

# Cultural Industry System Based on Interest Rate Risk Analysis of Commercial Banks

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## ABSTRACT

In order to study the cultural industry system, the cultural industry index is established based on the interest rate risk of commercial banks:

- 1) Realise and calculate the generalised autoregressive conditional heteroscedasticity (GARCH) model through the value-at-risk (VaR) risk analysis method.
- 2) Establish the cultural industry evaluation index, and use the entropy method to calculate the index weight.
- 3) The evaluation indicators of cultural industries are analysed and compared.

The research results show that the weights of representative cultural industry added value, cultural and government research and development, and education fiscal expenditure are 0.091, 0.088, and 0.089, respectively, which significantly impact cultural industries' development. The whole scale will be closer to the adjustment of interest rate sensitive assets and liabilities of joint-stock commercial banks, which indicates that joint-stock commercial banks are more flexible in coping with interest rate risks than large state-owned commercial banks. A theoretical basis is provided for the development of cultural industries.

**Keywords:** *commercial bank, Interest rate risk, Culture, GARCH model*

## 1. INTRODUCTION

Revitalizing cultural industry and realizing cultural power was is an important national strategy during the 12th Five-Year Plan period. The development of Chinese culture industry has been casting brilliant achievements in the past ten years.

However, the financial products and services of commercial banks to support cultural industries are seriously inadequate, which has become the main factor restricting the development of cultural enterprises [1]. There is not much research on commercial banks promoting cultural industry, but there is a more detailed study on the financing of cultural industry. Goodell (2019) [2] tested by comparing the national cultures that influence the financial system. Either by shaping the code of conduct and the appropriate logic, or by shaping the environment, the incentives of different actors can be influenced to maximize utility. Adams (2021) [3] compared the values and attitudes of financial professionals with the values of the general population in two data sets. Studies have shown that there is often a more negligible difference between financial professionals and people's "moral" values in countries

where people trust financial institutions more. However, as trust increases, these value differences become more extensive.

However, many scholars' researches on commercial banks promoting the development of cultural industries are mostly qualitative analysis. They propose to construct the cultural support of the integration of banking and government. According the interest rate risk of commercial banks to study the cultural industry system, the GARCH model and cultural industry evaluation indicators are established, and the VaR risk analysis method is used to calculate the index weights. The cultural industry evaluation indicators are analyzed and compared. Provide suggestions for commercial banks to support cultural industries to improve efficiency.

## 2. INTEREST RATE RISK OF COMMERCIAL BANKS AND CULTURAL INDUSTRY

### 2.1. Cultural industry

In 1947, German scholars Adorno and Horkheimer put forward the "cultural industry" concept for the first time. Cultural industries have different understandings around the world as it develops, as shown in Table 1.

Table 1 Different definitions of cultural industries.

Country/organization	Cultural industry definition
United Nations Educational	The cultural industry is the tertiary industry, mainly engaged in production and operation services, cultural activities, and products.
United States of America	In the social environment and cultural and artistic expression, cultural industry-related institutions, departments, enterprises, non-governmental organizations, etc.
Britain	Culture values and exerts people's subjective initiative and improves society's overall wealth and employment opportunities through personal innovation.
Japan	Culture covers various industries and related cultures such as exhibitions, press and publishing, tourism, and sports, highlighting its spiritual connotation.
Chinese Ministry of Culture	The cultural industry is a commercial industry that aims to provide related products and services to the public.

### 2.2. Interest rate risk of commercial banks

For banks, naturally, interest rate risks are important sources of profits and stock value [4]. However, if the interest rate risk is too high, it will make the bank's profits and capital under a significant impact. Interest rate changes will significantly affect the economic value of bank balance sheets and off-balance sheet instruments and cash flows [5]. The factors of the interest rate risks in commercial banks are mainly divided into interest rate marketization and internal factors. Among them, the factors of interest rate marketization include:

- 1)The impact of interest rate marketization on the "three attributes" of banks.
- 2)The initial stage risk of interest rate marketization.
- 3)Interest rate marketization Long-term risks in the middle and late stages.

The internal factors of commercial banks include:

- 1)The income structure is not reasonable.
- 2)Lack of a complete organizational system.

- 3)Lack of effective risk management tools.
- 4)Lack of risk early warning mechanism.

Therefore, commercial banks can improve their security through the interest rate risk management system.

### 2.3. GARCH model establishment

In order to describe the characteristics of financial statements more fully in real life, the GARCH model has gradually become known and widely used [6].

Suppose GARCH model to be:

$$R_t = \Phi R_{t-1} + \varepsilon_t, \varepsilon_t \in (0, \sigma^2) \quad (1)$$

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 \sigma_{t-1}^2 \quad (2)$$

$R_t$  stands for the dependent variable,  $R_{t-1}$  refers to the vector of the explanatory variable,  $\varphi$  refers to the vector of the unknown parameter,  $\alpha_0, \alpha_1$  and  $\beta_1$  refer to the parameters to be estimated, and  $\sigma_t^2$  refers to the conditional variance and  $\varepsilon_t$  refers to the residual term.

According to the regression of the model, each parameter coefficient involved in the GARCH model shows remarkable characteristics, so the GARCH model can be obtained by bringing the coefficients of each parameter into the GARCH model as follows:

$$R_t = 0.152878R_{t-1} + \varepsilon_t, \varepsilon_t \in (0, \sigma^2) \quad (3)$$

$$\sigma_t^2 = 0.000431 + 0.244578\varepsilon_{t-1}^2 + 0.748089\sigma_{t-1}^2 \quad (4)$$

$R_t$  represents the dependent variable,  $R_{t-1}$  refers to the vector of the explanatory variable,  $\varepsilon_t$  refers to the residual term, and  $\sigma_t^2$  refers to conditional variance.

### 2.4. VaR value analysis method

Interest rate risk can be measured by the VaR analysis method, which can directly measure the current risk level or predict the short-term risk level in the future [7]. The VaR analysis method focuses on the interest rate risk of the market as a whole, which avoids some defects of the previous gap model. Therefore, It can be widely used as a very advanced method [8].

The equation for calculating VaR risk is:

$$prob(\Delta p > VaR) = 1 - c \quad (5)$$

Among them,  $\Delta p$  is the actual loss of assets during the holding period,  $VaR$  is the risk value, and  $c$  is the confidence level. Usually, when the confidence level is higher, a higher degree of insurance is needed than before, so the corresponding risk value will become more prominent.

### 2.5. Construction of cultural industry evaluation system

To effectively evaluate the cultural industry, we must first build a complete and adequate cultural industry evaluation index system and then apply

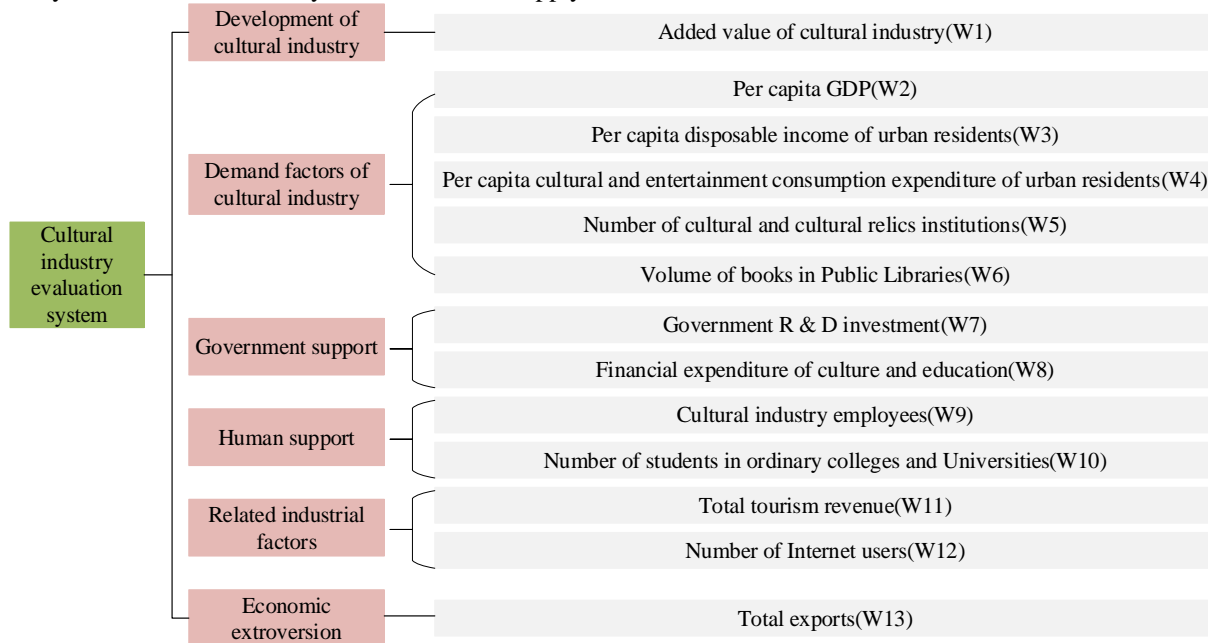


Figure 1 Cultural industry evaluation index system.

The method of determining the index weight is the entropy method. Because the dimensions of the data are different, the calculation will be inconvenient. Therefore, the data should be standardized. The method used is the range standardization method.

When  $X_{ij}$  refers to a positive index:

$$A_{ij} = \frac{X_{ij} - \min(X_j)}{\max(X_j) - \min(X_j)} \tag{6}$$

When  $X_{ij}$  refers to a negative index:

$$A_{ij} = \frac{\max(X_j) - X_{ij}}{\max(X_j) - \min(X_j)} \tag{7}$$

$X_{ij}$  refers to the  $j_{th}$  index value of the  $i_{th}$  county unit,  $A_{ij}$  refers to the standardized index value,  $\min(X_j)$  refers to the  $j_{th}$  index minimum value, and  $\max(X_j)$  refers to the  $j_{th}$  index maximum value.

The selected research interval is 2017-2019. The reason for choosing this period is that the interest rate volatility is more remarkable than before, and it is getting closer and closer to the interest rate risk of commercial banks brought about by interest rate volatility.

corresponding evaluation methods on this basis [9]. When selecting evaluation indicators for cultural industries, we must first ensure that the selected indicators are scientific and reasonable. Figure 1 shows the cultural industry evaluation system established.

### 3. EVALUATION AND ANALYSIS OF CULTURAL INDUSTRY SYSTEM BASED ON INTEREST RATE RISK OF COMMERCIAL BANKS

#### 3.1. Index weight results of cultural industry system

Every parameter coefficient involved in the GARCH model shows remarkable characteristics. Then, the conditional heteroscedasticity test is carried out on the variance equation, and Table 2 shows the final result.

Table 2 Conditional heteroscedasticity test results of variance equation.

F-statistic	0.111761	Prob.F(22148)	0.8951
Obs*R-squared	0.223794	Prob.Chi-Square(2)	0.8949

From the GARCH model, it can be concluded that the fluctuation of income is only related to the level of the previous period, and the reason why the income does not produce too significant average level is that there is no constant term in the equation;  $\alpha_j$  indicates the impact of some external factors on the rate of return. If  $\alpha_j > 0$ , it indicates that the impact of these external factors will cause the fluctuation of the rate of return to become violent to a certain extent. According to the

equation,  $\alpha_1=0.244578$ , which indicates that the impact of these external factors will directly the yield series fluctuation violent.  $\beta_1=0.748089$ , which indicates that the logarithmic income sequence will have long-term memory.

**3.2. Index weight results of cultural industry system**

Table 3 Weight of cultural industry evaluation index.

index	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13
weight	0.091	0.086	0.089	0.085	0.083	0.081	0.088	0.095	0.063	0.066	0.093	0.091	0.061

Table 3 shows that the weight of cultural and educational expenditure (W8) is 0.095, which is the highest; the weight of total tourism revenue (W11) is 0.093; the weight of added value of cultural industry (W1) is 0.091; the weight of netizens (W3) and government R&D funds (W7) Similar, they are 0.089 and 0.088 respectively. All influencing factors are closely related to the development of cultural industries.

**3.3. Impact of added value of cultural industry**

The most common index for judging the development of the cultural industry is the added value of cultural industry (W1).

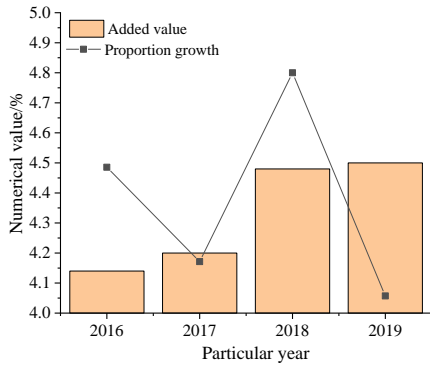


Figure 2 The added value of cultural industry and its proportion growth from 2016 to 2019.

Figure 2 shows that from 2017 onwards, the inflection point of the slowdown in the growth of added value and the decline in the proportion of cultural industry gradually began to appear. According to data released by the National Bureau of Statistics, the added value of the national cultural industry in 2017 was accounting for 4.2% of GDP, only 0.06 percentage points higher than the previous year, the proportion of GDP decreased by 0.11% from the previous year (0.17% in 2016).

Under normal circumstances, when evaluating the development of cultural industry, the influence of each selected index on the final evaluation result is different to a certain extent. In order to make an objective and practical evaluation of the specific conditions of the cultural industry development, it is necessary to distinguish one by one according to the specific importance of each indicator. Therefore, the weight of each selected index is required, and the weight of the cultural industry evaluation index is shown in Table 3.

**3.4. Comparative analysis of commercial banks by stages**

According to the annual report data disclosed by each bank, the one-year interest rate sensitivity gap and sensitivity ratio of Bank of China (A), Industrial and Commercial Bank of China (B), China Construction Bank (C), Bank of Communications (D), China Merchants Bank (E), Industrial Bank (F), China Minsheng Bank (G) and Shanghai Pudong Development Bank (H) are sorted out, as Figure 2 and Figure 3.

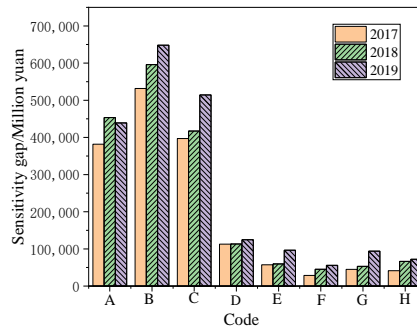


Figure 3 Interest rate sensitivity gap of commercial banks in 2017-2019.

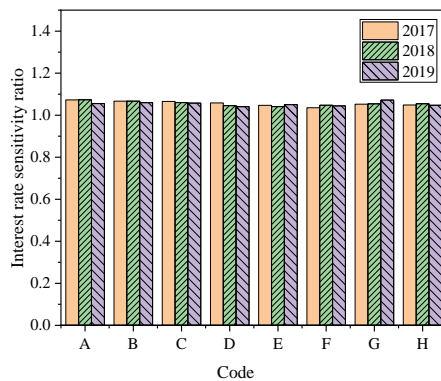


Figure 4 Interest rate sensitivity ratio of commercial banks in 2017-2019.

Figure 3 and Figure 4 show that China's overall interest rate level was rising in 2018. The most suitable operation mode for commercial banks should be to make their gap level positive in 2018 and adjust it out of the negative gap in 2019. This will lead to higher profitability in 2018 and 2019. Through the analysis of financial statements of commercial banks, it can be seen that commercial banks have not adjusted the relative scale of assets and liabilities.

At present, all kinds of commercial banks in China have adopted the strategy of preventing interest rate risk. That is, the adjusted joint-stock commercial bank's interest-rate-sensitive asset-liability ratio is close to Compared with large commercial banks, the interest-rate-risk-response strategies will be more flexible. This is mainly because joint-stock commercial banks have relatively small assets and more mature profitability and development models. However, the development model of state-owned banks is relatively weak and cannot withstand high-interest rate risks. Joint-stock commercial banks have always acted by market rules.

#### 4. CONCLUSION

The development of cultural industry plays an essential role in enhancing the soft power of the regional economy and strengthening the evaluation of cultural industry, which is conducive to promoting the healthy development of cultural industry, thus making the development of cultural industry more targeted. Based on the interest rate risk of commercial banks, the cultural industry system is studied, and the results show that these factors, such as the representative added value of the cultural industry, the financial expenditure of culture and education, and the government's investment in research and development, will have a more noticeable impact on the development of the cultural industry. Adjustment of interest rate sensitive assets and liabilities of joint-stock commercial banks is relatively closer in overall scale, which indicates that the joint-stock commercial banks are more flexible in coping with interest rate risks than large state-owned commercial banks. It provides a theoretical basis for the development of the cultural industry, but there are also some shortcomings. In order to make the evaluation indicators more operable and complete, the selection of indicators is screened, and the indicators that can obtain complete data are selected as far as possible.

#### AUTHORS' CONTRIBUTIONS

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#### ACKNOWLEDGMENTS

The title "ACKNOWLEDGMENTS" should be in all caps and should be placed above the references. The references should be consistent within the article and follow the same style. List all the references with full details.

#### REFERENCES

- [1] P. Illiashenko, L. Laidroo. National culture and bank risk-taking: Contradictory case of individualism. *Research in International Business and Finance*, 2020, 51: 101069. DOI: <https://doi.org/10.1016/j.ribaf.2019.101069>.
- [2] J.W. Goodell. Comparing normative institutionalism with intended rationality in cultural-finance research. *International Review of Financial Analysis*, 2019, 62: 124-134. DOI: <https://doi.org/10.1016/j.irfa.2018.11.018>.
- [3] R. B. Adams. Trust in finance: Values matter. *Journal of the Japanese and International Economies*, 2021, 60: 101123. DOI: <https://doi.org/10.1016/j.jjie.2021.101123>.
- [4] R. F. D. D. Chaudron. Bank's interest rate risk and profitability in a prolonged environment of low interest rates. *Journal of Banking & Finance*, 2018, 89: 94-104. DOI: <https://doi.org/10.1016/j.jbankfin.2018.01.007>.
- [5] X. Zhang, J. Li. Credit and market risks measurement in carbon financing for Chinese banks. *Energy Economics*, 2018, 76: 549-557. DOI: <https://doi.org/10.1016/j.eneco.2018.10.036>.
- [6] Z.-Y. Guo. Risk management of Bitcoin futures with GARCH models. *Finance Research Letters*, 2021: 102197. DOI: <https://doi.org/10.1016/j.frl.2021.102197>.
- [7] S. Banihashemi, S. Navidi. Portfolio performance evaluation in Mean-CVaR framework: A comparison with non-parametric methods value at risk in Mean-VaR analysis. *Operations Research Perspectives*, 2017, 4: 21-28. DOI: <https://doi.org/10.1016/j.orp.2017.02.001>.
- [8] S. D. Hosseini, M. Verma. A Value-at-Risk (VAR) approach to routing rail hazmat shipments. *Transportation Research Part D: Transport and Environment*, 2017, 54: 191-211. DOI: <https://doi.org/10.1016/j.trd.2017.05.007>.
- [9] Q. Wei, L. Qingna. Construction of cultural industry development factor model based on factor analysis, artificial intelligence and big data. *Microprocessors and Microsystems*, 2021, 82: 103880. DOI: <https://doi.org/10.1016/j.micpro.2021.103880>.