



Does more moral equal less corruption? The different mediation of moral foundations between economic growth and corruption in China

Feng Huang^{1,2} · Sijia Li^{1,2} · Huimin Ding³ · Nuo Han^{1,2} · Tingshao Zhu¹

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Abstract

Corruption aggravates societal inequality and challenges organizations and governments. Although numerous studies confirm that economic growth inhibits corruption, corruption in China rises rather than falls with economic growth. No study found to date has focused on the psychological mechanisms underlying economic influence on corruption. Based on the stimuli-organism-response (SOR) framework and moral foundations theory (MTF), we collected social media big data from 30 provinces in mainland China (involving 1.16 million active users) from 2011 to 2016 to investigate the relationship between economic growth, moral foundations and the incidence of corruption. The results show that: (1) economic growth positively predicts corruption in China; (2) *binding foundations* rather than *individualizing foundations* can predict corruption; (3) *Loyalty* and *Authority* positively mediate the prediction of economic growth for corruption and (4) *Sanctity* negatively mediates the prediction of economic growth for corruption. The results confirm the mediating role of moral foundations between economic growth and corruption while providing insights to prevent corruption from a psychological perspective.

Keywords Corruption · Moral foundations · Economic growth · Social media · Big data

Introduction

Corruption is 'the abuse of entrusted power for private gains' (Graycar & Smith, 2011; Li et al., 2021b; Treisman, 2000). In China, 'duty-crime' defines corruption in legal terms, including offenses like favoritism, bribery, and abuse of power (Luo, 2018; Zhang et al., 2015). As a pervasive and complex social problem, corruption aggravates societal inequality and challenges organizations and governments (Hu et al., 2021; Mauro, 1995). Though numerous studies claim that corruption can be inhibited by the improvement

of economic growth (Bai et al., 2013; Sandholtz & Koetzle, 2000; Treisman, 2000), it rises rather than falls with the economic growth in some Asian countries like China, forming the 'East Asian paradox' (Ang, 2020; Dong & Torgler, 2013; Wedeman, 2012). How the paradox happened is unknown. Exploring the psycho-behavioral mechanisms behind economic-corruption is essential to understanding how corruption happens and why the 'East Asian paradox' occurs.

The legislation defines corruption as a crime, while in psychology, it results from moral abnormality. For example, Moore (2008) considered that low moral awareness leads to organizational corruption; Yin and Zhong (2012) address an unsound system as the external factor of corruption while moral depravity is its internal factor; Brief et al. (2014) theorized that moral disengagement is the root cause of corruption. In addition, as the focus of long-standing discussions in psychology and sociology, morality is widely considered to be influenced by socioeconomic. Kohlberg (1963) points out how resource shortages can turn a good person into an immoral one; the lack of money was cited as the root cause of theft in this series of discussions (Dubois et al., 2015; Kohlberg, 1963). Other studies suggest that people's

Feng Huang and Sijia Li contributed equally to this work.

✉ Tingshao Zhu
tszhu@psych.ac.cn

¹ CAS Key Laboratory of Behavioral Science, Institute of Psychology, Chinese Academy of Sciences, 16 Lincui Road, Chaoyang District, Beijing 100101, China

² Department of Psychology, University of Chinese Academy of Sciences, Beijing 100049, China

³ School of Education Science, Xinyang Normal University, Xinyang 464000, China

morality is at odds with their economic status. For instance, compared with the poor, rich people are more likely to break the law while driving, lie in negotiations to increase their chances of success, and endorse more immoral behavior at work (Piff et al., 2010, 2012). Although the findings of past researchers are inconsistent in the relationship between them, the current consensus is that morals are significantly influenced by economic status.

Since morality can influence corrupt behavior and is affected by economic status, the present study considers morality as the mediator variable between economics and corruption. Meanwhile, we propose the Stimulus-Organism-Response framework (SOR; Woodworth, 1930) to explain the relationship between economic status, morality, and corrupt behavior. SOR is a cognitive theory for predicting and identifying people's behavior and suggests that the influence of environmental stimulus on human behaviors must be mediated by the organizing variables (people's physiology or psychology). SOR theory has been widely used in exploring the mechanism behind the behavior, such as impulse-buying (Floh & Madlberger, 2013), cyber violence (Fan et al., 2021), and criminal behavior (see Clements, 1980; Jeffery, 2017). Since corruption is a kind of social behavior, the mechanism behind it can also be examined through this framework. Based on previous studies and SOR theory, we consider that economic status (S) affects regional corruption (R) by influencing people's morality (O).

Nevertheless, although morality receives much attention when examining economic or corruption issues in sociology, ethics, and economics, the diversity of moral content has been neglected in previous studies (e.g., Antonaccio & Tittle, 2008; Huang, 2014; Litina & Palivos, 2016). In psychology, the moral foundations theory (MFT) concludes that humans' moral foundations as multi-dimensional, including *Care* (protect and help others), *Fairness* (equal social relations), *Loyalty* (in-group and cooperation), *Authority* (a hierarchical structure within the organization), and *Sanctity* (self-restraint, pure body and mind). Based on functional psychology, the five moral components are divided into *individualizing foundations* and *binding foundations*. Specifically, *individualizing foundations* include *Care* and *Fairness*, which emphasize how people should protect and respect others at the individual level. In contrast, *binding foundations* include *Loyalty*, *Authority*, and *Purity*, emphasizing the connection between an individual and the group and how different groups get along.

Based on MFT, the present study assume that *binding foundations* rather than *individualizing foundations* could mediate the effect of economic growth on regional corruption. Since corruption is generally considered a group/collective behavior (Ashforth & Anand, 2003; Persson et al., 2013; Solaz et al., 2018), it could be governed by *binding foundations* which always operate at the group level (Graham et al., 2009; van

Leeuwen et al., 2012). Previous research has shown that economic growth in mainland China enhances public moral foundations (Huang et al., 2020b), but as Skitka et al. (2009) claimed, the moral-psychological mechanism was often a double-edged sword. Specifically, although *Loyalty* and *Authority* emphasize group-binding loyalty, honesty, and duty (Cantarero et al., 2018; Graham et al., 2009), they are closely related to favoritism, fascism, and blind obedience.

The present study considers that the relationship between economic growth and regional corruption in mainland China follows the SOR theory. More specifically, economic status (a far-end factor of corruption) indirectly affects regional corruption by influencing people's *Loyalty*, *Authority*, and *Sanctity* (a near-end factor). Based on the SOR framework and MFT, we hypothesize that:

Hypothesis 1: *Binding foundations, rather than individualizing foundations, serve as the mediator to explain the relationship between economic status and corruption.*

Hypothesis 2a: *Loyalty and Authority positively mediate the prediction of economic status to corruption.*

Hypothesis 2b: *Sanctity negatively mediates the prediction of the economic status to corruption.*

Due to the difficulty in measuring the public's moral foundations longitudinally across regions and consecutive years using questionnaires, traditional psychological research hardly examines the robust effects of group factors on corruption as economics does. Psychologists have constructed the Moral Foundations Dictionary (MFD, Graham et al., 2009), which has been developed in multiple languages such as Portuguese (Carvalho et al., 2020), Japanese (Matsuo et al., 2019), and Chinese (Wu et al., 2019), and can be used to measure public moral foundations through social media (see Hoover et al., 2020; Huang et al., 2020b; Li et al., 2021a). Weibo is China's leading social media platform, with 566 million monthly active users (Tandoc & Eng, 2017; Weibo-Corporation, 2021). Users express opinions in real-time by sharing text messages (Huang & Sun, 2014; Jendryke et al., 2017). These data are used to non-invasively measure the moral foundations of the public, thus providing the possibility to analyze the relationship between economic, moral, and foundations. The present study will use Weibo big data to calculate the moral foundations of the public in mainland China and intend to understand how the economic growth affects corruption through moral foundations.

Materials and methods

The present study used the Per Capita Gross Regional Product (PRGDP) and the Per Capita Disposable Income (PCDI) to represent the regional economic status and the duty-crime

rate to measure regional corruption. The textual analysis of Weibo posts from each province in mainland China was used to construct regional moral foundation indicators. Data was collected from 2011 to 2016 due to Weibo fully covering most users in 2011 (Peng, 2021), and the duty-crime count released by China Procuratorial Press was updated to 2016 (see CPP, 2021). Figure 1 portrays the procedure of the present study, from data collection to statistical analysis. The details of indicators selection, data cleaning, and variables calculation are described in the corresponding sections.

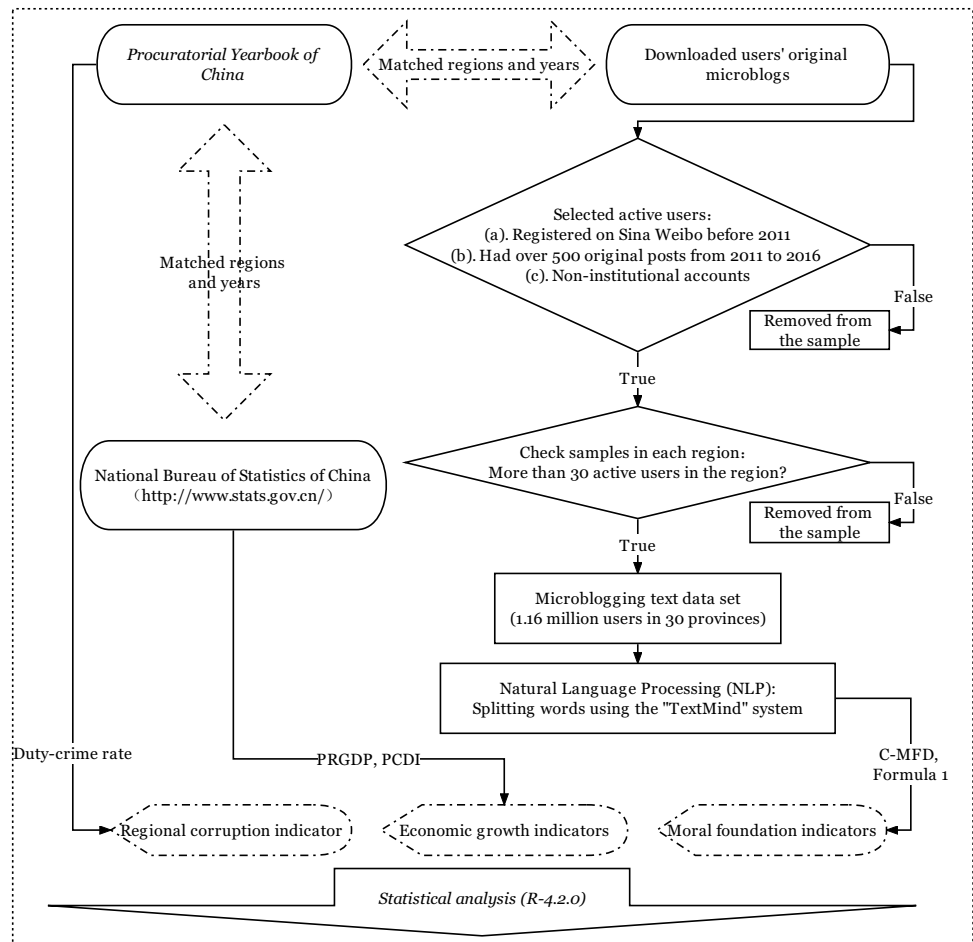
Data collection

The texts used to construct regional moral foundations in the present study were obtained from the original Weibo data pool containing more than 1.16 million active Weibo users (Li et al., 2014). Weibo is a leading Chinese social platform with over 566 million active daily users as of June 2021 (Weibo-Corporation, 2021). These users get used to sharing their daily life and interacting with each other through Weibo functions (e.g., publish, forward, reply), providing rich data for researchers in human behaviors on social media.

The present study first collected the duty-crime count by checking the *Procuratorial Yearbook of China* 2012–2017 (each book provided data from last year). Next, we downloaded data on PRGDP and PCDI from the National Bureau of Statistics of China (NBSC, n.d.). Finally, the posts of all active users from January 1, 2011, to December 31, 2016, are downloaded using the Weibo public Application Programming Interface. The definition for active users is based on previous studies (Li et al., 2014, 2021a), which have over 500 posts after registering and have recently posted. In addition, we excluded the institutional users (including business, celebrity, government agency accounts, etc.) and retained only private users, as the institutional users' posts may not represent their personal views.

In accordance with the central limit theorem (see Abranovic, 1997, pp. 307–308), the present study requires each province to have at least 30 active users to ensure that the texts generated by these users are sufficiently representative of the region. Therefore, Tibet, which has less than 30 active users, is excluded from the present study. Moreover, the Weibo posts used in the present study are publicly available, while users' privacy is strictly protected according to ethical principles (Kosinski et al., 2015).

Fig. 1 The procedure from data collection to statistical analysis



Calculation of variables

Regional corruption Following previous studies (Luo, 2018; Wederman, 2005; Zhang et al., 2015), the duty-crime count is used to measure corruption. In China, 'duty-crime' is the offense of illegally using authority to benefit oneself or others by persons working for state organs, public organizations and state-owned companies, enterprises and institutions, etc., such as bribery, favouritism, and abuse of authority under the Criminal Law (Chen, 2013). The present study uses the ratio between local duty-crime numbers and its resident population to control city size.

Economic status PRGDP is used as the indicator of regional economic status for the present study, which is the ratio of the absolute value of GDP to the regional population in that year. Since PRGDP controls the variance of city sizes, it more objectively represents regional economic status levels than GDP (Huang et al., 2020b). PCDI was used as a replacement variable for PRGDP to check the robustness of the final model.

Moral foundations The present study used the "TextMind" system (Gao et al., 2013) to split the microblogging text of each province into words. And then, the Chinese version of the MFD (C-MFD; Wu et al., 2019) was used to calculate the regional moral foundations. According to the theory of moral foundations, Graham et al. (2009) established MFD, which has been widely used to identify moral foundations in social media texts. The development of MFD has gone through the steps of expansion, compression, contextual verification, and scoring, and its effectiveness has been widely verified (see Graham et al., 2009; Hoover et al., 2020; Hopp et al., 2021). Wu et al. (2019) revised C-MFD through a standard 'translation-back translation' procedure (expansion, compression, contextual validation, and scoring). It suggested that C-MFD had good reliability in all dimensions. Besides, many researchers have applied C-MFD in various studies with reasonably valid results. For instance, Liu et al. (2020) further analyzed and discussed the relationship of each dimension of C-MFD with disgust and infectious disease vigilance. Meanwhile, Li et al. (2021a) found that people's suicidal ideation was related to the hurt, betrayal, and dirty dimensions of C-MFD. These findings are in line with the basic assumptions of moral foundation theory and confirm that C-MFD has good ecological validity in the Chinese context.

The present study manually contextualized a random sample of keyword-captured microblog texts to ensure that the moral keywords were valid. See the examples given in Table 1, where people's use of virtue and vice keywords reflects their focus on diverse sides of moral content. Referring to the

calculation of moral motivation in previous research (Zhang & Yu, 2018), we calculate five moral foundations using the following formula:

$$MF_{r,y} = \frac{\sum Vir_{r,y}}{\sum Vic_{r,y}} \quad (1)$$

Where, $MF_{r,y}$ means the score of a moral foundation (*Care, Fairness, Loyalty, Authority or Sanctity*) in a specific region during any year; $\sum Vir_{r,y}$ and $\sum Vic_{r,y}$ means the frequency of the words' virtue' and 'vice' for the region in that year. In this formula, r is 'every region,' and y is 'every year'.

Statistical analysis

Based on previous studies (Baron & Kenny, 1986; Preacher & Hayes, 2008), we preferred estimating the mediation effect and testing our hypotheses in three steps. Step 1: estimate the effect of economic status on corruption; Step 2: estimate the effect of economic status on moral foundations; Step 3: estimate the co-effect of economic status and moral foundations on corruption and test the mediation effect.

The present study uses the regional fixed effects model based on the least-squares method for parameter estimation. Since our data conform to the short panel type ($N \gg T$), there is no necessity to consider pseudo-regressions caused by time effects (Baltagi, 2008; Phillips & Moon, 2000), and both unit root and cointegration tests are not applicable (Chen, 2014). In addition, the presence of PRGDP and PCDI in the model implies that the introduction of year dummy variables necessarily leads to severe multicollinearity. Considering the theory, intuition, or available empirical research, the corruption degree of a region would be more related to the local economic status and moral factors than years. Thus, we discarded the use of time-fixed effects. It is worth noting that factors such as regional cultural customs, geographic location, and climate might affect corruption (see Dobel, 1978; Gardiner, 2006), and these factors generally stabilize within the region. Therefore, we used the regional fixed-effects model to control omitted variable bias due to unobserved regional heterogeneity (Neumayer & Plümper, 2017). The model is:

$$Y_{it} = \beta X_{it} + \alpha_i + \varepsilon_{it} \quad (2)$$

Where Y_{it} refers to the response variable (corruption in steps 1 and 3, and moral foundations in steps 2); X_{it} refers to the explanatory variable (economic status in steps 1 and 2, while step 3 includes economic status and moral foundations). α_i represents the regional fixed effect. ε_{it} is the error term.

Although the regional fixed effects model is theoretically the most suitable, it needs validation on data. The mixed, random effects and fixed effects models are constructed in step 3; F-test and Robust Hausman-test are used to select the

Table 1 Examples of Weibo post text

Moral foundations	Definitions	Representative Words	Example (in Chinese)	
<i>individualizing foundations</i>	<i>Care</i>	Protect and help others	关爱(to care) <ul style="list-style-type: none"> • ...calling on everyone to care for left-behind children! (virtue) 	
			消灭(destroy) <ul style="list-style-type: none"> • ...the enemy will destroy you if you don't destroy them. (vice) 	
	<i>Fairness</i>	Equal social relations	公正(justice) <ul style="list-style-type: none"> • Which is better, outcome justice or process justice? I think both. (virtue) 	
			偏爱(favouritism) <ul style="list-style-type: none"> • # favouritism #Whatever he does is correct, providing it is someone I love. (vice) 	
<i>binding foundations</i>	<i>Loyalty</i>	In-group and cooperation	忠诚(loyal) <ul style="list-style-type: none"> • ...the nature of a soldier is to be loyal to his country and his people. (virtue) 	
			移民(immigrate) <ul style="list-style-type: none"> • ...anyone with experience share how to immigrate ***? (vice) 	
	<i>Authority</i>	Hierarchical structure within the organization	权威(authoritative)	<ul style="list-style-type: none"> • ...don't listen to all kinds of gossip until authoritative news is released. (virtue)
			抗议(protest)	<ul style="list-style-type: none"> • ...I strongly protest that some people are privileged simply because they are older. (vice)
	<i>Sanctity</i>	Self-restraint; Pure body and mind	虔诚(devout)	<ul style="list-style-type: none"> • ...people should remain devout and believe that good things come to good people. (virtue)
放纵(indulgence)			<ul style="list-style-type: none"> • ...youth is an indulgence, never mind all the red tape. (vice) 	

best model (Baltagi, 2021). Further, we changed the measure of economic status to test the robustness of the final model, using PCDI instead of PRGDP. All statistical analysis processes used *R public statistics software*(version: 4.0.5).

Results

Descriptive statistic

We conducted some preliminary analysis. Table 2 shows the descriptive statistics for all variables. To eliminate dimensional differences, we standardize all the indicators

by Z-core before entering the subsequent analysis. Figure 2 shows the bivariate correlations of all variables. As shown in Fig. 2, without controlling for regional fixed effects and other variables, economic status (both PRGDP and PCDI) is positively correlated with moral foundations (*Care*, *Loyalty*, *Authority* and *Sanctity*, $p < 0.01$) and negatively with DC ($p < 0.001$). Moral foundations (*Fairness* and *Authority*) are positively correlated with DC ($p < 0.05$).

Power analysis

The present research did not conduct a priori power analysis because we used a dataset with all possible regions in

Table 2 Descriptive statistics of all variables

Variables	Unit	Mean	SD	Min	Max
<i>PRGDP</i>	China Yuan (CNY)	49164.22	22388.72	16413.00	118198.00
<i>PCDI</i>	China Yuan (CNY)	19511.36	8545.31	8025.78	54305.35
<i>Care</i>	/	0.93	0.26	0.59	2.22
<i>Fairness</i>	/	4.81	0.64	2.62	8.48
<i>Loyalty</i>	/	1.15	0.24	0.76	1.83
<i>Authority</i>	/	5.3	0.66	4.1	7.51
<i>Sanctity</i>	/	1.59	0.32	0.93	2.92
<i>DC</i>	Cases per 10 ⁴ people	0.39	0.13	0.17	0.89

^a Abbreviations: *PRGDP* Per Capita Gross Regional Product; *PCDI* Per Capita Disposable Income; *DC* Degree of corruption. $n = 30$, $T = 6$, $N = 180$

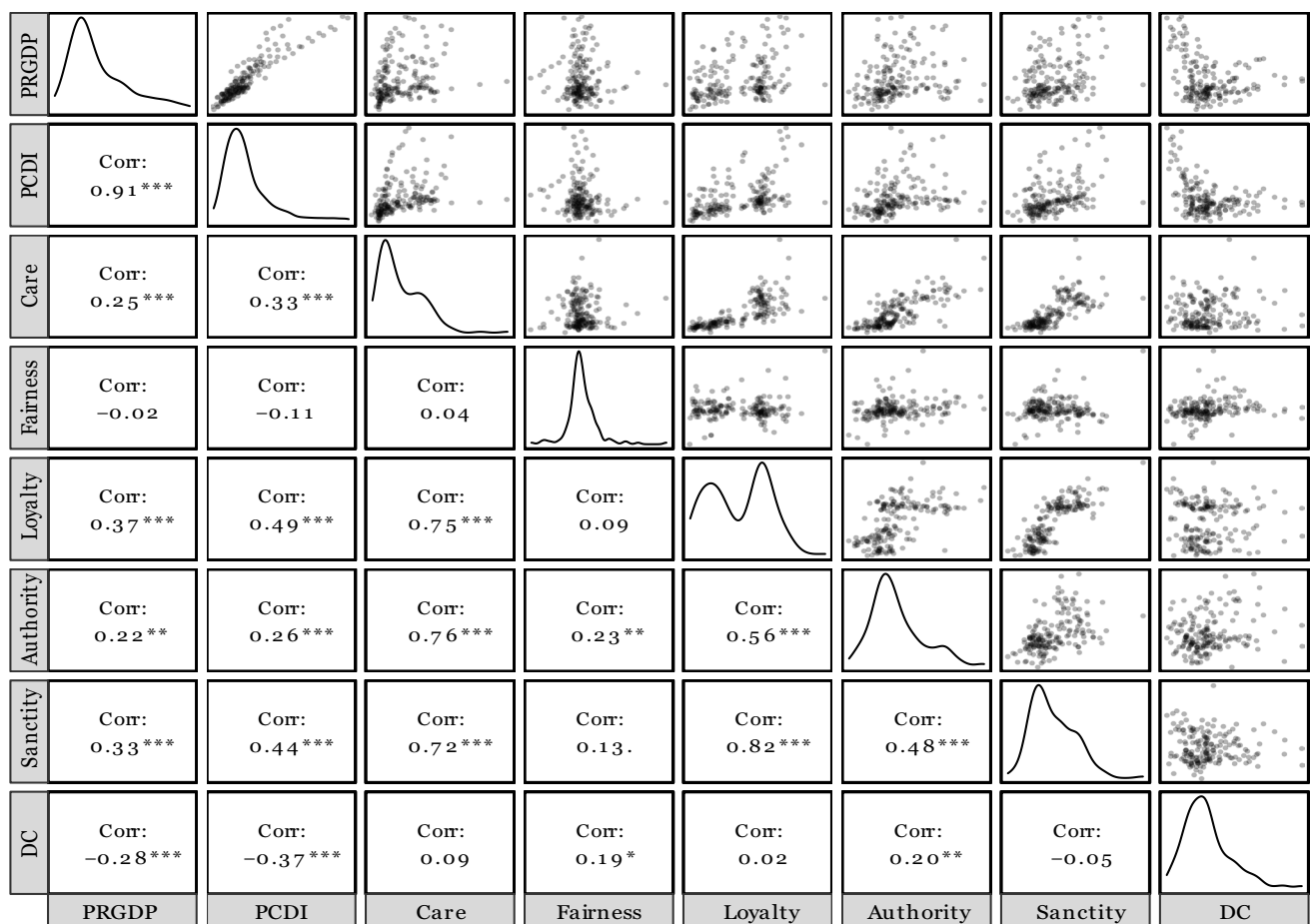


Fig. 2 Bivariate correlations of all variables. ^a The lower left part shows the Pearson correlation coefficients between variables, and the upper right part shows the bivariate scatter plot. ^b Abbreviations:

PRGDP, Per Capita Gross Regional Product; PCDI, Per Capita Disposable Income; DC: Degree of corruption. $n=30$, $T=6$, $N=180$. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

the Simplified Chinese context and thus evaluated power using post hoc analysis. We followed the recommendation of Cohen (1988) and conducted power analysis for multiple regression using the R package pwr (Champely et al., 2017). The results showed that the effect sizes (f^2) of all regression models reached an intermediate level, and 118 samples were enough to detect any of them with $\alpha=0.05$ and a power of 90%. Therefore, the sample size currently used (180) was sufficient for the present study.

The fixed effects model

The F-test result of the 'economic-moral-corruption' model is significant ($F=32.26$, $p < 0.001$), indicating that there are unobservable individual differences inside. Secondly, the Robust Hausman-test result shows that individual differences are related to independent variables ($Chisq=43.09$, $p < 0.001$). Both tests suggest that the fixed effects model should be adopted. The stepwise regression model fits are summarised in Table 3.

As Table 3 shows, in step 1 (Model 1), PRGDP positively predicts DC ($p < 0.05$) upon controlling for regional fixed effects. In step 2 (Model 2a~2e), PRGDP positively predicts *Care*, *Loyalty*, *Authority* and *Sanctity* ($p < 0.001$). In step 3 (Model 3), PRGDP no longer predicts DC when moral foundations are integrated into the regression equation; DC is positively predicted by *Loyalty* ($p < 0.001$) as well as negatively predicted by *Sanctity* ($p < 0.001$). *Authority* positively predicts DC but is not statistically significant ($p=0.065$).

Mediation effect test

The R package *Mediation* (Tingley et al., 2014) was used to test the mediation effect. The results show that PRGDP effects DC through the mediations of *Loyalty* (*Indirect Effect* = 0.80, $p > 0.001$, 95% CI [0.48, 1.14]), *Authority* (*Indirect Effect* = 0.22, $p=0.059$, 95% CI [-0.01, 0.45]) and *Sanctity* (*Indirect Effect* = -0.60, $p > 0.001$, 95% CI [-0.93, -0.28]). Moral foundations completely mediate the effect of

Table 3 Regression models summary

Variables	Model 1 DC		Model 2		Model 3 DC	
	Estimate	t	Estimate	t	Estimate	t
PRGDP	0.23	2.36*	2.19	11.41***	0.08	15.96***
Care					-0.08	-1.22
Fairness					-0.01	-0.08
Loyalty					0.30	4.90***
Authority					0.10	1.86†
Sanctity					-0.24	-3.69***
ΔR ²	0.85	0.42	0.47	0.42	0.88	0.88
F	34.80***	5.27***	6.28***	5.28***	37.53***	37.53***

^a Abbreviations: PRGDP Per Capita Gross Regional Product; DC Degree of corruption. n = 30, T = 6, N = 180. †p < .10, *p < .05, ***p < .001

PRGDP on DC. The mediation paths of ‘economic-moral-corruption’ are summarized in Fig. 3.

Model robustness test

Further, we replace PRGDP with PCDI as the economic status indicator to test the robustness of the model. The outcomes show that the coefficients and significance of all variables are basically unanimous in the two models, which confirms the robustness of the model. The model outcomes of replacing variables are shown in Table 4.

The results of mediation effect test show that, PCDI effects DC through the mediations of *Loyalty* (Indirect Effect = 0.65, p > 0.001, 95% CI [0.40, 0.91]), *Authority* (Indirect Effect = 0.17, p = 0.069, 95% CI [-0.01, 0.35]) and *Sanctity* (Indirect Effect = -0.47, p > 0.001, 95% CI [-0.75, -0.20]). The mediation paths are summarized in Fig. 4.

Discussion

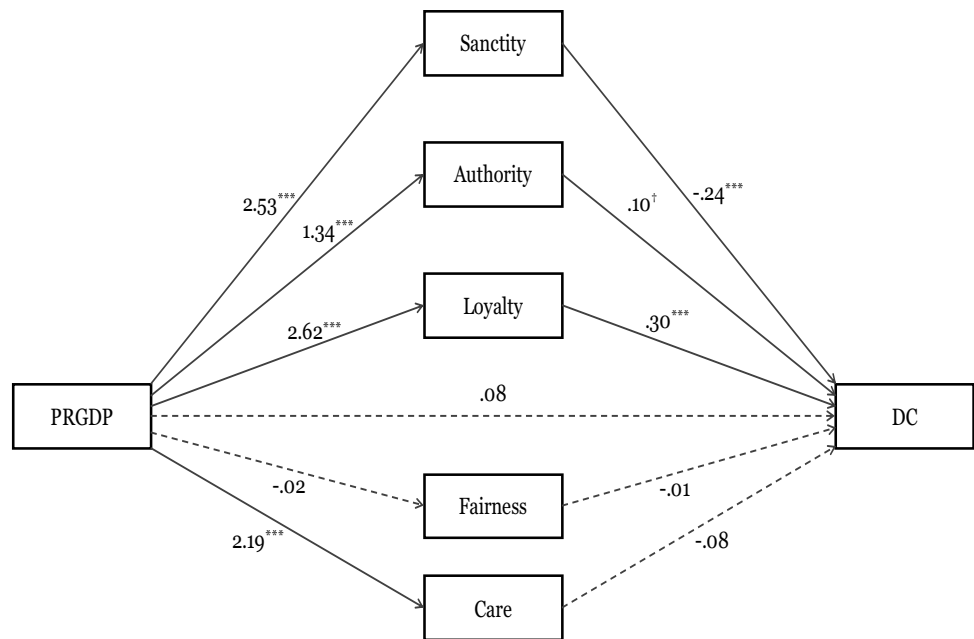
Corruption is considered a serious threat to civilized society (Akçay, 2006). The present study found that corruption was related to economic status and *binding foundations*. Specifically, *Loyalty* and *Authority* positively mediate the relationship between economic status and corruption, while *Sanctity* plays a negative role.

Economic growth positively predicts regional corruption, consistent with previous studies (Ang, 2020; Dong & Torgler, 2013; Wedeman, 2012), in which economic growth and transition increased corruption in China. Economic growth also positively predicts *Care*, *Loyalty*, *Authority*, and *Sanctity*, consistent with the previous research (Huang et al., 2020b). Morality is defined by philosophers, like Marx, as the superstructure built on an economic foundation (Marx, 1970). Regional economic increases generally mean improved living conditions for locals; thus, economic growth provides the material basis for moral foundation improvements.

The moral foundations—specifically, the three *binding foundations* completely mediate the predictive effect of PRGDP on corruption, which supported **hypothesis 1**. The underlying mechanism of economic(S)-moral(O)-corruption(R) is compatible with behavioral science. As a complex behavior, although environmental factors like the economy stimulate corruption, the psychological factor is its proximal factor. Compared to general criminal offenses, corruption is typically motivated by group benefit, occurs within relationships, and can hardly be committed by individuals alone (Brief et al., 2001; Shover & Scroggins, 2009). Behavioral science defines such a 'group' as two or more interacting and interdependent people who join to achieve particular objectives (Saavedra et al., 1993). *Binding*

Fig. 3 Mediation paths graph. ^a

The solid line marks significant regression paths, and the dotted line mark insignificant regression paths. ^b Abbreviations: PRGDP, Per Capita Gross Regional Product; DC: Degree of corruption. $n = 30$, $T = 6$, $N = 180$. [†] $p < 0.10$, ^{***} $p < 0.001$



foundations dictate moral frameworks adopted by people within the 'group' that further influence their attitudes and behaviors (Graham et al., 2009; Haidt, 2012).

We find that *Loyalty* and *Authority* positively transmit the stimulating impact of the economic status on corruption, verifying **hypothesis 2a**. In prior moral psychology research, *Loyalty* is generally related to in-group bias, cronyism, nepotism and favouritism (Hildreth et al., 2016; Zogmaister et al., 2008). The *high-loyalty* could be a significant risk factor for corruption, and Numerous corruption case reports show that profiting for 'one of our ingroup' (e.g., relatives, cronies and fellow-villagers) is the primary cause of power decay (Cao, 2019). Another typical example of 'ingroup corruption' is corrupt officials falling from power because they fail to refuse the illegal requests from their relatives, fellow-townsmen, and classmates in school days (Hwang, 1987). It is worth noting that although the relationship between *Authority* and corruption is not statistically significant in the present study, we are still inclined to suggest that it is a meaningful statistic. Not only because the positive correlation between *Authority* and corruption is consistent with previous studies, but this relationship is also very close to statistical significance. *Authority* results in blind obedience (Altemeyer, 1996; Benjamin & Simpson, 2009), which may increase the risk of corruption.

The *high-loyalty* could increase the incentives as well as reduce the psychological cost of corruption. For officials, high loyalty for an in-group means a stronger corruption motivation – precisely, they may prefer to profit for the in-group members at the expense of others. People in need could expect more from officials who are somehow connected to them, thus more easily bribing the officials and

making illegal demands. Furthermore, a high ingroup awareness means people could be more adept at binding themselves to an official by finding 'guanxi' – a Chinese social concept based on the exchange of favours, in which personal relationships are considered more important than laws and written agreements (Chen & Chen, 2004); in fact, people can make a connection to anyone in the world through up to six others, based on the Six Degrees of Separation Theory (Watts, 2004), which could explain why corruption is so frequent in the context of high in-group societies. Additionally, in-groupness provides more cognitive resources to defend against fears and reduce risk perceptions when facing epidemics and disasters (Huang et al., 2020a; Kim et al., 2016). Similarly, the high ingroup awareness could provide higher psychological protective efficacy for the corrupt – 'we' are more insulated than 'I' from worries about the underlying legal consequences of corruption.

Sanctity negatively mediates the effect of the economic status on corruption, which confirms **hypothesis 2b**. Although *Sanctity* is a *binding foundation*, in its framework, people are not divided by inner-outer groups or superior-inferior but by purity (Graham et al., 2013; Gray & Keeney, 2015; Haidt, 2012). Being shaped by disgust and contamination (Graham et al., 2009), high *Sanctity* could have people disgusted by immoral activities like corruption, as well as reject and marginalize people or groups associated with such. Additionally, *Sanctity* emphasizes self-control and inspires people to live in an elevated and noble way and less carnally (Graham et al., 2009, 2013), which could inhibit the motivation of corruption.

The mediating role of *binding foundations* between economic status and corruption could explain the existence of

Table 4 Regression models summary (replacing variable)

Variables	Model 4 DC		Model 5		Model 6 DC	
	Estimate	t	Estimate	t	Estimate	t
PCDI	0.16	2.19*	1.77	13.37***	0.01	0.06
Care					-0.08	-1.16
Fairness					-0.01	-0.12
Loyalty					0.32	5.05***
Authority					0.09	1.79†
Sanctity					-0.23	-3.43***
ΔR ²	0.85	0.50	0.47	0.68	0.88	
F	34.60***	7.05***	6.30***	13.73***	37.45***	
					15.02***	
					19.66***	
					2.02	
					13.37***	
					1.77	
					19.35***	
					0.50	
					7.06***	

^a Abbreviations: PCDI Per Capita Disposable Income; DC Degree of corruption. *n* = 30, *T* = 6, *N* = 180. †*p* < .10, **p* < .05, ****p* < .001

the "East Asian paradox" to some extent. Cultural psychology studies show that the *binding foundations* predominate in collectivist cultures and receive less attention in individualist cultures (AlSheddi et al., 2019; Graham et al., 2013; van Leeuwen et al., 2012). Collectivism is mainly promoted in some Asian countries, especially China, while individualism is commonly promoted in Western countries (Hui, 1988). Research shows that, globally, individualism is surging as economies grow, while the opposite is true in Asian countries (Santos et al., 2017). Based on existing studies, we reasoned that *binding foundations* are strengthened in collectivism and decrease individualism with economic growth. Unfortunately, combining the present findings, two of the three *binding foundations*—*Loyalty* and *Authority* – are risk factors for corruption, resulting in corruption increasing in collectivism and decreasing in individualism. Since *binding foundations* mediate the relationship between economic status and corruption, socio-cultural differences, specifically, the difference in the importance attached to various moral foundations in the East and West, could contribute to the opposite relationship between economic growth and corruption in diverse countries.

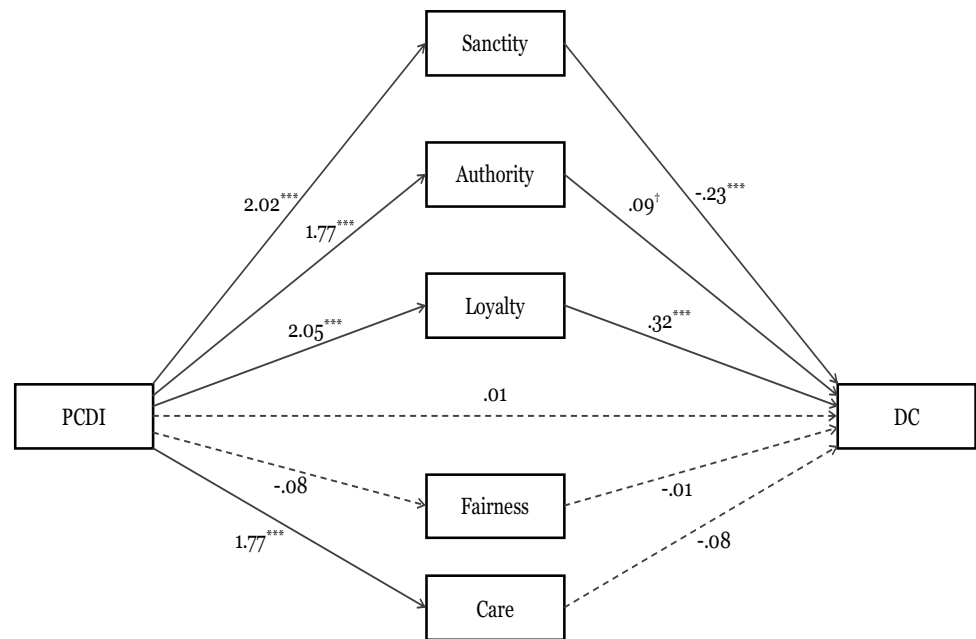
Religion may also be significant. *Sanctity*—the only binding foundation that negatively predicts corruption—is derived from religious ideology (Graham et al., 2013; Haidt, 2012). Religious individuals are usually considered to have a higher *Sanctity*, which is repeatedly confirmed in studies (Graham et al., 2009, 2013). Actually, a few localized researchers have found that religious beliefs (i.e., Taoism and Buddhism) of a region play a positive role in curbing official corruption (see Xu et al., 2017). However, with the economic and technological growth, religion has gradually weakened in China, where atheism is prevalent; thus, the inhibiting power of *Sanctity* can hardly compete with the worsening effects of the growth of *Loyalty* and *Authority* on corruption. Contrarily, the West's efforts on religious protection could curb corruption via *Sanctity*. Such inferences require further confirmation by cross-cultural studies effectively.

Because of the secrecy and uncertainty of corruption (Shleifer & Vishny, 1993), detecting and preventing it by only perfecting the law is complex. Based on this study, public officials' training may help prevent corruption at the psychological level, for example, by enhancing their sensitivity to in-group attitudes and behaviors, alongside building their professional principles (loyalty to the law rather than a superior). Also, appropriate mobility in public office may prevent 'cliques' and reduce the risk of corruption.

Limitations

This study has limitations. First, we selected research subjects only from social media, which could involve a

Fig. 4 Mediation paths graph (replacing variable). ^a The solid line marks significant regression paths, and the dotted line mark insignificant regression paths. ^b Abbreviations: PCDI, Per Capita Disposable Income; DC: Degree of corruption. $n=30$, $T=6$, $N=180$. [†] $p < 0.10$, ^{***} $p < 0.001$



potential sampling bias as there may be more young people than older among Weibo users, the future studies could incorporate more diverse sampling methods to balance the participants. Second, we use duty-crime rates estimates corruption crudely, and the relationship between variables is on a correlation level; future studies could use more rigorous methods like experiments to examine variables' causal relationships. Third, the research subjects all came from China, which means the cross-cultural generalization of the results should be further verified. Finally, corruption is a complex social phenomenon and topic; the present study only provides insights from a moral psychology view; future interdisciplinary and cross-disciplinary studies should be conducted.

Conclusions

Using big data analysis based on MFT and SOR framework, we examine the mediating role of moral foundations between economic growth and corruption. The estimation of fixed effects showed that: (1) economic growth positively predicts corruption in China, (2) *binding foundations* rather than *individualizing foundations* can predict corruption, (3) *Loyalty* and *Authority* positively mediate the prediction of economic growth for corruption, and (4) *Sanctity* negatively mediates the prediction of economic growth for corruption. The results enhance the practical value of MTF and provide insights into preventing corruption from a psychological perspective.

Authors' contributions *Feng Huang* and *Sijia Li* were responsible for the design of the study and contributed equally to this article. *Huimin Ding* made insightful contributions to the study conception. *Nuo Han* was responsible for data acquisition and data cleaning. *Tingshao Zhu* provided critical revision and full guidance of the paper.

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Data availability Due to copyright issues and protect the participants' privacy, the Yearbooks and original posts used for the analysis are not publicly available but are available from the corresponding author on reasonable request.

Code availability All statistical analysis processes used R public statistics software (version: 4.0.5). The processed data set and code are available on <https://osf.io/AWUH8/>

Declarations

Ethics approval This research project was approved by Ethics Committee, Institute of Psychology, Chinese Academy of Sciences (project number: H15009).

Consent to participate Because the Sina microblog are freely accessible, and following the procedure and ethical principles in the research field (Kosinski et al., 2015), Informed consent was waived by the Ethics Committee, Institute of Psychology, Chinese Academy of Sciences.

Consent for publication All authors have read and approved the final manuscript.

Conflict of interests On behalf of all authors, the corresponding author states that there is no conflict of interest.

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