Computational Social Science Thesis

Do global events impact the preferences and consumption patterns of music?

A research study about the type of music people in Ukraine listened to during 2022 using Spotify API.

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Abstract

This study investigates the influence of global events, specifically the 2022 war in Ukraine, on the music behavior of Spotify users in Ukraine. There is a growing trend towards streaming platforms as the preferred medium of listening. The research draws on statistical data from Spotify, utilizing the Spotify API to analyze the audio features of songs played in Ukraine during 2022. It compares the findings to the listening patterns during the COVID-19 lockdown, citing the study of Yeung (2023) on nostalgic music trends.

The results focus on the analysis of audio features, including e.g. danceability, instrumentalness, valence, and acousticness. It is acknowledged that the limitations posed by language bias in valence measurements and the decrease in streaming users after the invasion of Ukraine in early 2022 are held. The thesis proposes a multidimensional approach for future research, which involves comparing different platforms and exploring the potential for visual analysis of song covers that reflect cultural expressions during times of conflict.

The exploratory nature of the study is important and the highlights of the observed shifts in musical preferences that coincide with the timeline of the war are visible throughout different measurements. There is a potential change in behavior among Spotify users in Ukraine. However, the findings are preliminary, and caution is advised in interpreting them. The need for further research to uncover the complex interplay between global events and music listening behaviors has to be adressed at this point.

Contents

1 Introduction and Motivation

Most people love to listen to music and surround themselves with it throughout the day. According to the IFPI (2023) report, the average person listens to 20.1 hours of music per week. It is also common to listen to music unattended, for example in the shopping mall or an elevator. Many people listen to the radio during working hours or in the car (IFPI, 2023). However, a new popular way of listening to music is through streaming apps or websites such as Apple Music, Spotify, Deezer and Youtube Music. In the second quarter of 2022, there were 616.2 million streaming subscribers worldwide. Of these, 188 million were paying users of Spotify (Götting, M.C. (statista) (2023), Götting, M.C. (statista) (2024)). Approximately one-third of all paying music streaming users use Spotify Premium. The number of people streaming music is increasing, as evidence by the rise in paying Spotify users to 226 million in third quarter of 2023 (Götting, M.C. (statista) (2023), Götting, M.C. (statista) (2024), IFPI (2023)).

Why do people listen to music? They listen to music for various reasons. One of the main reasons is that it can provide companionship during the day or help to calm down after a though day. Music can be a reliable source of comfort. It can also be used to motivate during exercise or in social settings. The rhytmic beats and uplifting melodies can provide the necessary drive to push through physical exertion. When listening to music intentionally, it may be to regulate emotional arousal, which can effect the mood and potentially reduce loneliness and aggression, as noted by Thoma et al. (2012) and Schäfer et al. (2013).

However, various factors can influence mood, including personal health, environment, and global events such as the COVID-19 lockdowns (Goh et al. (2023)). Can user behavior on music streaming platforms be linked to global events?

In my research on music listening during global events, I came across the Yeung (2023) paper, which found that people tended to listen to old nostalgic music during the first COVID-19 lockdown in the UK in 2020. The type of music listened to was independent whether it was positive or negative. Yeung used the Spotify API to obtain the TOP200 streamed songs on Spotify during that time. About the first half of 2020, a regression analysis was conducted to determine the factors influencing the choice of old songs. They found out which old songs are back and analyzed the audio features of these songs. The results indicate that people tend to seek out older and more positive music during lockdown.

This thesis is a contribution to the field of music research as it explores the relationship between global events and music preferences. By focusing on the war between Russia an Ukraine, the study aims to shed light how this conflict might influence the listening behavior of Ukrainians on Spotify in 2022. The use of Spotify API allows the collection of extensive data on music. Furthermore, it would be beneficial to compare the listening behavior of Ukrainians during the war with their preferences in previous years, but this is not possible due to time constraints.

Chapter 2 outlines the process of collecting data on the TOP200 weekly played songs on Spotify in Ukraine and the preprocessing that was carried out. Following this, Chapter 3 presents an overview of the measurement variables, including certain audio features. The results of this descriptive analysis focuses on the trend of the audio features during the year 2022 and are located in Chapter 4. Chapter 5 contains the discussion of the results and the overall validity, followed by the conclusion in chapter 6.

2 Data collection

The aim of this research was to compare the impact of a global event on Spotify listening behavior. To achieve this, I used the Spotify API (Application Programming Interface) to obtain the TOP200 daily songs in Ukraine. The Spotify API is a web API for developers that provides access to metadata, recommendations, and playlist management for Spotify account holders (Spotify, 2024d).

2.1 Step 1: Charts lists

Unfortunately, Spotify has removed the ability to retrieve the information from the charts sites via the API and it is not possible to scrape the sites. The only way is to copy the content of the charts website (Spotify, 2024c) and paste it into an Excel file for further processing. As this is a lot of work, the perspective of doing this 365 times led to getting the data for the weekly charts and doing this only 52 times. The information from the website consists of:

- the position in the charts (1-200)
- the tracks name
- the artists names
- the peak (highest rank of the song)
- the position in the previous week
- the streak (total number of consecutive weeks in the charts)
- the number of streams in this week

In Excel, I collected all the information (excluding the previous position) on one spreadsheet in a wide format. The spreadsheet contains 200 rows, with one column for helper numbers, one column for chart positions, and a track, artist, peak, streak, and streams column for each week. This results in a total of 262 columns. The first week covers 31st December 2021 - 6th January 2022, and the last week covers 23rd December 2022 - 29th December 2022.

2.2 Step 2: Get the track ID

The subsequent step involved importing the Excel file into RStudio and performing additional preprocessing. Initially, a list of all 930 unique songs was compiled. To retrieve information about a song using the Spotify API, a unique Spotify ID is required, and the `spotifyr` package must be installed (Thompson et al. (2022)). As only the track and artist names were available for each song, the integrated function `search_spotify` had to be used. The function `get_track_id(name, artist)` retrieves the track ID based on the song name and artist character string. Please refer to Table 2.1 for its functionality.

The function `get_track_id(name, artist)` searches for the ID of a song on Spotify. It returns a vector containing the resulting ID, the song's name and artist, as well as the Levenshtein distance between the found song and the original input for the title, artist, and the sum of both.
arguments: `name`: a string, consisting of a songs name `artist`: a string, consisting of a songs artists, seperated by ", " if there are more artists
1. search spotify for the tracks name and artist via `search_spotify`, with a limit of 20 songs **2.** get the list of information about the found artists **3.** extract the artists names **4.** combine multiple artists for one song to a string, where the artists are seperated by a comma **5.** add these strings to the search result from above **6.** get the useful information such as the found ID, name and artist string **7.** compute the levenshtein distance for name and artist to the arguments and the sum of both **8.** return the songs ID, name, artists, levenshtein distances with the lowest total distance

Table 2.1: Description of the `get_track_id(name, artist)` function, written in RStudio

The `search_spotify` function did not work for 10 of the 930 songs, so the song ID had to be found on the Spotify charts website, where the song ID website is always linked (Spotify, 2024c), and entered by hand. Using this function on all the other 920 songs resulted in a total Levenshtein distance of 0 for 904 songs, meaning the other 16 had to be adjusted by hand as well.

2.3 Step 3: Get the features of interest

The following step involved obtaining the desired information about the songs. To achieve this, I created the `get_relevant_information(trackid)` function, as shown in Table 2.2.

The final step of the preprocessing involved obtaining information about the songs in the weekly streams dataset in long format. This resulted in a dataset comprising 10400 observations (52 weeks multiplied by 200 songs) and 15 variables:

- the position in the charts (1-200)
- the week of the ranking
- the tracks name
- the artists names

- the number of streams in this week
- the popularity measure of the 26th January 2024 (1-100)
- the danceability (0.0 to 1.0)
- the energy (0.0 to 1.0)
- the loudness (-60 dB to 0 dB)
- the speechiness (0.0 to 1.0)
- the acousticness (0.0 to 1.0)
- the instrumentalness
- the valence (0.0 to 1.0)
- the tempo (here 60 BPM to 230 BPM)
- the duration (here 40000 ms to 480000 ms)

The further explanation of the new variables can be seen in Chapter 4 or on Spotify (2024b). One limitation of the analysis is the unavailability of a genre variable through Spotify API, which was a desired feature for the tracks.

The function `get_relevant_information(trackid)` retrieves specific track information for a song on Spotify. It returns a vector containing the track's most recent popularity score and audio features
arguments: `trackid`: a string, consisting of the unique songs ID
1. get the popularity with the `get_track` function **2.** get all audio features with the `get_track_audio_features` **3.** combine and return the information

Table 2.2: Description of the `get_relevant_information(trackid)` function, written in RStudio

3 Methods

The plot in Figure 3.1 provides an insightful overview of the total number of weekly streams for the top 200 songs on Spotify in Ukraine throughout 2022. The x-axis represents the year, while the y-axis portrays the number of streams in millions. To highlight the most important events, two vertical lines have been included in the plot. The first line denotes the day of Russia's invasion of Ukraine on February 24th, 2022, while the second line represents the day of Russia's mobilization on September 21st, 2022. One notable observation from the plot is a huge decrease in streams, dropping from 10 million to less than 6 million, immediately after the invasion. This decline could be attributed to various factors, such as a decrease in music consumption due to the tense situation or a shift in the variety of music being listened to during that period. However, it is encouraging to note that following this drop, there is again an increase in the number of streams, indicating a potential recovery in music consumption and a return to normalcy. Furthermore, a minor decrease in the number of streams is observed at the start of December. While the exact cause of this decline is not explicitly detectable, it could be influenced by seasonal factors, such as the holiday season or other cultural events that may have diverted people's attention away from music streaming temporarily. Overall, the plot provides valuable insights into the streaming trends in Ukraine throughout 2022, highlighting the impact of significant events and showcasing the resilience of the music industry in the face of challenging circumstances.

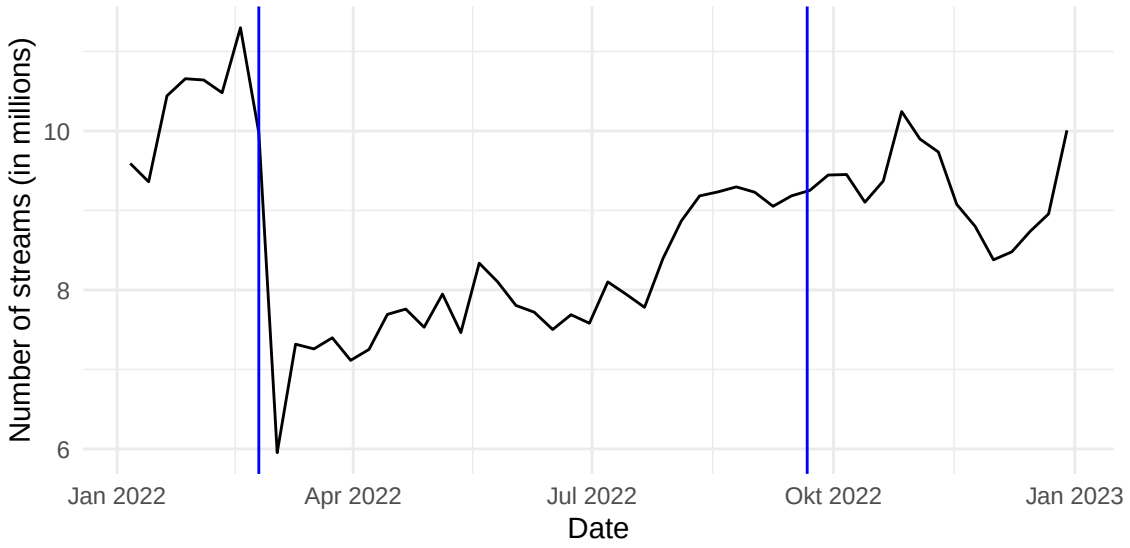


Figure 3.1: Trend of weekly sum of streams of the TOP200 songs in Ukraine

This part provides an overview of how popularity and audio characteristics are presented in different ways, such as through a 5-point summary and the average in Table 3.1. Additionally, a histogram is used to gain a better understanding of the music preferences of Ukrainians on Spotify in 2022, based on 930 unique songs.

Table 3.1 displays a summary of the variables of interest, including the popularity measure. The popularity measure, which indicates a song's popularity compared to others, has a median value of 53.0 and an interquartile range (IQR) of [44.0; 63.0] (Spotify, 2024a). This information helps to gauge the relative popularity of each song. Figure A.1, which represents a histogram of the popularity measure, reveals that there are 12 songs that are considered "outdated" and no longer popular. By examining the popularity measure and the histogram, we can gain insights into the music preferences of Ukrainians on Spotify in 2022.

	Min	1st Qu.	Median	Mean	3rd Qu.	Max
Popularity	0.0	44.0	53.0	54.9	63.0	96.0
Danceability	0.234	0.608	0.714	0.701	0.802	0.986
Energy	0.087	0.546	0.651	0.658	0.776	0.999
Loudness	-26.8	-8.5	-6.7	-6.9	-5.2	1.1
Speechiness	0.025	0.047	0.084	0.131	0.197	0.757
Acousticness	0.000	0.024	0.114	0.206	0.313	0.982
Instrumentalness	0.000	0.000	0.000	0.060	0.001	0.958
Valence	0.037	0.310	0.458	0.472	0.637	0.972
Tempo	62.9	100.0	123.2	123.0	140.2	220.0
Duration (in ms)	57327	133205	160770	166714	191783	473920

Table 3.1: 5-point summary and mean of the popularity and acoustic measures from the 930 unique songs

The danceability range, which measures how suitable a song is for dancing, varies widely from 0.234 to 0.986. The histogram displayed in Figure A.2 reveals a concentration around 0.75, indicating an intriguing trend that could be explored further over time.
The loudness feature displays the amount of decibels by which Spotify adjusts the loudness of a song to match the loudness of other songs in the album or playlist. This is part of the normalization process, where all songs are adjusted to have a loudness of -14 dB LUFS. Negative values indicate that the song was louder than the norm and required a negative gain adjustment to align with the target loudness of -14 dB LUFS. Figure A.4 illustrates that the majority of songs do not require high adjustments to their loudness levels, as they are concentrated around close to 0 dB. However, table 3.1 indicates that the median is -6.7 dB, suggesting that the songs are louder than usual and require adjustment by Spotify.
In addition to danceability and loudness, the speechiness metric is used to identify the presence of spoken words in a song. A value above 0.66 suggests that the track primarily consists of spoken words. If the value falls between 0.33 and 0.66, it indicates a mixture of both music and speech. On the other hand, a value below 0.33 signifies music without speech-like elements. Figure A.5 illustrates that the majority of the songs predominantly contain music rather than speech.
In Figure A.7 and A.8 are the histograms for instrumentalness, it predicts whether a songs contains no vocals, while "oohs" and "aahs" are treated as instruments. Values over 0.5 indicate instrumental songs, with higher values indicating greater confidence. The plots

illustrate that the majority of songs have vocals.
The most important measure for this analysis is valence, which Spotify defines as a measure from 0.0 to 1.0 that describes the positivity of the music conveyed by a track. Tracks with high valence sound more positive, such as happy, cheerful, or euphoric, while tracks with low valence sound more negative, such as sad, depressed, or angry (Spotify, 2024b). The valence distribution of the songs has a median of 0.458 (IQR [0.310; 0.637]) and a mean of 0.472, with a range of [0.037; 0.972]. This indicates that the majority of songs have a valence score close to the median value of 0.458. The nearly symmetric shape around 0.45 suggests that there is a balance between positive and negative emotions in the songs, which is an important aspect to consider when interpreting the results. Figure 3.2 provides a visual representation of the valence distribution. But it shows that the valence scores are almost equally distributed, with some modes. This suggests that there is a diverse range of emotional tones in the songs.
Moving on to the tempo of the songs, they range from adagio (63 BPM) to prestissimo (220 BPM). However, the median and average tempo fall within the allegro range at 123 BPM. This indicates that the most frequently played songs by Ukrainians in 2022 tend to be fast-paced and energetic. Figure A.9 illustrates the distribution of song duration in seconds.
The duration of the songs varies between 57 seconds and 7 minutes and 53 seconds. However, the majority of songs fall within the 2 to 3-minute range, refer to Figure A.10. This suggests that songs of shorter duration are more popular among Ukrainian listeners in 2022. Overall, the valence, tempo, and duration of songs provide valuable insights into the musical preferences of Ukrainians in 2022.

In addition to the histograms, there are trend plots (refer to section 4) that show the average popularity of the weekly TOP200 over the year (see Figure 4.1). The weighted average (computed by the `weighted.mean` function), where the weights are the streams of the corresponding week, the weighted median and the weighted first and third quartiles (all computed by the `weighted.quantile` function from the `modi` package (Hulliger (2023))). The plots are produced by using the `ggplot2` package and the `ggpubr` package (Wickham (2016) and Kassambara (2023)).

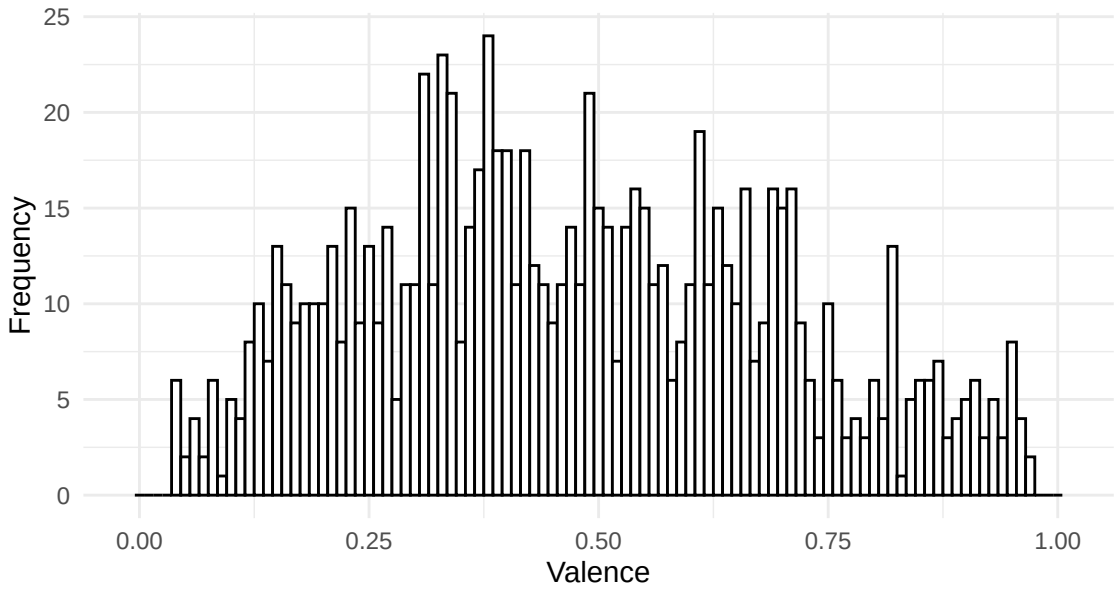


Figure 3.2: Histogram of the valence from all 930 unique songs

4 Results

The trend plots of the audio features provide valuable insights into the popularity of songs in Ukraine throughout 2022. Figure 4.1 specifically showcases the popularity trend plot of the weekly TOP200 songs. The grey line in the graph represents the average popularity measure of the TOP200 songs for each week, which was measured on 26th January 2024. It is crucial to consider this date when interpreting the results, as it helps to understand that the popularity of the latest songs in 2022 may be higher than that of older songs. To enhance the reliability of the results, the weighted mean by the number of streams was plotted. This approach offers a more accurate reflection of listening behavior. Figure 3.1 illustrates the total number of streams per week for the TOP200 songs, which varied significantly throughout the year. To account for this variation, weights (defined as $w_{ij} = \frac{streams_{ij}}{\sum_{i=1}^{200} streamsij}$, where $i \in 1, ..., 200$ and $j \in 1, ..., 52$) were calculated for each week, with the number of streams serving as the basis for these weights. The black line in the graph represents the weighted mean, while the dark grey line represents the weighted median, which helps to address any outliers. For a comprehensive understanding of the distribution and its changes over time, the first and third quartiles are plotted in light green. These quartiles provide insights into the distribution of the data and how it may have evolved over the course of the year. Additionally, light grey lines are included to display the original first and third quartiles of the 930 unique songs in the dataset. This comparison aids in identifying significant shifts in the distribution, whether they are upward or downward. Lastly, the blue lines in the graph correspond to the events of Russia's invasion in Ukraine on 24th February 2022 (left) and when Russia began mobilization on 21st September 2022 (right). These markers help to contextualize any potential impact these events may have had on the popularity trends of the TOP200 songs. It is worth noting that the popularity of songs can be influenced by various factors, including cultural events, marketing campaigns, and social media trends. Therefore, while the events of Russia's invasion and mobilization may have had an impact on the popularity trends, it is important to consider other factors as well when analyzing the data.

As shown in Figure 4.1, the popularity of the 2022 songs ranges from 55 to 60 points at the beginning of the year and increases to 60 points or higher towards the end of the year. Secondly, it is worth noting that the second quartile, which represents the middle of the data, shows a steady increase in popularity throughout the year. This indicates that a high number of songs released in 2022 gained traction and maintained a consistent level of popularity. Thirdly, the data also reveals an interesting trend in the third quartile. It experiences an increase from just over 60 to almost 80 points. This surge in popularity can be attributed to three factors. Firstly, as previously discussed, more recent songs tend to be more modern, which often resonates with a larger audience. Secondly, during the data acquisition period, there was a noticeable increase in the popularity of Christmas songs towards the end of the year. This seasonal trend contributed to the overall rise in popularity during that period.

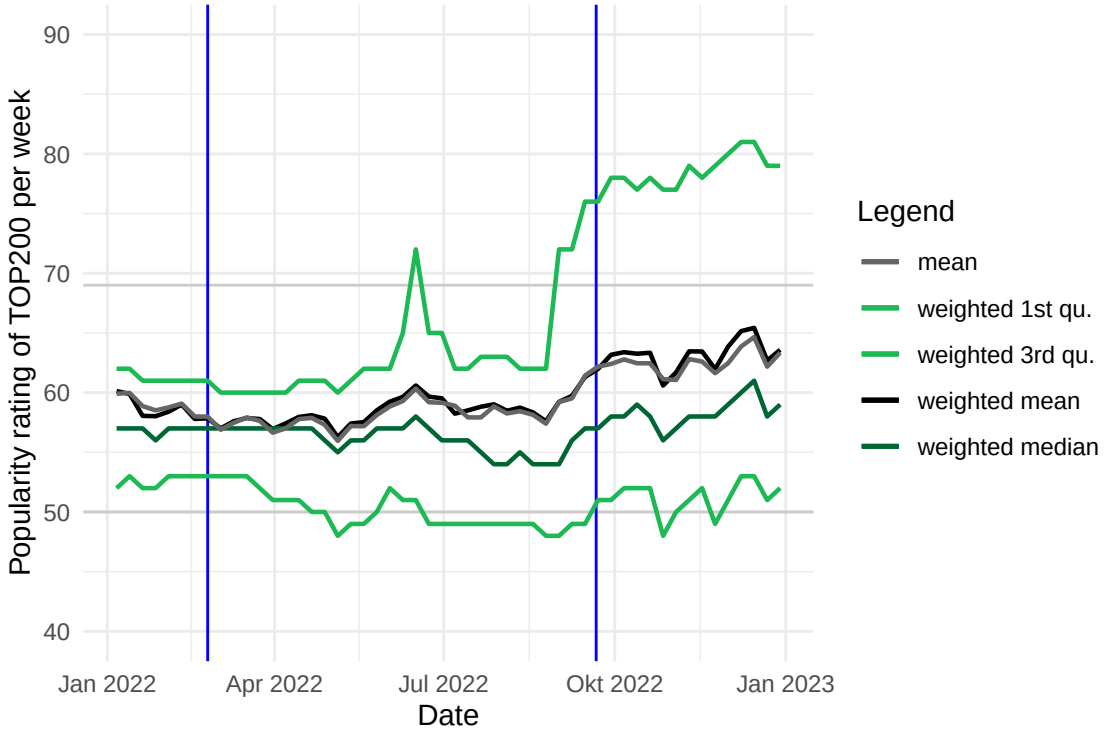


Figure 4.1: Trend plot of popularity measure

Additionally, the analysis of the data indicates a peak in listening behaviour at the end of June. Although the cause of this peak remains unclear and may be unreliable, it suggests a potential surge in interest or a specific event that captured the attention of music listeners during that time. Further investigation into this anomaly could provide valuable insights into the factors influencing music popularity trends.

Figure 4.2 illustrates the danceability trend over the year. The means, median, and quartiles consistently exhibit similar patterns. Following the invasion, there is a subtle decline in danceability, indicating a possible decrease in people's inclination towards danceable songs during that period. Conversely, there is an upward trend observed in July and August, which can be attributed to the summer months when people generally experience heightened happiness. Additionally, after the mobilisation, a downward trend becomes apparent, which could be associated with either the impact of the war or the onset of the winter blues that typically begin in autumn. Throughout the year, the danceability score remains relatively stable at around 0.7, indicating a preference among Ukrainians for danceable songs.

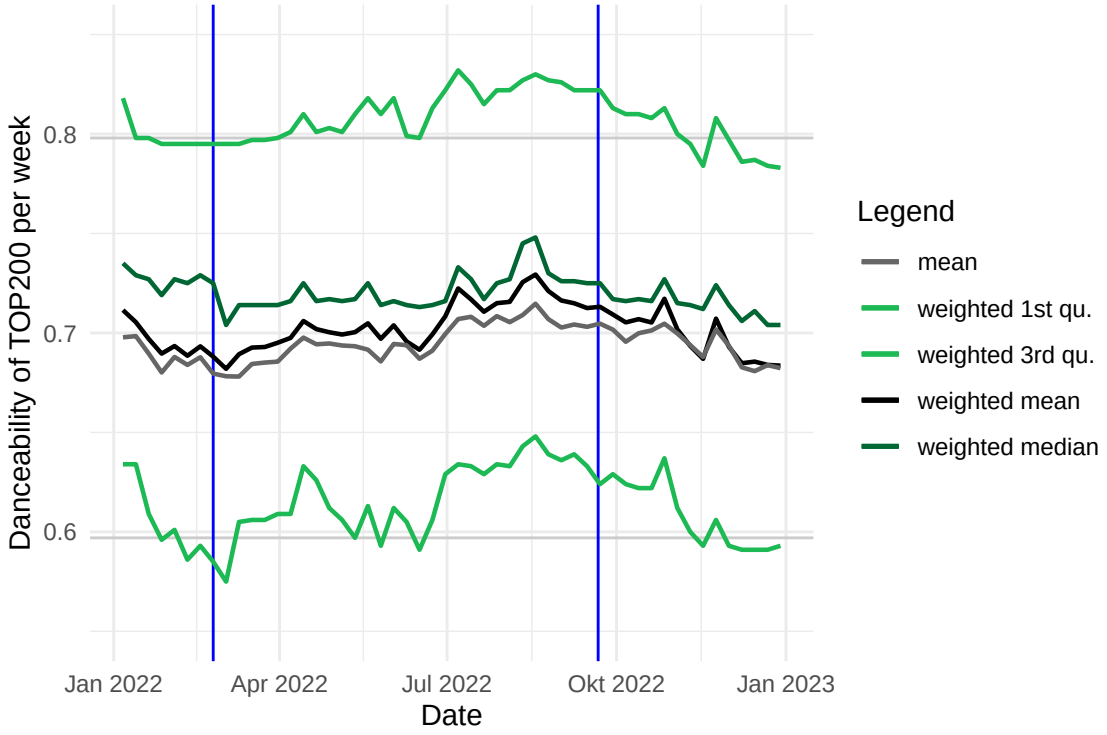
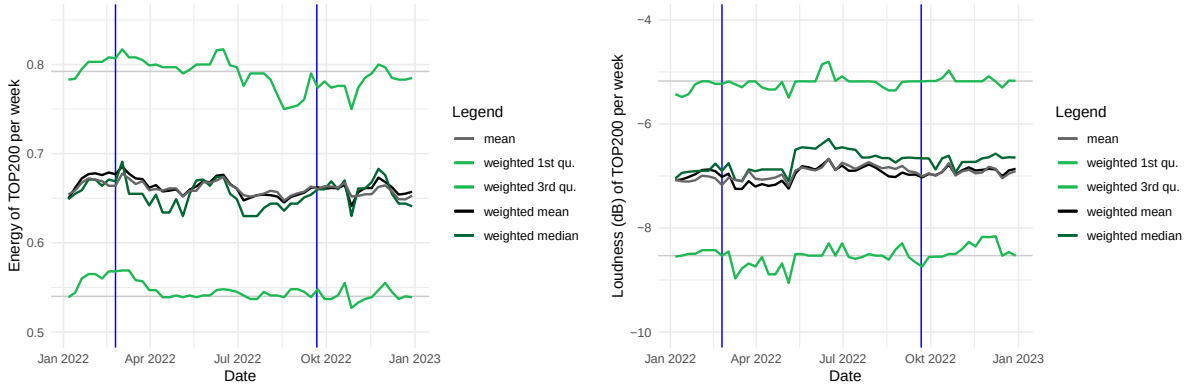


Figure 4.2: Trend plot of danceability measure

Figure 4.3 (a) provides a visual representation of the energy trend over the course of the year. It is visible that the energy levels remain relatively stable, fluctuating only within the range of 0.6 to 0.75. This consistency indicates that the songs maintain a consistent level of energy throughout the year, without any variations. Furthermore, the weighted quartiles depicted in the figure align with the overall quartiles of the 930 songs. This suggests that the distribution of energy levels in the songs is consistent and representative of the entire dataset. In Figure 4.3 (b), the graph illustrates the loudness of the songs throughout the year. The data shows that the loudness levels remain consistent, ranging from -5 dB to -8.5 dB. This indicates that the songs maintain a relatively constant loudness, without any changes in volume over time as in energy.



(a) Trend plot of energy

(b) Trend plot of loudness

Figure 4.3: Trend plots of energy and loudness (dB)

In 2022, there was a slight decrease in the speechiness of the TOP200 weekly songs. The values mostly ranged between 0.05 and 0.25, indicating fewer spoken words in the songs. The mean and third quartile showed a decline from the beginning of the year until June, after which they remained relatively stable. Please refer to Figure 4.4 for a visual representation. Figure A.11 shows that the acousticness of the songs varies between 0 and 0.4 throughout the year, with many fluctuations. However, only the first quartile remains unaffected by these changes. There is a slight drop after the invasion, followed by an upward trend in April and May, another drop, and then another upward shift in July, August, and September. After the mobilization and at the beginning of December, there is another drop. Overall, there is low confidence that the songs are acoustic.

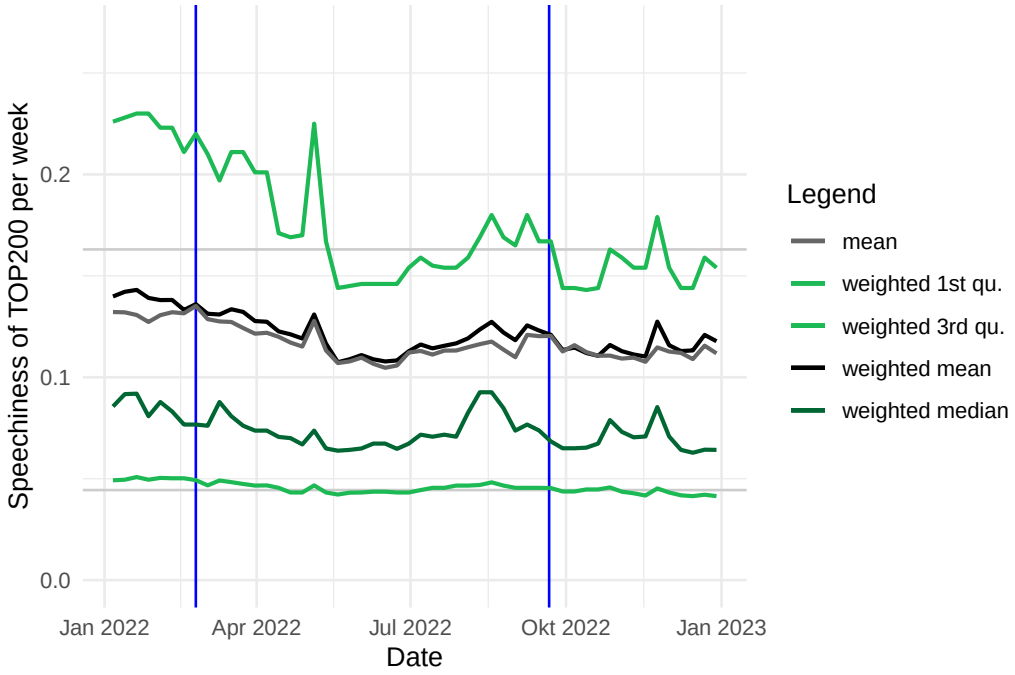


Figure 4.4: Trend plot of speechiness

As shown in Figure A.7 and Table 3.1, instrumentalness generally has very low measures and often results in 0. This results in the y-axis being very small in Figure 4.5. The plot shows that the mean and weighted mean are influenced by high measurements, causing them to fall outside of the IQR. The weighted first quartile and the weighted median are at 0, and the light green line represents the weighted third quartile. Throughout the year, there is an upward trend in instrumentalness, but overall, the songs are not classified as instrumental.

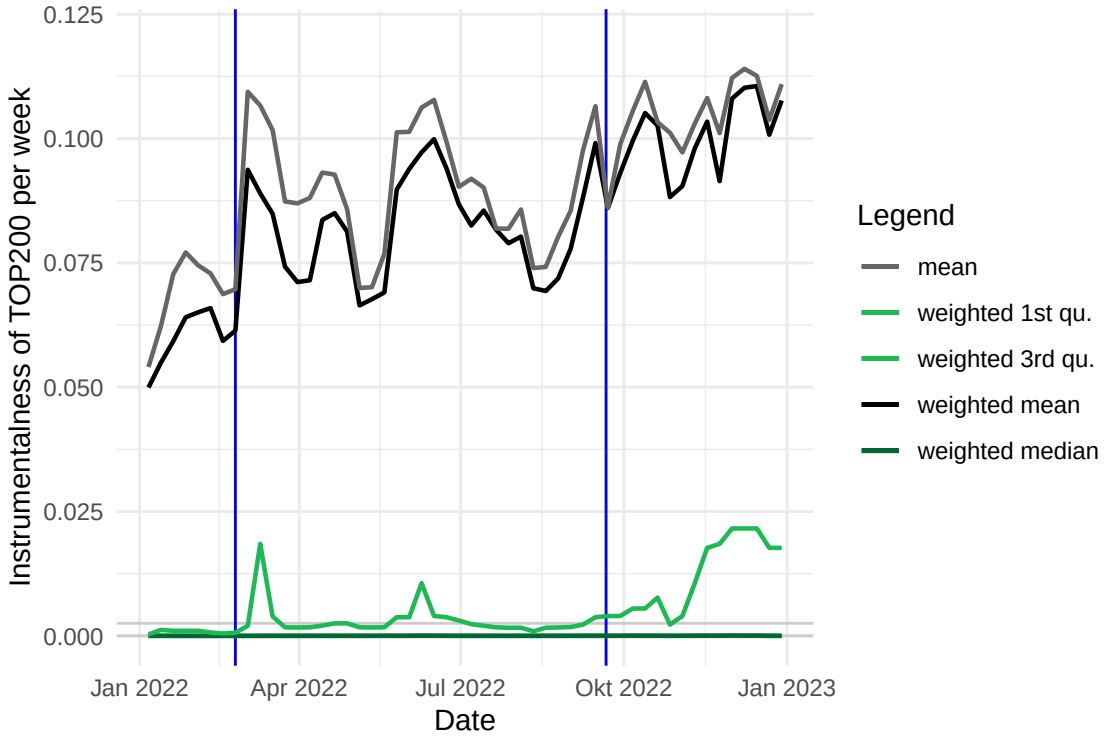


Figure 4.5: Trend plot of instrumentalness

One interesting observation from the trend of valence throughout the year 2022, as shown in Figure 4.6, is that the majority of values fall within the range of 0.25 to 0.7. This indicates that the songs analysed generally have a moderate to positive mood. It is worth noting that the mean, weighted mean, and weighted median of valence values range from 0.4 to 0.5, suggesting a consistent level of lower positivity in the songs analysed. Furthermore, there is a slight downward trend in valence over the course of the year, indicating a gradual shift towards a slightly sadder mood in the music. Interestingly, after the invasion of Russia in February 2022, there was a smaller drop in valence than expected. This suggests that the impact of the invasion on the overall mood of the songs analysed was not as anticipated. However, there was a noticeable drop in the first and third weighted quartile after the mobilization, indicating a shift towards a sadder mood during that period. It is worth considering that the drop in valence could be attributed to either the mobilization itself or the onset of winter blues in autumn. The change in season and the associated decrease in daylight hours can often have an impact on people's mood, which

could potentially be reflected in the music analysed. Overall, the analysis of valence in music provides valuable insights into the emotional characteristics of songs throughout the year 2022, highlighting the interplay between external events and the mood conveyed through music.

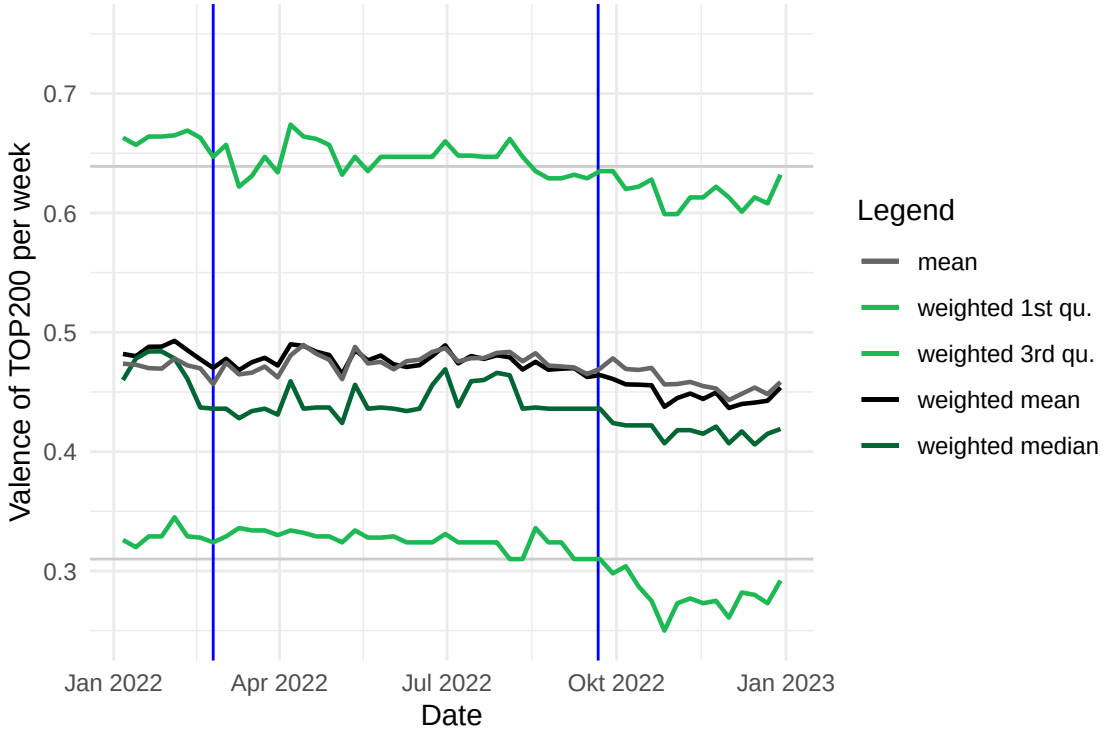


Figure 4.6: Trend plot of valence

The Figure A.12 displays the trend of the tempo, measured in beats per minute (BPM), of the songs. The displayed values range from 90 BPM to 160 BPM, indicating faster songs in general. The mean and median remain relatively stable around 120 BPM, but the first weighted quartile shifts upwards between July and November, while the third weighted quartile consistently shifts downwards throughout the year. This results in a smaller interquartile range (IQR) overall for the year. Finally, the trend of song duration in seconds is displayed in A.13. The data shows that there is no identifiable trend throughout the year, with duration (in seconds) staying between 150s and 175s.

The plots clearly illustrate that specific measurements, such as danceability, instrumentalness, valence, or acousticness, show a noticeable change in behaviour following either the invasion or mobilisation. This suggests that these events have an impact on the way people perceive and engage with music. Furthermore, an interesting observation can be made regarding a slight difference in behaviour towards the end of June. This difference is evident in various measurements, including duration, acousticness, loudness, energy, instrumentalness, and popularity. It is intriguing to note that these changes coincide with a particular time period, which could indicate a seasonal or cultural influence on listening habits. To gain a deeper understanding of these behavioural shifts, further analysis

is required. By delving into the underlying factors and exploring potential correlations, researchers can uncover the reasons behind these changes in listening behaviour. This additional analysis will provide valuable insights into the dynamics of music consumption and the impact of external events on our musical preferences. Chapter 5 contains additional recommendations and points of discussion.

5 Discussion

This work delves into the analysis of audio features in songs played in Ukraine during 2022. The study highlights the intriguing results obtained from slight variations in the measurements of these audio features. However, it is crucial to engage in a thorough discussion regarding the validity of these outcomes. It is worth noting that the subjective evaluations have been deliberately excluded from the study, ensuring that the language used remains clear, concise, and objective. Furthermore, the text adheres to the conventional academic structure and formatting. In exploring the changes in measurements following the mobilization at the end of September, it is plausible to consider the influence of the onset of winter blues. To ascertain the validity of this point, it may prove beneficial to examine a different year, such as 2021, or even consider 2019 as a comparative reference due to potential changes in listening behavior caused by the COVID-19 pandemic. Additionally, it is important to acknowledge that certain values, like valence, may exhibit bias as they are primarily trained on English texts rather than other languages such as Ukrainian. Unfortunately, a solution to this problem does not seem to exist, and it is crucial to bear this in mind when interpreting the results. Moreover, the decrease in the number of users on streaming platforms in Ukraine after the invasion began in early 2022 undermines the validity of the findings. Therefore, it may be worthwhile to compare the songs played on other platforms, such as Youtube Music or Apple Music, to determine if the results remain consistent across different platforms. Interestingly, during the data collection process, song covers were observed, and as the war continued, more covers prominently featured the colours of the Ukrainian flag. Conducting a visual analysis of these covers could potentially serve as an intriguing research study, offering insights into the evolving cultural expressions during times of conflict.

To further elaborate on the comparison between the results and those from Yeung (2023), it is worth noting that the difference in data collection methods and time periods analysed can impact the findings. While Yeung had access to daily data for the year 2020 and concentrated on the first half of the year, this analysis was based on weekly data and encompassed the entire year of 2022. This discrepancy in data precision and time frame could lead to variations in the observed trends and patterns. Moreover, it is important to consider the user base of Spotify in different countries. The UK has a larger number of Spotify users compared to Ukraine. This difference in user demographics can influence the overall listening habits and preferences, potentially affecting the results obtained from the two datasets. Additionally, it is worth mentioning that certain measurements or analytical techniques may yield different outcomes when applied to English songs compared to Ukrainian ones. Factors such as language nuances, cultural references, and musical styles can contribute to variations in the analysis. Furthermore, while Yeung primarily focused on the resurrection of old songs, this analysis did not have access to the year of publication for the songs. This limitation might have influenced the conclusions drawn from the data. Lastly, it is worth noting that Yeung also highlighted song lyrics from old songs to draw conclusions about their style. However, this task can be challenging if one does not have a good command of the Ukrainian language. Understanding the cultural context and linguistic complications of a particular language is crucial for accurate analysis and interpretation of song lyrics.

6 Conclusion

This study provides insights into the potential impact of the war in Ukraine in 2022 on the music preferences of Spotify users in Ukraine. Although it is an exploratory study, it sheds light on interesting findings that warrant further investigation.

The analysis conducted in this study focused on several key measurements, including danceability, instrumentalness, valence, and acousticness. These measurements were chosen as they can reflect changes in musical preferences and behaviour. The study revealed noticeable changes in these measurements following major events, suggesting a possible shift in user behaviour due to the war. However, it is important to note that these findings do not allow for definitive conclusions to be drawn. To gain a deeper understanding of these findings, additional analysis could be conducted. This could involve examining specific songs or genres that experienced significant changes. By doing this, researchers could uncover more nuanced patterns and potentially identify the underlying factors driving these changes. Interestingly, the data also indicates a shift in the measurements' behaviour towards the end of June 2022. It would be interesting to investigate whether this change was influenced by a global event or if it was simply a result of the summer season. Exploring this aspect could provide valuable context and help researchers better interpret the observed changes in music preferences. In conclusion, while this study offers valuable insights into the potential impact of the war in Ukraine on Spotify users' music preferences, it is important to approach the findings with caution. Further analysis and investigation are necessary to fully understand the implications and underlying factors behind these changes.

A Appendix

In this section are some discussed plots presented.

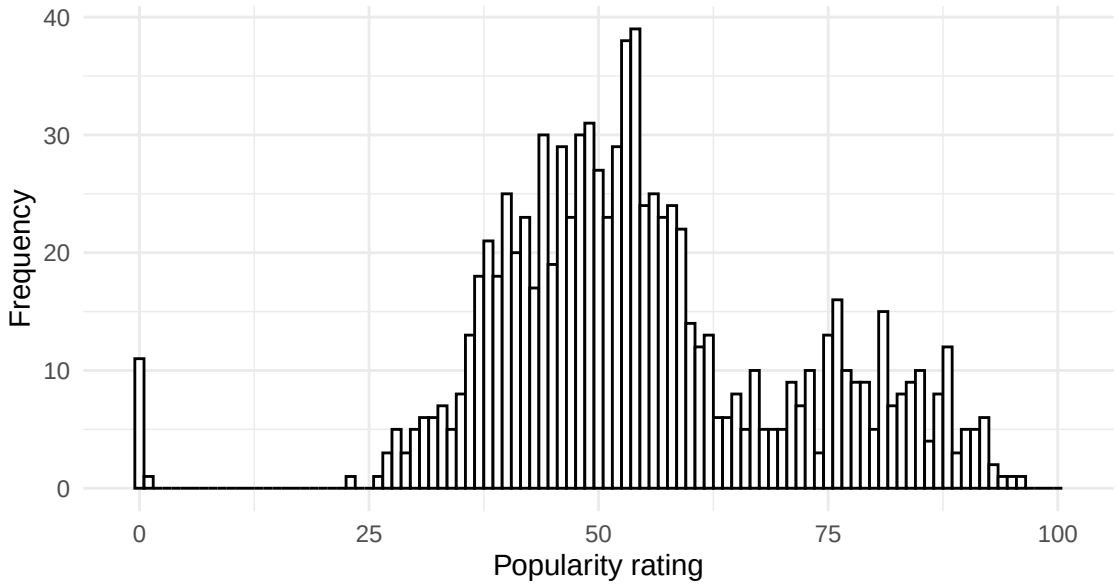


Figure A.1: Histogram of the popularity measure (of 26th January 2024) from all 930 unique songs

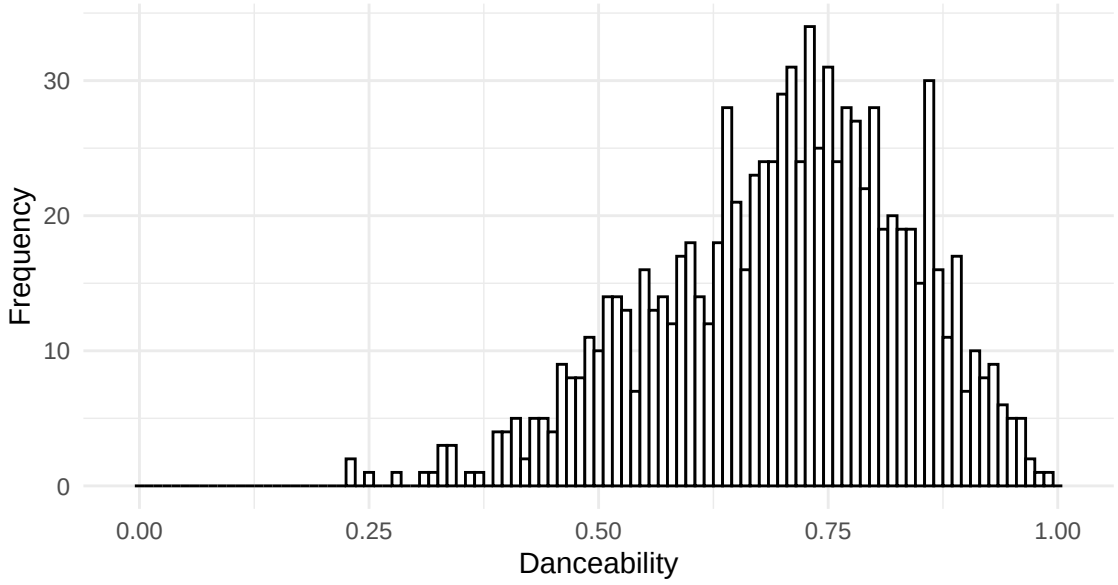


Figure A.2: Histogram of the danceability from all 930 unique songs

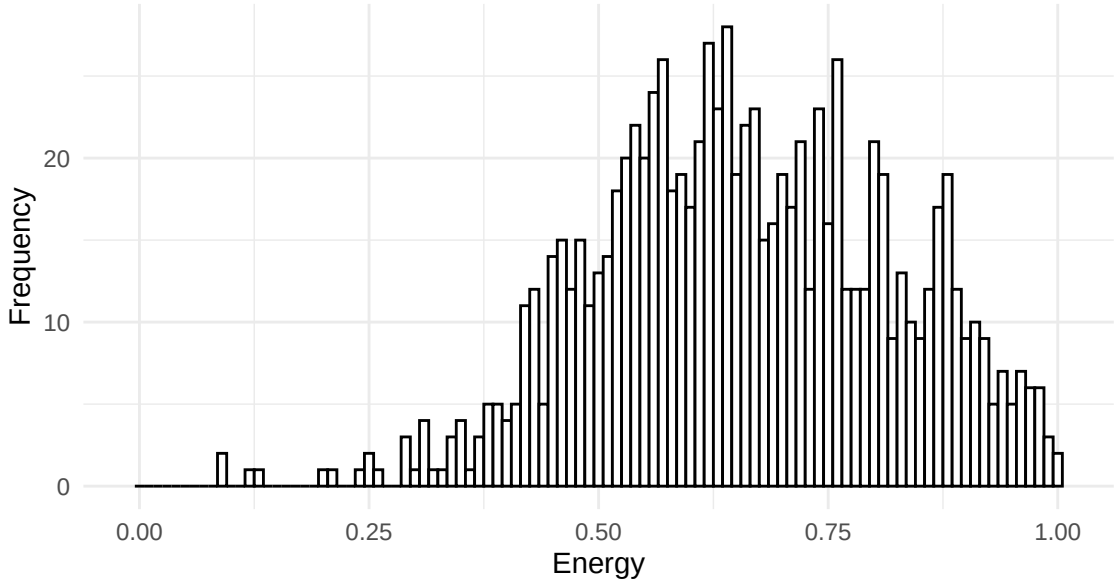


Figure A.3: Histogram of the energy from all 930 unique songs

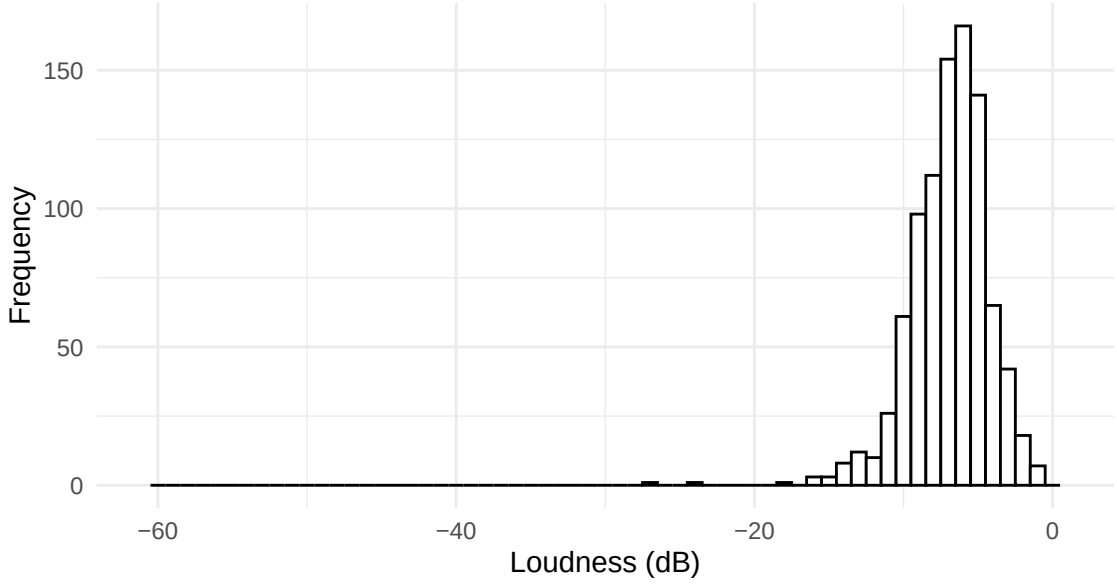


Figure A.4: Histogram of the loudness from all 930 unique songs

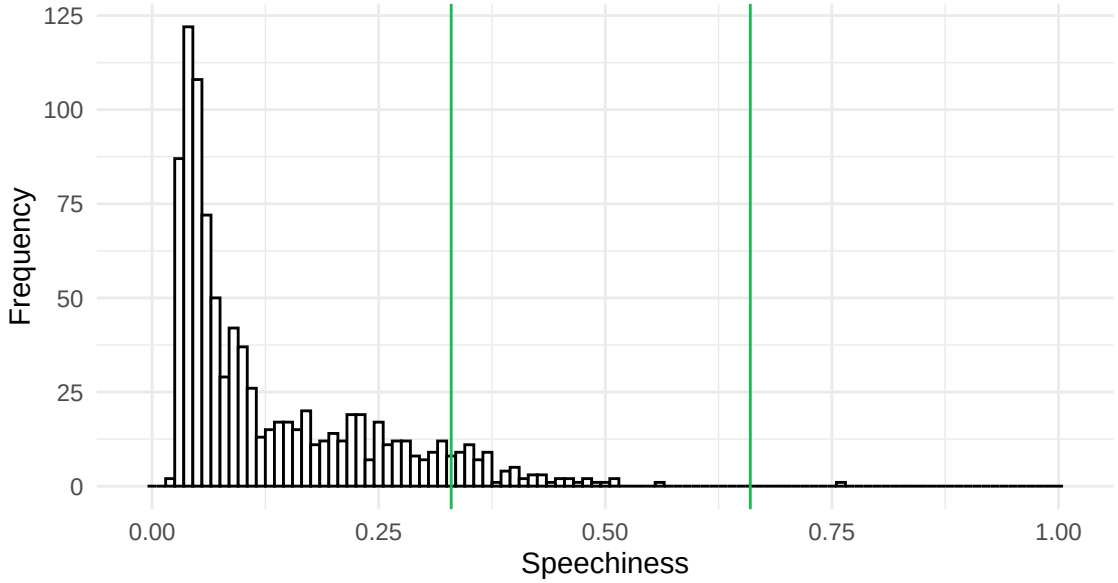


Figure A.5: Histogram of the speechiness from all 930 unique songs, vertical lines (0.33 and 0.66) indicate interpretation boundaries

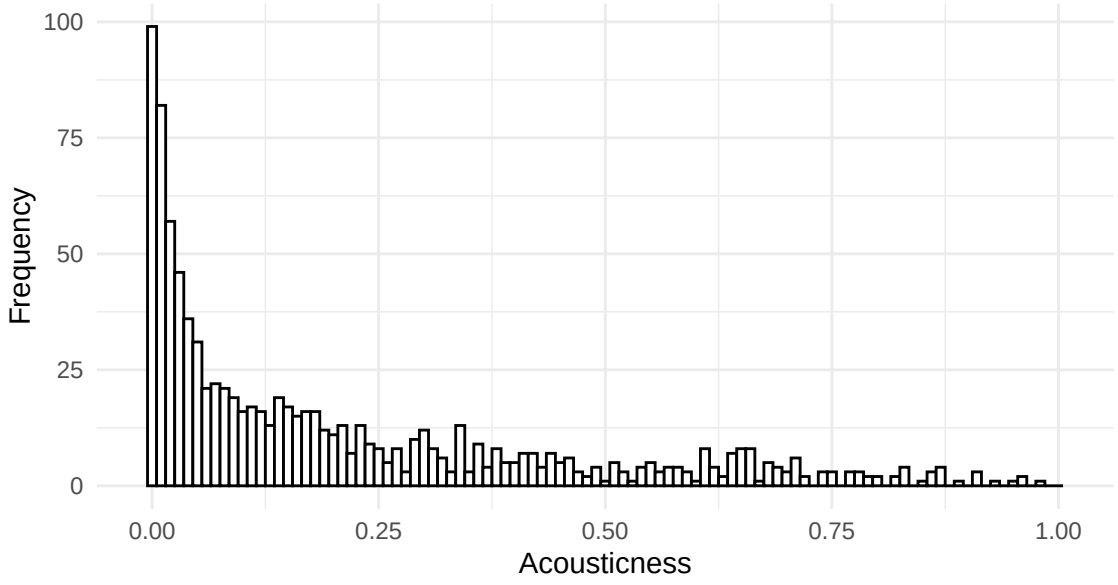


Figure A.6: Histogram of the acousticness from all 930 unique songs

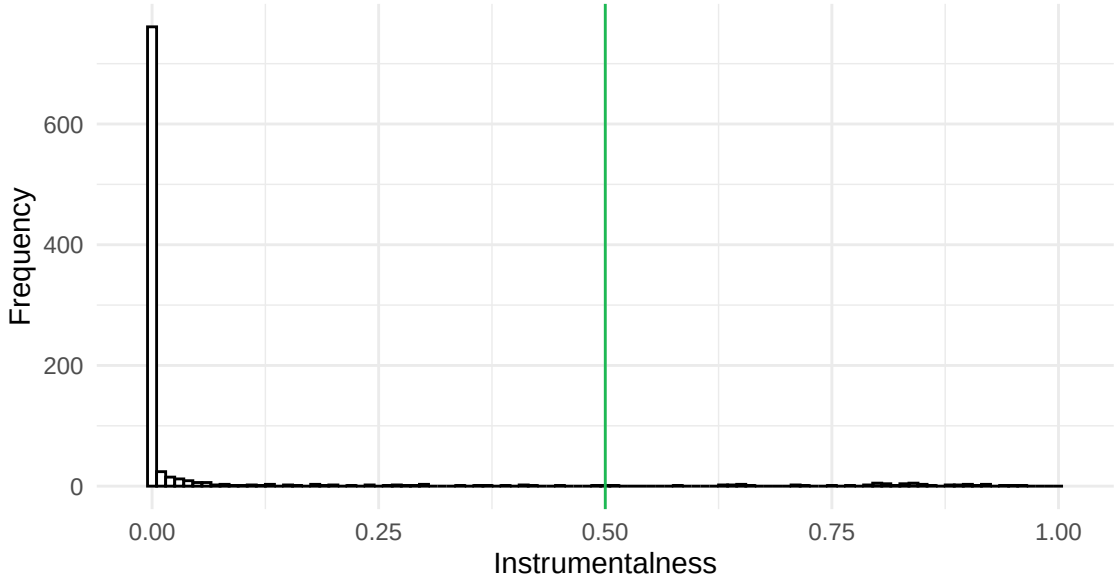


Figure A.7: Histogram of the instrumentalness from all 930 unique songs, vertical line indicates an interpretation boundary

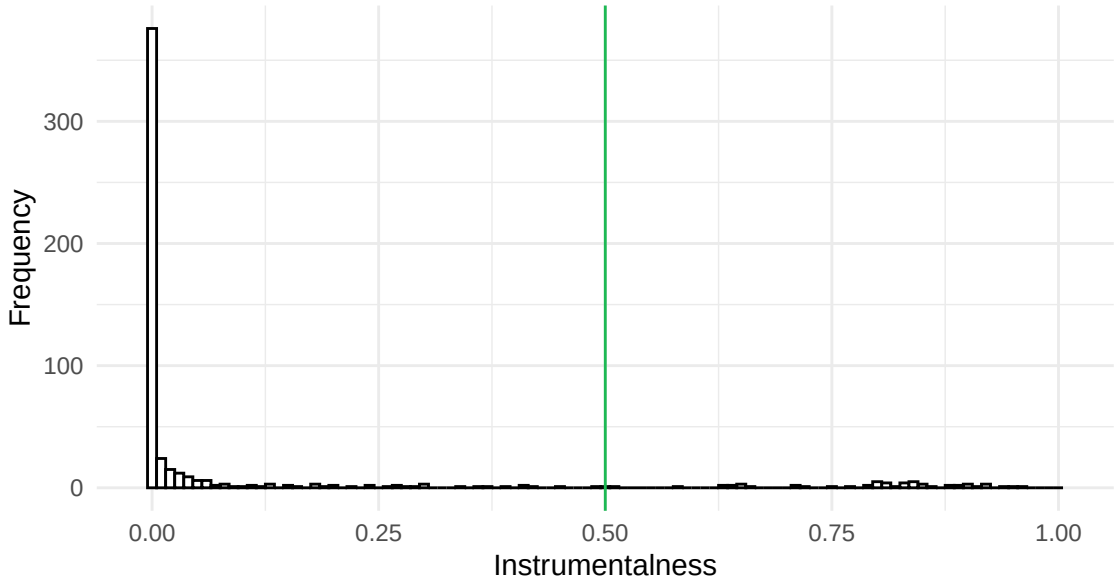


Figure A.8: Histogram of the instrumentalness from all songs where the instrumentalness is not equal to zero, vertical line indicates an interpretation boundary

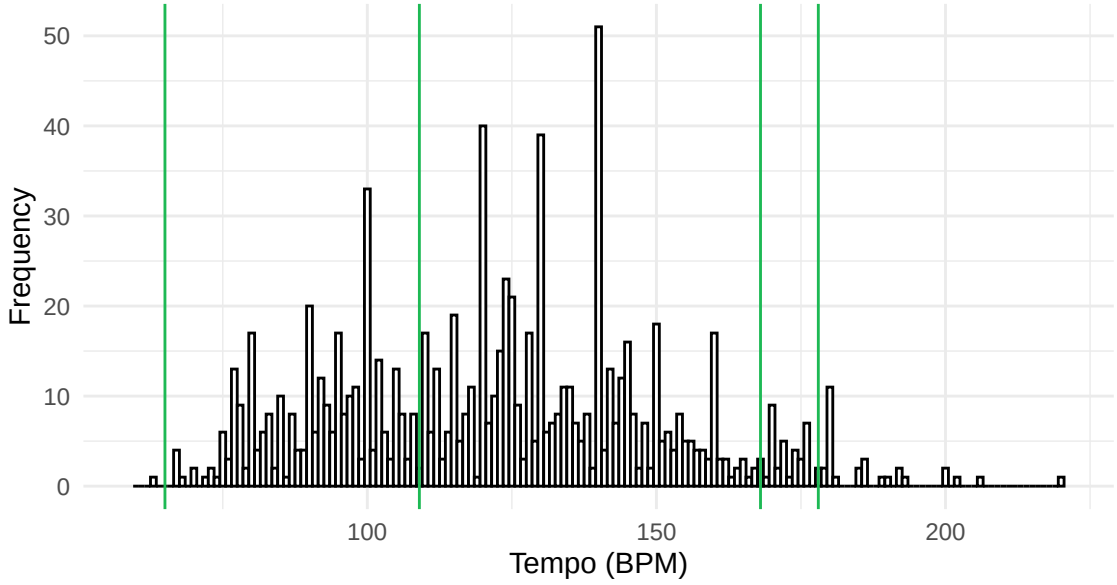


Figure A.9: Histogram of the tempo from all 930 unique songs, vertical lines indicates the tempi adagio, allegro, presto, prestissimo (from left to right)

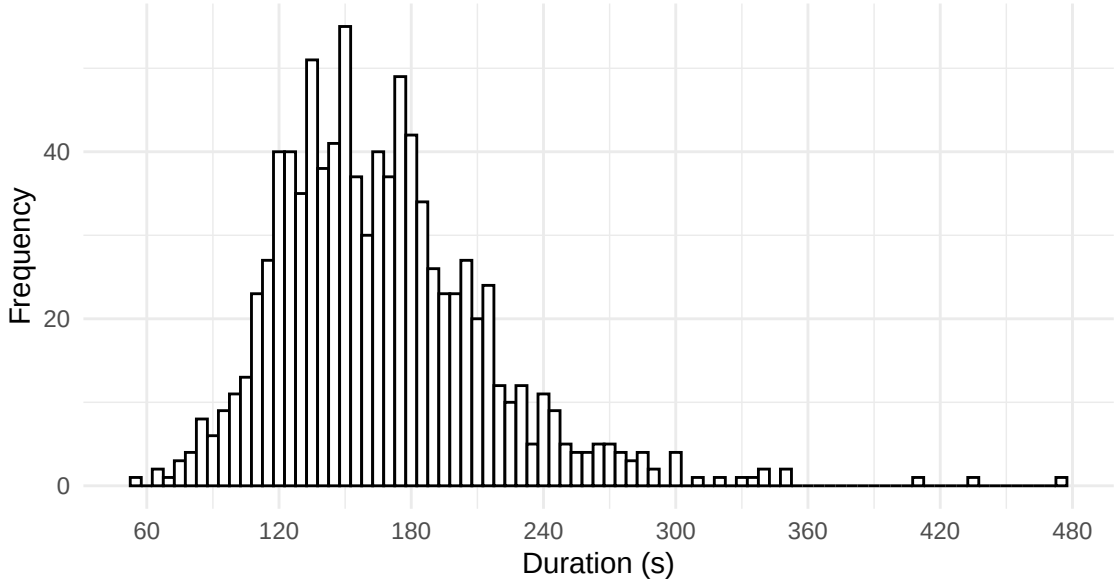


Figure A.10: Histogram of the duration of a songs in seconds

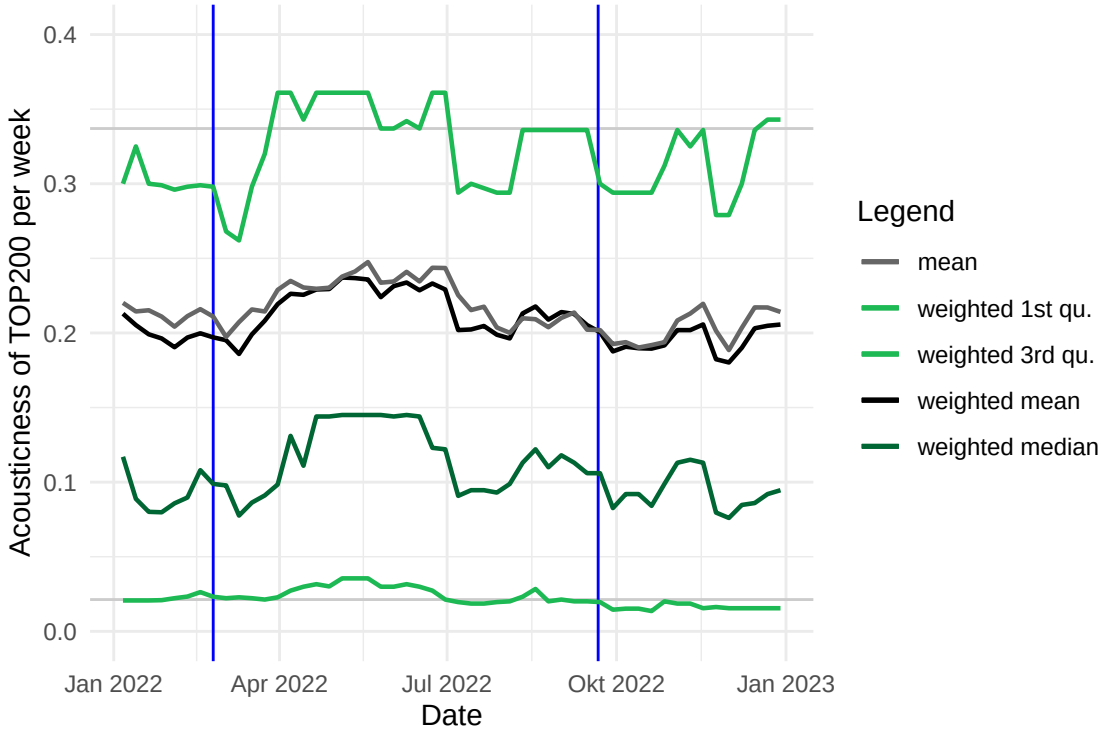


Figure A.11: Trend plot of acousticness

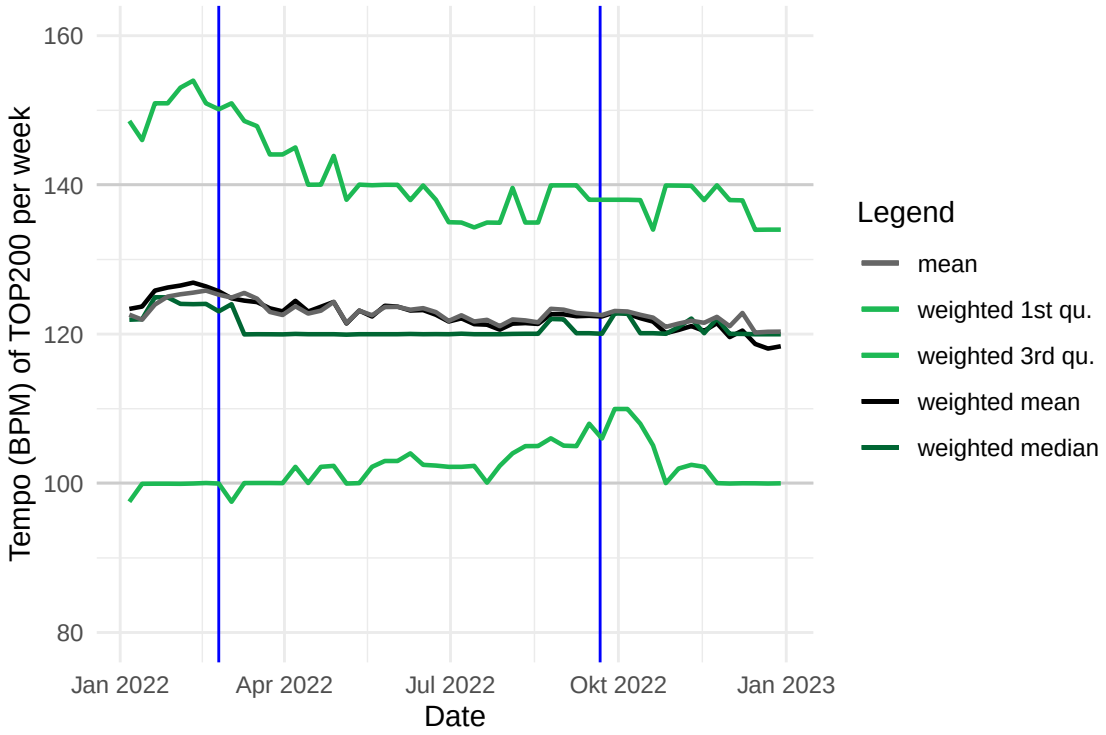


Figure A.12: Trend plot of tempo

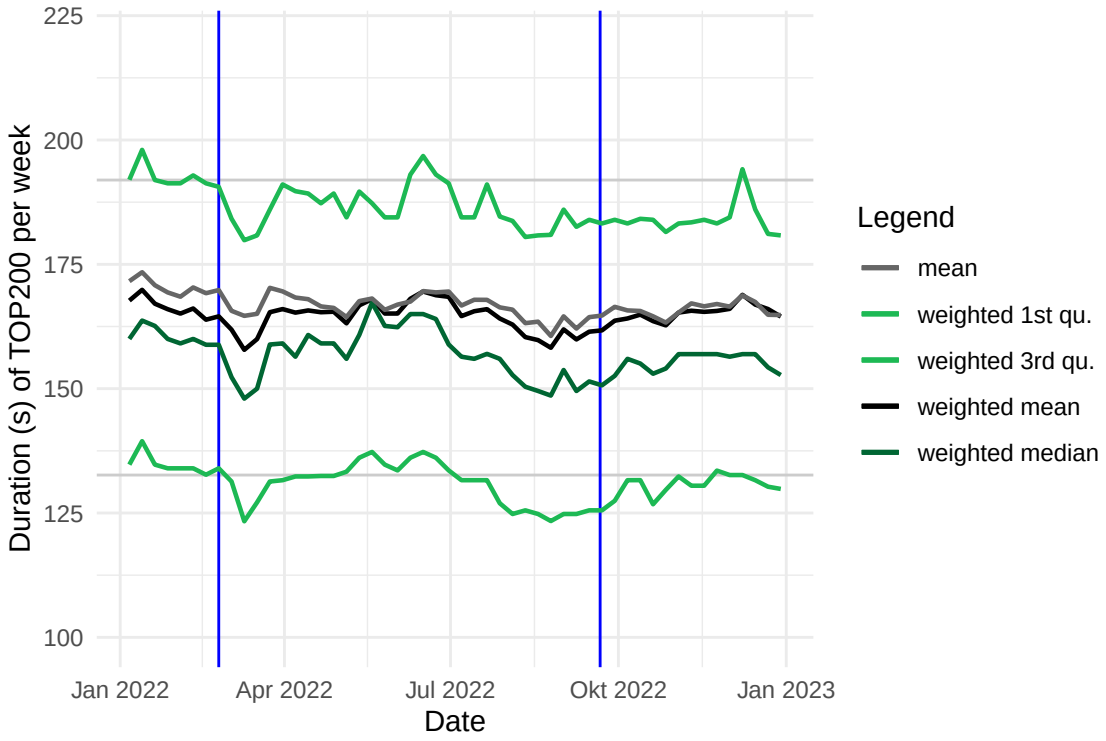


Figure A.13: Trend plot of duration (s)

B Electronic appendix

Data, code and figures are provided in electronic form. See for this the github repository: https://github.com/marie-kraft/spotify_project

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