Effects of Provincial Economic Development Levels on Individualism and Collectivism in China Across Different Temporal and Spatial Scales

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Abstract

This study analyzes the impact of economic development levels across Chinese provinces on individualism and collectivism at different temporal and spatial scales, based on panel data of economic indicators and Weibo word frequency data for individualism and collectivism from 2010 to 2020. Through principal component analysis, the economic indicators were dimensionally reduced to extract three main components: economic scale, living standards, and price levels. We constructed a principal component model, a principal component-time interaction model, and a principal component-time-region interaction model. The results show that both collectivism and individualism are significantly affected by economic scale and price levels, with price levels having a smaller impact. Time moderates the effect of economic scale on both collectivism and individualism, and the positive effect of economic scale may gradually weaken over time. Region only affects collectivism; the effect of economic scale on collectivism in the eastern region fluctuates with changes in years. The findings indicate that time moderates the impact of economic development levels across Chinese provinces on individualism, and both time and region significantly moderate the relationship between economic development levels and collectivism across Chinese provinces, further suggesting that research on individualism and collectivism should consider larger temporal and spatial scales.

Full Text

Preamble

The Impact of the Degree of Economic Development on Individualism and Collectivism in Chinese Provinces at Different Temporal and Spatial Scales

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Abstract

Based on panel data of economic indicators and microblog word frequencies of individualism and collectivism across Chinese provinces from 2010 to 2020, this study examines the effects of provincial economic development on individualism and collectivism at different temporal and spatial scales. Principal component analysis was employed to reduce the dimensionality of economic indicators, extracting three main components: economic scale, living standard, and price level. We constructed principal component models, principal component-time interaction models, and principal component-time-region interaction models. The results demonstrate that both collectivism and individualism are significantly influenced by economic scale and price level, with price level exhibiting a smaller effect. Time moderates the impact of economic scale on both collectivism and individualism, with the positive effect of economic scale potentially diminishing over time. Region only affects collectivism, as the influence of economic scale on collectivism in eastern regions fluctuates across years. These findings suggest that time moderates the relationship between economic development and individualism across Chinese provinces, while both time and region significantly moderate the relationship between economic development and collectivism, underscoring the need to consider broader temporal and spatial scales in research on individualism and collectivism.

Keywords: individualism; collectivism; degree of economic development

Introduction

In cultural psychology, Hofstede and colleagues identified six fundamental value dimensions: individualism-collectivism, power distance, uncertainty avoidance, masculinity-femininity, long-term versus short-term orientation, and indulgence versus restraint. Individualism represents a loosely structured society that distinguishes between in-groups and out-groups, where members prioritize their own thoughts and pursue personal goals. Collectivism, conversely, describes a strong, cohesive in-group where members emphasize the opinions of significant others and social norms, focusing on relationships and collective goals.

Multiple theories have been proposed to explain the determinants of individualism and collectivism. Modernization Theory posits that individualism emerges as a consequence of modernization. Cross-temporal analyses of the United States and Japan have documented rising individualism over recent decades, supporting this theory. Research defining five birth cohorts (1900-1919, 1920-1939, 1940-1959, 1960-1979, 1980-1999) similarly found society becoming more indi-

vidualistic. A study analyzing data from 1988-2023 revealed that Asian countries with improved sociopolitical conditions exhibited declining collectivism, though these improvements did not predict increased individualism. Research on the United States found that individualism expands during prosperous periods and contracts during recessions, as economic downturns generate uncertainty that moderates individualism and promotes interdependence. Beugelsdijk and Welzel proposed that cultural differences can be explained by economic development, generational effects, and unique geographical and political-historical factors, with economic development and generational change accounting for approximately half of cultural variation. As economic development advances, people experience greater existential security and more opportunities, leading to increases in both individualism and happiness. The remaining cultural differences may relate to each nation's unique geography and history, which prove relatively persistent over time.

Climate-economic theory suggests that the interaction between climate suitability and affluence explains collectivism differences, with collectivism weakest in temperate provinces regardless of income (e.g., Guangdong), stronger in high-income provinces with harsh climates (e.g., Hunan), and strongest in low-income provinces with harsh climates (e.g., Heilongjiang). Rice theory posits that regions cultivating rice exhibit stronger collectivism than wheat-growing regions. Cultural dynamics theory argues that southern Chinese demonstrate stronger relational collectivism, showing greater tolerance and generosity toward friends with more pronounced psychological boundaries between inner and outer circles compared to northerners. This relates to cultural influence, as the continuous southward migration of traditional Chinese cultural centers has exposed southern regions to more central plains traditional culture, thereby strengthening local collectivist tendencies. Zhang and colleagues proposed that ecological and humanistic environments may also constitute important variables affecting cultural orientation. Research on ethnic minorities found that Oroqen and Han students in Oroqen areas tended toward individualism, while Dong and Han students in Dong areas leaned toward collectivism. Additionally, county-level research identified bloodline genealogy development as a key variable explaining Chinese cultural regions.

In summary, current research on the distribution of individualism-collectivism in China yields inconsistent results. Modernization theory suggests that greater economic development strengthens individualism; rice theory argues that rice-growing regions exhibit stronger collectivism; and climate-economic theory proposes that regions with favorable climates show stronger individualism, while in regions with harsh climates, weaker economies correlate with stronger collectivism. As one of Hofstede's cultural dimensions, individualism and collectivism hold significant importance not only in psychology but also in economics, political science, and other fields.

Research on these dimensions reveals that cultural differences can be explained by temporal changes, economic factors, and unique geographical and

political-historical factors, with economic and temporal factors accounting for approximately half of cultural dimension variation, and unique geographical and political-historical factors comprising the remainder. Over time, studies have found collectivism declining and individualism rising in the United States and Japan, while research on Asian countries shows that improved economic conditions correlate with declining collectivism but do not predict increased individualism. Thus, although individualism and collectivism represent opposite ends of the same cultural dimension, their changes may not be perfectly synchronized across countries.

As a rising power influenced by Confucian and other traditional cultural ideologies while experiencing rapid economic development over the past decade, China's evolution of individualism and collectivism may be particularly complex. This study therefore simultaneously considers economic, temporal, and spatial factors, employing principal component analysis and panel data analysis to examine how economic development affects individualism and collectivism across Chinese provinces at different temporal and spatial scales. The research framework is illustrated in Figure 1 [Figure 1: see original paper].

Methodology

2.1 Data Sources

The analytical dataset comprises macroeconomic indicators for 31 provinces from 2010-2020, including: per capita GDP, per capita disposable income of all residents, per capita consumption expenditure of all residents, per capita disposable income of rural residents, regional GDP, regional GDP index, local fiscal general public service expenditure, local fiscal general budget expenditure, number of participants in urban-rural social pension insurance, urban population, average wages of urban unit employees, urban unit employment, per capita disposable income of urban residents, employment in urban private enterprises and self-employment, consumer price index, year-end permanent population, total retail sales of consumer goods, and value-added of tertiary industry. Provincial region classifications (eastern/western/central) and microblog word frequencies for individualism and collectivism were also included. Missing values were imputed using mean substitution.

2.2 Principal Component Analysis

Principal Component Analysis (PCA) is a widely used dimensionality reduction technique that extracts principal features from high-dimensional data while reducing dimensions. By linearly combining original variables into a new set of orthogonal principal components, PCA retains primary information while eliminating redundancy. The core principle involves projecting data onto directions of maximum variance to capture as much variability as possible. This method is extensively applied in dimensionality reduction, feature extraction, pattern recognition, and visualization, helping simplify data structures and improve sub-

sequent analytical efficiency. Given the large number of economic indicators, PCA was first applied to these 18 economic variables. All variables were standardized (mean = 0, standard deviation = 1) prior to analysis to eliminate scale differences.

2.3 Model Construction

Based on the PCA results, we constructed three model types: (1) Principal component models examining direct effects of components on individualism/collectivism; (2) Principal component-time interaction models introducing interactions between components and time to test whether time moderates component effects; and (3) Principal component-time-region interaction models further incorporating interactions among time, region, and components to explore how component effects vary across temporal and spatial dimensions.

Results

3.1 Principal Component Analysis

As shown in Figure 2 [Figure 2: see original paper], the cumulative variance contribution rate of the first three principal components reached 89.87%, approaching the conventional 90% threshold and effectively representing the data's primary information. Adding a fourth component increased variance contribution by only 3.17%, offering limited benefit while potentially increasing model complexity and interpretation difficulty. Therefore, retaining three components proved more reasonable, and subsequent analyses focused on these three components.

PCA results (Table 2 , Table 3) revealed that PC1 primarily correlates with regional GDP, local fiscal expenditure, tertiary industry value-added, and urban employment, indicating this component mainly measures regional economic activity scale, which we named "economic scale." PC2 correlates with resident income, consumption expenditure, and urban unit average wages, reflecting quality of life and economic welfare, which we named "living standard." PC3 shows high loadings on consumer price index and regional GDP index, representing price levels and regional economic dynamics, which we named "price level." The cumulative variance contribution rate of these three components reached 89.87%, demonstrating they effectively summarize most original variable information. PC1 contributed 56.85% of variance, the largest proportion, indicating economic scale variables play a crucial role. PC2 and PC3 contributed 26.67% and 6.35% of variance respectively, capturing information related to living standards and price levels. Figure 3 [Figure 3: see original paper] illustrates temporal trends for PCA1 (economic scale), PCA2 (living standard), and PCA3 (price level).

3.2 Direct Effects of Economic Development on Individualism

Principal component model results (Table 3) showed that PCA1 (economic scale) significantly negatively predicted individualism (β = -4.83 $\times$ 10^{-4}, p $<$ 0.001), suggesting that increased economic scale may inhibit individualism development. PCA2 (living standard) also significantly negatively predicted individualism (β = -5.79 $\times$ 10^{-4}, p $<$ 0.001), indicating that improved living standards may correlate with reduced individualism. PCA3 (price level) significantly positively affected individualism ($\beta = 4.69 \times 10^{-4}$, p < 0.001), suggesting that rising price levels may promote individualism. Model fit indices showed $R^2 = 0.5083$, indicating independent variables explain 50.83% of dependent variable variance. Adjusted $R^2 = 0.4555$ shows the model explains 45.55% of variance after accounting for complexity, with F = 105.79, p $<$ 0.001, demonstrating overall model significance.

The principal component model indicates that PCA1 (economic scale) and PCA2 (living standard) significantly negatively affect individualism, suggesting that higher economic scale and living standards may not favor individualism development. This may relate to how greater economic or quality-of-life demands tend to strengthen collective values. The significant positive effect of PCA3 (price level) on individualism may reflect how rising prices stimulate stronger personal autonomy and individual consciousness (e.g., independent coping behaviors in response to economic pressure). The model demonstrates high fit, adequately explaining variance in the data and providing a foundation for subsequent introduction of temporal and regional interaction effects.

3.3 Time Moderation of Economic Development Effects on Individualism

Principal component-time interaction model results (Table 4) revealed that PCA1 (economic scale) had a significant positive effect on individualism ($\beta = 3.13 \times 10^{-3}$, p < 0.001), as did PCA3 (price level) ($\beta = 2.71 \times 10^{-3}$, p < 0.001). The main effect of PCA2 (living standard) was not significant (p = 0.128). Year main effects showed that individualism significantly declined from 2012 onward (e.g., 2017: β = -1.52 $\times$ 10^{-2}, p $<$ 0.001; 2020: β = -1.97 $\times$ 10^{-2}, p $<$ 0.001), indicating an overall downward trend over time.

PCA1-time interaction effects were significant across multiple years (2013-2020, e.g., 2013: β = -7.87 $\times$ 10^{-4}, p = 0.006; 2017: β = -1.45 $\times$ 10^{-3}, p $<$ 0.001; 2020: β = -1.60 $\times$ 10^{-3}, p $<$ 0.001), suggesting the effect of economic scale on individualism gradually weakened over time (Figure 4 [Figure 4: see original paper]). PCA3-time interaction effects were significant in several years (2012-2013, 2019-2020, e.g., 2019: β = -4.53 $\times$ 10^{-3}, p $<$ 0.001; 2020: β = -2.11 $\times$ 10^{-3}, p = 0.041), indicating the positive effect of price level significantly diminished over time (Figure 5 [Figure 5: see original paper]). PCA2-time interaction effects were not significant, suggesting living standard's effect on individualism showed no temporal dynamics (Figure 6 [Figure 6: see original paper]). Results

also showed that overall individualism levels declined over time, while component effects (particularly economic scale and price level) exhibited significant temporal changes. The positive effect of economic scale on individualism gradually weakened, and price level's positive effect significantly diminished in later periods. Wald test results showed $^{2}(40) = 72.62$, $p = 0.001$, confirming that adding year interaction terms significantly improved model fit (Table 5).

3.4 Joint Moderation of Time and Region on Economic Development Effects on Individualism

After adding three-way time-region interactions, model fit improved (R^2 increased from 0.613 to 0.741), but all main and interaction effects became non-significant. This likely occurred because the regional dimension introduced excessive noise. Therefore, analyses primarily focused on principal component-time interaction models to avoid complexity obscuring main trends and effects.

3.5 Direct Effects of Economic Development on Collectivism

Principal component model results (Table 6) showed that PCA1 (economic scale) and PCA2 (living standard) significantly negatively predicted collectivism, indicating that growth in economic scale and living standard may correlate with reduced collectivism, reflecting a potential weakening effect of economic indicators on collectivism. PCA3 (price level) approached significance ($p = 0.0679$), suggesting a weak but potentially meaningful effect. Model fit indices showed $R^2 = 0.4065$, indicating independent variables explain 40.65% of dependent variable variance. Adjusted $R^2 = 0.3428$ reflects explanatory power after accounting for model complexity, with $F = 70.102$, $p < 0.001$, demonstrating overall model significance and providing a foundation for subsequent model extensions.

3.6 Time Moderation of Economic Development Effects on Collectivism

Principal component-time interaction model results (Table 7) indicated that PCA1 (economic scale) had a significant positive main effect ($\beta = 6.33 \times 10^{-4}$, $p < 0.001$), showing economic scale positively affects collectivism. PCA2 (living standard) and PCA3 (price level) showed marginally significant and significant main effects respectively ($\beta = 5.86 \times 10^{-4}$, $p = 0.060$; $\beta = 3.98 \times 10^{-4}$, $p = 0.025$). Year main effects revealed significant negative impacts on collectivism from 2014 to 2020 (e.g., 2014: $\beta = -1.92 \times 10^{-3}$, $p < 0.001$; 2020: $\beta = -4.42 \times 10^{-3}$, $p < 0.001$). PCA1-time interaction effects were significant across multiple years (2013, 2015-2020, e.g., 2017: $\beta = -3.30 \times 10^{-4}$, $p < 0.001$), indicating time moderates economic scale's effect on collectivism (Figure 7 [Figure 7: see original paper]). PCA3-time interaction was significant in 2019 ($\beta = -6.66 \times 10^{-4}$, $p = 0.037$), showing price level effects vary temporally (Figure 9 [Figure 9: see original paper]). Wald test results showed $^{2} = 132.17$, $p < 0.001$, confirming that adding year interaction terms significantly improved model fit (Table 8),

demonstrating that economic scale and price level effects on collectivism adjust significantly over time.

3.7 Joint Moderation of Time and Region on Economic Development Effects on Collectivism

Principal component-time-region interaction model results (Table 9) showed PCA1 (economic scale) had a significant main effect (β = 2.12 × 10^{-3}, p = 0.043), indicating positive effects on collectivism. From 2016 onward, year variables showed gradually significant negative effects on collectivism (e.g., 2016: β = -1.11 × 10^{-2}, p = 0.047; 2020: β = -1.39 × 10^{-2}, p = 0.020), indicating overall collectivism decline over time. PCA1-time interaction effects were significant in multiple years (e.g., 2017: β = -2.04 × 10^{-3}, p = 0.039; 2019: β = -2.08 × 10^{-3}, p = 0.049), showing time moderates economic scale's effect. Neither PCA2 nor PCA3 showed significant time interaction effects. Significant three-way interactions between PCA1 (economic scale), eastern region, and year emerged, particularly from 2017-2019 (e.g., 2018: β = 2.01 × 10^{-3}, p = 0.048), indicating eastern region economic scale effects on collectivism vary by year. No significant effects appeared for PCA2 or PCA3 interactions across regions and years. These results suggest both time and region moderate component effects on collectivism, particularly regarding economic scale's varying influence across years and regions. Model fit comparison (Table 10) shows that while adding regional interactions increased R^2, adjusted R^2 slightly decreased, indicating that although overall model fit improved, regional interaction complexity may introduce extraneous variance, limiting net explanatory power gains.

Discussion

Both individualism (Figure 10 [Figure 10: see original paper]) and collectivism (Figure 11 [Figure 11: see original paper]) across Chinese provinces exhibited dynamic temporal changes between 2010 and 2020. The findings demonstrate that both dimensions are significantly affected by economic scale and price level, though these effects significantly weaken over time. Living standard effects on both individualism and collectivism remained relatively stable without clear temporal trends. These results indicate that as time progresses, the impact of China's socioeconomic development on cultural values (individualism and collectivism) is dynamically adjusting, potentially related to regional economic equalization, living cost changes, and cultural integration. Huang and colleagues proposed that psychological changes in individualism and collectivism are inherently complex, and that individualism's rise and collectivism's decline are not inevitable linear processes. Building on interactionist and cultural convergence perspectives, a self-construal model comprising five core dimensions—individuality, relationality, collectivity, autonomy, and equality—has been developed, transcending the traditional independent/interdependent dual-dimensional model to more comprehensively explain Chinese self-construal characteristics.

Integrating policy analysis, recent national strategies for coordinated regional development (e.g., the 2014 Beijing-Tianjin-Hebei Coordinated Development Plan Outline, 2018 Guangdong-Hong Kong-Macao Greater Bay Area Development Plan Outline, and 2019 Yangtze River Delta Integration Development Plan Outline) have gradually narrowed regional economic disparities. As regional economies equalize, cross-regional competition decreases and collective cooperation demands diminish. Simultaneously, as economic resources become more widely distributed to individuals, individualism's prominent role may weaken. Furthermore, according to cultural convergence effects, urbanization and internet popularization have gradually eliminated traditional cultural regional differences. For instance, younger generations receive increasingly globalized cultural education, weakening local cultural identity. The opposition between collectivism and individualism becomes less pronounced, with individuals' social roles becoming more diverse and dynamic, diminishing the absolute importance of either collective or individual values. These findings partially support the notion that individualism and collectivism are not binary opposites. As sociologist Pan Guangdan, grounded in Confucian thought, proposed, the "compromised family system" integrates extreme individualism and extreme collectivism, referencing individualist ideas while not completely abandoning traditional family system advantages.

Limitations

This study has several limitations. First, sample representativeness: Weibo user demographics from 2010-2020 showed significant youthification and higher education levels, with geographic concentration in economically developed regions (e.g., Pearl River Delta, Yangtze River Delta, Beijing-Shanghai-Guangzhou). The growth of younger users and stable high-education background of Weibo's primary user base reflect the platform's sustained appeal to socially influential youth groups, potentially influencing results. For example, the youthification and high-education bias may lead Weibo expressions of collectivism and individualism to reflect particular sociocultural trends. Second, as a public platform, Weibo users tend to express more personalized or emotional content rather than complete behavioral characteristics of collectivism or individualism. Therefore, Weibo word frequency analysis may better reflect language usage and expression styles than cultural values per se. For instance, excessive self-expression on Weibo may not necessarily represent "individualist" core values but could result from social pressure or identity anxiety. Third, recent Chinese policies have strengthened constraints on online speech and public discussion, potentially suppressing language patterns expressing collective or individual tendencies, leading to overall lower word frequency results. Finally, word frequency analysis represents only a superficial text analysis method that cannot directly capture deeper cultural and social-psychological factors. For example, certain individualist terms (e.g., "I," "freedom") may appear frequently due to popular culture dissemination without necessarily indicating value shifts. Future research should incorporate additional data sources (e.g., questionnaire surveys

or sociological statistics) for comparison and validation.

Conclusions

(1) Both collectivism and individualism are significantly influenced by economic scale and price level, with time moderating economic scale's effects, suggesting its positive impact may gradually diminish over time.

(2) Region only affects collectivism, as eastern region economic scale effects on collectivism fluctuate across years, possibly reflecting earlier and faster economic development in the east creating more complex temporal patterns of cultural value influence.

(3) Living standard effects on individualism and collectivism remain relatively stable without clear temporal trends.

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Note: Figure translations are in progress. See original paper for figures.