Pandemics, Music, and Collective Sentiment: Evidence from the Outbreak of COVID-19

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Major Findings

After the first COVID-19 case in a country was confirmed, the sentiment of artists users listened to becomes more negative. This negative effect is pronounced for males while females' music emotion is less influenced by the outbreak of the COVID-19 pandemic. We further find a negative association between the number of new weekly COVID-19 cases and users' music sentiment.

Background

Music listening has various functions in people's daily lives, especially in terms of psychological aspects. However, the influence of real-world events, such as human or natural disasters, on users' mood-based music selection remains less explored.

As of May 4, 2020, with 3.57 million cases and over 250 thousand deaths reported, COVID-19 has posed a severe threat to public health. Causing economic and social pressure, the pandemic is putting enormous stress on all of us and might trigger feelings of distress and anxiety. Investigating whether and the extent to which collective sentiment inferred from music listening behavior is influenced by the pandemic can deepen our understanding of the relationship between real-world events and users' sentiment reflected by the music they listen to, and contribute to mitigating negative mental health impacts caused by the pandemic, and help people adapt, and be resilient during distress times.

Research Questions

RQ1: How did the first COVID-19 case in a country affect the music sentiment of users in that country?

RQ2: How did the number of new COVID-19 cases and hence, the spread of the disease in a country affect the music sentiment of users in that country?

Data

We gathered the listening records of users in the LFM-1b dataset between November 1, 2019, one month before the first COVID-19 case in the world was confirmed, and March 27, 2020. We collected data on confirmed COVID-19 new cases by date for these countries. We identified the date of the first confirmed COVID-19 case in each country and define it as the date when the COVID-19 outbreak started in this country

Method

➤ *Measuring music sentiment*

We capture the sentiment values assigned to all artists by crawling the user-created tags assigned to those artists from Last.fm. The sentiment of an artist is then defined as the weighted average sentiment values of the tags assigned to the artist.

➤ *Difference in differences approach*

To capture the relationship between the outbreak of the COVID-19 pandemic and the sentiment of music listened to by users, the DD model is used. One distinct advantage of the DD model is that it can disclose causality.

➤ *Dependent variables*

The first dependent variable is the average sentiment of artists a user listened to (hereafter referred to as USE) in a given week. The values of USE range from 0 to 1. The larger the USE value is, the more positive the user's music sentiment.

The second dependent variable we propose to use is whether the music sentiment of a user in a given week is extremely positive . We refer to this variable as POS.
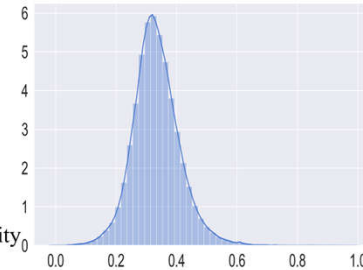

Figure 1. Distribution of USE with USE on x-axis and probability density on y-axis.

➤ *Independent variables*

We propose to use the outbreak of COVID-19, denoted as COVID-19 hereafter, as the independent variable. Specifically, it is a binary variable indicating whether or not the first COVID-19 case has been confirmed in a given country in a given week.

➤ *Interaction effect between the COVID-19 and gender*

We generate two interaction terms between gender and the independent variables respectively, COVID#Gender and Case#Gender.

Results

The effects of the independent variable, COVID-19, on dependent variable, weekly USE (user's music sentiment) are shown in columns 1 to 4 in Table 2 (Panel 1) .

Gender differences are also found in the model of USE with the intersection term (column 2, Panel 1). The coefficient on the interaction term between COVID-19 outbreak and gender, COVID#Gender, is significantly positive, indicating that females are less influenced by the pandemic, as compared to their male peers.

Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	USE				POS			
	All	All	Female	Male	All	All	Female	Male
Panel 1								
COVID19	-0.0020***	-0.0024***	0.0008	-0.0028***	-0.0284***	-0.0290***	-0.0161***	-0.0316***
	(0.0006)	(0.0006)	(0.0015)	(0.0007)	(0.0023)	(0.0024)	(0.0062)	(0.0025)
Gender	0.0141***	0.0136***			0.0335***	0.0329***		
	(0.0005)	(0.0005)			(0.0018)	(0.0020)		
COVID#Gender		0.0025**				0.0036		
		(0.0012)				(0.0047)		
Age	-0.0000**	-0.0000***	0.0001**	-0.0000***	-0.0001	-0.0001	0.0003*	-0.0001***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0001)	(0.0001)	(0.0002)	(0.0001)
Constant	0.3321***	0.3322***	0.3428***	0.3328***	0.0999***	0.1000***	0.1199***	0.1025***
	(0.0005)	(0.0005)	(0.0013)	(0.0005)	(0.0020)	(0.0020)	(0.0053)	(0.0020)
Observations	184,277	184,277	31,894	152,383	184,277	184,277	31,894	"152,383"
R-squared	0.030	0.030	0.036	0.025	0.014	0.014	0.020	0.011
Panel 2								
COVID19 cases	-0.0005**	-0.0005***	-0.0003	-0.0006***	-0.0067***	-0.0065***	-0.0069***	-0.0068***
	(0.0002)	(0.0002)	(0.0006)	(0.0002)	(0.0008)	(0.0009)	(0.0023)	(0.0009)
Gender	0.0141***	0.0141***			0.0340***	0.0351***		
	(0.0005)	(0.0005)			(0.0018)	(0.0020)		
Case#Gender		0.0001				-0.0014		
		(0.0003)				(0.0010)		
Age	-0.0000***	-0.0000**	0.0001**	-0.0000***	-0.0001	-0.0001	0.0003*	-0.0001**
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0001)	(0.0001)	(0.0002)	(0.0001)
Constant	0.3321***	0.3322***	0.3432***	0.3327***	0.0996***	0.0995***	0.1224***	0.1017***
	(0.0005)	(0.0005)	(0.0013)	(0.0006)	(0.0020)	(0.0020)	(0.0055)	(0.0021)
Observations	184,277	184,277	31,894	152,383	184,277	184,277	31,894	152,383
R-squared	0.030	0.030	0.036	0.025	0.013	0.013	0.020	0.011

Table 2. Estimated effect of the outbreak of COVID-19 (Panel 1) and number of new COVID-19 cases (Panel 2) on users' music sentiment.

The results of the analyses of the POS variable provide consistent findings that user's music sentiment turns more negative after the outbreak of COVID-19. Column 5 of Table 2 (Panel 1) reveals that there is a significantly negative relationship between the outbreak of COVID-19 and the positiveness of users' music sentiment (POS).
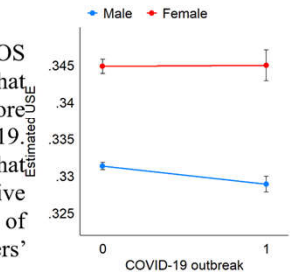

Figure 2. Estimated interaction effect between COVID-19 outbreak and gender

In a country where a larger number of people are infected with COVID-19 in a given week, the weekly average sentiment of artists the user listened to becomes more negative.