

Study on the Construction of Multilevel Regression Model for the Integration of Sichuan Rural Music and Cultural Tourism Industry under the Rural Revitalization Strategy

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ABSTRACT

The integration and development of Sichuan's rural music and cultural tourism industry is of great significance in the context of rural revitalization strategy. The purpose of this paper is to construct a multilevel regression model to deeply explore the influencing factors and role mechanisms of the integration of the two. Through theoretical analysis and empirical research, the research variables are clarified, and the null model, random effect model and complete model are constructed and data validation and analysis are carried out. The results show that the richness of rural music resources, the level of cultural and tourism industry, policy guidance and support, market demand and human resources have a significant positive impact on the integration of rural music and cultural and tourism industry in Sichuan. The results of the full multilevel regression model show that the same level of rural music resource abundance has different impacts on the integration of rural music and cultural and tourism industries due to regional differences. The results of the study provide theoretical support for the development of cultural tourism industry in Sichuan Province, and deeply help the implementation of rural revitalization strategy in Sichuan Province.

Keywords: multilevel regression model, null model, random effects model, country music, cultural tourism industry

1. Introduction

Rural music is an indispensable and important part of rural culture and emotional ties, reflecting the contemporary rural life and urbanization in the context of the strong “nostalgia, rural feelings, rural sounds, rural encounters, rural knowledge, rural nostalgia”. Vigorously developing rural music can let people find the “green leaves to the roots of the friendship”, help create a strong cultural atmosphere, and help inherit Chinese civilization and revitalize the national culture [1]. Rural music is one of the

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various forms or categories of music, and it is an indispensable part of most rural cultures and emotional ties [2]. Nowadays, country music has more and more independent and mature artistic value and industrial development value, not only as a countryside surrounding industry or music industry, but also as a relatively independent and important industry to carry out new thinking [3].

In the context of the new era, Sichuan, as a province with rich history, culture and natural resources, the development of rural music is of great significance in promoting local cultural heritage, economic development and social progress. Rural music is a part of Sichuan's diverse culture, which carries the region's historical memory and folk wisdom [4]. In today's accelerating globalization and modernization, preserving and developing rural music is not only a respect for traditional culture, but also a reinforcement of local identity. Through the integration with modern pop music elements and digital music technology, country music can also take on a new vitality, attracting more young people to pay attention to and participate in the preservation and innovation of traditional culture [5]. In addition, compared with the traditional cultural tourism development relying on natural resources and historical landscapes, which has already entered the platform and maturity period, the development of cultural tourism industry with rural music experience as the highlight is still a new thing. Sichuan in the new era really needs rural music, which is not only a cultural phenomenon, but also an important force to promote the overall development of local economy and society [6]. Through rational planning and effective implementation, rural music has every possibility to become a key to promote the revitalization and sustainable development of Sichuan's countryside.

Cultural tourism is a kind of tourism industry developed by humanistic tourism resources to meet people's cultural tourism consumption needs and to improve the quality of people's tourism activities with creative cultural products. Literature [7] explores the current situation of the music cultural tourism industry and the development of traditional country music in Tennessee, as well as the promotion of country music for the development of the local tourism industry, which provides a platform for travelers to perform music to their heart's content. Literature [8] reveals that the element of Fear of Missing Out (FOMO) is highly positively correlated with tourists' intention to revisit country music festivals through an empirical investigation, and points out that FOMO provides potential opportunities for tourists to participate in country music festivals and strengthens the tourists' participation experience to a certain extent. Literature [9] talks about how Southern Appalachian music heritage tourism programs have a great cultural appeal to tourists by presenting cultural stories such as music culture, musicians, music history, and music landscapes. Literature [10] examines and analyzes the Country Music Hall of Fame and the Museum of Popular Music and Culture cultural and tourism industry development models and characteristics, demonstrating the presentation and influencing factors of tourists in different music heritage tourism. Literature [11] reviewed the research related to pop culture and cultural tourism, and concluded that it is necessary to make targeted adjustments to cope with the impact of subcultures, social media, and cultural diversity on the cultural tourism industry, and to deeply understand the nature and significance of cultural pluralism, diversity, and competition. Based on empirical analysis, literature [12] reveals the attitudes and behaviors of millennials in terms of tourism concepts and how they influence their destination experiences, providing some references for policy making in cultural tourism management. Literature [13] clarifies that music festival culture as well as music tourism has successfully shaped the city's tourism brand image, and argues that the development of music tourism and the further establishment of the city's tourism brand image need to be promoted by the joint efforts of the government, the community, and the universities.

This paper provides an in-depth analysis of the development potential and recognition of rural music in Sichuan Province, and describes the practical basis for the integration of rural music and cultural tourism industry in Sichuan. Based on the theoretical analysis of the influence of the richness of rural music resources, the level of development of the cultural and tourism industry, policy guidance and support, market demand, and talent resources on the integration of rural music and cultural and

tourism industry, this paper puts forward research hypotheses and measures each variable. Based on the theoretical foundation of multilevel regression model, the regression model of this study is constructed, and the data are obtained for regression analysis according to the data collection method proposed in this paper. The results of the regression analysis are used to verify the reasonableness of the research hypotheses in this paper, and to provide path support for the integration of rural music and cultural and tourism industries as well as the in-depth implementation of the rural revitalization strategy in Sichuan Province.

2. Realistic basis for integrated development

2.1. Country music has a strong potential for development

According to public information from the Sichuan Provincial Department of Culture and Tourism, the music industry in Sichuan has developed rapidly in recent years. According to statistics, as of 2023, the total output value of Sichuan's music industry reached 106.847 billion yuan, up 17.05 percent from 2019. The province has more than 24,000 original musicians, the second largest number in China. Figure 1 shows the statistics of the total output value of music in Sichuan province from 2010 to 2023. From the figure, it can be seen that during the past 14 years, the total output value of music in Sichuan Province has shown a year-on-year growth trend, and the total output value of music in Sichuan Province in 2022 will increase by as much as 6.495 billion yuan compared with that in 2021. The music industry has shown strong vitality.

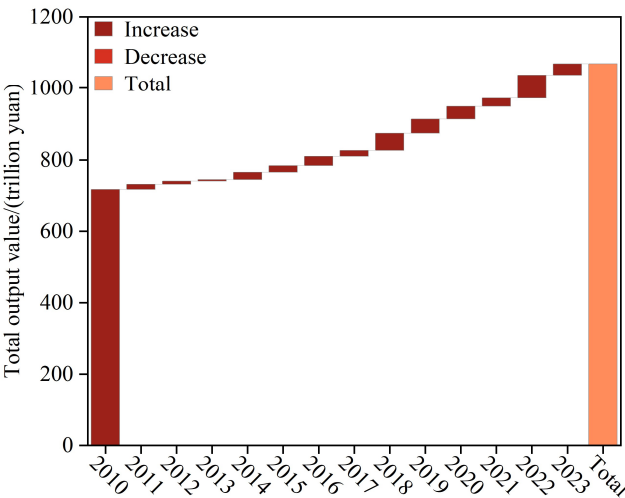


Fig. 1. Statistical results of total music output value

Countries around the world have had successful experiences in utilizing music culture to create tourist destinations to increase the income of the tourism industry, for example, Vienna, the capital of Austria, the city of music, the Salzburg Music Festival in Austria, the Sydney Music Festival in Australia, and the Gulangyu Piano Museum in China. The town of Branson in the United States is a typical case of the integration of rural music and cultural tourism. Branson is located in the hinterland of the Ozark Mountains in the central United States, with an area of 54 square kilometers and a household population of only 11,000 people. Although it is a small remote town, Branson is the focus of American rural culture, but also the capital of American country music, attracting up to more than 8 million tourists and music lovers every year, able to obtain 1.6 billion U.S. dollars in tourism revenue. Another example: China's first large-scale landscape performance - "Impression - Liu Sanjie", since its first public performance, has won the "First Ministry of Culture Innovation Award", the China Performers Association "China's top ten performance event award" and many other honors. Since its first public performance, "Impression Liu Sanjie" has won many honors, such as "The First Ministry of Culture

Innovation Award” and “China's Top Ten Performance Events Award” of China Performers Association. By the end of 2023, “Impression - Liu Sanjie” has been performed for more than 8,200 times, and received about 21 million audiences. Only from the third to the eighth day of the Chinese New Year in 2024, it received nearly 58,000 audiences, with an operating income of nearly ten million yuan.

2.2. Country music has a high level of recognition

Rural music in Sichuan is rooted in the deep cultural soil of the land of Ba Shu, and is widely recognized by the society and the masses, such as: Bashan Dorsal Song, Sichuan River Horn, Northern Sichuan Weeding and Drumming, Qiang Multi-Voice Folk Songs, Nanping Quzi, Western Sichuan Tibetan Mountain Songs, Wenchang Dongjing Ancient Music, Mouth String Music, Xiling Mountain Songs, and Bimo Music, etc., which also produce a number of musical works of a higher standard and with a stronger spreading power, such as: Kangding Love Song, Casting Flowers, When Will the Acacia Flowers Bloom, and August Gui Blossoms Bloom Everywhere, etc. Picking Flowers”, ‘When Will the Sophora Blossoms Bloom’, ‘August Osmanthus Blossoms Bloom Everywhere’ and so on.

At the same time, Sichuan has a certain practical foundation in the “music + culture + consumption” scene building. 2023 August, China - Kangding International Love Song Festival grand opening, a wonderful opening, nine special cards, attracted a lot of tourists. A wonderful opening, nine special punch cards, attracted a large number of tourists. 2019, China's first theatrical illusion city - “Only Emei Mountain” opened. The project retained some of the villages and houses of the aboriginal people under Emei Mountain, and organically fused the theater with the surrounding ecological villages, creating China's largest live-action village theater.

All of the above cases prove that under the strategy of rural revitalization, Sichuan's rural music has become more and more independent and mature in terms of artistic value and industrial development value. It has become a new trend to use rural music to promote and market rural culture, and to incorporate it into the overall planning of rural cultural revitalization and cultural and tourism industry development.

3. Research design

3.1. Research hypotheses

In the in-depth exploration of the driving mechanism of the integration of rural music and cultural and tourism industries in Sichuan Province, the theory of industrial integration and the theory of tourism industry integration provide a valuable theoretical framework for this paper. Combined with the analysis of research results from various countries, it can be seen that the driving force for the integration of rural music and cultural and tourism industry in Sichuan Province is mainly the richness of rural music resources, the development level of cultural and tourism industry, policy guidance and support, market demand motivation, and talent resources and other factors. For the specific situation of the development of rural music and cultural tourism industry in Sichuan Province, these motivating factors are further refined into five parts.

3.1.1. Country Music Resourcefulness. Rural music resources in Sichuan Province are rich in forms, such as the Sichuan River Horn and other labor horns, Yi folk songs and other ethnic songs, as well as various types of folk ditties. In the process of developing rural tourism resources in Sichuan Province, paying attention to the cultural heritage of rural music and developing rural tourism for rural music will further expand the scope of development of rural cultural tourism industry in Sichuan Province and enrich the form of rural cultural tourism in Sichuan Province. Rich rural music is an important component of traditional culture and art in Sichuan Province, carrying the long cultural history of Sichuan Province, and is an important carrier for the promotion and dissemination of traditional culture and art in Sichuan Province. In the process of tourism resources development, it is of great

significance to develop the tourism industry with the help of rich rural music and art resources. Rural music is an important component of Sichuan's folk culture industry and the main body of Sichuan's rural cultural tourism, so it is important to pay attention to the development of rural music art to promote the development of Sichuan's rural culture and tourism industry, and to promote the integration of rural music and culture and tourism industry. Based on this, this paper puts forward the following hypotheses:

H1: The richness of rural music resources has a significant positive effect on the integration of rural music and cultural tourism industry.

3.1.2. Level of development of the cultural tourism industry. The higher level of development of the cultural and tourism industry in Sichuan Province means that the infrastructure in rural areas, such as transportation, communication and accommodation, is constantly being improved. This makes it more convenient to organize rural music performances and other activities, attracting more musicians and tourists, and creating good conditions for the integration of rural music and cultural tourism. At the same time, the development of cultural tourism industry will attract talents, capital, technology and other factors to the countryside, and the rural music industry can use this to obtain more creative capital, professional musicians, and advanced music production technology, etc., to promote the creation and dissemination of rural music. In addition, the high level of development of the cultural tourism industry can attract a large number of tourists from inside and outside the province or even at home and abroad, and the rural music industry can take advantage of these tourists to expand its influence and market scope, so that the rural music works and performances can be more easily accepted and loved by the public, thus promoting the integration of the rural music and the cultural tourism industry in Sichuan Province. Based on this, this paper proposes another hypothesis:

H2: The development level of cultural and tourism industry also has a significant positive effect on the integration of country music and cultural and tourism industry.

3.1.3. Policy guidance and support. The government plays an irreplaceable guiding role in the integrated development of rural music and cultural tourism industry in Sichuan Province. Through the efforts of policy formulation, infrastructure construction, financial support, talent cultivation, market supervision and publicity and promotion, the government can promote the in-depth implementation of the integrated development of rural music and cultural and tourism industries, and realize the win-win situation in various aspects such as economy, society and culture. Driven by the strategy of rural revitalization and the development strategy of regional tourism, Sichuan Province actively integrates rural music and cultural tourism resources, promotes the integrated development of the industry, and injects Qingda's policy impetus for the integration of rural music and cultural tourism industry. At the same time, the government also optimizes the spatial layout and resource allocation for integrated development through planning and guidance, infrastructure construction, etc., to promote the deep integration and synergistic development among industries. Based on the above analysis, this paper proposes the following hypotheses:

H3: Policy guidance and support have a significant positive impact on the integration of rural music and cultural tourism industry in Sichuan.

3.1.4. Market demand drivers. With the improvement of people's living standards and the change of consumption concepts, there is a growing demand for high-quality, personalized and experiential tourism products and services. Sichuan Province has met the diversified needs of tourists for in-depth cultural experience, exploration of rural life, and health and wellness by creating tourism projects with diversified functions and topics, such as rural music appreciation, rural music education, and rural music wellness. This expanding market demand and consumption upgrading provide a strong market impetus for the integration of rural music and cultural tourism industry. Therefore, this paper proposes the hypothesis:

H4: Market demand has a significant positive impact on the integration of rural music and cultural tourism industry in Sichuan.

3.1.5. Talent resources. The development of rural culture and tourism industry can not be separated from the support of human resources, rural culture and tourism talent team construction status determines the development level of rural culture and tourism industry. In recent years, Sichuan Province fully recognizes the importance of the construction of rural culture and tourism talents, to create a rural culture and tourism industry development talent gathering platform, focusing on rural music and culture, rural culture and tourism projects as a carrier, to attract a number of professional music talents and artists in the village, flexible formation of consistent rural culture and tourism industry required professional talent team. Subsidized funding, preparation for the construction of studios and other related support policies, leading to a number of domestic and foreign music artists and local villages in Sichuan Province, twinning public will, cultural support and nourishment of rural areas, rural music and cultural and artistic creativity infiltration of the countryside revitalization, adding cultural endogenous power of rural cultural tourism industry development. Based on this, this paper has the following assumptions:

H5: Talent resources have a significant positive impact on the integration of rural music and cultural tourism industry in Sichuan.

3.2. Variable Selection and Measurement

3.2.1. Explanatory variables:

1) Richness of rural music resources (X_1): including the number of rural music types, the number of musical talents, the number of musical works and other indicators, which are obtained through example research and statistical data.

2) Level of development of culture and tourism industry (X_2): Indicators such as tourism revenue, visitor reception, and the degree of improvement of tourism infrastructure are selected for measurement, and the data are obtained from the statistical yearbook of the Sichuan Provincial Department of Culture and Tourism and relevant tourism data platforms.

3) Policy guidance and support (X_3): Since policy support is not easy to quantify, this paper uses the proportion of culture, sports and media in public financial expenditure to measure the government's financial support.

4) Market demand (X_4): GDP per capita and disposable income of urban residents can reflect the city's market economic environment and consumer demand, as an indicator to explore the impact of market demand on the integration level of Sichuan's rural music and culture and tourism industries.

5) Talent resources (X_5): Higher education plays an important role for society to cultivate professionals and specialists in this machine, and the number of general colleges and universities can reflect the city's education level and its ability to cultivate high-level talents, representing the number of composite talents. The average salary of practitioners can reflect the city's investment in labor force, which is related to the service quality of practitioners. Therefore, this paper measures talent resources by the number of general higher education institutions and the average salary of employees.

3.2.2. Explained variables. Integration degree of rural music and cultural tourism industry (Y): Considering the depth and breadth of industrial integration, constructing the indicator system from the aspects of product innovation, market expansion, and economic benefits of industrial integration, adopting the hierarchical analysis method to determine the weights of each indicator, and calculating the value of integration degree.

3.2.3. Control variables. In order to reduce the error caused by omitted variables, the following control variables are selected: (1) the level of economic development ($PGDP$): the scale and speed of

economic development in Sichuan Province, characterized by GDP per capita. (2) Degree of government intervention (*Gov*): the government's use of its macro-regulatory economic functions in particular, as measured by the share of the general public budget expenditures of the Sichuan government in GDP. (3) Level of technological innovation (*Tech*): Sichuan's ability to invent, create and innovate in the field of science and technology, measured by the number of patent applications. (4) Openness to the outside world (*Open*): the degree of openness of Sichuan's economy to domestic and foreign markets, as measured by the proportion of total import and export trade to GDP. (5) Level of Informatization (*Inte*): the degree of application of information technology in Sichuan Province, characterized by the total volume of postal and telecommunication services.

3.3. Data collection methods

1) In-depth interviews. In-depth interviews are a qualitative research method designed to obtain detailed and rich information through in-depth, one-on-one communication with interviewees. Prior to the interviews, a detailed interview outline was first developed, covering various aspects of the integration of Sichuan's rural music and cultural and tourism industries, including policy support, implementation measures, evaluation of effects, problems and future suggestions. In order to ensure the smooth conduct of the interviews, a number of mock interviews were conducted to adjust and improve the content of the outline. During the interviews, face-to-face exchanges were conducted with the interviewees to ensure that the real thoughts and feelings of the interviewees could be understood in depth. Each interview lasted between 1-2 hours, and the interviews were recorded with the consent of the interviewees for subsequent analysis. After the interviews were completed, the recordings were transcribed and the interviews were organized and analyzed.

2) Participatory observation. Participatory observation is a method of obtaining first-hand information through the researcher's personal involvement and observation of the daily activities of the research object. In this study, through a long-term stay in the village, we are deeply involved in the process of integrating rural music and cultural tourism industry in Sichuan villages. We actively participated in and recorded various cultural and tourism activities in the village, such as folk song experiences, cultural festivals, and tourism receptions. By personally participating in these activities, we are able to gain an in-depth understanding of the organization and implementation of the activities, as well as the interaction between tourists and villagers.

3) Literature collection. By collecting and analyzing relevant literature, we are able to obtain the theoretical basis and practical experience about the integrated development of culture and tourism. We collect and analyze the policy documents and reports on the integrated development of rural music and cultural tourism industry issued by the Sichuan Provincial Government to understand the government's policy orientation and support measures. We also collect and analyze academic papers and research reports on the integrated development of rural music and cultural and tourism industries at home and abroad, to understand the hotspots and frontiers of current research, and to learn from the successful experiences and lessons of other regions.

4. Multilevel regression modeling

4.1. Basis for modeling

Multilevel regression modeling [14] begins with the creation of a null model, which is the first step in coming to test the need for a hierarchical structure for stratified data. There are no explanatory variables in the null model for levels one and two, just a decomposition of the equation into the portion that is due to individual differences and the portion that is due to differences in the footprints by differences. This analysis is an analysis of variance (ANOVA), which allows for estimation of both

between-group and within-group effects, and then the addition of the null model with explanatory variables at levels one and two, thus explaining through theory how the overall variation in the explanatory variables is affected by the explanatory variables at levels one and two. The following are the relevant theoretical foundations for the construction of multilevel regression models.

4.1.1. Zero model. Sometimes researchers use analysis of variance components to decompose the equation into parts caused by differences between groups and parts caused by individual differences. Using this method requires only a null model with no predictor variables.

The data are assumed to have two levels, with y_{ij} representing the j rd observation of the variable for the i nd individual, when j represents the second level, and i represents the first level of the hierarchy. The two-level model can only be built on a case-by-case basis after analysis from the simplest null model. The model is of the form:

$$\text{Level 1: } y_{ij} = \alpha_1 + e_{ij} \quad (1)$$

$$\text{Level 2: } \alpha_1 = \alpha_0 + \mu_0 \quad (2)$$

$i = 1, \dots, n; j = 1, \dots, m_i$, substituting Eq. (2) into Eq. (1) yields the total model as:

$$\text{Total Model: } y_{ij} = \alpha_0 + \mu_{0,j} + e_{ij} \quad (3)$$

In the total model (3), α_0 can be the fixed effects component and $\mu_{0i} + e_{ij}$ is called the random effects component. From the results of the estimation, $\text{Var}(e_{ij}) = \sigma^2$ and $\text{Var}(\mu_{01}) = \tau_{00}$ can be obtained, from which the correlation coefficients between groups can be calculated, while the empirical significance of ICC is that it is possible to determine what proportion of the overall variant species is due to differences in the second stratum, explained by the formula:

$$ICC = \tau_{00} / (\tau_{00} + \sigma^2) \quad (4)$$

ICC can indicate both the correlation coefficient between individuals within a group, which ranges from 0 to 1, and the between-group variation. When ICC is close to 0 it indicates that there is no obvious hierarchical structure between the screened data, at which point a fixed-effects model can be used, and when ICC is close to 1 it indicates that there is an obvious hierarchical structure in the data, at which point a multilevel model should be considered for analysis.

4.1.2. Random effects regression model. The random effects regression model [15] is constructed as follows:

$$\text{Level 1: } y_{ij} = \alpha_{0j} + \alpha_{1j}x_{ij} + \gamma_{ij} \quad (5)$$

$$\begin{aligned} \text{Level 2: } \alpha_{0j} &= \gamma_{00} + \mu_{0j} \\ \alpha_{1j} &= \gamma_{10} + \mu_{1j} \end{aligned} \quad (6)$$

Unlike the traditional OLS regression [16], the random effects model is a model with no predictor variables on the second level, there are no predictor variables on the second level to explain the variation in the regression equation of the first level, and the intercept and regression coefficients of the first level are randomized, and by doing so, it can be screened to identify which predictor variables in the first level have variations on the second level, and the random effects regression model established in this paper only analyzes the first level of the variables are analyzed and the variables that are significantly different at the second level are identified by the results of the significance test of the random portion of the variables at the first level. Models with predictor variables are built as

needed using the regression coefficients of these variables as the dependent variables at the second level. Those variables with non-significant differences do not need to be modeled at the second level.

4.1.3. Complete models. A complete model is a model in which predictor variables are present at both the first and second levels. The complete model uses theoretical constructs to illustrate or explain how the predictor variables in the first and second levels affect the overall variance. The simplest complete model is shown below, where just one predictor variable is present at both the first and second level in the complete model below, modeled as follows:

$$\text{Level 1: } y_{ij} = \alpha_{0j} + \alpha_{1j}X_{ij} + e_{ij} \quad (7)$$

$$\begin{aligned} \text{Level 2: } \alpha_{0j} &= \gamma_{00} + \gamma_{01}W_{1j} + \mu_{0j} \\ \alpha_{1j} &= \gamma_{10} + \gamma_{11}W_{1j} + \mu_{1j} \end{aligned} \quad (8)$$

Substituting Eq. (8) into Eq. (7) yields the total model as.

$$y_{ij} = \gamma_{00} + \gamma_{10}X_{ij} + \gamma_{01}W_{1j} + \gamma_{11}X_{ij}W_{1j} + \mu_{0j} + \mu_{1j}X_{ij} + e_{ij} \quad (9)$$

In the total model the fixed effects component is $\gamma_{00} + \gamma_{10}X_{ij} + \gamma_{01}W_{1j} + \gamma_{11}X_{ij}W_{1j}$ and the random effects component is $\mu_{0j} + \mu_{1j}X_{ij} + e_{ij}$. γ_{11} is the interaction effect of the two-level explanatory variable W_{1j} and the one-level explanatory variable X_{ij} .

4.2. Modeling

This paper uses two levels of data structure, including the regional level and the village level, where the village level variables include the richness of rural music resources (X_1), the development level of cultural and tourism industry (X_2) and talent resources (X_5), and the regional level variables include the policy guidance and support (X_3) and market demand (X_4). Through this hierarchical data structure to establish a multilevel regression model can distinguish between regional variables and rural variables, the use of multilevel regression model can be more comprehensive analysis of the problem, to overcome the previous research just put the regional level variables and rural level variables simply together for modeling and estimation, without taking into account the differences between the regional and rural levels, through the multilevel regression model can be obtained at different levels of the correlation between the variables. Correlations between variables at different levels of hierarchy can be obtained through multilevel regression modeling, allowing the use of both district and village observations in a single model without violating the assumption of independent observations, thus providing correct standard errors and meaningful measurements.

Let the explanatory variables of the j nd village in the i st region of Sichuan Province be Y_{ij} , the explanatory variables be $X_{ij_1}, X_{ij_2}, \dots, X_{ij_p}$, the control variables be $Z_{ij_1}, Z_{ij_2}, \dots, Z_{ij_q}$, and the random effects be $\mu_{0i}, \mu_{1i}, \dots, \mu_{pi}$, then the general form of the multilevel regression model in this paper is:

$$\begin{aligned} Y_{ij} &= \beta_0 + \beta_1X_{ij_1} + \beta_2X_{ij_2} + \dots + \beta_pX_{ij_p} + \gamma_1Z_{ij_1} + \gamma_2Z_{ij_2} \\ &+ \dots + \gamma_qZ_{ij_q} + \mu_{0i} + \mu_{1i}X_{ij_1} + \dots + \mu_{pi}X_{ij_p} + \varepsilon_{ij} \end{aligned} \quad (10)$$

where β_0 is the intercept term and $\beta_1, \beta_2, \dots, \beta_p$ is the fixed effects regression coefficient reflecting the average effect of the explanatory variables on the explained variables. $\gamma_1, \gamma_2, \dots, \gamma_q$ is the regression coefficient for the control variables. μ_{0i} is the random intercept at the district level, reflecting differences between districts, and $\mu_{1i}, \mu_{2i}, \dots, \mu_{pi}$ is the random slope at the village level,

reflecting differences in the impact of the explanatory variables on the explained variables across villages. ε_{ij} is the individual-level random error term, which follows a normal distribution $N(0, \sigma^2)$.

5. Empirical analysis

5.1. Descriptive statistics of variables

According to the data collection and variable measurement methods described in the previous section, the data on the variables related to the integration of rural music and cultural and tourism industries in Sichuan Province from 2009 to 2023 were collected and organized and analyzed. Table 1 shows the results obtained after normalizing the raw data of the variables collected in this study, and Table 2 shows the results of descriptive statistics of the variables, in which Mean, Std, Min, and Max represent the mean, standard deviation, minimum value, and maximum value of the variables, respectively. As can be seen from the table, the minimum value of the explanatory variables is 0, and the maximum value is 0.97, indicating that with the passage of time, the integration degree of Sichuan rural music and cultural tourism industry has increased significantly. The mean value of the explanatory variable “richness of rural music resources (X_1)” is 0.543, which further demonstrates that Sichuan province is rich in rural music resources and plays an important role in the integration of rural music and cultural tourism industry.

Table 1. Variable data normalization

Year	Y	X_1	X_2	X_3	X_4	X_5	$PGDP$	Gov	$Tech$	$Open$	$Inte$
2009	0.00	0.77	0.07	0.02	0.04	0.03	0.05	0.06	0.07	0.07	0.03
2010	0.09	0.66	0.09	0.05	0.09	0.19	0.14	0.14	0.15	0.08	0.1
2011	0.22	0.58	0.21	0.12	0.16	0.24	0.26	0.16	0.19	0.11	0.12
2012	0.26	0.94	0.25	0.32	0.2	0.32	0.33	0.26	0.24	0.18	0.18
2013	0.26	0.4	0.28	0.33	0.27	0.46	0.36	0.32	0.25	0.19	0.33
2014	0.31	0.87	0.28	0.52	0.4	0.49	0.38	0.35	0.37	0.25	0.43
2015	0.47	0.36	0.38	0.57	0.45	0.5	0.41	0.37	0.38	0.28	0.52
2016	0.53	0.2	0.57	0.61	0.47	0.54	0.51	0.45	0.52	0.31	0.53
2017	0.54	0.38	0.68	0.61	0.53	0.55	0.54	0.46	0.57	0.41	0.61
2018	0.59	0.36	0.78	0.68	0.57	0.59	0.66	0.47	0.57	0.49	0.62
2019	0.69	0.73	0.85	0.72	0.61	0.74	0.73	0.69	0.62	0.65	0.7
2020	0.69	0.19	0.87	0.74	0.91	0.79	0.73	0.78	0.65	0.71	0.76
2021	0.86	0.63	0.87	0.74	0.96	0.83	0.77	0.8	0.69	0.84	0.84
2022	0.92	0.97	0.88	0.85	0.97	0.85	0.88	0.81	0.74	0.92	0.88
2023	0.97	0.1	0.97	0.87	0.98	0.95	0.94	0.82	0.88	1.00	0.89

Table 2. Descriptive statistics of variables

Variable	Mean	Std	Min	Max
Y	0.493	0.17	0.00	0.97
X_1	0.543	0.14	0.10	0.97
X_2	0.535	0.12	0.07	0.97
X_3	0.517	0.13	0.02	0.87
X_4	0.507	0.15	0.04	0.98
X_5	0.538	0.17	0.03	0.95
$PGDP$	0.513	0.16	0.05	0.94
Gov	0.463	0.14	0.06	0.82
$Tech$	0.459	0.15	0.07	0.88
$Open$	0.433	0.12	0.07	1.00
$Inte$	0.503	0.11	0.03	0.89

5.2. Regression analysis

5.2.1. Zero Model Analysis. The null model in this paper is a null model that removes all predictor variables, in which the integration degree of country music and cultural tourism industry (Y) is an explanatory variable in the model. The model is used to determine the intra- and inter-group variability to test the necessity of constructing a two-level multilevel model. Table 3 shows the results of the null model regression. The intercept in the table indicates the overall integration of Sichuan's rural music and cultural tourism industry, and the estimated value is 0.836, with a p-value significant at the level of 0.001. The random effects in the first and second levels indicate that the differences in the integration of rural music and cultural and tourism industries stem from intra-individual and inter-individual differences, respectively. In the variance component, the between-group variance value was 0.246, and the chi-square value was 109.473, with a p-value of less than 0.001, indicating that the between-group differences were significant. Meanwhile, the cross-level correlation coefficient $ICC = \tau_{00} / (\tau_{00} + \sigma^2) = 0.246 / (0.246 + 0.227) = 0.342$ was calculated, indicating that 34.2% of the overall difference in the integration of country music and cultural tourism industry was due to inter-

individual differences. According to the judgment criteria $ICC > 0.138$ is highly intra-group correlation, and there are significant inter-group differences in the explanatory variables, so it is suitable to use multilevel regression model.

Table 3. The regression results of zero model

Fixed effect	Coefficient	Standard error	Freedom	T	P
Intercept	0.836	0.121	18.026	35.471	<0.001***
Random effect	Standard error	Variance component	Freedom	χ^2	P
Second layer	0.496	0.246	18.026	109.473	<0.001***
First layer	0.478	0.227			

5.2.2. Random effects model analysis. The random-effects model is based on the zero model by adding the predictors of the first level (i.e., the village level) and only examining the effect of the three variables of the first level on the intercept in the second level equation. Table 4 shows the random-effects regression results, with tables *Coe* and *VC* representing the regression coefficient of the fixed part and the variance component of the random part, respectively. The data of 2009, 2013, 2018 and 2023 were selected for regression analysis. According to the estimation results in the table, the fixed effect results show that the regression coefficients of the explanatory variables at the first level are all significant, and the signs of the regression coefficients are positive, indicating that the "richness of rural music resources (X_1)", "development level of cultural tourism industry (X_2)" and "talent resources (X_3)" at the rural level have a significant positive impact on the integration of rural music and cultural tourism industry, and hypotheses 1, 2 and 5 are proven. After setting all the regression items in the first layer as random effects and running the software, only the P values of the intercept term were significant in the 2009, 2013 and 2018 models, and the P values of the intercept term and country music resource richness were significant in the 2023 model. This indicates that there are significant differences in the second layer of the model intercept term in 2009, 2013 and 2018, and there are significant differences in the second layer in 2023. The random effects corresponding to the other variables did not pass the significance test, and the P values were all greater than 0.100, indicating that the coefficient regression corresponding to these variables should be set as a fixed effect rather than a random effect.

Table 4. The regression results of random effect model

	2009				2013			
	Fixed part		Random part		Fixed part		Random part	
Layer 1	<i>Coe</i>	P	<i>VC</i>	P	<i>Coe</i>	P	<i>VC</i>	P
Intercept	-1.38	0.000	0.839	0.000	-1.46	0.000	0.748	0.000
X_1	0.192	0.000	0.017	0.241	0.203	0.000	0.014	0.125
X_2	0.183	0.000	0.029	0.574	0.194	0.000	0.026	0.562
X_5	0.089	0.000	0.038	0.158	0.093	0.000	0.043	0.513
	2018				2023			
	Fixed part		Random part		Fixed part		Random part	
Layer 1	<i>Coe</i>	P	<i>VC</i>	P	<i>Coe</i>	P	<i>VC</i>	P
Intercept	-1.73	0.000	0.642	0.000	-1.92	0.000	0.569	0.000
X_1	0.205	0.000	0.011	0.108	0.217	0.000	0.009	0.009
X_2	0.196	0.000	0.023	0.534	0.199	0.000	0.021	0.521
X_5	0.095	0.000	0.045	0.271	0.102	0.000	0.044	0.209

5.2.3. Full model analysis. The complete model of this paper is divided into three sub-models, which are adding policy guidance and support variables first in Model 1, policy guidance and support and market demand variables in Model 2, and the product term of policy guidance and support and market demand in Model 3. In order to facilitate comparison and analysis, the data of two years, 2009 and 2023, are selected in this section of the study, thus making the results more concise and intuitive. Tables 5 and 6 represent the regression results of Model 1, Model 2, and Model 3 for the years 2009 and 2023, respectively. As can be seen from the results of the three models, in Model 1, the regression coefficients of the policy guidance and support variables in 2009 and 2023 pass the test at the 1% significance level and the coefficients are positive, indicating that the policy guidance and support has a significant positive impact on the integration of rural music and cultural and tourism industries, and Hypothesis 3 of this paper has been proved. In model 2, the coefficient of policy guidance and support and market demand are both positive, and the regression coefficient P value is significant, indicating that the market demand also has a significant positive impact on the integration of rural music and culture and tourism industry, hypothesis 4 of this paper has been proved. In model 3, the non-linear relationship between policy guidance and support and market demand on the integration of rural music and cultural and tourism industry in Sichuan, the coefficient of the product term is significantly positive, and the result shows that the integration of rural music and cultural and tourism industry will show an upward trend under the joint effect of policy guidance and support and market demand.

Table 5. Complete model results of 2009

	Model 1		Model 2		Model 3	
Fixed part	<i>Coe</i>	P	<i>Coe</i>	P	<i>Coe</i>	P
Layer 1- intercept						
Layer 2- intercept	0.724	0.061	-1.738	0.000	0.368	0.317
X_3	0.638	0.000	0.524	0.000	0.483	0.000
X_4			0.248	0.000		
$X_3 \times X_4$					0.698	0.000
X_1	0.346	0.000	0.342	0.000	0.342	0.000
X_2	0.273	0.000	0.274	0.000	0.274	0.000
X_5	0.214	0.000	0.209	0.000	0.209	0.000

Table 6. Complete model results of 2023

	Model 1		Model 2		Model 3	
Fixed part	<i>Coe</i>	P	<i>Coe</i>	P	<i>Coe</i>	P
Layer 1- intercept						
Layer 2- intercept	0.324	0.451	-2.384	0.001	0.017	0.994
X_3	0.749	0.000	0.758	0.000	0.592	0.000
X_4			0.359	0.000		
$X_3 \times X_4$					0.386	0.000
X_1	0.367	0.000	0.364	0.000	0.372	0.000
X_2	0.298	0.000	0.298	0.000	0.298	0.000
X_5	0.259	0.000	0.259	0.000	0.259	0.000

6. Conclusion

In this paper, we constructed a multilevel regression model to study the effects of rural music resource richness, cultural and tourism industry development level and other variables on the integration of rural music and cultural and tourism industry in Sichuan. The results show that the variables of rural music resource richness, cultural and tourism industry development level, policy guidance and support, market demand and talent resources all have significant positive impacts on the integration of rural music and cultural and tourism industry at the 1% significant level. At the same time, the results of the multilevel regression model further show that there is a significant difference between different villages and different regions of Sichuan Province in the integration of rural music and cultural tourism industry, which demonstrates the rationality of the multilevel regression methodology used in this paper to construct the model for the study while arguing for the hypothesis of this paper. It provides an effective empirical reference for promoting the integration of rural music and cultural tourism industry in Sichuan Province and promoting the implementation of the strategy of rural revitalization in Sichuan Province.

About the Author

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