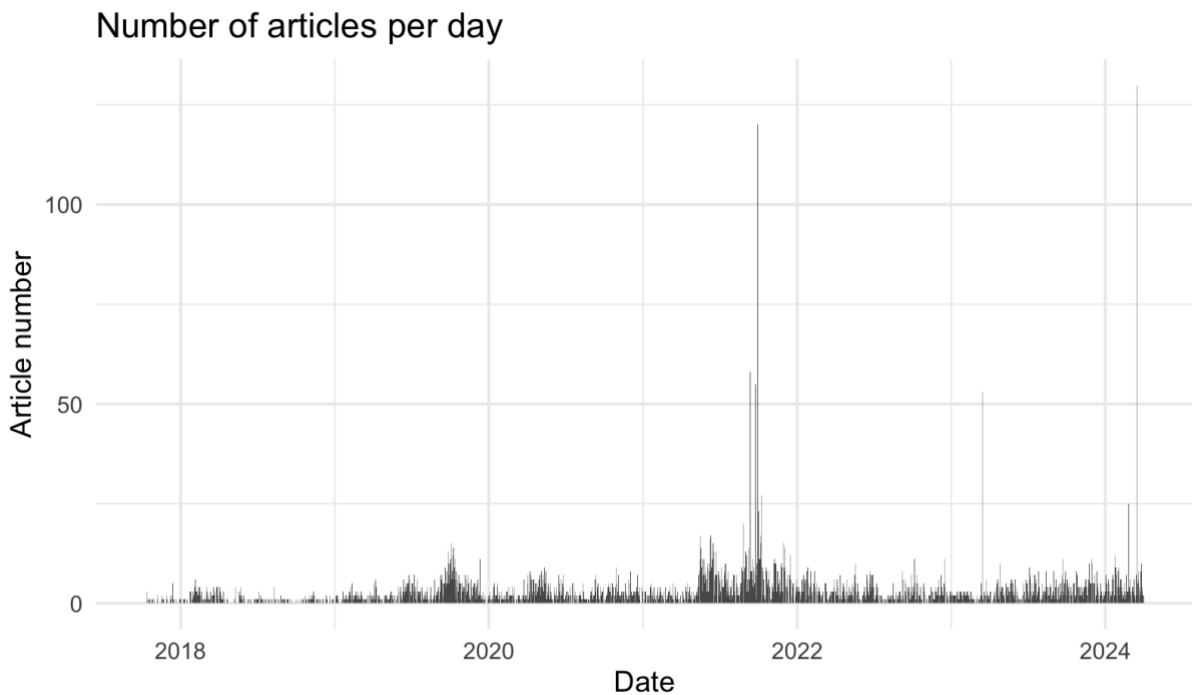


Figure 3: Number of articles per day. (Own work)

By visually inspecting figure 4, a number of outlier dates could be seen. Some of the articles written are only in a small part about transportation. In fact, the outliers can be connected to certain dates, which have political significance. They were still scraped, because either keywords were picked up by search or the tags used could have been transportation-related. The spikes can also be attributed to live feeds, which used the same tags over and over again. For example, “biciklisáv” (bike lane in English) resulted in many articles tagged “Karácsony” (after Gergely Karácsony, the Mayor of Budapest) being scraped. While they may only mention bike lanes briefly, it still fulfills the criteria of thematization, as it aims to guide discourse toward talking about bike lanes. The most intensive day was 2024.03.15, where multiple live feeds talked about the Mayor, who in turn talked about Budapest in his speech, the second most intensive day was 2021.09.30, the day after the end of the first round of elections in the opposition primary. Notable spikes also include around September first of every year when schools reopen.

6 Findings

6.1 Regression analysis of TCI_max and Datetime

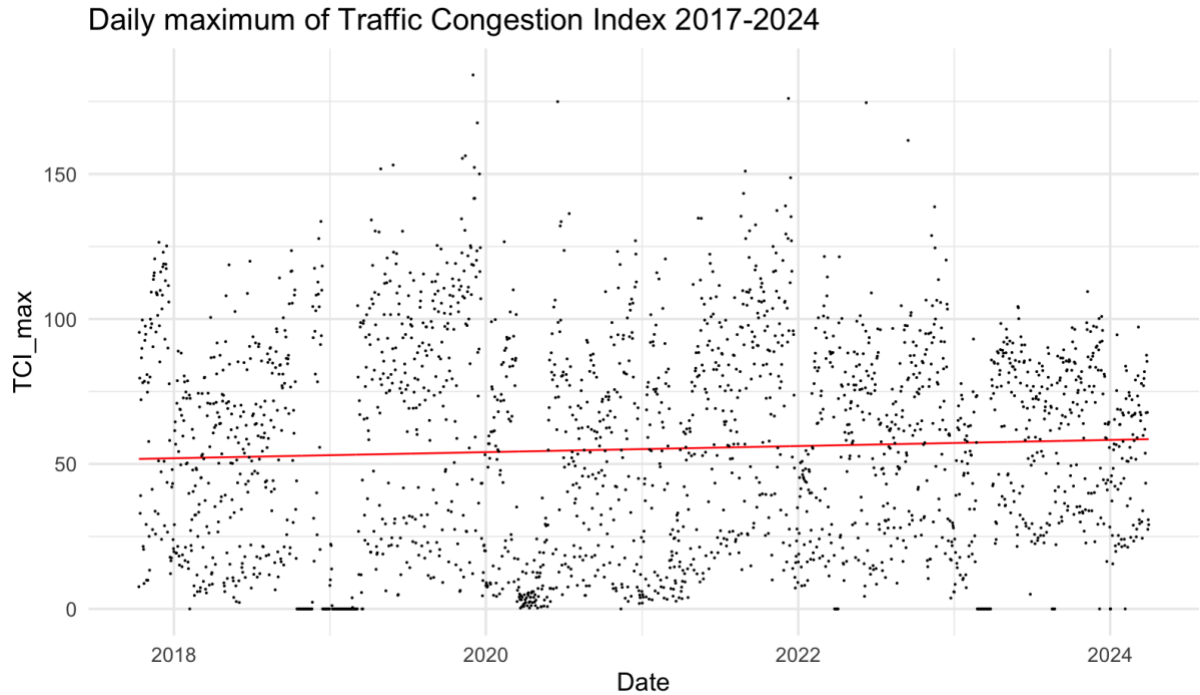


Figure 4: TCI_max overtime with model fitted line on top. (Own work)

Estimate	Estimate	Std. Error	T value	P value	Significant?
Intercept	1.445	20.64	0.070	0.944	No ($P > 0.05$)
Datetime_local	3.335e-08	1.281e-08	2.603	0.00931	Yes ($P < 0.05$)
RSE	36.73	Adj. R^2	0.002	P value	0.00931

Table 2: Regression summary of tci_max~datetime_local (Own work)

According to these results, TCI_max is indeed statistically significantly increasing over time. By looking at the data visually, it can be observed that while the maximums of TCI_max are decreasing over time, the minimum values are increasing. This would signal that there are fewer days when traffic is horrible, but overall roads are more saturated than before. Possible reasons include the increased number of cars, overall movement towards agglomerations, relocation of workplaces, increased willingness to spend more time in the car, etc., looking deeper into this is beyond the scope of this paper.

6.2 Relationship between traffic and thematization

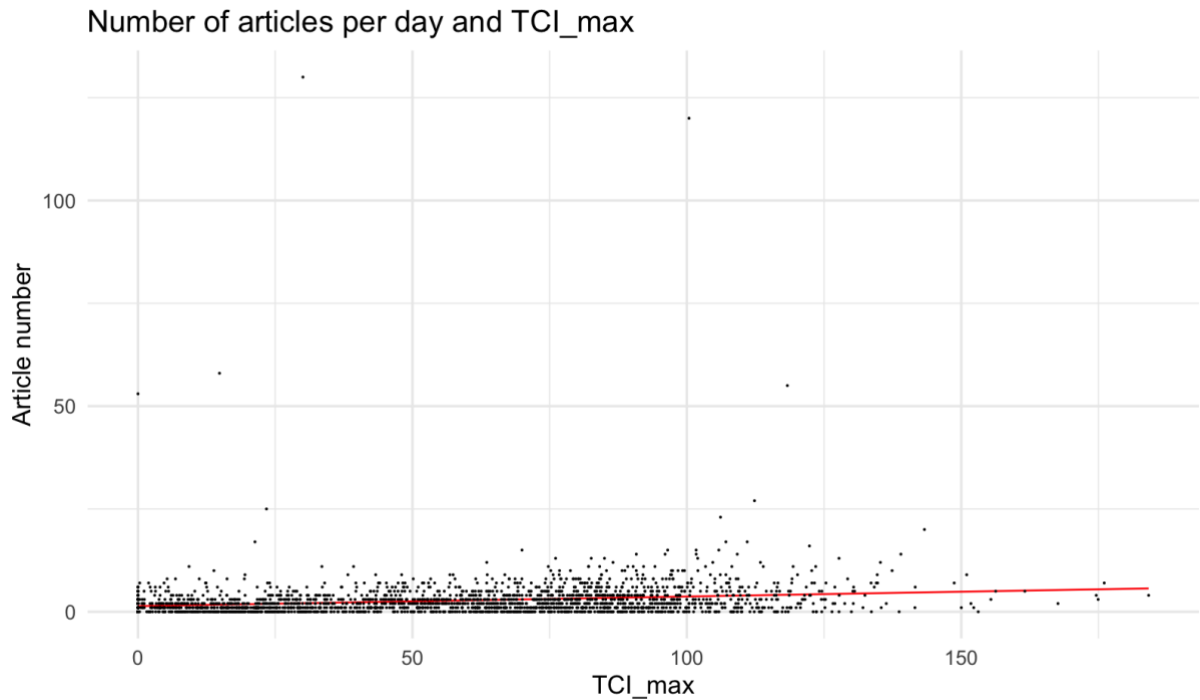


Figure 5: Article number and TCI_max with fitted data, (Own work)

Coefficients	Estimate	Std. Error	T value	P value	Significant?
Intercept	1.373	0.178	7.716	0.000	Yes (to 0)
TCI_max	0.023	0.003	8.698	0.000	Yes (to)
RSE	4.801	Adj. R²	0.038	P value	0.000

Table 3: Regression summary of article number~tci_max. (Own work)

An R^2 of 0.038 means that 3.8% of the change in the number of articles is explained by the change in TCI_max. It is apparent that there is room for improvement regarding model fit, however, this paper is only interested in the single variable of TCI_max. Adding another variable from the dataset would cause collinearity, as evidenced by the high R^2 in Table 1. The few outlier days make this chart hard to read, and while the general direction of the fitted line can already be seen, a zoomed-in plot provides a clearer picture:

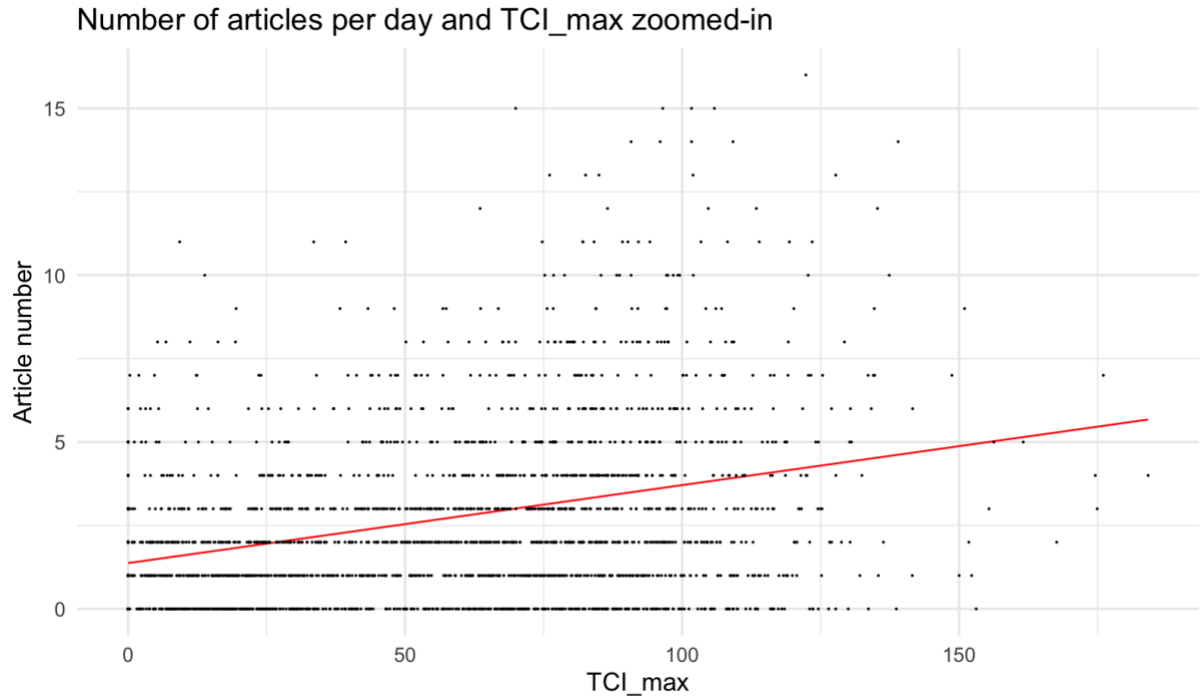


Figure 6: Article count~TCI_max with fitted line, zoomed-in. (Own work)

This model can be slightly improved if we take the natural log of Article number:

Coefficients	Estimate	Std. Error	t value	P value	Significant?
Intercept	0.546	0.0316	17.29	0.000	Yes (to 0)
Tci_max	0.006	0.000	13.87	0.000	Yes (to 0)
RSE	0.713	Adj. R ²	0.096	P value	0.000

Table 4: Regression summary of $\ln(\text{Article number}) \sim \text{tci_max}$. (Own work)

After the log transformation of the article number, R^2 increased to 0.096 ($P < 0.05$), meaning 9.6% of the change in article numbers is explained by the change in tci_max, or maximum daily congestion. Looking at weekly instead of daily data results in R^2 of 0.08 ($P < 0.05$), while quantreg results in R^2 of 0.38 ($P < 0.05$). Using SARIMA, R^2 came out to 0.038 ($P < 0.05$).

With a significant P level, we fail to reject the null hypothesis, thus the relationship between Tci_max and the number of articles is statistically significant. Conducting a Ljung-Box test for each model results in rejecting the null hypothesis for every tested model. The conclusion is the following: while it is significant, only looking at traffic data is insufficient to predict the number of articles made on the topic, which signals that there are other variables to deciding to write articles on Budapest's transportation.

7 Conclusion

The media has an outsized role in modern society. It is a tool for spreading information, controlling and changing public opinion, and influencing choices. Hungarian leaders have long noticed these trends, and while the direction of media freedom has been going in a negative for most of the past three decades, the process has accelerated in the last 15 years. On the one hand, online mediums have become more active in this role, fueled by the endless coffers of the state, as evidenced by the high number of articles written on this topic. On the other hand, the mayor claims that congestion has become less of a concern over the past years (24.hu, 2024). The validity of this claim depends on the criteria used. It could be concluded, that the average travel time decreased along with the maximum amount of congestion, while the daily congestion values became more compact – signaling more frequent but less severe congestion.

Based on the findings in this paper, while the relationship between the number of articles is significant, context matters. Traffic is covered more in the media, and it is also worsening in some aspects. No model was able to explain the relationship with an R^2 of more than 10%, which means that congestion is part of why coverage is so high, but not the only reason. These findings also mean that traffic will be covered negatively regardless of whether it is improving or not. Nevertheless, it remains an important topic in public discourse. It is also highly seasonal, and thus the time of day interactions heavily influence the opinion made on the topic. This daily variance is heavily reinforced in the picture media outlets paint. After all, one bad experience can spoil a thousand good ones.

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