The Impact Mechanism of Income Inequality on Mental Health: The Mediating Role of Moral Centrality

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Abstract

In recent years, researchers have largely converged in recognizing the impact of income distribution inequality on mental health; however, the underlying psychological mechanisms remain poorly understood. As a macro-environment in which individuals are situated, the economic environment shapes people' s distinct values and endows individuals with varying levels of motivational orientations. Previous research has demonstrated that when individuals can effectively coordinate agentic motivations representing "self-interest"and communal motivations representing "altruism," they tend to exhibit relatively high levels of moral centrality. Moral centrality reflects the equilibrium state of the internal motivational system; it can reduce conflicts between intrinsic motivations, promote mutual support and reinforcement between these two motivational types, assist individuals in efficiently achieving personal value, enhance well-being through the search for life meaning, and consequently mitigate the risk of mental health problems. Therefore, moral centrality may serve as a potential mediator in the relationship between income distribution inequality and mental health. This study seeks to investigate how income distribution inequality influences public mental health levels through its effect on moral centrality, thereby enriching the theoretical foundation of the mental health domain while simultaneously providing a theoretical basis for mental health interventions and facilitating the development of targeted strategies to enhance public psychological well-being. By leveraging social media big data and natural language processing techniques, we utilize posts published by regional Weibo users, extract word frequency features representing group moral centrality and group mental health levels through a psychological semantic lexicon, and employ panel data analysis to examine how income distribution inequality affects regional groups' negative emotions and suicide risk via moral centrality. The research findings confirm that moral centrality mediates the effect of regional income distribution inequality on group

negative emotions/suicide risk; regions with higher degrees of income distribution inequality tend to be associated with lower levels of group moral centrality, consequently leading to increased negative emotions/suicide risk among the regional population.

Full Text

Research on the Mechanism of the Impact of Income Distribution Inequality on Mental Health: The Mediating Role of Moral Centrality

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Abstract

In recent years, researchers have increasingly recognized the impact of income distribution inequality on mental health. However, the underlying psychological mechanisms remain unclear. As the macro-environment in which individuals live, economic conditions shape people' s values and motivational orientations. Previous research indicates that individuals who can effectively coordinate agency motives (representing self-interest) and communion motives (representing altruism) tend to exhibit relatively high levels of moral centrality. Moral centrality reflects the balance of an individual' s internal motivational system, reducing conflict between competing motives and enabling them to support and energize each other. This balance helps individuals efficiently realize personal value, enhance well-being through meaning-making, and reduce the risk of mental health problems. Therefore, moral centrality may serve as a potential mediator in the relationship between income distribution inequality and mental health. This study investigates how income distribution inequality affects public mental health through its impact on moral centrality, aiming to enrich theoretical foundations in mental health research and provide theoretical support for targeted interventions to improve psychological well-being. Using social media big data and natural language processing techniques, we extracted word-frequency features representing group-level moral centrality and mental health from regional Weibo user posts. Panel data analysis was employed to examine how income distribution inequality affects regional groups' negative emotions and suicide risk through moral centrality. The results confirm that moral centrality mediates the effect of regional income distribution inequality on group negative emotions and suicide risk. Regions with higher income inequality tend to have lower group moral centrality, which in turn leads to increased negative emotions and suicide risk among the population.

Keywords: Moral Centrality, Mental Health, Income Distribution Inequality, Social Media Big Data, Psycholinguistic Lexicons

Mental health is a crucial factor in maintaining overall individual well-being. It represents not merely the absence of mental disorders but a more positive, comprehensive, and optimal psychological state that enables individuals to realize their potential, cope with normal life stresses, work productively, and contribute to their communities (World Health Organization, 2022). Despite its importance for individual and societal development, the current state of mental health worldwide and domestically remains concerning. A recent global study indicates that one in two people will experience a mental health disorder during their lifetime (McGrath et al., 2023). Research on mental health development among Chinese nationals shows that mental health problems remain prevalent among adults, with depression and anxiety being the most prominent issues (Fu et al., 2023).

Given the prevalence and severity of mental health problems, they have become a central focus in public health research, with efforts to quantify key influencing factors (Caplan & Jones, 1975; Kendler et al., 1995, 1999, 2002; Oliver & Paull, 1995). Among these factors, income distribution inequality has received considerable attention, though findings have been mixed. First, some researchers have found that regions with higher income inequality exhibit higher incidence rates of mental health problems such as depression and psychiatric disorders (Bechtel et al., 2012; Burns et al., 2014; Burns & Esterhuizen, 2008; Elgar et al., 2015; Group, 2000; Johnson et al., 2015; Kirkbride et al., 2014; Layte, 2012; Messias et al., 2011; Steptoe et al., 2007). Second, another group of researchers has found this relationship only in specific subpopulations, particularly among women (Pabayo et al., 2014), low-income groups (Ahern & Galea, 2006), countries with high Human Development Index (Cifuentes et al., 2008), and high-income regions (Weich et al., 2001). Third, some studies have found no significant relationship between income distribution equality and mental health problem incidence (Gresenz et al., 2001; Henderson et al., 2004; Rai et al., 2013; Sturm & Gresenz, 2002).

The first set of findings is supported by the Income Inequality Hypothesis, which suggests that beyond a certain level of per capita GDP, the association between absolute income and health outcomes weakens, while income distribution within society becomes a more important factor affecting physical and mental health (Wilkinson, 2002). Some researchers argue that the negative health effects of income inequality can be analyzed through the lens of social comparison theory. According to Festinger (1954), individuals tend to compare their social status and resources with others. In environments with high income inequality, individuals may perceive substantial status differences, leading to negative emotions such as envy, dissatisfaction, or powerlessness. Layte (2012) empirically demonstrated that in societies with greater income inequality, status differences become more salient, and individuals' perception of their social status hierarchy, combined with feelings of relative deprivation, intensifies status anxiety, subsequently generating shame and distrust.

The second set of findings, regarding group differences in how income inequality

affects mental health, is understandable and not contradictory to the aforementioned conclusions. Specifically, groups at higher socioeconomic levels are typically the primary beneficiaries of resource distribution. These groups, due to their superior status and economic advantages, tend to identify with and support existing social and economic structures, including income distribution systems (Taylor et al., 1997). Moreover, their greater resource access provides more avenues for stress mitigation and mental health problem prevention. In contrast, lower socioeconomic status groups face disadvantages in resource distribution, and the scarcity of resources and opportunities makes them more vulnerable to negative emotions and mental health problems (He & Pan, 2011).

The third set of findings, showing no significant association between income inequality and mental health, may relate to both geographic region and subjective perceptions of social structural flexibility. Regarding geographic region, national-level measures of income inequality may fail to capture individual-level income differences precisely, resulting in coarse data granularity. Additionally, greater physical distance leads to cognitive abstraction, reducing perceived importance and sensitivity (Liberman et al., 2007). Consequently, perceptions of inequality at larger geographic scales (e.g., national level) may be weaker than at provincial or district levels, making it difficult to detect precise relationships between income distribution and mental health at the national level. Regarding perceptions of social structural flexibility, when people perceive social structures as relatively open and elastic (regardless of reality), they believe that individuals in lower social positions can achieve upward mobility through effort, reducing feelings of helplessness and disappointment about current social structures and mitigating the negative mental health effects of income inequality (Alesina et al., 2004). Conversely, in a subjectively perceived rigid, low-mobility social structure, individuals believe that changing their social status through personal effort is difficult, especially across socioeconomic classes, leading to reduced social mobility, unequal opportunities, and increased wealth inheritance. This contradiction between expectations and reality regarding social mobility may contribute to mental health problems and decreased well-being (Alesina et al., 2004).

Although the relationship between economic development balance and mental health represents an important topic in social science research, current discussions have not sufficiently addressed the specific psychological mechanisms through which income distribution inequality affects individual mental health. While individual-level factors such as biology and family environment can be targeted with specific psychological interventions, macro-level economic factors cannot be directly manipulated by individuals, making it crucial to understand the psychological pathways through which they influence mental health.

According to Bronfenbrenner' s (2000) Ecological Systems Theory, individuals in different environments may exhibit differences in values and motivational orientations. Schwartz (1992), based on surveys of thousands of people across different countries and cultures, proposed that human values can be categorized

into ten basic types, which can be further grouped into four dimensions based on motivational goals: Self-transcendence, Self-enhancement, Conservation, and Openness to Change. Frimer et al. (2011) suggested that self-enhancement can be viewed as an agency motive because it focuses on self-interest, emphasizing independence and advancement through power and control, involving themes of achievement and competition. In contrast, self-transcendence can be seen as a communion motive because it focuses on promoting others' interests, emphasizing caring for others and contributing to society, involving benevolence, attachment, and empathy. Frimer and Walker (2009) proposed that when individuals can coordinate agency motives (representing the self) and communion motives (representing others' interests), they achieve moral centrality. Individuals with moral centrality perceive that when practicing moral behaviors representing others' interests, their own interests are also realized, representing a high integration of agency and communion.

Previous research indicates that in environments with high income inequality, individuals experience greater status anxiety and reduced social capital, leading to decreased interpersonal trust (Layte, 2012). Individuals may become more focused on enhancing and maintaining personal status, strengthening agency motives while weakening communion motives due to reduced trust and social cohesion. This ultimately leads to decreased moral centrality. Regarding status anxiety, individuals in unequal environments become more sensitive to hierarchy and status cues (Kraus et al., 2017) and experience greater stress when perceiving inequality (Mooney, 2010), leading them to pursue higher status more intensely (Paskov et al., 2013). Similarly, Walasek and Brown (2019) found that as economic distance increases, socioeconomic status (SES) plays a more important role in individuals' self-worth cognition. For example, people show greater interest in status-signaling goods and spend more money on lotteries (Bol et al., 2014; Walasek & Brown, 2015). Furthermore, immersive experiences in unequal environments shape individuals' perceptions of social interactions. Specifically, when immersed in such environments, perceived economic inequality intensifies beliefs that the social environment is highly individualistic and competitive, fostering a social atmosphere with extreme demands on personal ability and achievement, leading to more competitive behavior (Sánchez-Rodríguez et al., 2019; Sommet et al., 2019). In this context, individual behavior tends toward competition rather than cooperation, emphasizing personal interest maximization. Social capital describes factors such as social networks, interpersonal relationships, and trust, norms, and values in social interactions that promote cooperation among members (Coleman, 1994; Putnam et al., 1993). Layte (2012) argued that higher income inequality leads to greater status differences between individuals/groups, lower civic engagement and social integration, and reduced interpersonal trust, thereby weakening collective action and social cohesion. Consequently, in environments lacking trust and social cohesion, individuals may become more self-protective, focusing on personal interest pursuit while neglecting or rejecting consideration for others and public welfare.

Previous research has found that the balance between agency and communion

motives significantly affects mental health. Frimer and Walker (2009) proposed that developing moral centrality reduces imbalance in individuals' internal motivational systems, with agency "breathing life" into communion and communion providing greater purpose to agency. The balance and coordination between these motives enable mutual support and energization, allowing individuals to realize their value with minimal effort, achieve positive feelings through meaning-making, enhance well-being, and reduce susceptibility to negative emotions such as anxiety and depression. Empirical results support these hypotheses, showing that moral centrality expressed in self-narratives positively correlates with well-being and self-esteem, and negatively correlates with negative emotions, anxiety, and depression, even after controlling for altruism (Hoyda, 2023). Helgeson and Fritz (2000) argued that when agency and communion motives become imbalanced, unmitigated agency and unmitigated communion emerge. Unmitigated agency is characterized by egocentrism (arrogance and self-centeredness) and negative views of others (cynicism and hostility), while unmitigated communion represents preoccupation with others' thoughts and behaviors, leading to self-neglect (Helgeson & Fritz, 2000). Both unmitigated agency and unmitigated communion have been found to negatively affect mental health, positively correlating with anxiety and depression (Bruch, 2002; Helgeson & Fritz, 1998).

In summary, moral centrality may mediate the effect of income distribution inequality on mental health. Groups in regions with greater income inequality may focus more on personal status enhancement and maintenance, leading to decreased moral centrality and subsequently affecting mental health. This study aims to explore and verify these psychological pathways to deepen theoretical understanding of how economic factors influence mental health and to develop more comprehensive, specific, and effective mental health intervention strategies, providing scientific evidence for public health policy and mental health services to mitigate negative impacts of macro-environmental factors.

Negative emotions represent a core issue in mental health research, typically referring to unpleasant emotions detrimental to psychological well-being, such as sadness, anxiety, anger, fear, shame, and frustration. Increased, persistent, or poorly managed negative emotions may not only manifest as symptoms of mental health problems but also contribute to their development. Furthermore, as mental health problems intensify, suicide risk increases accordingly. Negative emotions serve as a warning signal for mental health disorders, while suicide represents an extreme manifestation of severe mental health consequences. Both play important roles in mental health research. Based on this, our study examines 31 provincial-level administrative regions in mainland China as research subjects, using social media data and natural language processing techniques to verify through panel data analysis how income distribution inequality affects regional groups' negative emotions and suicide risk, and the mediating role of moral centrality.

Building on previous research, we hypothesize that moral centrality mediates the relationship between income distribution inequality and individual mental

health. Specific hypotheses are as follows:

H1: Moral centrality positively mediates the prediction of income distribution inequality on individual negative emotions. That is, regions with higher income inequality exhibit lower group moral centrality and more negative emotions.

H2: Moral centrality positively mediates the prediction of income distribution inequality on individual suicide risk. That is, regions with higher income inequality exhibit lower group moral centrality and higher suicide risk.

2.1 Data Collection and Screening

Since Sina Weibo was launched in August 2009 and the COVID-19 pandemic began after December 2019, significantly impacting mental health (Cullen et al., 2020; Talevi et al., 2020; Vindegaard & Benros, 2020), this study collected Weibo data from 2010 to 2019. We downloaded all public Weibo posts from individuals across 31 provincial-level administrative regions in mainland China between 2010 and 2019 using the Sina Weibo Application Programming Interface (API).

After downloading, we screened users meeting the following criteria: (1) registered before January 2010; (2) personal accounts (not public, commercial, or zombie accounts); (3) users who posted new public Weibo content every month during 2010-2019.

2.2 Index Calculation

Income Distribution Inequality: Following Tian' s (2012) method for calculating the Gini coefficient, we computed the annual Gini coefficient for residents' income in each of China' s 31 provincial-level administrative regions from 2010 to 2019.

Moral Centrality: Based on the Chinese Version of the Moral Foundations Dictionary (Zhang & Yu, 2018), we calculated annual agency motive word frequency and communion motive word frequency for each region from 2010 to 2019. We then derived their ratio using Formula 6-1 and transformed it using Formula 6-2 to obtain the Moral Centrality Index (MCI). Formula 6-2 uses an inverse transformation to constrain MCI values within (0, 1], where higher MCI values (closer agency and communion word frequencies) indicate higher group moral centrality.

$$\alpha = \frac{WF_{agency}}{WF_{communion}} \quad (6\text{-}1)$$

$$MCI = \begin{cases} \alpha & \text{if } \alpha \leq 1 \\ \frac{1}{\alpha} & \text{if } \alpha > 1 \end{cases} \quad (6\text{-}2)$$

where WF_{agency} represents agency motive word frequency and $WF_{communion}$ represents communion motive word frequency.

Suicide Risk: Using the Chinese Suicide Dictionary (Lv et al., 2015), we calculated annual suicide behavior dimension word frequency for each region from 2010 to 2019.

Negative Emotions: Using the Simplified Chinese LIWC dictionary (Zhao et al., 2016), we calculated annual negative and positive emotion word frequencies for each region from 2010 to 2019, using their ratio (negative/positive) to represent negative emotion levels.

3.1 Descriptive Statistics

Using the above methods, we computed annual Gini coefficients and scores for moral centrality, negative emotions, and suicide risk for 31 provincial-level administrative regions in mainland China from 2010 to 2019. Average values across this period are shown in Figures 3 [Figure 3: see original paper]-1 to 3-4, while trends are displayed in Figures 3-5 to 3-8. For most provincial regions, Gini coefficients, negative emotions, and suicide risk showed upward trends from 2010 to 2019, while moral centrality, despite fluctuations, showed an overall downward trend.

3.2 Mediation Analysis Results

We conducted panel data mediation analysis using the sgmediation2 command in Stata 17.0. Results for negative emotions and suicide risk are presented in Tables 3 -1 and 3-2. The Gini coefficient positively correlated with negative emotions ($r = 0.309$, $p < .001$) and suicide risk ($r = 0.264$, $p < .001$), indicating that greater income inequality corresponds to higher negative emotions and suicide risk. The Gini coefficient negatively correlated with moral centrality ($r = -0.316$, $p < .001$), meaning higher income inequality associates with lower group moral centrality. Moral centrality also negatively correlated with negative emotions ($r = -0.321$, $p < .001$) and suicide risk ($r = -0.290$, $p < .001$), indicating that lower moral centrality corresponds to higher negative emotions and suicide risk.

Mediation analysis results support a partial mediating role of moral centrality. Income distribution inequality indirectly increases negative emotions and suicide risk by reducing moral centrality.

This study analyzed macroeconomic data and social media big data from 31 provincial-level administrative regions in mainland China from 2010-2019 to examine relationships between regional income inequality and group negative emotions and suicide risk, and the mediating role of moral centrality. Results confirm that moral centrality mediates the effect of regional income inequality on group negative emotions and suicide risk. Specifically: (i) regional income inequality positively predicts group negative emotions and suicide risk; (ii) regional income inequality negatively predicts group moral centrality; (iii) moral centrality negatively predicts group negative emotions and suicide risk. These findings highlight the potential harm of economic inequality to social mental

health and the important role of moral centrality in the relationship between economic factors and mental health. This study enriches the theoretical framework regarding how income distribution inequality affects mental health, providing scientific insights for reducing the mental health impacts of income inequality amid rapid economic development and relatively low social mobility.

The relationship between regional income inequality and group mental health indicates that increased inequality worsens population mental health status. Since China' s reform and opening up, GDP has grown continuously, with living standards improving significantly. From 1978 to 2019, China' s average annual GDP growth rate was approximately 9.36% (World Bank, 2020a), and per capita GDP increased from just over $200 in 1978 to about $10,143 in 2019 (World Bank, 2020b). However, economic development and material abundance have not proportionally improved health (physical or mental). For instance, Yang et al. (2019) found that since China became a middle-high income country in 2009, happiness inequality has risen, with income inequality being a significant factor. This phenomenon may be explained from two perspectives. First, the marginal diminishing effect: as a factor increases, its additional benefits gradually decrease. When a country is relatively poor, economic growth and income increases substantially improve quality of life. However, as the economy develops and per capita income rises, the same magnitude of growth yields diminishing returns, reducing the positive impact of wealth on happiness and mental health. Second, since the 21st century, China' s Gini coefficient has remained above the international warning level of 0.4 (National Bureau of Statistics, n.d.). During China's economic transition, some social groups have not benefited from development or have been marginalized by existing interest groups, experiencing relative deprivation as their need satisfaction lags behind reference groups (Guo, 2001). Even for high-income groups, Weich et al. (2001) found that, after controlling for income level, high-income individuals in more unequal areas had higher rates of common mental disorders (e.g., anxiety and depression) than those in more equal areas, possibly due to increased social competition and reduced social cohesion. Although economic development undoubtedly improves material living standards, if accompanied by widening income gaps, the phenomenon of "worrying about inequality rather than scarcity" emerges. Both marginalized low-income groups and high-income vested interest groups are more likely to experience negative effects from income inequality, triggering more severe mental health problems.

Our findings suggest these negative effects can be explained through the mediating role of moral centrality. Data show that regions with more unbalanced economic development (e.g., Beijing) have lower moral centrality, manifested in extremely high agency motivation levels. In areas with high income inequality, people tend to focus more on their own interests. Low-income groups may compete more aggressively for social resources to enhance their status, while high-income groups, despite material advantages, may worry about losing status and economic benefits, leading them to acquire more resources to protect their wealth and position rather than investing in public welfare or promoting

social equity. In such competitive and self-interested environments, individuals with extreme agency motivation are more likely to exhibit hostile and unsympathetic attitudes, attempting to dominate or control others, thereby damaging interpersonal relationships and social connections (Helgeson & Fritz, 1999). This undermines the establishment and maintenance of supportive and reciprocal social networks and access to social support when needed, which numerous studies have confirmed as crucial for mental health (Harandi et al., 2017; Hefner & Eisenberg, 2009; Turner & Brown, 2010).

Overall, this study reveals a potential pathway to mitigate the negative mental health effects of income inequality by enhancing moral centrality, supporting the close relationship between the balance of agency and communion motives (i.e., moral centrality) and mental health at the group level. By combining social media big data and natural language processing techniques, this study overcomes limitations of traditional methods in measuring group moral centrality and mental health, offering new perspectives on how economic factors influence mental health. These technologies reduce research costs, improve efficiency, and point to new technical pathways for future research. However, several limitations should be acknowledged.

First, this study has sample selection bias, as participants are Sina Weibo users with an average age of approximately 24 years, representing a young demographic. This sampling bias may affect the generalizability and external validity of findings, as this specific group may not fully represent broader demographic characteristics. Despite this limitation, the study provides valuable insights into mental health mechanisms within this particular population. Future research should include broader age ranges and diverse backgrounds to enhance representativeness and generalizability by covering various socioeconomic statuses, education levels, and cultural backgrounds.

Second, since data come from social media platforms, collection is influenced by users' posting habits. When calculating psychological semantic word frequencies from Weibo texts, we could only collect publicly posted content. Additionally, to prevent floor effects, we set posting frequency criteria to ensure data quality and avoid instability from small sample sizes. However, this approach may limit sample diversity, potentially excluding individuals who post privately, use social media infrequently, or prefer brief posts. Nevertheless, social media big data and natural language processing techniques partially compensate for limitations of traditional psychological measurement methods in large-scale group-level assessment.

Third, although social media big data and natural language processing enable convenient and efficient acquisition of group-level psychological indicators, they do not measure mental states directly. While textual psychological semantic features have been shown to reflect psychological states to some extent, natural language processing still faces challenges in interpreting contextual complexity, sarcasm, and humor, potentially limiting accuracy in representing mental states. Future research could explore integrating multiple data sources to improve ac-

curacy, such as combining social media text data with behavioral data (e.g., online behavior patterns, activity frequency) or even traditional psychological measurement tools (e.g., questionnaire results) to enhance conclusion validity.

In conclusion, despite limitations in data sources and technical methods regarding sample diversity and measurement accuracy, this study successfully overcomes traditional research constraints, providing new perspectives and methods for exploring complex mechanisms through which economic factors affect mental health, while offering valuable insights for mental health interventions and policy formulation.

This study examined the mechanism through which regional income distribution inequality affects mental health, testing the mediating role of moral centrality. Results confirm that moral centrality positively mediates the effect of regional income inequality on group negative emotions and suicide risk. Specifically, increased regional income inequality reduces group moral centrality, leading to higher agency motivation levels, which in turn increases group negative emotions and suicide risk.

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