ORIGINAL ARTICLE

How does urban violence impact choices of cultural participation? The case of the Maré *favela* complex in Rio de Janeiro

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Abstract

The impact of urban violence on society has been the subject of several studies, but the consequences of fear for habits of cultural consumption are missing in cultural economics research. This article investigates whether the fear of urban violence explains individuals' choice between different options of cultural participation with a particular focus on the activities of watching movies and listening to music. Based on individual data from a survey conducted in 2019 with 1211 residents from a conglomeration of sixteen favelas (slums) located in the Maré neighbourhood in Rio de Janeiro (Brazil), this study employs Simultaneous Bivariate Ordered Probit Models to verify the association between individuals' fear of violence and their choice of consuming culture in private or public spaces. Controlling for socioeconomic, demographic, and territorial variables, the findings indicate that consuming culture in private spaces is a substitute for public spaces when individuals are more afraid of violence. The results presented in this work provide evidence for the design and implementation of policies targeting territories impacted by high levels of violence.

Keywords Cultural participation · Urban violence · Brazilian favelas · Probit model

JEL Classification D91 · R22 · Z11

1 Introduction

Urban violence has been the object of several economics-based studies. Empirical evidence revealed that violence generally imposes costs on society and, at the individual level, the fear of becoming a victim often affects behaviours and habits

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(Greenbaum & Tita, 2004; Skogan & Maxfield, 1981; Warr, 2000). This paper looks at the way this fear affects the means through which people participate in cultural activities. Many different approaches have dealt with the indirect consequences of urban violence. These consequences range from losses in terms of gross domestic product and costs imposed on the labour market, to the influence over individuals' decisions of where to live and what to consume (Carboni & Detotto, 2016; Cullen & Levitt, 1999; Greenbaum & Tita, 2004; Mejía & Restrepo, 2016). However, none of these studies investigated the impact of the fear of victimization on decisions of where to participate in activities that can be taken either in public or in private spaces.

This question is particularly relevant in a global context where new technologies progressively offer digital consumption alternatives that compete with traditional modalities (presential, physical or face-to-face) in numerous sectors. The cultural sector was especially affected by this in recent years. Access to cultural and creative content is increasingly made via digital means, through platforms such as YouTube, Spotify, Netflix, and others (Waldfogel, 2017). At the same time, part of the importance of culture and creativity in terms of socioeconomic development seems to be related to public spaces. There is an acknowledgement of the role of culture and creativity for socioeconomic development, economic growth, quality of life and urban regeneration (Florida, 2002; Galloway, 2006; Schlesinger, 2016). Since the 90s, several cultural-based initiatives at the local level were implemented to support and stimulate economic and social development. Those are committed to appealing to the creative class and providing an intensive cultural supply (Florida, 2002). This is also part of the creative economy paradigm, which associates creativity with human capital and long-term productivity and competitiveness (Bakhshi et al., 2015).

This paper focuses on the decision between participating in cultural activities in public or private spaces in territories where armed conflicts are frequent and the fear of violence restricts mobility. If the fear of being a victim constitutes an obstacle to participation in cultural life, urban areas affected by violence may lag behind in terms of socioeconomic development and in any possibility of improving quality of life through a creative economy.

It is widely known that urban violence is unevenly distributed across territories and that some segments of the population commonly face greater risk than others (Winton, 2004). Briceño-León and Zubillaga (2002) reported, for instance, that the homicide rate in Rio de Janeiro is on average 4.5 times higher in the lower-income districts than in the city's middle-class and tourist areas. Most of the favelas[1] are particularly affected by violence due to the presence of gangs linked to illegal drug trade or of militias that exploit basic services through the use or threat of violence, and precariously monopolize functions that the State is supposed to regulate. At the same time, public security agents generally do not recognize the right of this population to live in safety and use practices that intimidate and contribute to creating insecurity and fear in daily life. The current logic of the State in most of these spaces is warmongering, characterized by specific actions of police operations marked by intense armed conflict. These conflicts often employ heavy weaponry, such as

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[1] Favela is used in the remainder of the paper to refer to Rio de Janeiro's slums.

grenades and modern military machine guns, and regularly lead to deaths, including of those not directly involved in the drug trade. The imminence and unpredictability of armed confrontations, whether between rival armed groups or between those groups and the police forces, have massive adverse impacts on the daily lives of favela residents, particularly on their freedom to move. In Rio de Janeiro, 1.3 million people (around 22% of the population) live in favelas according to the Brazilian Institute of Geography and Statistics (IBGE, 2010).

This article studies the case of the sixteen favelas of the Maré district, which is home to approximately 10% of the population living in favelas in Rio de Janeiro. Based on individual data from a survey conducted in 2019 with 1211 residents, it associates the fear of victimization with choices between different ways in which people can consume culture. More specifically, between listening to music and watching movies in public spaces as compared to private spaces. The findings show a statistically significant and negative effect of the fear of being hit by a stray bullet on cultural practices that require individuals to go out (as compared to modalities that take place in private spaces). Results also show that fear represents a stronger determinant of individuals' behaviour than the actual occurrence of armed conflict events.

The paper is organized as follows. Section 2 reviews the literature in two parts: first, looking at the impacts of violence on individuals and society, then examining the findings that describe the typical determinants of cultural participation. Section 3 defines the hypothesis of this study and the theoretical background that supports them. Section 4 describes the context of the empirical study, the data and variables used for the analysis and the estimation strategy. Sections 5 and 6 provide the results and discuss them respectively. Section 7 concludes the article.

2 Literature review

2.1 The impact of violence on individuals and society

The consequences of violence and the fear of crime were the subject of several empirical studies in a variety of research fields, including economics, psychology, criminology, and urban studies. The effect of territorial violence on individuals and the society have been observed in different aspects, but for the purposes of this article this review focuses on the economic and behavioural impacts. In this sense, multiple results were observed. These range from negative impacts on macroeconomics outcomes, such as the gross domestic product (e.g., Carboni & Detotto, 2016) to impacts on the individual level, such as health deterioration (e.g., Ross & Mirowsky, 2001). Most of the analyses discuss and provide evidence of what can be called the indirect costs of violence, which in turn affect the quality of life of individuals and society as a whole (Hale, 1996). Among those studies, a few are on the effects of the fear of crime on individuals' behaviours and habits, including where they choose to live (e.g., Cullen & Levitt, 1999), their use of public transportation (Patterson, 1985), handgun ownership (DeFronzo, 1979) and conspicuous consumption (Mejía & Restrepo, 2016). No study was found however on the association between the fear

of violence and individuals' avoidance to go out for certain activities that can alternatively be done without leaving their residence. The literature suggests that this kind of avoidance behaviour must inevitably provoke negative feedback effects on violence rates (Hale, 1996), decrease levels of social interaction (Garofalo, 1981) and negatively impact economic activities (Warr, 2000), with all of these bringing losses in terms of well-being.

From a development economics and human capital accumulation perspective, Brown and Velásquez (2017) showed that young adults exposed to increased local violence attained significantly fewer years of education and were less likely to complete compulsory schooling. Furthermore, the effect of armed conflict on the accumulation of schooling in Tajikistan were studied by Shemyakina (2011). The author's findings indicate that exposure to violent conflict had a large and statistically significant negative effect on girls' enrolment and completion of compulsory studies, but no significative effect on the education of boys. Similarly, evidence from the 1994 Rwandan Genocide revealed its strong negative impact on schooling, with exposed children presenting a drop in education attainment of 18.3% relative to the average (Akresh et al., 2008). In Brazil, Monteiro and Rocha (2017) showed that the gunfights between drug gangs in Rio de Janeiro decreased students' scores at school, and that the supply side of education played as an important mechanism, since schools in violent areas in Brazil experienced larger teacher absenteeism, less stability in administration and were more likely to temporarily close.

Other indirect economic costs of urban violence include the effects on businesses and the labour market. Greenbaum and Tita (2004) found a negative impact of violent crime on the creation of new business establishments and the growth of employment in existing businesses. Looking at the businesses' choice in terms of location, Rosenthal and Ross (2010) showed that retailers are more likely to locate in safer areas as compared to wholesalers in the same industry. Regarding impacts on the labour market, Hamermesh (1999) found that homicide rates deter working in the evening and at night, shifting it to the daytime. Besides, multiple studies have shown that the Mexican Drug War adversely impacted employment and earning outcomes (BenYishay & Pearlman, 2013; Dell, 2015; Robles et al., 2013; Velásquez, 2020).

The housing market is also deeply affected by criminality and violence in urban areas, especially in most crime ridden areas (Lynch & Rasmussen, 2001). For instance, Linden and Rockoff (2008) and Pope (2008) found significative negative effects on property values when a registered sex offender moved into a neighbourhood. This happens as a result of a lower demand for living in areas perceived as dangerous (Hartnagel, 1979). Studies on the effect of crime on an individual's residence location confirm this trend. Cullen and Levitt (1999) found that high crime rates cause people to move out of cities and Gould Ellen and O'Regan (2008) indicated that cities are better able to retain residents after crime rates are reduced.

The choice of where to live is not the only behavioural aspect impacted by urban violence that was the subject of research. Mejía and Restrepo (2016) showed that property crime reduces the consumption of visible goods, not only because some of these may be stolen, but also because they reveal information about an individual's wealth. Besides, scholars refer to other multiple individual reactions to the fear of crime, such as: adopting more protective behaviour and ensuring personal safety,

like owning guns (DeFronzo, 1979; Krahn & Kennedy, 1985), avoiding activities perceived as dangerous, like walking down some shared-use routes (Ravenscroft et al., 2002), and using less public transportation (Patterson, 1985). Moreover, Hale (1996) argues that the fear of crime is expected to make individuals stay at home more. No study was found, however, on the impact of violence and fear on cultural participation.

2.2 The determinants of cultural participation

There is a vast body of literature on the socioeconomic determinants of cultural participation, from the studies of Baumol and Bowen (1966) and Bourdieu and Passeron (1964) to the present days. These studies provide empirical evidence on how differences between social strata (such as income, type of employment and education) and demographic groups (like age and gender) are associated with differences in terms of cultural participation.

Among all socioeconomic determinants, schooling (measured by years of study in the formal education system) is seen as the main factor associated with the intensity of cultural participation (Seaman, 2006). Most empirical studies are carried out in developed countries, but the few studies conducted in the developing world find similar results: education and income are positively associated with participation in most cultural activities (Courty & Zhang, 2018). In areas considered to be of low income in developed countries such as the United States, United Kingdom and Ireland, findings indicate low cultural participation in general for all inhabitants (Moore, 1998). In Brazil, Diniz and Machado (2011) and De Almeida et al. (2020) analysed data from the Family Budget Survey (POF) and found that spending on culture is strongly determined by education and income.

Other personal characteristics are also indicated by the empirical literature as determinants of cultural participation. Particularly, the type of content accessed and of activity practiced can be influenced by socioeconomic and demographic factors. For example, social class, location of residence, age and race seem to be specially associated with styles of musical content accessed (Mellander et al., 2018). Besides, gender is a strong determinant for participation in visual arts, where women are generally more participative than men (Bennett & Silva, 2006). Finally, the level of participation in cultural activities in childhood is also distinguished as a strong determinant for cultural participation in adult life (Orend, 1988).

Concerning the relationship between violence and culture, this was studied mainly in the opposite direction: how arts, culture and the creative sector make territories safer, reducing and preventing urban violence. The report of the European Working Group on Culture and Development "In from the Margins: A contribution to the debate on Culture and Development in Europe" (1997), identifies the reduction of crime as an indirect social impact of arts and culture. According to the document, this impact results from the ability of culture to enrich the social environment with public amenities, to induce educational effects, to stimulate creativity, among others. Several studies verified this association empirically (Azevedo, 2016; Matarasso,

1997; Tubadji et al., 2015). However, no study was found on the other direction of this association, that is, on how violence may shape cultural participation.

3 Theoretical background and hypothesis

This study investigates whether urban violence explains individuals' choice between participating in cultural activities in private or public spaces. A large body of evidence in economic psychology, criminology and urban studies suggests that fear of crime shapes individuals' behaviour and choices (Becker & Rubinstein, 2011; Garofalo, 1981; Greenbaum & Tita, 2004; Liska et al., 1988). Particularly, behavioural economists acknowledge that individuals' emotions cannot be ignored by any theory of choice (Kahneman, 2002).

Among different types of individual behavioural reactions to crime (as a consequence of fear), avoidance is defined as "actions taken to decrease exposure to crime by removing oneself from or increasing the distance from situations in which the risk of criminal victimization is believed to be high." (DuBow et al., 1979, pp. 16). For instance, the fear of being a victim makes people alternate the routes they take when commuting, the form of transportation they use and the number of times they choose to leave their residence (see DuBow et al., 1979; Warr, 1994). According to survey data, spatial avoidance is the most common reaction to fear of urban violence in the United States (Warr, 1994). Such responses of avoidance must undeniably affect economic, leisure and social activities (Warr, 2000). An implication of this for the cultural and creative sector is that fear is expected to make people reduce attendance to these activities in public spaces. Hence, this study formulates the following hypothesis:

H1 Individuals with more fear will choose to participate more in culture in private spaces as compared to public spaces.

From the perspective of the economic geography field, the literature on objective and subjective geography of opportunities provides a theoretical framework to understand the way urban violence limits behaviours in the territory (Galster & Killen, 1995). This theory links individuals' process of decision making to their geographical context. In short, subjective geography is seen as a limitation of the opportunities that are in fact available for individuals (objective geography). In the particular case of this study, investment on cultural equipment is essential to improve available opportunities for cultural participation (objective geography), but the fear of violence (subjective geography) might limit these opportunities. From an economic development perspective, this is also in line with Amartya Sen's capability approach (Sen, 1999). More specifically, the fear of violence can be seen as a factor that limits individuals' capabilities (or their freedom to act and make choices). In other words, the fear caused by urban violence is expected to restrict the real opportunities and the freedom of choice that people have.

Table 1 Maré's favelas encompassed by each geographical stratification

Geographical strata	Favelas
Area 1	Nova Holanda, Parque Maré, Parque Rubens Vaz e Parque União
Area 2	Baixa do Sapateiro, Conjunto Bento Ribeiro Dantas, Conjunto Esperança
	Conjunto Pinheiros, Morro do Timbau, Nova Maré, Salsa e Merengue, Vila do João, Vila dos Pinheiros
Area 3	Marcílio Dias, Parque Roquete Pinto, Praia de Ramos

4 The empirical approach

4.1 Context of the empirical study

To contextualise the empirical examination, it is important to provide a brief characterization of the area under study (The Maré Favela Complex). The territory of Maré is composed of sixteen favelas occupying an area of 5.79 km^2. The last official data accounted for a population of 139,073 inhabitants in 2013 (Redes da Maré, 2019). This makes it the ninth most populous neighbourhood in Rio de Janeiro, and more populous than 96% of Brazilian municipalities. At the same time, according to IBGE, Maré has the fourth lowest human development index and the fifth lowest income per capita among 126 neighbourhoods in Rio de Janeiro (IBGE, 2010). This is a reflection of a public sector that historically neglects favelas. Also, this implies a shortage of many basic services and public infrastructures.

In what concerns the cultural and creative field, the neglect of the state produces a scenario in which cultural initiatives usually come from the third sector or informal community mobilizations. For instance, the Centre of Arts of Maré,[2] founded by the non-governmental organization Redes da Maré, or an itinerant cinema, which is organized by a community resident.[3] According to the Building Barricades mapping of cultural spaces (2019), there is no formal cinema in the whole territory of Maré and live music events mainly occur in bars and public squares. Besides, problems related to urban mobility, such as poor public transport and traffic jams, reduce the possibilities of cultural outings in the vicinity and in other parts of the city of Rio de Janeiro. This is an issue that affects all the dwellers of Maré in the same way. Indeed, in the metropolitan region of Rio de Janeiro, the average time people spend commuting per route is of 67 min, which is the highest in Brazil and one of the highest in the world.

The sixteen favelas of Maré demarcate three different areas in the territory, as distinguished by Table 1. The demarcation of the territory by different areas emerged

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[2] The Centre of Arts of Maré does not exhibit movies or live concerts.

[3] The itinerant cinema is organized once per month in varied locations of the 16 slums of Maré.

with the development, history of occupation, migratory movements and urban policies of the several favelas that compose it.[4]

There is a correspondence of these areas with the occupation and regulation by different armed groups.[5] Since the public sector traditionally neglects favelas, these criminal groups ended up finding an aperture to control the territory (Silva et al., 2008). The actuation of these armed groups occurs through the governance of a series of illegal and irregular economic activities, such as drug trafficking, security services, public transportation, taxation of the sale of gas cylinders, distribution of TV signals and Internet connection, among others. All of this is sustained by an armed base and the frequent use of violence (Silva et al, 2008). This setting ends up producing a scenario marked by conflicts between different factions of the drug trafficking and between the state police and the armed gangs, which are central sources of violence and fear. People who live in areas affected by armed conflicts or near them are deeply impacted. Particularly, freedom of movement is considerably restricted during armed conflicts, given the danger of being hit by stray bullets.

Some facts and figures can help positioning the violence in Maré in light of other regions of Brazil and the world. In the year 2019 alone, there were 49 deaths by firearms in Maré, 34 as a result of police action and 15 as a result of the action of armed groups, resulting in 1 death every 7 days and a firearm homicide rate of 35 per 100,000 inhabitants. The firearm homicide rate in the state of Rio de Janeiro is also high: a total number of 2321 deaths resulted in a firearm homicide rate of 34.5 per 100,000 inhabitants. These firearm homicide rates in Maré and the state of Rio de Janeiro are comparable to those of the most violent countries of the world, such as El Salvador (36.8), Venezuela (33.3), Guatemala (26.1) and Colombia (26.4) and to the most violent states in the United States, such as Alaska (24.4) and Mississippi (24.2). In Brazil, the firearm homicide rate was of 21.9 per 100,000 inhabitants in 2019, showing the differences in exposure to violence within the country.[6] These data indicate that although the problem of violence is particularly serious in Maré, it is not an exclusivity of the territory, and other contexts in the world might be similarly affected by it.

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[4] These three areas are not homogeneous: they count with different housing characteristics, social dynamics, as well as access roads and public facilities. While the firsts favelas originated at the beginning of the XXth century, when the Pereira Passos reform removed the poorest population living in the city centre and in the south zone of Rio de Janeiro towards Maré, other favelas emerged more recently. For instance, during the dictatorship period, or by the removal of populations living in territories at risk of landslides and floods.

[5] The introduction of drug trafficking in the 1990s divided the favela complex into areas controlled by rival armed factions (the Militia, the Comando Vermelho and the Terceiro Comando).

[6] Data about Maré is from the Boletim Direito a Segurança Pública na Maré (Redes da Maré, 2019). Data about Brazil and the Other countries are from the World Population Review.

4.2 Data and variables description

The data used on this work were extracted from the Building Barricades survey[7] carried out in the period between September 2019 and January 2020 with 1211 adults residing in Maré. The in-person, door-to-door survey[8] was organised and mediated by Redes da Maré, a local non-governmental organization. The surveyed population was made up of adults aged 18 years old or over, residing in households of the sixteen favelas in Maré.[9] The estimated number of people aging 18 years old or over in Maré was 101,549 for the year of 2019. The sample size of 1211 adults was chosen as sufficient to reduce the margin of error and significantly represent the total population. Appendix 1 includes the tables containing the estimated population of Maré by age groups and gender in 2019, as well as the sample distribution by age groups and gender.

The Building Barricades survey included sixty questions and lasted around fifty minutes. The respondents were asked about the frequency of their participation in a variety of cultural practices, their perceptions and experiences of violence, as well as their personal and socioeconomic characteristics, such as age, gender, education, employment, and the favela of residence. The variables used in this article are described in Table 2.

For the purpose of this study, two variables of cultural practice were selected: watching movies and listening to music. The choice of these practices is justified by the fact that both are well developed and widely popularized in their domestic modalities (through online platforms or by other means, such as CDs and DVDs), which enables the comparison between participation in private and public spaces. Activities in public spaces typically involve leaving the home, while practices in private spaces do not require leaving the home. More specifically, watching movies in the cinema and listening to live music are cultural activities that take place in public

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[7] This survey was carried out in the context of the research project 'Building the Barricades', supported by the Economic and Social Research Council (ESRC) and the Arts and Humanities Research Council (AHRC) of the UK (ES/S000720/1 ESRC-AHRC GCRF Mental Health 2017).

[8] There are no concerns that a door-to-door survey would lead to a biased sample. The sample of people at home is a random sample representative of the whole population. The door-to-door survey was conducted every day, and at different times of the day. When the selected person was not at home, the interviewer would redo the visit. The sampling process employed in the survey is stratified and selected in two stages. In the first stage, households were selected by inverse sampling (Haldane, 1945; Vasconcellos et al., 2005; Vasconcellos et al., 2013). In the second stage, an adult resident was selected with equal probability among the adult residents of the selected household. Inverse sampling is a sequential sampling procedure that aims to mitigate the non-responses observed in classic household surveys. In this process, the interviewer receives the list of addresses and visits them sequentially until reaching the number predicted or exhausting the area (stratum or unit sample) of research. For that, the research population was stratified into three geographic strata, composed of clusters of favelas in Maré, delimited according to their location, housing characteristics and social dynamics of the favelas, in addition to access to roads and common public facilities.

[9] The linear trend method (Madeira & Simões, 1972) was used to estimate the population of Maré for July 1st, 2019. This was based on the population estimates by Federation Unit and simple age produced by the Brazilian Institute of Geography and Statistics (IBGE) for the years of 2010 (2010 Demographic Census, from IBGE), 2013 (year of the Maré Census) and 2019 (year of the Building Barricades survey).

Table 2 Description of the variables

Dependent variables	
Gap movies cinema—Internet	Categorical ordered variable ranging from − 4 to 4
Gap movies cinema—by other means	Categorical ordered variable ranging from − 4 to 4
Gap music live—Internet	Categorical ordered variable ranging from − 4 to 4
Gap music live—by other means	Categorical ordered variable ranging from − 4 to 4
Independent variables	
Fear of being hit by stray bullet	No fear = 0, rarely = 1, sometimes = 2, many times = 3, always = 4
Age	Numerical discrete variable
No education or pré-school	Dummy (if this was the last level of education completed = 1, otherwise = 0)
Elementary or middle education	Dummy (if this was the last level of education completed = 1, otherwise = 0)
High school	Dummy (if this was the last level of education completed = 1, otherwise = 0)
University, specialization or Master's degree	Dummy (if this was the last level of education completed = 1, otherwise = 0)
Female	Dummy (female = 1, male = 0)
Household income	Numerical discrete variable
Childhood incentive	Dummy (yes = 1, no = 0)
Unemployment	Dummy (unemployed = 1, employed = 0)
Internet quality	No Internet = 0, terrible = 1, bad = 2, regular = 3, good = 4, excellent = 5
Favela Baixa do Sapateiro	Dummy (if residing in this favela = 1, otherwise = 0)
Favela Conjunto Bento Ribeiro Dantas	Dummy (if residing in this favela = 1, otherwise = 0)
Favela Conjunto Esperança	Dummy (if residing in this favela = 1, otherwise = 0)
Favela Conjunto Pinheiros	Dummy (if residing in this favela = 1, otherwise = 0)
Favela Marcilio Dias	Dummy (if residing in this favela = 1, otherwise = 0)
Favela Morro do Timbau	Dummy (if residing in this favela = 1, otherwise = 0)
Favela Nova Holanda	Dummy (if residing in this favela = 1, otherwise = 0)
Favela Nova Maré	Dummy (if residing in this favela = 1, otherwise = 0)
Favela Parque Maré	Dummy (if residing in this favela = 1, otherwise = 0)
Favela Parque Roquete Pinto	Dummy (if residing in this favela = 1, otherwise = 0)
Favela Parque Rubens Vaz	Dummy (if residing in this favela = 1, otherwise = 0)
Favela Parque União	Dummy (if residing in this favela = 1, otherwise = 0)
Favela Praia de Ramos	Dummy (if residing in this favela = 1, otherwise = 0)
Favela Salsa e Merengue	Dummy (if residing in this favela = 1, otherwise = 0)
Favela Vila do João	Dummy (if residing in this favela = 1, otherwise = 0)
Favela Vila do Pinheiros	Dummy (if residing in this favela = 1, otherwise = 0)

spaces. On the other hand, practices that take place in private spaces are listening to music through online platforms or by other means (such as CDs and radio) and watching movies through online platforms and by other means (such as DVDs and

TV). Participation in cultural activities were assessed in the survey using five levels of frequency, ranging from daily participation to not participating at all.

Since the interest of this article is to assess the individuals' choice between participating in cultural activities in private or public spaces, four new variables were created to be used as dependent variables: (i) the individual gap between the frequency of watching movies in the cinema and watching movies through online platforms; (ii) the individual gap between the frequency of watching movies in the cinema and watching movies by other means (DVDs, TV, etc.); (iii) the individual gap between the frequency of listening to live music and listening to music via online platforms; (iv) the individual gap between the frequency of listening to live music and listening to music by other means (CDs, radio, etc.). Each of the four gaps are measured by the difference between the individuals' frequency of consuming movies and music in public and private spaces. Therefore, these variables assess individuals' propensity to consume culture in public spaces as compared to private spaces. Relying on the gaps' measurement, instead of considering only the frequency of cultural participation forms in public spaces, allows this study to control for personal preferences for culture. In other words, it certifies that it is not other factors, such as lack of motivation or interest, that determine the individual's decision not to attend the form of the activity that takes place in public spaces. Furthermore, the separation of online and offline activities in private spaces allows to assess differences when considering different types of cultural participation at home.

For the calculation of the gap variables, the five levels of frequency of the variables of cultural participation were transformed into categorical ordered values ranging between 0 and 4 (where never = 0, less than once per month = 1, at least once per month = 2, at least once a week = 3, daily or almost daily = 4). Since the gaps are calculated by the difference between two variables of cultural participation, the gaps variables can assume nine levels of frequency, and, when transformed into categorical ordered values, they range between − 4 and 4.

To account for the explanatory variable of violence, the individuals' subjective assessment of danger was measured by five degrees of fear of being hit by a stray bullet, ranging from never to always. The categorical frequencies of fear were thus recoded into a numerical ordinal scale as follows: no fear at all = 0, rarely = 1, sometimes = 2, many times = 3, always = 4. The choice of the fear of being hit by a stray bullet as the indicator representing the individuals' perception of violence is because of its relevance in Rio de Janeiro, where previous studies have shown that this is the biggest fear of people living in the city (Rio Como Vamos, 2011). Not only this subjective measurement of violence was included in the model. An objective measurement of violence was also subsequently considered. This variable is measured by the number of violence events occurred in the favela where the respondent resides during the 30 days previous to the survey interrogation, including police operations and armed conflicts by criminal groups. When included in the model, it was divided
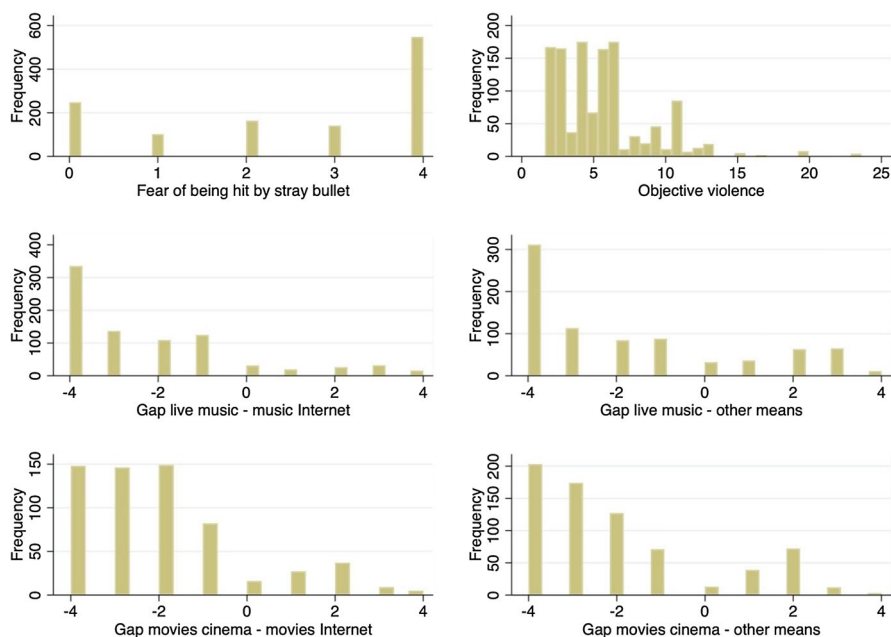
Fig. 1 Histogram with the distribution of the dependent and the violence variables

by the population size of the corresponding favela. The distribution graphics of the dependent variables and the violence variables are represented in Fig. 1.[10]

Besides, the model includes as control variables socioeconomic and demographic characteristics, such as age, gender, education, household income, and employment. There is a consensus in the literature that socioeconomic and demographic variables are strong determinants for both fear and cultural participation. Generally, studies report that older people, women, people with low income, the unemployed and people with less formal education feel more vulnerable to crime and consequently show more fear (for a review of the literature, see Hale, 1996). Also, low income, unemployed and less educated people are associated with less cultural participation, and gender and age determine specific patterns and preferences of participation in the cultural life (see, for instance, Falk & Katz-Gerro, 2016 and Seaman, 2006).

In the model, age and household income[11] are included as numerical discrete variables. The education level is transformed into four dummy variables (for the categories 'no education' or pré-school; elementary or middle education; high school; and university, specialization or Master's studies), which assume the value

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[10] In accordance with what is done subsequently, the non-consumers are removed from the histogram of the dependent variables. That is, only individuals who listened to music by at least one form of music consumption were considered in the graphs represented in the second line of Fig. 1, and only individuals who watched movies by at least one form of movies consumption were considered in the graphs represented in the third line of graphs of Fig. 1

[11] A second analysis separated the sample by income level, doing two regressions: one for the 50% lower revenue and the other for the 50% higher revenue.

1 if the person achieved a specific level, and zero otherwise. Gender and unemployment are also dummy variables: gender assumes the value 1 if female and 0 if male; and unemployment is equal to 1 when the respondent does not have a job, and 0 otherwise.

Finally, the model also includes as control variables the Internet quality, the incentives to carry out cultural activities in the childhood, and the favela of residence among the sixteen in Maré. These variables are included to avoid endogeneity problems. Particularly in the case of the favela of residence, intrinsic territorial characteristics, such as the proximity to public equipment and better services infrastructure, might impact both the cultural participation behaviour and the perception of violence. In the model, the Internet quality is an ordinal variable that can assume values ranging between 0 and 4 (no Internet = 0, terrible = 1, bad = 2, regular = 3, good = 4, excellent = 5); the childhood incentive variable is a dummy that assumes the value 1 when the person had incentive to carry out cultural activities as a child, and 0 in the contrary case; and the favelas are incorporated as sixteen dummies, assuming the value 1 if the individual resides in the corresponding favela, and 0 otherwise.

Table 3 summarizes the (weighted) descriptive statistics of the variables included in the model.[12] Observations with missing values were dropped from the analysis. This amounted to less than 5% of the observations for each of the variables.

4.3 The estimation strategy

The econometric model aims at analysing the effect of violence on the individuals' choice between cultural participation in public or private spaces. The econometric strategy chosen is the simultaneous bivariate ordered probit model. In the case of this study, the ordered probit model is more suitable than conventional regression procedures (e.g., ordinary least squares) because the dependent variables are discrete ordered values, ranging between limited lower and upper boundaries (Greene, 2002). The variables are discrete ordered values because they were constructed based on the frequency of practice of the two cultural activities. The choice of a simultaneous bivariate econometric model is to analyse the joint determination of two dependent variables with correlated disturbances (Greene, 2002). In this case, it was necessary to analyse simultaneously the determination of the choice of the cultural outgoing activity of reference (cinema or live concerts) over doing the activity both through the Internet and by other means.

The model is built around latent variables Y^*, which are unobserved, but can be associated to observed discrete dependent variables Y (Wooldridge, 2012). In this case, the latent variables are: (i) the gap between watching movies in the cinema and through the Internet; (ii) the gap between watching movies in the cinema and by other means; (iii) the gap between listening to live music and through the Internet; and (iv) the gap between listening to live music and by other means.

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[12] Due to the sampling design, a weight must be employed for the statistical analysis, so as to adjust the sampling in accordance to the gender and age of the whole population. This is calculated by multiplying the inverse of the probability of selection of an adult for a calibration factor (Silva, 2004).

Table 3 Descriptive statistics of the variables

	Obs	Mean	SD	Min	Max
Dependent variables					
Live music	1209	0.745	1.216	0	4
Music on the Internet	1209	2.289	1.869	0	4
Music by other means	1209	1.935	1.887	0	4
Movies in the cinema	1209	0.463	0.883	0	4
Movies by other means	1209	1.643	1.751	0	4
Movies on the Internet	1206	1.511	1.74	0	4
Gap movies cinema—Internet	1208	− 1.541	2.025	− 4	4
Gap movies cinema—other means	1208	− 1.19	2.183	− 4	4
Gap music live—Internet	1206	− 1.046	1.674	− 4	4
Gap music live—other means	1208	− 1.182	1.863	− 4	4
Independent variables					
Fear of stray bullet	1201	2.53	1.603	0	4
Violence events	1211	5.635	3.274	1.634	23.595
Age	1211	43.86	16.942	18	91
No education or pré-school	1211	0.079	0.27	0	1
Elementary or middle education	1211	0.458	0.498	0	1
High school	1211	0.403	0.491	0	1
University, specialization or Master's degree	1211	0.057	0.232	0	1
Female	1211	0.614	0.487	0	1
Household income	1112	1801.259	1091.485	0	5000
Childhood incentive	1200	0.308	0.462	0	1
Unemployment	1210	0.441	0.497	0	1
Internet quality	1205	2.417	1.591	0	5
Favela Baixa do Sapateiro	1211	0.038	0.191	0	1
Favela Conjunto Bento Ribeiro Dantas	1211	0.016	0.124	0	1
Favela Conjunto Esperança	1211	0.019	0.137	0	1
Favela Conjunto Pinheiros	1211	0.035	0.183	0	1
Favela Marcilio Dias	1211	0.107	0.31	0	1
Favela Morro do Timbau	1211	0.042	0.201	0	1
Favela Nova Holanda	1211	0.088	0.283	0	1
Favela Nova Maré	1211	0.012	0.107	0	1
Favela Parque Maré	1211	0.073	0.26	0	1
Favela Parque Roquete Pinto	1211	0.162	0.368	0	1
Favela Parque Rubens Vaz	1211	0.044	0.205	0	1
Favela Parque União	1211	0.131	0.338	0	1
Favela Praia de Ramos	1211	0.065	0.247	0	1
Favela Salsa e Merengue	1211	0.016	0.124	0	1
Favela Vila do João	1211	0.079	0.27	0	1
Favela Vila do Pinheiros	1211	0.074	0.262	0	1

The observed dependent variables Y are available in discrete form, with nine possible values, ranging from -4 (no participation in public spaces $= 0$, and daily or almost daily participation in private spaces $= 4$) to 4 (daily or almost daily participation in public spaces $= 4$, and no participation in private spaces $= 0$). The values that the observed variable can assume result from different combinations of participation frequencies in public and private spaces. For instance, when the observable variable is equal to 3, it can result of two different combinations: daily participation in public spaces and less than once per month participation in private spaces ($Y_i = 4 - 1$), or at least once a week in public spaces and no participation in private spaces ($Y_i = 3 - 0$). The correspondence between the latent variable and the observed dependent variable is expressed as follows:

$$Y_i \begin{cases} -4 & \text{if } -\infty < Y_i^* \leq y_1 \\ -3 & \text{if } y_1 < Y_i^* \leq y_2 \\ -2 & \text{if } y_2 < Y_i^* \leq y_3 \\ -1 & \text{if } y_3 < Y_i^* \leq y_4 \\ 0 & \text{if } y_4 < Y_i^* \leq y_5 \\ 1 & \text{if } y_5 < Y_i^* \leq y_6 \\ 2 & \text{if } y_6 < Y_i^* \leq y_7 \\ 3 & \text{if } y_7 < Y_i^* \leq y_8 \\ 4 & \text{if } y_8 < Y_i^* \leq +\infty \end{cases}$$

The dependent variable is thus a function of the latent variable Y^*, which is assumed to depend linearly on a set of personal, socioeconomic and demographic variables X, and on the continuous explanatory variable of fear Z. Thus, the dependent variable is determined as such:

$$Y_i(Y_i^*) = \sum_{n=1}^{N} \beta_n X_{ni} + \alpha Z_i + \varepsilon_i \therefore \varepsilon_i \sim N(0,1), \tag{1}$$

where i is the individual, β is the vector of coefficients to be estimated for the set of personal, socioeconomic and demographic variables, α is the coefficient to be estimated for the explanatory variable fear of violence, and ε is the error term, which is assumed to be normally and identically distributed with a mean of zero and variance normalized to one.

When applying the econometric model, the sample was reduced to consider only the individuals who do at least one of the three possible modalities of participating in each of the practices (in public spaces, in private spaces through Internet or in private spaces by other means). Thus, when analysing watching movies, the sample was reduced to 761 individuals, considering only those who watch movies at least "less than once per month" either in the cinema, or through Internet, or by other means. When analysing listening to music, the sample was reduced to 953 individuals, who listen to music at least "less than once per month" either live, or through Internet, or by other means. In other words, individuals who do not consume movies or music at all (in public or private spaces) are dropped from the regression. In this

way, the study can deal with two problems. First, it avoids a zero-inflated regression model, which happens because of a large number of zero-valued observations (Heilbron, 1994). In addition, it prevents people who have no interest in the cultural practice (whether listening to music or watching movies) from being considered equal to those who participate with the same frequency in the modalities that take place in public and private spaces, given that both cases would result in a zero-valued observation. In other words, by eliminating the non-participants in any modality, the analysis focuses only on individuals who show interest for the corresponding cultural practice.[13]

5 Results

5.1 Descriptive statistics

Among the weighted sample, 13.3% of the people declared not to be afraid of being hit by a stray bullet, while 9.2% rarely fear it, 14.8% fear it sometimes, 12.4% fear it many times, and 50.2% fear it every day. This represents a total of 86.7% fearing it at least partially, which shows the relevance of the fear of being hit by a stray bullet among the residents of Maré. Although relatively more widespread in Maré, it is worth noting that the fear of being hit by a stray bullet is not a particularity of this territory. Contrarily, it affects the whole state of Rio de Janeiro, where 80% of the people are afraid of being hit by a stray bullet, against 66% of the people living in São Paulo (Forum Brasileiro de Segurança Pública, 2022).

Concerning the cultural practices of interest for this study, attendance in public spaces is significantly smaller than participation in private spaces for both movies and music. Besides, among those participating in cultural practices in private spaces, the majority do it on a daily base (or almost daily). While 71.3% of the interrogated declared not having gone to the cinema in the three months preceding the interview, the non-participants corresponded only to 46.5% and 47.2% of the people for watching movies in the Internet and by other means respectively.[14] Attending the cinema was done by 7.2% of the respondents less than once per month, by 17.7% at least once per month, by 2.9% at least once a week, and by 0.9% daily or almost. Watching movies on the Internet was done by 1.9% of the people less than once per month, by 6.8% at least once per month, by 18.3% at least once a week, and by 26.4% daily or almost. Watching movies by other means was done by 2.2% less than

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[13] We have checked that excluding the non-participants does not bias the results. In a configuration where the non-participants are added to the sample with a gap equal to zero, the results remain unchanged.

[14] At the same time, a survey on cultural practices in 12 capital cities of different regions in Brazil found that only 32% of the people in Rio de Janeiro did not go to the cinema in the previous 12 months (and 54% of the least educated people). Despite differences between the two surveys in the methodology and the period of time analysed, it signals a significative difference between cultural outgoings in Maré and in the city of Rio de Janeiro as a whole (Cultura nas Capitais, 2017). The percentage of people in the southeast of Brazil who declared not having watched movies online in the previous 3 months is only 27%, way below the 46.5% in Maré (TIC Domincílios, 2016).

once per month, by 6.5% at least once per month, by 18.9% at least once a week, and by 25.1% daily or almost.

Analogously, 65.4% of the respondents did not attend live music concerts, far above the 30.3% and 49.4% who did not listen to music on the Internet or by other means respectively.[15] Listening to live music was done by 4.6% of the people less than once per month, by 14.2% at least once per month, by 12.9% at least once a week, and by 2.9% daily or almost. Among those listening to music on the Internet and by other means, the majority do it daily or almost. This corresponded, respectively, to 54.6% and 37.3% of the interviewed. Listening to music on the Internet was also done by 0.6% less than once per month, by 1.9% at least once per month, by 12.6% at least once a week. Listening to music by other means was also done by 2.0% less than once per month, by 2.4% at least once per month, and by 9.0% at least once a week.

Moreover, it is possible to notice that practices in public spaces and on the Internet are more common among individuals who are younger and reached higher educational levels. On the other hand, listening to music and watching movies by other means are more homogeneously practiced across the population groups. The descriptive statistics of the average frequency (ranging between 0 and 4) of cultural participation in each modality of watching movies and listening to music, by educational level, age range and household income, are displayed in Table 4.

5.2 Econometric estimation

This study aims at analysing the hypothesis that individuals' cultural choices are affected by their fear of violence in the territory, which in this case is represented by the fear of being hit by a stray bullet. For that, two simultaneous bivariate ordered probit models were estimated, measuring if fear affects the frequency with which individuals chose to participate in cultural activities that take place in public spaces (cinema and live music) over those that can take place in private spaces (watching movies and listening to music on the Internet and by other means). People with more fear of violence are expected to choose more often cultural participation in private over public spaces (*H1*). Therefore, the coefficient of the variable that captures the individuals' fear is expected to be negative.

The joint regression of the dependent variables that represent the gaps between movies (music) in the cinema (live) and on the Internet, and movies (music) in the cinema (live) and by other means is proved to be necessary. The LR tests of independence of equations (see Tables 5, 6) indeed show that we can reject the null hypothesis of independence between the two equations. This corroborates the choice

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[15] At the same time, a survey on cultural practices in 12 capital cities of different regions in Brazil found that only 51% of the people in Rio de Janeiro did not attend live concerts in the previous 12 months (and 69% of the least educated people). Despite differences between the two surveys in the methodology and the period of time analysed, it signals a significative difference between cultural outgoings in Maré and in the city of Rio de Janeiro as a whole (Cultura nas Capitais, 2017). The percentage of people in the southeast of Brazil who declared not having listened to music online in the previous 3 months is only 27%, below the 30.3% in Maré (TIC Domincílios, 2016).

Table 4 Average frequency (between 0 and 4) of cultural participation in each modality of watching movies and listening to music, by educational level, age range and household income

	Live music	Music Internet	Music other means	Cinema	Movies Internet	Movies other means
Educational level						
No education/pre-school	0.769	1.003	1.914	0.229	0.392	1.028
Elementary/middle education	0.603	1.898	1.922	0.192	1.108	1.673
High school	1.002	3.31	1.723	0.817	2.444	1.862
University/specialization/Master	1.237	3.598	1.824	1.244	2.414	1.71
Age range						
18–29 y.o	1.076	3.572	1.4	0.948	2.619	2.019
30–49 y.o	0.898	2.815	1.883	0.481	1.795	1.752
50–65 y.o	0.453	1.38	2.357	0.236	0.846	1.502
66 y.o. or more	0.359	.225	1.993	0.067	0.223	0.875
Household income						
0–1500	0.67	2.28	1.81	0.39	1.30	1.64
1500–2000	0.71	2.72	1.91	0.55	1.77	1.76
> 2500	1.02	2.69	1.77	0.64	2.01	1.74

Table 5 Regression results for the gap between listening to music in public and private spaces

	Simultaneous bivariate ordered probit for listening to music			
	Gap music live—Internet		Gap music live—by other means	
Age	0.0177***	(0.00292)	− 0.0188***	(0.00292)
No education/pre-school	Ref		Ref	
Elementary/middle education	− 0.0717	(0.152)	− 0.0608	(0.159)
High school	− 0.191	(0.167)	− 0.0627	(0.172)
University/specialization/Master	− 0.279	(0.215)	− 0.126	(0.215)
Female	− 0.0543	(0.0756)	− 0.00177	(0.0747)
Household income	− 0.000000521	(0.0000353)	0.0000786**	(0.0000346)
Fear of being hit by stray bullet	− 0.0509**	(0.0247)	− 0.0661***	(0.0244)
Childhood incentive	0.00482	(0.0812)	0.152*	(0.0792)
Unemployed	− 0.0309	(0.0775)	− 0.0525	(0.0765)
Internet quality	− 0.283***	(0.0286)	0.0839***	(0.0279)
Controlled for 16 favelas	Yes			
Observations	953			
LR test of indep. eqns	Chi2(1) = 95.17	Prob > chi2 = 0.0000		

Athrho and cuts were not reported in the tables in order to summarize the results

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

Table 6 Regression results for the gaps between watching movies in public and private spaces

	Simultaneous bivariate ordered probit for watching movies			
	Gap movies cinema—Internet		Gap movies cinema—by other means	
Age	0.00776**	(0.00322)	− 0.00912***	(0.00325)
No education/pre-school	Ref		Ref	
Elementary/middle education	− 0.310	(0.201)	0.139*	(0.0819)
High school	− 0.310	(0.213)	0.0000811**	(0.0000382)
University/specialization/Master	0.183	(0.247)	− 0.218	(0.207)
Female	0.138*	(0.0816)	0.124	(0.218)
Household income	− 0.0000779**	(0.0000382)	0.425*	(0.251)
Fear of being hit by stray bullet	− 0.0576**	(0.0270)	− 0.0509*	(0.0271)
Childhood incentive	− 0.0286	(0.0841)	− 0.0433	(0.0843)
Unemployed	0.0230	(0.0837)	− 0.171**	(0.0846)
Internet quality	− 0.227***	(0.0321)	0.115***	(0.0320)
Controlled for 16 favelas	Yes			
Observations	761			
LR test of indep. eqns.:	chi2 = 49.79	Prob > chi2 = 0.0000		

Athrho and cuts were not reported in the tables in order to summarize the results

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$; standard errors in parenthesis

of the simultaneous bivariate model for the analysis of the joint determination of the dependent variables, which present correlated disturbances (Greene, 2002).

Let us consider first the estimates for the traditional socioeconomic and demographic variables. Age is significant for determining all the four dependent variables. While it positively affects the individuals' choice of participating in cultural activities in public spaces as opposed to the Internet (significant at 1% level for music and at 5% for movies), it negatively affects participation in public spaces as opposed to other means (significant at 1% level for both music and movies). In other words, all other variables being constant, the older a person is, more she is expected to participate in culture by other means (CDs, radio, DVDs, TV, etc.) as compared to public spaces (cinema and live music), and more she is expected to participate in culture taking place in public spaces as compared to doing it on the Internet. Likewise, Internet access and quality is significant (at 1% level) for determining all dependent variables. Not surprisingly, it is negatively associated with the choice between cultural participation in public spaces and on the Internet, and positively associated with the choice between participation in public spaces and by other means. Also, household income is significant for determining most of the dependent variables (except for the gap between live music and music on the Internet). While it is positively associated with the gap between the frequency of cultural participation in public spaces and by other means (at 5% level for music and 10% level for movies), it is negatively associated with the choice of watching movies in the cinema over doing it on the Internet.

Table 7 Marginal effects for the variable that captures the fear of violence

	Gap music live—Internet	Gap music live—by other means	Gap movies cinema—Internet	Gap movies cinema—by other means
− 4	0.0272***	0.0245**	0.0250***	0.0157*
− 3	0.0001	0.0012*	0.0075***	0.0027*
− 2	− 0.0035**	− 0.0014**	− 0.0056**	− 0.0026*
− 1	− 0.0083***	− 0.0033**	− 0.0089***	− 0.0031*
0	− 0.0031**	− 0.0019**	− 0.0023**	− 0.0007
1	− 0.0021**	− 0.0026**	− 0.0039**	− 0.0028*
2	− 0.0032**	− 0.0059**	− 0.0068**	− 0.0068*
3	− 0.0042**	− 0.0082**	− 0.0029**	− 0.0018
4	− 0.0030**	− 0.0024**	− 0.0021*	− 0.0007

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

Furthermore, while education is distinguished by the research literature as an important characteristic associated with greater levels of cultural participation (see, for instance, Seaman, 2006), the results indicate mostly that it is not significant for impacting individuals' choice between modalities of participation. The only exception is that the probability of watching movies in the cinema as compared to other means increases when the individual accomplishes elementary studies or middle education (significant at 10% level) and high school (significant at 5% level). Similarly, unemployment is only significant (at 5% level) for determining the same choice. In other words, unemployed individuals are less likely to choose cinema attendance over watching movies by other means. In its turn, gender is only significant for determining the choice between going to the cinema and watching movies on the Internet, which probability of being greater increases if the respondent is a woman (significant at 10% level). Finally, the incentive to carry out cultural activities in the childhood is only significant for determining the choice between listening to live music and doing it by other means (significant at 10% level).

Both simultaneous bivariate ordered probit models, for movies and music, corroborate the hypothesis 1 (*H1*) that the fear of stray bullet negatively impacts the choice of attending cultural events in public or private spaces.[16] The results are significant at 5% level when comparing cinema and live music to watching movies and listening to music through the Internet respectively, at 10% level when comparing cinema to watching movies by other means, and at 1% level when comparing live music to listening to music by other means. Table 5 describes the econometrics

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[16] The two regressions were repeated separating the sample by income level to check if there are any differences for the 50% lower income and the 50% higher income. The results remained the same for movies and music regardless of the income level. Furthermore, the results were also consistent when doing linear regression instead of the ordered probit model and when grouping together the 'Internet' and 'other means' variables into a single variable representing participation at home (in private spaces). All these regression tables can be provided by the author upon request.

results for the gap between listening to music in public spaces and in private spaces, and Table 6 the ones for the gaps between watching movies in public spaces and in private spaces.

Table 7 reports the marginal effects of changes from the minimum to the maximum level of fear on the dependent variables representing the gaps between cultural participation in public and private spaces. For instance, let us consider the case of the variable Gap music live—Internet. Each of the four steps of the variation from fear of stray bullet = 0 to fear of stray bullet = 4 increases the probability of being "intensive in private spaces" (category − 4 of the gap variable) by 2.7 percentage points. This means that all other variables being constant, when the fear of violence goes from the minimum to the maximum (from 0 to 4), the probability to be a music listener intensive in private spaces increases by $4 \times 2.7 = 10.8$ percentage points. Likewise, when the fear of violence goes from the minimum to the maximum, the probability to be intensive in private spaces increases by 9.8 percentage points for the Gap music live—by other means, by 10.0 percentage points for the Gap movies cinema—Internet, and by 6.3 percentage points for the Gap movies cinema—by other means. Therefore, it is noteworthy that an increase in the level of fear has mainly the effect of rising cultural participation in private as opposed to public spaces.

The fact that the results are similar for movies and music indicates the robustness of the analysis. It implies that the association between fear and individuals' choice among different modalities of cultural participation is not simply a problem of supply. That is, it could be expected to find lower supply of spaces for cultural participation in parts of the territory that are more affected by violence. However, the Building Barricades mapping of cultural spaces (2019) indicates that there is no formal cinema in the whole territory of Maré and the equipment for listening to live music are more or less uniformly distributed across all the 16 favelas.[17] Hence, the ability to go out and watch movies and watch live shows is the same across different areas and different crime rates in the territory of Maré.

To test for endogeneity in the model, the instrumental variable method is used (Newhouse & McClellan, 1998). In this case, endogeneity could occur because of omitted variables correlated with both fear and the error term, or because of simultaneity, meaning that the dependent variables could also affect the explanatory variable of fear. Indeed, there are evidence of how social behaviour and cultural life affect individuals' fear (De Donder et al., 2005; Liska et al., 1988). An instrumental variable (IV) must satisfy both exclusion and inclusion restrictions. The exclusion restriction stipulates that the IV should not directly impact the dependent variable, whereas the inclusion restriction means that the IV should be correlated with the possible endogenous variable.

This robustness check is done by introducing as the IV an indicator of the fear that anyone close to the respondent would be hit by a stray bullet (0–4 scale). The fear for others is not expected to affect directly the dependent variables (satisfying the exclusion restriction), while it is correlated with the individuals' fear for

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[17] There are bars and squares in all parts of Maré where the majority of the respondents listen to live music. Also, there is the itinerant cinema, which is informally organized once per month in different locations of the 16 slums of Maré.

themselves (satisfying the inclusion restriction). A simple ordered probit model with the instrument as an independent variable and the potentially endogenous variable as the dependent variable should show that both variables are highly correlated. The conduction of four simultaneous bivariate ordered probit models for the joint determination between each of the dependent variables and the variable of fear should not allow the rejection of the null hypothesis of independence between the equations. The results (presented in the Appendix 2) indicate that, for all dependent variables, the observed LR test of independence of equations indicates that the null hypothesis of independence between the two variables cannot be rejected. Therefore, the models do not seem to present any endogeneity problem and the regressions presented in Tables 5 and 6 are relevant.

Finally, to test differences between subjective violence (measured by fear) and objective violence, data with the actual number of violence events in the favelas of Maré were extracted from a database provided by Redes da Maré (2019) and incorporated into the econometric model. The objective violence indicator is a value attributed to each of the sixteen favelas and associated with the respondents according to the favela where they reside (among the sixteen in Maré). It is measured by the number of violence events occurred in the favela where the respondent resides during the 30 days previous to the survey interrogation, including police operations and armed conflicts by criminal groups, divided by the population size of the corresponding favela. The regression tables including the variable of objective violence are presented in the Appendix 3. The results indicate that fear (subjective violence) affect people's behaviour and choices more than the actual occurrence of violent events (objective violence).

6 Discussion

This paper provides evidence on the way violence restricts individuals' behaviour. It documents a statistically significant and negative effect of the fear of being hit by a stray bullet on cultural participation (watching movies and listening to music) in public spaces (as compared to the modalities in private spaces). Results also show that subjective violence (fear) is a stronger determinant of individuals' behaviour than objective violence (its actual occurrence). This is in line with other studies: while the frequency of violent events might affect individuals' perception of danger, the literature of behavioural economics shows that individuals' fear and responses to risk are not proportional to the probability of victimization, and individuals' decisions and behaviours are more likely to be based on their fear than on the actual probability of occurrence of the feared situation (Becker & Rubinstein, 2011).[18] The findings of this study are important because of their territorial and economic implications, as well as the implications to the development of the cultural sector. They also fit into a broader cultural economics approach to the understanding of the

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[18] Researchers have focused on bounded rationality and availability heuristics to explain these divergences between individuals' judgments and the probability of occurrence of an event (Tversky and Kahneman, 1982).

determinants of inequalities in cultural participation and contribute to the formulation of evidence-based cultural policies.

There are various implications linked to the effect of violence on decisions between undertaking activities in private and public spaces. At the territorial level, it represents a limit for the potential of culture and creativity to generate positive effects in terms of socioeconomic development and quality of life. Arts and culture are typically associated with safer territories, since it enriches the social environment with public amenities, induces educational effects, stimulates creativity, among others (Azevedo, 2016; Matarasso, 1997; Tubadji et al., 2015). Hence, if violence prevents cultural outgoings, it is likely that in less safe territories there will be a feedback cycle where violence diminishes cultural participation and this, in turn, leads to an even less safe environment. Furthermore, restricting cultural participation in public spaces might also reduce the socialization and well-being benefits that are typical of cultural outgoings for the inhabitants of the territory.

At the economy level, the avoidance of cultural consumption in public spaces might provoke direct and indirect economic losses. Direct losses come from reduced ticket sales, while indirect losses result from less sales of goods and services that are normally consumed along the way or in a complementary way to the fruition of the cultural activity in public spaces (for instance, popcorn in cinemas or drinks in bars where live music is played).

At the policy level, this paper provides evidence to inform policymaking in a context where there is usually a lack of official data and empirical research that can inform public policies. Based on the results, the intertwined nature of cultural policies with other public policies should be emphasized. While localized investment in the cultural supply side could benefit urban regeneration in favelas, it should be designed in coordination with comprehensive security and social policies. Supply side investments on cultural services and infrastructure in socioeconomically disadvantaged territories such as favelas will only be effective if coordinated with other policies to guarantee the conditions for individuals to effectively access it. Policymakers of all sectors should pay particular attention to the way that security policies are designed and implemented. Those should not be solely concentrated on reducing objective violence, whereas ignoring subjective violence. For instance, there is a risk that their focus on confronting armed groups and drug trafficking ends up strengthening or reproducing the feeling of fear in favelas. This would have a negative impact on cultural outgoings and the overall cultural sector.

Another policy implication is related to the fact that the Internet could be a particularly relevant tool in contexts in which violence restricts mobility and consequently the fruition of activities that require leaving home. People can substitute activities that demand going out for cultural activities on the Internet or other more traditional means. In the precise case of cultural participation, there is a global trend of shifting from offline to online (Waldfogel, 2017). Since the Coronavirus pandemic outbreak and the social distancing that it imposed, this trend accentuated even more and digital access to culture has become more critical than ever (Radermecker, 2021). However, this study shows that different individual characteristics explain choices of substitution by each of the alternative means. In the context of Maré, the Internet does not seem to be a perfect substitute for other means yet. More

specifically, the data show that the youngest, with greater educational achievements and earning higher income are the ones most frequently accessing culture online, while access by other means is almost homogenous across personal characteristics (see Table 4). Indeed, the digital divide might represent a strong obstacle for the development of online activities as alternatives (Van Dijk, 2006). Opportunities for access to and use of the Internet do not seem to be equally distributed across different demographic and socioeconomic strata of the population (see, for instance, Ateca-Amestoy & Castiglione, 2016). On top of that, the distribution of Internet access in Brazilian favelas is economically controlled by armed groups. It should be a mission of the public sector to intertwine security, technological and cultural polices to develop and guarantee the access and effective use of Internet in these territories.

7 Conclusion

This study provides evidence that the fear of being a victim (more than the actual occurrence of armed conflicts) negatively affects the frequency of cultural outgoings as compared to the modalities of cultural participation that take place in private spaces. Although several studies have examined the negative externalities of urban violence, this study contributes to filling a gap in the examination of how this affects cultural participation. The impact that violence has on cultural participation behaviour may represent an obstacle for the improvement of the quality of life in territorially disadvantaged areas through the stimulus of a creative environment, as well as a restriction for the overall development of the cultural sector in the given context. This is an issue that might similarly affect a variety of other territories in Latin America and the rest of the world. Hence, it is key to incorporate territorial aspects when analysing inequalities in cultural participation and formulating cultural policies to address them. To be effective, these policies should account for territorial specificities and be developed in harmony with other public policies, such as security and Internet dissemination policies.

This study opens avenues for future research. First, to inform cultural policies, more research is needed on the association between territorial aspects and cultural participation. Prospective studies can examine the influence of other territorial features on choices of cultural participation, such as the influence of the availability and quality of public transportation or of climate conditions. Second, future studies can analyse the dimension of the negative impact of violence on cultural participation, including its consequences for the territory and the economy. This includes an assessment of the difference between cultural consumption in public and private spaces in terms of how it impacts individuals' well-being, mental health and safety in the territory; and an assessment of the direct and indirect economic losses resulting from a reduction in cultural outgoings when people fear violence. Finally, the ability of the Internet to mitigate negative externalities linked to territorial aspects should be assessed. Given the restrictions that fear causes to mobility, Internet could be a compensation tool for certain activities. However, Internet access inequalities and the digital divide are still a worldwide reality, which is expected to impact

especially socioeconomically disadvantaged territories such as favelas. Indeed, the case of Maré suggests that new technologies are not yet perfect substitutes for traditional modalities of consumption in private spaces. Future research can investigate differences in the determinants of digital cultural participation when compared to other means of cultural access in private spaces.

This study is not without limitation. The econometric strategy and robustness check allowed the assessment of the causal association between an increase in the fear of violence and a rise in the probability of being more intensive in consumption in private spaces, disentangling the effects of other personal characteristics that correlate with cultural engagement. However, it is based on cross-sectional individual differences rather than temporal variation. An ideal investigation would, instead, rely on a database that collects information of the same individuals along the time, so as to enable the assessment of how variations in fear (and in the actual occurrence of violence events) provoke variations in the type of cultural participation. This would minimize measurement errors and omitted variable biases. Another limit of the analysis is that there could be inverse causality. Instead of preventing people from consuming culture in public spaces, violence could for instance prevent artists from performing. Also, having cultural equipment could be the reason why an area would offer a greater sense of security. This reasoning would imply that safer favelas would be closer to movie theaters and music venues, and less safe areas would be more distant to them. However, the Building Barricades mapping of cultural spaces (2019) indicates that cultural supply is uniform across all the favelas. There is no formal cinema in the whole territory and there are bars where people can listen to live music across all the favelas. Moreover, the econometric analysis controls for fixed effects associated to each favela, thus accounting for any supply discrepancies. Hence, this does not seem to be a pertinent problem. Also, it is important to emphasize that going out to watch movies and listen to live shows and consumption in private spaces are not perfect substitutes, and individuals are likely to have an underlying preference for one over the other. There are several reasons for people to prefer consuming culture in private or in public spaces. They may prefer to consume it at home to avoid traffic, congestion, and just in general save time. They may prefer public spaces to go out and socialize. The intention of the paper is not to capture all these reasons. It is to verify the importance of violence. The omitted variables don't interfere the effect of the perception of violence. Therefore, the result is still valid to identify the association between violence and lower cultural consumption in public spaces.

Despite its limitations, this study provides theoretical, empirical and methodological contributions to the literature, in particular to the field of cultural economics. From a methodological standpoint, this work offers an alternative for dealing with the problem of measuring what people are not doing. Indeed, a major difficulty to deal with the behavioural effects of fear in empirical sciences is the difficulty involved in measuring what people are *not* doing (Warr, 2000). By relying on the gaps between the frequencies of cultural consumption in public and private spaces, the empirical method proposed controls for personal preferences and avoids putting under the same umbrella those who are not attending cultural activities in public spaces because of fear and those who are not doing it because of lack of interest.

From an empirical and theoretical point of view, although the impact of urban violence for individuals and the society as a whole have been studied in other fields of research, there's a lack of analysis on the effects of spatial avoidance on cultural outgoings. This paper not only investigates this phenomena, but it does it in a type of territory that is usually overlooked by cultural economics studies. While inequalities in cultural participation have been a primary research focus in the field of cultural economics, most of the existing studies have focused on socioeconomic and demographic individual characteristics to explain these differences, including factors such as age, gender, education, income, occupation, race, and the household structure. The location where individuals live is usually only superficially considered, typically using aggregate measures indicating for instance if it is an urban or rural area. This study brings a new perspective to understand inequalities in cultural participation. By shifting the focus from individual preferences to the influence of territorial specificities, it helps understanding other factors that affect cultural consumption and interfere in the development of the cultural sector. It shows that incorporating territorial aspects into the discussion is key to better inform policies that aim at addressing inequalities in cultural participation.

Appendix 1

See Tables 8 and 9.

Table 8 Estimated population older than 18 years old in Maré by gender and age groups (1st July 2019)

Age group	Total	Male	Female
Total	101.549	49.435	52.114
18–29 y.o	30.603	15.186	15.417
30–49 y.o	45.911	22.911	23.000
50–65 y.o	17.750	8.418	9.332
More than 66 y.o	7.285	2.920	4.365

Table 9 Sample description by age group, gender and geographical stratification

Geographical strata	Total	Age group and gender							
		18–29 y.o		30–49 y.o		50–65 y.o		More than 66 y.o	
		Male	Female	Male	Female	Male	Female	Male	Female
Total	1.211	113	168	190	303	116	166	49	106
Area 1	406	32	66	68	101	36	53	14	36
area 2	400	38	50	63	107	34	63	18	27
Area 3	405	43	52	59	95	46	50	17	43

Appendix 2

See Tables 10, 11, 12 and 13.

Table 10 Simultaneous bivariate ordered probit for the variable of fear and the gap between listening to live music and listening to music by other means

| | Simultaneous bivariate ordered probit | | | |
	Gap music live—by other means		Fear of stray bullet	
Age	− 0.0175***	(0.00340)	0.00726*	(0.00400)
No education/pre-school	Ref		Ref	
Elementary/middle education	0.0163	(0.178)	0.240	(0.200)
High school	0.0354	(0.197)	0.340	(0.227)
University/specialization/Master	− 0.0746	(0.249)	0.204	(0.291)
Female	− 0.0294	(0.0884)	0.151	(0.106)
Household income	0.000101**	(0.0000415)	0.00000719	(0.0000503)
Fear of being hit by stray bullet	− 0.0746**	(0.0350)		
Fear for others			1.012***	(0.0467)
Childhood incentive	0.173*	(0.0941)	0.0399	(0.117)
Unemployed	− 0.0441	(0.0909)	− 0.121	(0.108)
Internet quality	0.0418	(0.0319)	0.0844	(0.0390)
Controlled for 16 favelas	Yes			
Observations	721			
LR test of indep. eqns	Chi2(1)=0.09	Prob > chi2=0.7649		

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$; standard errors in parenthesis

Table 11 Simultaneous bivariate ordered probit for the variable of fear and the gap between listening to live music and listening to music on the Internet

| | Simultaneous bivariate ordered probit | | | |
	Gap music live—Internet		Fear of stray bullet	
Age	0.0118***	(0.00355)	0.0000106	(0.00414)
No education/pre-school	Ref		Ref	
Elementary/middle education	− 0.274	(0.243)	0.239	(0.283)
High school	− 0.323	(0.251)	0.301	(0.293)
University/specialization/Master	− 0.346	(0.285)	0.326	(0.331)
Female	− 0.105	(0.0857)	0.147	(0.0994)
Household income	− 0.00000674	(0.0000401)	− 0.00000604	(0.0000473)
Fear of being hit by stray bullet	− 0.0930***	(0.0353)		
Fear for others			1.009***	(0.0450)
Childhood incentive	0.136	(0.0885)	− 0.00629	(0.104)
Unemployed	− 0.0909	(0.0902)	− 0.143	(0.104)
Internet quality	− 0.271***	(0.0368)	0.0600	(0.0433)
Controlled for 16 favelas	Yes			
Observations	748			
LR test of indep. eqns	Chi2(1)=0.70	Prob > chi2=0.4014		

***$p < 0.01$; standard errors in parenthesis

Table 12 Simultaneous bivariate ordered probit for the variable of fear and the gap between watching movies in the cinema and by other means

| | Simultaneous bivariate ordered probit | | | |
	Gap movies cinema—by other means		Fear of stray bullet	
Age	− 0.00833**	(0.00359)	0.00391	(0.00440)
No education/pre-school	Ref		Ref	
Elementary/middle education	− 0.269	(0.218)	0.000242	(0.255)
High school	0.152	(0.232)	0.0369	(0.276)
University/specialization/Master	0.550**	(0.268)	0.0564	(0.321)
Female	0.189**	(0.0908)	0.139	(0.109)
Household income	0.0000737*	(0.0000423)	− 0.0000234	(0.0000517)
Fear of being hit by stray bullet	− 0.0322	(0.0378)		
Fear for others			1.039***	(0.0503)
Childhood incentive	− 0.0518	(0.0939)	− 0.104	(0.115)
Unemployed	− 0.174*	(0.0936)	− 0.0928	(0.112)
Internet quality	0.0856**	(0.0345)	0.0891**	(0.0417)
Controlled for 16 favelas	Yes			
Observations	641			
LR test of indep. eqns	Chi2(1)=0.93	Prob > chi2=0.3336		

***$p<0.01$, **$p<0.05$, *$p<0.1$; standard errors in parenthesis

Table 13 Simultaneous bivariate ordered probit for the variable of fear and the gap between watching movies in the cinema and on the Internet

| | Simultaneous bivariate ordered probit | | | |
	Gap moviescinema—Internet		Fear of stray bullet	
Age	− 0.000685	(0.00413)	0.00630	(0.00502)
No education/pre-school	Ref		Ref	
Elementary/middle education	− 1.023***	(0.302)	− 0.287	(0.384)
High school	− 0.747**	(0.303)	− 0.268	(0.387)
University/specialization/Master	− 0.160	(0.332)	− 0.196	(0.420)
Female	0.213**	(0.0964)	0.272**	(0.116)
Household income	− 0.0000164	(0.0000441)	− 0.00000485	(0.0000544)
Fear of being hit by stray bullet	− 0.0975**	(0.0398)		
Fear for others			1.036***	(0.0531)
Childhood incentive	0.0636	(0.0978)	− 0.0813	(0.120)
Unemployed	− 0.0163	(0.100)	− 0.103	(0.122)
Internet quality	− 0.164***	(0.0469)	0.0979*	(0.0564)
Controlled for 16 favelas	Yes			
Observations	556			
LR test of indep. eqns	Chi2(1)=0.20	Prob > chi2=0.6554		

***$p<0.01$, **$p<0.05$, *$p<0.1$; standard errors in parenthesis

Appendix 3

See Tables 14 and 15.

Table 14 Regression results (with objective violence) for the gap between listening to music in public and private spaces

	Simultaneous bivariate ordered probit for listening to music			
	Gap music live—Internet		Gap music live—by other means	
Age	0.0178***	(0.00293)	− 0.0186***	(0.00293)
No education/pre-school	Ref		Ref	
Elementary/middle education	− 0.0676	(0.152)	− 0.0588	(0.159)
High school	− 0.198	(0.167)	− 0.0595	(0.172)
University/specialization/Master	− 0.284	(0.215)	− 0.117	(0.216)
Female	− 0.0662	(0.0762)	0.00630	(0.0753)
Household income	− 0.00000458	(0.0000357)	0.0000735**	(0.0000350)
Fear of being hit by stray bullet	− 0.0455*	(0.0248)	− 0.0667***	(0.0245)
Violence events/inhabitants	− 0.201*	(0.111)	− 0.0308	(0.109)
Childhood incentive	− 0.00734	(0.0816)	0.155*	(0.0795)
Unemployed	− 0.0428	(0.0777)	− 0.0523	(0.0767)
Internet quality	− 0.277***	(0.0288)	0.0826***	(0.0281)
Controlled for 16 favelas	Yes			
Observations	945			
LR test of indep. eqns	Chi2(1)=95.50	Prob>chi2=0.0000		

$***p < 0.01, **p < 0.05, *p < 0.1$

Table 15 Regression results (with objective violence) for the gaps between watching movies in public and private spaces

	Simultaneous bivariate ordered probit for watching movies			
	Gap movies cinema—Internet		Gap movies cinema—by other means	
Age	0.00805**	(0.00323)	− 0.00891***	(0.00326)
No education/pre-school	Ref		Ref	
Elementary/middle education	− 0.312	(0.201)	− 0.225	(0.207)
High school	− 0.307	(0.213)	0.119	(0.218)
University/specialization/Master	0.184	(0.247)	0.419*	(0.251)
Female	0.150*	(0.0821)	0.148*	(0.0824)
Household income	− 0.0000767**	(0.0000386)	0.0000814**	(0.0000386)
Fear of being hit by stray bullet	− 0.0630**	(0.0272)	− 0.0528*	(0.0273)
Violence events/inhabitants	0.126	(0.121)	− 0.111	(0.121)
Childhood incentive	− 0.0248	(0.0844)	− 0.0335	(0.0846)
Unemployed	0.0195	(0.0839)	− 0.172**	(0.0847)
Internet quality	− 0.225***	(0.0322)	0.115***	(0.0321)
Controlled for 16 favelas	Yes			
Observations	756			
LR test of indep. eqns.:	chi2=49.91	Prob>chi2=0.0000		

$***p < 0.01, **p < 0.05, *p < 0.1$; standard errors in parenthesis

Declarations

Conflict of interest The authors declare that they have no conflict of interest.

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