A Game Theory Study on Music Creation Infringement Under Government Supervision

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Abstract. With the swift advancement of Internet technology and the widespread adoption of social media platforms, led to rampant infringement of music creators' rights, severely undermining their legitimate interests. This study focuses on the game dynamics of music copyright infringement under government oversight. By developing a game model and analyzing real-life cases, it delves into the conflicts of interest and strategic decisions between music creators and infringers. This paper asserts that to effectively protect the legitimate rights of music creators, enhance cultural services, and stimulate the creative impetus within the music industry, concerted efforts are needed to strengthen government regulation, refine legal frameworks, raise creators' awareness of rights protection, and foster technological innovation.

Keywords: Music composition; Copyright protection; game theory

1 Introduction

With the popularization of the Internet and the development of We Media, the transmission channels of music works are increasingly diversified, but at the same time, it also brings hidden dangers of copyright infringement. According to statistics, legal disputes caused by music infringement have been on the rise in recent years, especially in the new media fields such as short video platforms and live streaming platforms, which have become the hardest hit areas for infringement. According to the "2020 China Network Short Video Copyright Monitoring Report", from January 2019 to October 2020, the 12426 Copyright Monitoring Center monitored over 10 million short videos and detected a total of 30.0952 million suspected infringing short videos.[1]This data not only reveals the seriousness of infringement issues in the short video field, but also reflects the urgency of music copyright protection. Currently, domestic scholars are conducting research on "music infringement". In the area of music copyright protection, scholars have analyzed digital music copyrights on short video platforms. The scholar identifies the main issues in music copyright on short video platforms as vague standards for defining copyright infringement, challenges in defining secondary music creations, and frequent instances of "fishing" for copyright protection.[2]Xiang Xuefei and

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Tian Hongming argue that the "safe harbor" rule directly contributes to music copyright infringement on short video platforms. On one hand, platforms benefit from the "safe harbor" rule, gaining more profits while acquiescing to copyright infringements; on the other hand, Chinese regulations do not oblige platforms to undertake copyright review.[3]

In addition, some scholars have also introduced game theory to analyze copyright protection. Salar Ghama conducted a game analysis on how product manufacturers allocate intellectual property rights to supply chain strategies during the production process, pointing out the advantages and limitations of various anti-counterfeiting strategies when suppliers and third parties may produce counterfeit products.[4]Zhang Bing and Zhang Yan analyzed the infringers and creators in the infringement of short video platforms, established a two-stage dynamic game model, explored the factors affecting copyright protection, and proposed that the copyright protection of short video platforms requires the joint efforts of the public, platforms, and governments.[5]

To summarize, existing domestic research on "music infringement" primarily centers on the causes of such infringement on short video platforms, with some scholars also examining the platforms' operational mechanisms. However, academic research specifically on the quantitative analysis of "music infringement" on short video platforms remains scarce. In light of this, this paper seeks to delve into the underlying mechanisms and strategies for addressing music creation infringement under government oversight, using game theory as a lens. By conducting a game-theoretic analysis of the dynamics between infringers and creators on short video platforms, a dynamic game model is developed encompassing three dimensions: the financial gains and costs for music creators in asserting their rights, the financial benefits and costs for infringers, and the role of government intervention.

2 Model

2.1 Model Construction

Music creators create at the cost of using professional knowledge, a lot of energy and inspiration, and obtain benefits through licensing and other means. Due to their limited capabilities, music infringers, under the premise of violating certain laws and paying a price, take advantage of the information gap between listeners to infringe on the rights of creators and obtain benefits. There are conflicts of interest and optimal choices between music creators and infringers, so a game model between the two is established and the following assumptions are proposed.

Hypothesis 1: In the entire music market, both music creators and infringers have bounded rational agents. Under the premise of asymmetric information, both parties will make optimal decisions based on their own interests. Therefore, the decision-making of the infringer in the creative process is (infringement, non-infringement); The corresponding decision of the music creator is (protect rights, not protect rights). In this process, the government will intervene according to the current market situation. The usual intervention method is to impose additional punishment on the infringer beyond

the law. The probability of being discovered by plagiarists is β, provided that the creator does not protect their rights.

Hypothesis 2: The probability of music creators' rights protection is x, and the probability of infringers' infringement is y.

Hypothesis 3: The revenue of composers' works is C_1. Due to the occurrence of infringement, it is bound to reduce the enthusiasm of music creators and cause losses S1. In the process of rights protection, the income D_1 is calculated, and the expenditure D_2 is incurred during the process of rights protection.

Hypothesis 4: The income of music plagiarists is C_2.

Based on the above assumptions, a game matrix between music creators and infringers can be obtained, as shown in Table 1.

Table 1. Plagiarists

		Plagiarizing (y)	Not Plagiarizing $(1-y)$
Composer	Protecting the Rights (x)	$C_1+\beta D_1-S_1-\beta D_2$	C_1-D_2
		$C_2-\beta(D_1+S_2)$	0
	Not Protecting the Rights $(1-x)$	C_1-S_1	C_1
		$C_2-\beta S_2$	0

When a plagiarism incident occurs, the creators who choose to protect their rights and those who choose not to protect their rights have a profit of P_{11} and P_{12} respectively, with an average profit of $\overline{P_1}$,

$$P_{11}=[\underline{C_1}+\underline{\beta D_1}-S_1-\beta D_2]y+(1-y)(C_1-D_2)$$

$$P_{12}=(\underline{C_1}-S_1)y+(1-y)C_1$$

$$\overline{P_1}=xP_{11}+(1-x)P_{12}$$

The dynamic equation for composer strategy selection is:

$$\begin{aligned}Fx=\frac{dx}{dt}&=x(P_{11}-\overline{P_1})=x(1-x)(P_{11}-P_{12})\\&=x(1-x)[(\beta D_1-\beta D_2)y+(y-1)D_2]\\&=x(1-x)[\left(\beta D_1+(1-\beta)D_2\right)y-D_2]\end{aligned}$$

The benefits of infringers choosing to plagiarize and not plagiarize their rights are P_{21} and P_{22}, respectively, with an average benefit of $\overline{P_2}$,

$$P_{21}=[C_2-\beta(D_1+S_2)]x+(C_2-\beta S_2)(1-x)$$

$$P_{22}=0$$

$$\overline{P_2}=yP_{21}+(1-y)P_{22}$$

The dynamic equation for infringer strategy selection is:

$$F(y) = dy/dt = y(1-y)(P_{21} - P_{22})$$
$$= y(1-y)\left[-\beta D_1 x + (C_2 - \beta S_2)\right]$$

Based on F(x) and F(y), we construct a binary dynamic system between the infringer and the composer,

$$\begin{cases} F(x) = x(1-x)[(\beta D_1 + (1-\beta) D_2) y - D_2] \\ F(y) = y(1-y)\left[-\beta D_1 x + (C_2 - \beta S_2)\right] \end{cases}$$

2.2 Stability Analysis

Let $F(x) = F(y) = 0$ to obtain 5 equilibrium points $E_1(0,0)$, $E_2(0,1)$, $E_3(1,0)$, $E_4(1,1)$, $E_5\left(\frac{C_2 - \alpha S_3}{-\beta D_1}, \frac{D_2}{\beta D_1 + (1-\beta) D_2}\right)$. Then the above 5 equilibrium points may not necessarily be the stable evolution strategy EES of the system. Conduct stability research based on the Friedman test. The Jacobian matrix for constructing the system is as follows,

$$J = \begin{bmatrix} \frac{\partial F(x)}{\partial x} & \frac{\partial F(x)}{\partial y} \\ \frac{\partial f(y)}{\partial x} & \frac{\partial f(y)}{\partial y} \end{bmatrix}$$
$$= \begin{bmatrix} (1-2x)[(\beta D_1 + (1-\beta) D_2) y - D_2] & x(1-x)(\beta D_1 + (1-\beta) D_2) \\ -\beta D_1 (1-y) y & \left[-\beta D_1 x + (C_2 - \beta S_2)\right](1-2y) \end{bmatrix}$$

The values at the local equilibrium point are shown in Table 2.

Table 2. The parameter values at the local equilibrium point

	a_{11}	a_{12}	a_{21}	a_{22}
$E_1(0,0)$	$-D_2$	0	0	$C_2 - \beta S_2$
$E_2(0,1)$	$\beta D_1 - \beta D_2$	0	0	$\beta S_2 - C_2$
$E_3(1,0)$	D_2	0	0	$C_2 - \beta S_2 - \beta D_1$
$E_4(1,1)$	$\beta D_2 - \beta D_1$	0	0	$\beta S_2 + \beta D_1 - C_2$
$E_5(x^5, y^5)$	/	/	/	/

Scenario 1, when $S_2 > C_2/\beta$,the stable strategy EES of the system's evolutionary game was (0,0).

Scenario 2, when $S_2 < C_2/\beta$ and $D_2 > D_1$, the stable strategy EES of the system's evolutionary game is (0,1).

Scenario 3, when $S_2 < C_2/\beta - D_1$ and $D_2 < D_1$, the stable strategy EES of the system's evolutionary game is (1,1).

Scenario 4: When $C_2/\beta - D_1 < S_2 < C_2/\beta$ and $D_2 < D_1$, the system has no evolutionary game stability strategy.

3 Discussion

In order to more intuitively reflect the behavior of creators and infringers, the article analyzes the game trends under different situations and parameters.

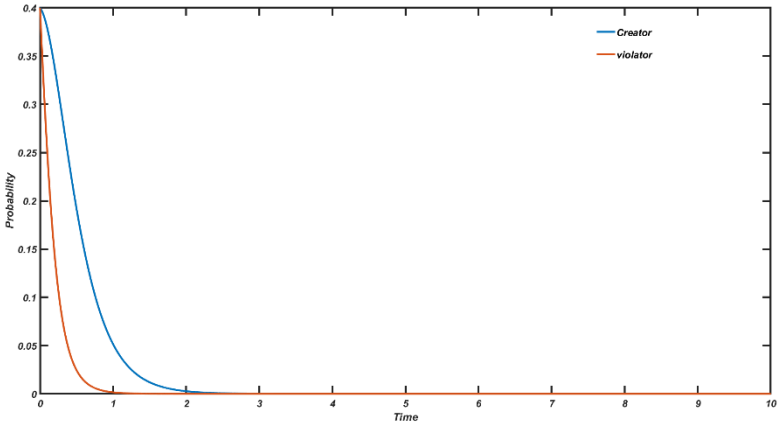

Fig. 1. System simulation diagram under situation 1

Scenario 1. Assuming that C_1=50, C_2=20, D_1=10, D_2=3, S_1=10, S_2=50, β=0.5. The basic conditions in case 1 are met. The evolution simulation results are shown in Figure 1. With the development of time, music creators do not carry out rights protection activities, and the number of plagiarists themselves is gradually decreasing. Both sides converge at the equilibrium point (0, 0). Based on this, we can conclude that when S2 is relatively large, that is, the government (music groups) can handle plagiarism in addition to intellectual property laws, it can reduce rights protection activities and greatly reduce plagiarism.

As can be seen from Figure 1, when the government (institution) severely punishes plagiarists, the rights of the original creator are protected, and the plagiarists are subject to legal sanctions, thereby fundamentally eliminating music infringement. For example, since October 2022, defendant Gan Mou, in the name of a network service company in Shenzhen under his actual control, has obtained music works through the Internet and other channels without obtaining permission from the copyright owner. After copying and mass reproduction, he has promoted and sold them on the Tiktok short video platform. As of March 26, 2023, a certain business operated by Gan on the short video platform Tiktok had sold a total of more than 14,000 orders of infringing products in 16 stores. The court found that the defendant Gan, for the purpose of profit, copied and distributed music works on short video platforms such as Tiktok without the permission of the copyright owner and sold more than 100,000 copies, which was particularly serious and constituted a crime of copyright infringement. Based on the facts, nature, circumstances and degree of social harm of the crime, the court sentenced the defendant Gan to three years' imprisonment, five years' probation, and a fine of 600,000 yuan.

The defendant Gan was ordered to be prohibited from engaging in electronic audio-visual product related work during the probation period.[6]

In this case, the severe punishment of the infringer by the People's Court of Xincheng District, Xi'an City is an important measure to protect intellectual property rights and enhance cultural soft power, and effectively establishes the awareness of protecting music copyright among the masses.

Scenario 2. Assuming that C_1=50,C_2=20, D_1=5, D_2=10, S_1=10, S_2=20, β=0.5.The basic conditions in case 2 are met. The evolution simulation results are shown in Figure 2. As time goes on, music creators do not engage in rights protection activities, but the behavior of plagiarists becomes increasingly worse, and the two sides converge at the equilibrium point (0, 1). The results show that the government (group) can take some sanctions, but if the degree of sanctions is not enough and $D_1 < D_2$, that is, the income of rights protection is less than the cost of rights protection, plagiarism is still difficult to prevent. Due to the difficulty of rights protection, creators will not protect their rights at this time. This will lead to serious consequences. The enthusiasm of music creators is bound to be affected.

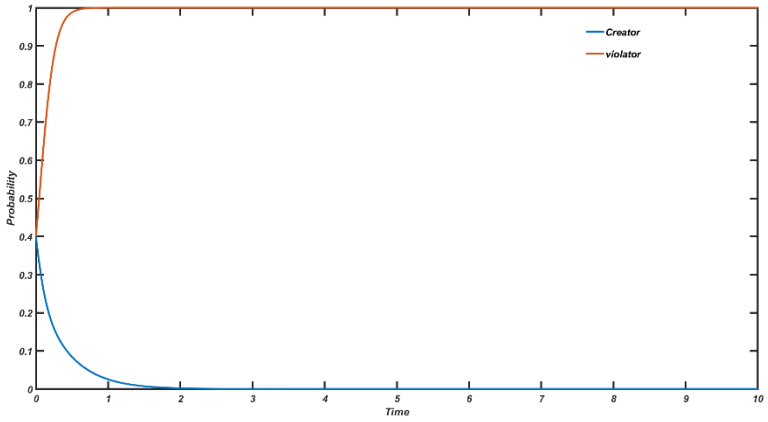

Fig. 2. System simulation diagram under situation 2

From Figure 2, it can be seen that when the government (institution) punishes plagiarists less severely, resulting in higher costs for rights defenders and relatively less profit after rights protection, the rights of original creators are not well protected, leading to them no longer protecting their rights. At the same time, it is also impossible to fundamentally eliminate the music infringement behavior of plagiarists. For example, in the first case of MCN network short video, plaintiff A company is a domestic music copyright authorization and music copyright customization service company. On March 19, 2019, it was approved by Lullatone in Japan Inc. Record Company is legally authorized to obtain exclusive recording and production rights, as well as rights to protect the rights of the music "Walking On the Sidewalk". Defendants B and C are the business managers of the well-known domestic short video production brand "Papitube", namely MCN organization. On January 8, 2019, the plaintiff discovered that

the two defendants had used the music involved in the case as background music without permission to create a commercial advertisement promotion short video called "20180804 2018 Strongest Domestic Mobile Phone Evaluation", and uploaded the video to a certain self media account for dissemination. In the end, the defendant compensated the plaintiff for economic losses of 4000 yuan and reasonable expenses of 3000 yuan.[7]

This case has been praised by the media as the first MCN network short video case. This case is conducive to helping the public establish copyright protection awareness at the beginning of the development of the new industry. However, the cost and benefits of original creators' rights protection are basically equal, so it cannot eliminate music infringers from the root.

Scenario 3. Assuming C_1=50, C_2=20, D_1=20, D_2=5, S_1=20, S_2=10, and β=0.5. The basic conditions in Scenario 3 are met. The simulation results of its evolution are depicted in Figure 3. Over time, music creators have actively engaged in rights protection activities, yet plagiarists have escalated their actions, with both eventually converging at the equilibrium point (1,1). This suggests that when government (or group) sanctions are too weak, yet the benefits of rights protection are substantial (or the costs minimal), creators will actively engage in rights protection activities. However, due to the government's sanctions being too weak, even with creators' robust rights protection efforts, plagiarism remains unchecked. This suggests that to reduce plagiarism, the government or institutions must propose more stringent sanctions.

From Figure 3, it can be seen that government agencies still impose moderate punishment, but when the cost of protecting rights for rights defenders decreases or the benefits of rights protection increase, although it cannot completely eliminate the music infringement behavior of plagiarists, it can motivate original creators to actively engage in rights protection behavior. For example, in the case of well-known singer Xiang Yang Zhuoma and a cultural company in Hubei who infringed on Daolang's copyright, since 2015, Xiang Yang Zhuoma has been unauthorized to cover the original song "Xihai Love Song" by the singer Daolang in several public occasions. Even on a music platform, Daolang's version of "Xihai Love Song" has been taken off the shelves, but instead, Xiang Yang Zhuoma's version of "Xihai Love Song" has become the object of paid subscriptions. The lyrics and composer of the song, Dao Lang, believed that this behavior violated his copyright, but Jiang Yangzhuoma firmly believed that what she did was to inherit and promote Tibetan culture, and did not infringe Dao Lang's rights. On January 16, 2024, after the first instance judgment of the Intermediate People's Court of Yichang City, the Hubei Provincial High People's Court ruled in favor of Dao Lang in this case and ordered Yang Zhuoma and its affiliated companies to compensate 75000 yuan as compensation for infringement.[8]

In this case, the copyright dispute between the original lyrics and music creators, as well as the original singers and cover singers, was resolved by the court, which held the infringer legally responsible.This allowed the rights defenders to protect their rights through litigation and other means, and also made the public deeply realize that copyright protection is not only to protect the rights of music creators, but also to protect the healthy development of the entire music industry.

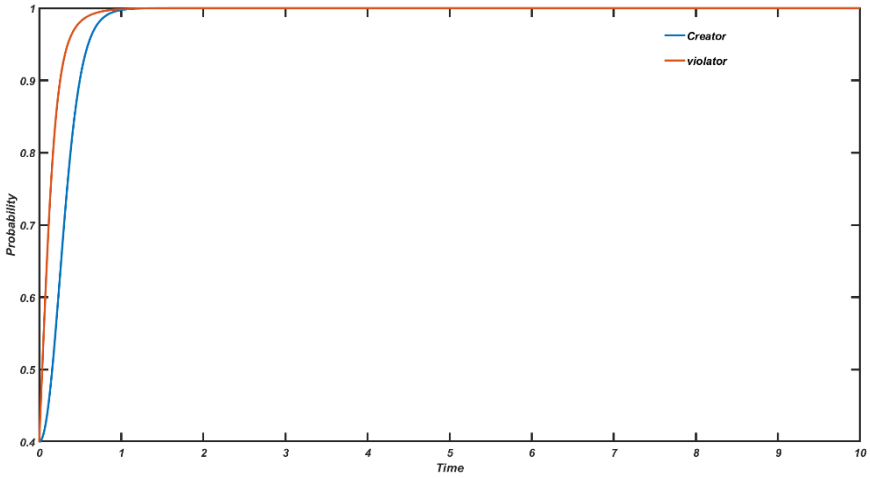

Fig. 3. System simulation diagram under situation 3

4 Conclusion

In response to the infringement of music creation in short videos, this article uses game theory to construct a game model between music creators and infringers based on the conflict of interests and optimal choices, and analyzes the different impacts of government (institutional) punishment on the behavior of creators and infringers. Based on the results of the model analysis, this article explores the effectiveness and limitations of government supervision in reducing music creation infringement. In order to effectively curb infringement and protect the legitimate rights and interests of creators, the following suggestions are proposed:

One is to strengthen government supervision. The government should increase its supervision of music creation infringement, improve law enforcement efficiency and punishment, and form an effective deterrent force; The second is to improve the legal and regulatory system, revise and perfect relevant laws and regulations such as the Copyright Law, clarify the legal responsibility and punishment standards for infringement, and provide strong legal protection for creators; The third is to enhance the awareness of creators' rights protection, strengthen publicity and education on copyright protection, improve creators' rights protection awareness and ability, and encourage them to protect their own rights through legal means; The fourth is to promote technological innovation and application, encourage the application of technological innovation in copyright protection, such as developing more efficient and convenient copyright protection technologies and tools, and improve the efficiency and accuracy of copyright protection.

In summary, this article conducts a game study on music creation infringement under government supervision, deeply analyzes the complexity and diversity of music creation infringement under government supervision, provides us with a new perspective to

understand infringement behavior and its governance mechanism, emphasizes the important role of government supervision in music copyright protection, provides theoretical support and practical guidance for the healthy development of the music industry, and provides new perspectives and ideas for effective protection of music copyright.

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