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Keywords: motivated beliefs, self-confidence, present bias, cooperation, cultural difference

JEL Classification: C91, D01, D91, O57, Z10

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Motivated Beliefs, Independence and Cooperation*

Wei Huang† Yu Wang‡ Xiaojian Zhao§

January 2023

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Individualism is what makes cooperation worth living.

Henry Ford

1 Introduction

Human civilization largely relies on large-scale cooperation, in which each individual's self-esteem may play a central role in how much to contribute. A confident individual tends to take heavier responsibilities in teamwork situations, acting as a key player in cooperative relationships. At the same time, an individual's self-esteem may vary when facing different social contexts (e.g., Dessi and Zhao, 2018). While the phenomenon of cooperation does prevail in all human societies, individuals' cooperative tendencies vary significantly across cultures (discussed below). How does an individual's self-esteem interact with his cooperation with others? What environmental factors affect individuals' self-esteem together with their tendency to cooperate? Why and how exactly do these factors co-determine self-esteem and cooperative tendencies? Given the imbalanced population distribution over the world, cooperative opportunities differ across societies. Does providing more opportunities for cooperation always promote human cooperation?

Self-esteem, as an important mental quality, has been broadly discussed in the economics and psychology literature (see Baumeister et al., 2003).[1] Meanwhile, an extensive literature reveals that self-esteem varies across cultures. For example, Heine and Lehman (1999) report significant self-enhancing biases for North Americans, while the Japanese are more likely to be self-critical. In addition to self-esteem, cooperative tendencies also vary across countries, exhibiting a similar pattern of East-West cultural differences. In a cross-cultural experiment of a public goods game, Yamagishi (1988) finds that American subjects had a higher level of trust and cooperated more than Japanese subjects in the absence of a sanctioning system. Similarly, Kocher et al. (2008) conduct a public goods game experiment on three continents and find that the United States had the highest proportion of conditional cooperators (80.6%) and the lowest proportion of free riders (8.3%), while the opposite was found to be the case in Japan (41.7% for conditional cooperators and 36.1% for free riders).[2] More importantly, self-cognition and cooperation appear to have certain connections. In psychology, an individual's level of self-confidence has been documented to be associated with his prosocial behaviors in

[1] For example, Heckman, Stixrud, and Urzua (2006) attribute educational and labor market outcomes to surveyed self-esteem.

[2] In a more recent large-scale global survey, Falk et al. (2018) report substantial heterogeneity in social preferences across countries, including altruism, positive reciprocity, negative reciprocity, and trust.

social interactions.[3] While the relation between self-confidence and the tendency to cooperate has been observed at the individual level, the environmental determinants of this link remain a puzzle. As documented in Heine and Lehman (1999), North American families and schools pay more attention to building self-esteem and independence in children and adolescents, while East Asian families and schools value introspection and modesty in the education of younger generations. This paper attempts to shed light on the role of *independence* or the frequency of social interactions in the establishment of self-esteem and how it affects people's behaviors in social interactions, in both theoretical and empirical studies.

In theory, we extend Bénabou and Tirole (2002) by incorporating the possibility of interaction between individuals and elucidate the interplay between an intraperson multi-self game and an interperson social interaction. Our model investigates the connection between an individual investment decision subject to imperfect willpower and a social interaction facing free-riding problems. For the individual investment problem, we allow for present bias as the primitive bias leading an individual to invest less than what he should. Thus, individuals have an incentive to manipulate their memory in order to deliver overconfidence to the future self to resolve this self-control problem. For the social problem, individuals decide whether to cooperate in a common project. In the absence of the individual problem, the free-riding outcome to the social problem occurs. In the presence of the individual problem, self-confidence generated from memory management due to present bias gives rise to a positive spillover on social interactions, suggesting a positive relation between self-confidence and prosocial behaviors. Thus, a high frequency of social interactions may actually reduce the tendency to cooperate, thus exacerbating the free-riding problem.

In the empirical part, we aim to investigate the key implications derived from our theoretical model using both cross-country observational data and individual-level experimental data. In country-level analysis, we adopt the self-competence component of the Rosenberg's self-esteem measure (Rosenberg, 1965) to proxy the self-confidence and collect data from a large-scale cross-country survey conducted by Schmitt and Allik (2005). We use the score of the "indulgence vs. restraint (IVR)" cultural dimension from Hofstede (2001)'s cultural dimensions theory to proxy the present-biased preference. The social interaction frequency in our model is measured

[3]For instance, Baumeister et al. (2003) show that a higher level of self-confidence generates better group performance and enhances the incentive to initiate interperson relationships. In economics, the relationship between self-confidence and cooperation is also extensively discussed. In a global survey involving 12 countries, Pirinsky (2013) finds that more confident individuals are more actively involved in cooperative interactions. Mertins and Hoffeld (2015) show that overconfident workers hold more optimistic beliefs about coworkers' cooperativeness, and are, accordingly, significantly more cooperative in the field experiment.

by the country-level population density[4] and the dummy of whether the country involves an extended family system.[5] The population density can be used as the measure of the frequency of interperson interactions between any two members of the society. In terms of intrahousehold cooperation, the domestic organization system of this country can be used as the measure of the frequency of intrahousehold interactions among family members. Finally, we borrow the "agreeableness" measure of individuals' inclination to cooperate, prosociality and social harmony from the Big Five personality traits (see Rustichini et al., 2016; Kagel and McGee, 2014) to represent the tendency to cooperate in our model.[6] Our cross-country evidence shows that people in countries with indulgent cultures tend to be more confident in terms of Rosenberg's self-competence score, individuals living in countries with a high population density or extended family systems appear less confident, and those in countries with high self-competence scores are more agreeable in personality traits.

Complementing the cross-country survey evidence, we further test our theory using an online experiment. The subjects took an incentivized emotional intelligence test, and then were asked to report their beliefs about their relative performance compared with other subjects. Both the emotional intelligence test and belief elicitation were randomly incentivized. We then identify the overconfident beliefs from the positive difference between self-reported quartile of their performance and the true quartile in which their score fell. We elicit the subjects' degree of present bias using the standard multiple-price list (MPL) design (Holt and Laury, 2002), and allow them to self-report their tendency to cooperate in the family context in the post-experiment survey. Based the the responses to two socio-demographic survey questions, we rely on whether the subjects are the only child in their families and the number of siblings as the proxies of frequency of social interactions within families. We find that subjects who are the only child or have fewer siblings are more likely to have higher relative overconfidence, and the overconfident subjects report higher tendency to cooperate in family issues. The empirical findings largely accord with our model's implications.

[4]Notably, *World Development Report 2009* (Scott, 2009) regards population density as one of the most important economic geography dimensions to be considered by the local governments in designing customized economic development strategies.

[5]The extended family system data are obtained directly from Enke (2019), whose empirical analysis is based on an ethnic-group-level dataset originally compiled by Murdock (1967). See Appendix D for variable definitions and data source descriptions.

[6]The agreeableness data are from a large-scale cross-country survey conducted by Schmitt et al. (2007).

1.1 Related Literature

The paper brings together four strands of the literature in economics of motivated beliefs. The first studies the functional role of motivated beliefs in resolving the self-control problem at the individual level.[7] Several papers in economic theory have started deriving certain types of motivated beliefs such as overconfidence and demonstrated the instrumental values of cognitive features of human beings across societies, which can be traced back to the earliest discussions in psychology (see James, 1890). Carrillo and Mariotti (2000) first illustrate how strategic ignorance resolves an individual's overconsumption problem due to present bias by ignoring information that may weaken his self-confidence. Bénabou and Tirole (2002) investigate the functional role of amnesia in delivering self-confidence in an intraperson game with investment activity. Relatedly, Bénabou and Tirole (2004, 2011) and Hong, Huang, and Zhao (2019) focus on the self-signaling value of undertaking costly actions in alleviating the underinvestment problem associated with present bias. In both theory and experiment, Chew, Huang, and Zhao (2020) find that positive false memory serves to enhance self-confidence in one's future self in equilibrium in an intraperson, multiple-self model. Relatedly, there is extensive experimental literature on asymmetric belief updating. Eil and Rao (2011) show that subjects tend to respect good news but discount or even ignore bad news. Similarly, Li (2013) reports an asymmetry of individuals' memory recall accuracy with a tendency of forgetting unpleasant experience in social interactions. Möbius et al. (2022) further suggest that experimental subjects substantially overweight good news relative to bad news and update too little overall, but these biases are less prevalent in an ego-free setting. In dictator games, Saucet and Villeval (2019) find evidence of the dictators' motivated memory in selectively recalling their allocations to the receivers. Zimmermann (2020) examines the role of memory encoding and retrieval in the asymmetric belief updating and the role of economic incentives in mitigating self-serving biases in memory. In an artefactual field experiment, Banerjee, Gupta, and Villeval (2020) find that the feedback on success in previous task increases winners' self-confidence and competitiveness in the following task, which is more prominent for more confident individuals. Exley and Kessler (2022) experimentally show that people make motivated decision errors only when the errors are self-

[7] In parallel, there is a growing literature focusing on affective reasons of motivated beliefs. See, e.g., Hagenbach and Koessler (2022) for a general framework of selective memory in the presence of preference over beliefs. An alternative theory initially proposed by Trivers (2011) and Von Hippel and Trivers (2011) proposes the signaling value of overconfidence, i.e., self-deception makes one more convincing when trying to persuade others of his superiority. Recently, Schwardmann and van der Weele (2019) conduct experiments to test this theory and find that individuals deceiving themselves into higher confidence about their cognitive ability are more successful at deceiving others.

serving. Huffman, Raymond, and Shvets (2022) report that the managers persistently make overconfident predictions about their future performance and have overly-positive memories of their past performance.

The second strand of literature concerns the functional value of motivated beliefs at the societal level, with a particular emphasis on cooperation. Although cooperation is ubiquitous in every human society, betrayal and free-riding are also prevalent. In the absence of policy interventions such as taxes and subsidies, individuals may not internalize the positive externality from potential cooperation. Dessi (2008) suggests that the younger generations fail to internalize the positive externalities of their cultural investment and therefore underinvest in their own culture from the perspective of the older generations. Motivated collective memories that falsely promote a high investment value of their own culture and norms can resolve the incongruent objectives between the younger and the older generations. In addition, Battaglini, Bénabou, and Tirole (2005) investigate how individuals' self-control problem is affected by observing each other's behavior in social interactions. Bénabou (2012) develops a model of wishful thinking in groups allowing for substitutability and complementarity of beliefs among agents as a result of different stakes in the project in the social problem.[8] Our paper combines the first two strands of literature studying the interaction of motivated beliefs in response to the self-control problem at the individual level and interperson cooperation at the societal level.

Third, in addition to the explorations of the mechanisms of motivated beliefs at the individual level or societal level, this emerging domain of research also implies cross-country heterogeneity in motivated beliefs. One remarkable example is the just-world hypothesis, which is known as a self-serving belief widely held across the world. People have a need to believe that they live in a world where "they reap what they sow". Bénabou and Tirole (2006) demonstrate a model explaining why people demand such a belief in a self-serving way and want to pass on such a belief to the younger generations. Their model can account for the cross-country heterogeneity in the prevalence of a just-world belief and redistributive politics. For example, the just-world belief is widely held in the United States but is not so prevalent in European countries. Consequently, American voters tend to elect a government that implements a lower tax rate and lower social spending, while European citizens favor a more egalitarian redistributive policy. Enke (2019) argues that the moral systems of human beings, including moral emotions, moral values, and moralizing religious beliefs, which have evolved for centuries, are functional mechanisms to enforce cooperative behavior in social dilemmas (e.g., international

[8] On the experimental side, Burks et al. (2013) test three mechanisms that can deliver overconfidence and their experimental evidence largely supports social signaling theory, but not Bayesian updating or self-image concerns.

trade and public goods provision). At both the ethnic-group level and country level, he empirically examines the relationship between the formation and evolution of these moral attributes and the historical heterogeneity in the tightness of kinship ties. In a cross-country empirical analysis, Dessi and Zhao (2018) find that the citizens living in nations with higher instability and dynamism in terms of the overall unemployment rate and peacefulness index are generally more self-competent than citizens living a secure and stable life, suggesting that the individual heterogeneity of overconfidence is partially determined by the degree of expected environmental instability, with greater instability breeding more optimistic beliefs.

Finally, our paper is closely related to the cooperativeness dimension of culture, such as social capital (Guiso, Sapienza, and Zingales, 2008) and trust (Butler, Giuliano, and Guiso, 2016). Guiso, Sapienza, and Zingales (2008) study the causes of the long-term persistence of cooperativeness in history and suggest that the tendency of a community to cooperate is largely dependent on the intergenerational transmission of priors about the trustworthiness of community members. Some other papers focus on specific forms of large-scale coordination like farming (Galor and Özak, 2016; Galor, Özak, and Sarid, 2020; Talhelm et al., 2014), while other works study the intergenerational transmission of cultural attributes including the coordination devices of languages (Chen, 2013; Hong and Zhao, 2017; Galor, Özak, and Sarid, 2020; Spolaore and Wacziarg, 2016) and folklores (Michalopoulos and Xue, 2021). Additionally, our study also sheds light on the root of the global variation in specific cultural characteristics (Galor and Özak, 2016; Galor, Özak, and Sarid, 2020) or economic features (Becker, Enke, and Falk, 2020). Specifically, Becker, Enke, and Falk (2020) find that the global heterogeneity of the prosocial dimensions (e.g., trust, altruism, and reciprocity) has its ancient origins in the temporal and spatial patterns of ancestral migration out of Africa. More generally, our paper contributes to the growing empirical and theoretical literature of cultural economics, especially the culturally based determinants of economic phenomena (Guiso, Sapienza, and Zingales, 2006; Alesina and Giuliano, 2015) and the deep determinants of cultural persistence and change (Giuliano and Nunn, 2020).

2 Model

Our model extends the single agent decision problem in Bénabou and Tirole (2002) by allowing for the interaction between two agents $i, j \in \{A, B\}$. The timing involves three dates, $t = 0, 1, 2$ (see Figure 1). At $t = 0$, each agent i privately receives a signal informative about their ability, θ_i, and then decides how to transmit this signal to his future self. At $t = 1$, with probability π, both agents face an individual problem in the absence of imposing any externality on the

other agent, or they interact with each other in a social problem with probability $1-\pi$. In the individual problem, each agent decides whether to invest in a project, the outcome of which will be realized at $t=2$. We allow for time-inconsistent preferences by assuming that the two agents are present-biased. In the social problem, each agent decides whether to exert efforts in cooperation and then obtains his benefit at $t=1$. Thus, each agent encounters a *self-control problem* in the individual problem, whereas in the social problem, they are subject to a *free-riding problem*.

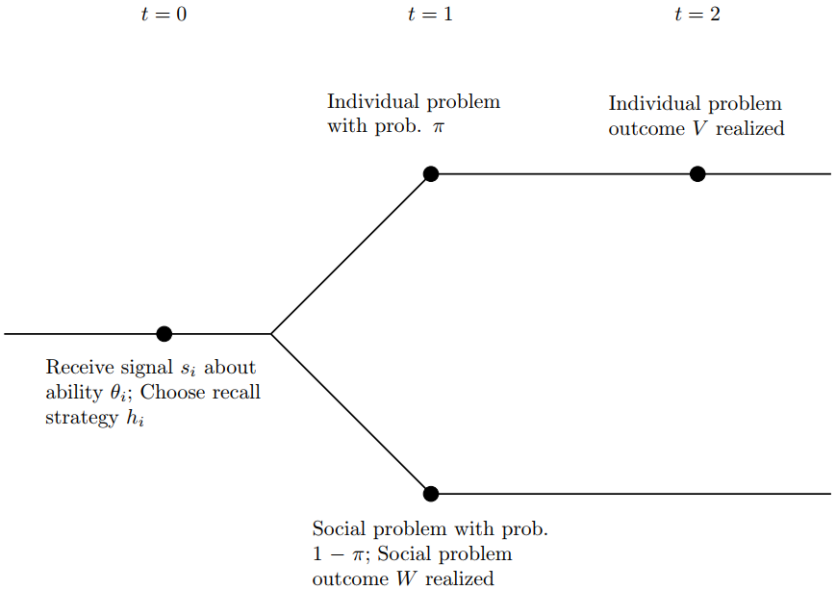

Figure 1: Timeline

Formally, at $t=0$, agent i receives a signal s_i concerning his ability θ_i, which is the probability of success of the project in the individual problem. For simplicity, we assume that s_i can take two values: $s_i=L$ (signal for a low ability) with probability $1-q$ and $s_i=H$ (signal for a high ability) with probability q. Slightly abusing notations, we let θ_{s_i} refer to the expected value of θ_i conditional on each possible realization of the true signal s_i, where

$$\theta_L = E[\theta_i|s_i=L] < \theta_H = E[\theta_i|s_i=H].$$

Following Bénabou and Tirole (2002), we allow for signal manipulation or (endogenous) memory management. Let $\hat{s}_i$ be the signal reported by agent i at $t=0$ to both agents at $t=1$. (i) If the true signal is $s_i=H$, for simplicity, there is no opportunity for signal manipulation; thus, $\hat{s}_i=H$. (ii) If the true signal is $s_i=L$, agent i at $t=0$ may either communicate the signal truthfully ($\hat{s}_i=L$) or report the other signal ($\hat{s}_i=H$).[9] Upon observing signal $s_i=L$, agent i at $t=0$ chooses the probability of truthfully reporting this signal: $h_i=\Pr[\hat{s}_i=L|s_i=L]$.

[9]There are two interpretations of the signal manipulation: 1) H can be no signal, whereas L represents a bad

At $t = 1$, in light of the reported signals observable to them, each agent forms expectations of his and the other agent's ability θ_i. We denote by h_i^* the equilibrium belief held by both agents at $t = 1$. Thus, each agent considers the possibility that agent i may have manipulated the true signal s_i. When $\hat{s}_i = L$, clearly there has been no signal manipulation for agent i; each agent at $t = 1$ will therefore have revised his belief about agent i's ability $\theta_i^*(L) = \theta_L$ upon observing the reported signal L. When $\hat{s}_i = H$, each agent will estimate the following probability that the signal is H for agent i given the belief h_i^* (the "reliability" of signal H):

$$r_i^*(H) = \Pr[s_i = H | \hat{s}_i = H; h_i^*] = \frac{q}{q + (1-q)(1-h_i^*)},$$

implying that each agent's revised belief conditional on signal H is given by

$$\theta_i^*(H) = r_i^*(H)\theta_H + (1 - r_i^*(H))\theta_L > \theta_L.$$

2.1 Individual Problem

At $t = 1$, with probability π, each agent is independent and faces the individual problem. Agent i then decides whether to invest at cost c in a project, which will yield benefit V with probability θ_i at $t = 2$. Each agent at t discounts his expected utility at $t + n$ at $\beta\delta^n$ for $n = 1, 2$ where $\delta = 1$ is the normal discount rate and $\beta < 1$ corresponds to the degree of present bias.[10] In other words, two agents give an "excessive" weight to the present. Thus, agent i will incur the cost of investment if and only if

$$\beta\theta_i^* V - c > 0.$$

At $t = 0$, however, agent i is uncertain about c but knows its smooth distribution function $F(c)$ with its density function $f(c)$.

When $s_i = L$, agent i chooses h_i. Should he transmit the signal accurately ($\hat{s}_i = L$), his expected utility in the individual problem is given by

$$\int_0^{\beta\theta_L V} (\theta_L V - c) dF(c).$$

By contrast, if he reports a high signal ($\hat{s}_i = H$), his expected utility in the individual problem is given by

signal. Transmitting L to H is interpreted as forgetting bad signals (Bénabou and Tirole, 2002). Alternatively, 2) H can be a good signal, whereas L reflects no signal. In this case, transmitting L to H is interpreted as fabricating good signals (Chew, Huang, and Zhao, 2020).

[10] Netzer (2009) provides an evolutionary explanation for time inconsistent preference in a general model. In this paper we take present bias as a primitive bias for simplicity.

$$\int_0^{\beta\theta_i^*(H)V} (\theta_L V - c)dF(c).$$

The net gain from manipulating the low signal in the individual problem is equal to

$$\int_{\beta\theta_L V}^{\beta\theta_i^*(H)V} (\theta_L V - c)dF(c). \tag{1}$$

Note that the upper bound $\beta\theta_i^*(H)V$ is strictly higher than the lower bound $\beta\theta_L V$ in the integral in (1). Signal manipulation generates overconfidence, which in turn resolves the underinvestment problem associated with the present bias in the individual problem. However, if self-confidence is too high, the cost of overinvestment can exceed benefit from alleviating underinvestment problem. Thus, it is ambiguous if the integral above is positive or not.

2.2 Social Problem

At $t = 1$, with probability $1 - \pi$, two agents face a social problem. Then, each agent $i \in \{A, B\}$ chooses his cooperative strategy $x_i \in \{0, 1\}$ and obtains the following material payoff:

$$y_i = \theta_i W x_i + \theta_j W x_j - e x_i.^{11}$$

Here, $x_i = 1$ means that agent i contributes to the social project, and $x_i = 0$ reflects his free-riding behavior. Thus, agent i contributes if and only if

$$\theta_i^* W - e > 0$$

which is independent of agent j's type θ_j and effort decision x_j. Notably, when $x_i = 0$, agent i can still enjoy $\theta_j W$ if $x_j = 1$. At $t = 0$, agent i is uncertain about e but knows its smooth distribution function $G(e)$ with its density function $g(e)$.

When $s_i = L$, the agent's net gain from repressing the low signal in the social problem is equal to

$$\int_{\theta_L W}^{\theta_i^*(H)W} (\theta_L W - e)dG(e). \tag{2}$$

[11] This assumption is in line with a large body of psychology literature suggesting a correlation between the team performance and some indices of cognitive abilities of its members (see, e.g., Devine and Philips, 2001). Many qualities and skills play the same role in both individual tasks and collaborative tasks, such as cognitive intelligence, emotional intelligence, diligence, multi-tasking, perseverance, timeliness, et al. For example, the success of a solo research project highly depends on the author's personal qualities (cognitive intelligence, perseverance, timeliness, and many more), while a joint project also relies on such qualities of all the coauthors.

Note that $\theta_i^*(H)$ is higher than θ_L. Overconfidence generated from signal manipulation gives rise to overinvestment in the social problem from the individual agent's point of view. Thus in the social problem, truth telling is always optimal at the individual level, leading to a free riding in cooperation. Here, self-esteem maintenance may not only enhance the individual's motivation in his future task, but also has a spillover to resolve the free-riding problem in social interaction, which will be elaborated in the following subsection.

2.3 Perfect Bayesian Equilibrium

> *I care for myself. The more solitary, the more friendless, the more unsustained I am, the more I will respect myself.*
>
> Charlotte Brontë, *Jane Eyre*

The following proposition characterizes two kinds of pure strategy perfect Bayesian equilibria (PBEs): a perfect recall equilibrium where $h_A^* = 1$, $h_B^* = 1$ and a signal manipulation equilibrium where $h_A^* = 0$, $h_B^* = 0$, and examine their relationship with π.

Proposition 1 *There exist $\underline{\beta} < \overline{\beta}$ such that*

(1) when $\beta \in (\overline{\beta}, 1]$, there exists a perfect recall PBE for any $\pi \in [0, 1]$;

(2) when $\beta \in [\underline{\beta}, \overline{\beta}]$, there exist $\pi'(\beta)$ such that there exists a signal manipulation PBE if $\pi \in (\pi'(\beta), 1]$; there exists a pure strategy perfect recall PBE for any $\pi \in [0, 1]$;

(3) when $\beta \in [0, \underline{\beta})$, there exist $\pi'(\beta)$ and $\pi''(\beta)$ such that there exists a signal manipulation PBE if $\pi \in (\pi'(\beta), 1]$; there exists a perfect recall PBE for any $\pi \in [0, \pi''(\beta))$.

All proofs are relegated to the Appendix A. We can see that for any given $\beta \in [0, 1]$, the incidence of signal manipulation is weakly increasing in π, and the incidence of correct recall is weakly decreasing in π i.e., when the chance of social problem is lower, the individual is more like to exhibit overconfidence. Specifically, in case (1) of Proposition 1 where β is high enough, i.e., the present bias is not severe, there is a unique equilibrium with perfect recall. In this case, even if the individual encounters the individual task for sure ($\pi = 1$), he will still always tell the truth. In this case, regardless of how frequent the social interactions, the individual motivation turns out to be insufficient to provide overconfidence to solve the free-riding problem in cooperation.

In case (2) with intermediate present bias β, for a sufficiently high frequency of social interactions ($\pi \in [0, \pi'(\beta))$), there is an equilibrium with perfect recall; for a low frequency of social interactions ($\pi \in (\pi'(\beta), 1]$), there are multiple equilibria in memory management.

When π is low enough, the cost of overconfidence in social problem dominates the its benefit in individual problem, therefore the individual will truthfully transmit the signal. When π is high, the two equilibria coexist. The multiplicity of equilibria comes from the complementarity between self-0's recall strategy and self-1's belief for each agent. The more truthful self-0 is, the more likely self-1 trusts the reported signal; thus, it is more risky for self-0 to manipulate the signal, and vice versa.

In case (3) where present bias is very severe, i.e., for high frequency of social interactions, there is an equilibrium with perfect recall; for low frequency of social interactions, there is an equilibrium with signal manipulation. In this case, the conflict between multiple selves is strong enough, signal manipulation is always beneficial as long as social interaction is not very prevalent, therefore manipulating the signal is the unique equilibrium.

Proposition 1 directly implies the following observation on the relation between signal manipulation and frequency of social interactions π.

Observation 1 *For any $\beta \in [0,1]$, the incidence of signal manipulation is weakly increasing in π, and the incidence of correct recall is weakly decreasing in π.*

The following proposition links the perfect Bayesian equilibria to present bias β.

Proposition 2 *Suppose $\beta > \theta_L/[q\theta_H + (1-q)\theta_L]$ and q is sufficiently small. There exist $\underline{\pi} < \overline{\pi}$ and $\underline{\underline{\beta}} < \overline{\overline{\beta}}$ such that*

(1) when $\pi \in [0, \underline{\pi})$, there exists a perfect recall PBE for any β;

(2) when $\pi \in (\underline{\pi}, \overline{\pi}]$, for $\beta > \overline{\overline{\beta}}$, there exists a perfect recall PBE; for $\beta < \overline{\overline{\beta}}$, the two PBEs coexist;

(3) when $\pi \in (\overline{\pi}, 1]$, for $\beta > \overline{\overline{\beta}}$, there exists a perfect recall PBE; when $\underline{\underline{\beta}} < \beta < \overline{\overline{\beta}}$, the two PBEs coexist; for $\beta < \underline{\underline{\beta}}$, there exists a signal manipulation PBE.

Proposition 2 points out that when β is high enough, the incidence of signal manipulation is weakly decreasing in β for any $\pi \in [0,1]$. This monotonicity only holds when β is not very low. When β is low enough and the present bias is severe, equation (1) suggests that the net gain from signal manipulation is limited for a small β; the cost of signal manipulation for the social problem is substantial, thus, truth-telling may still be the unique equilibrium.[12] This intuition can be summarized in the following observation.

[12] This is inconsistent with Proposition 2 of Bénabou and Tirole (2002) in which the incidence of signal manipulation is monotonically decreasing in β without cost of signal manipulation.

Observation 2 *When β is sufficiently large, for any $\pi \in [0,1]$, the incidence of signal manipulation is weakly decreasing in β, and the incidence of correct recall is weakly increasing in β.*

Figure 2 illustrates an example of the key relations in Propositions 1 and 2. As discussed in the empirical part, this result is inline with our empirical findings that θ^* is always significantly positively correlated with π, while the monotonicity of the relation between θ^* and β is weaker. Their correlation is statistically significant only in our cross-country survey evidence, but not in the within-country experimental evidence.

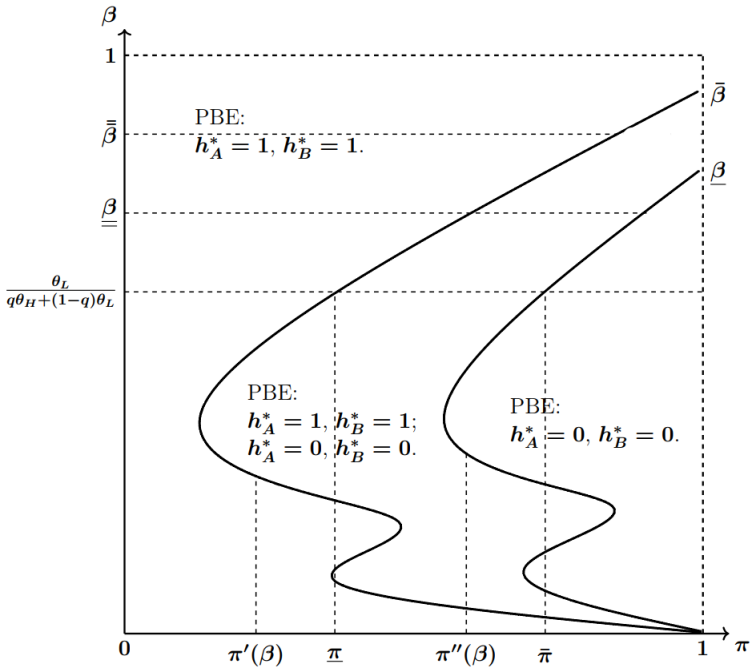

Figure 2: Memory management in equilibrium

2.4 Spillover of Self-confidence

It is worth mentioning that the presence of social interactions leads to the equilibrium behavior qualitatively differing from the pattern in Bénabou and Tirole (2002). In Bénabou and Tirole (2002), with a high degree of present bias, there exists a unique equilibrium of signal manipulation, because the benefit from overconfidence, which alleviates the future self's procrastination problem, outweighs the cost of overinvestment. In our model, however, we obtain the opposite result that the individual always reports the true signal when present bias is sufficiently severe. From equation (1), we can find that when present bias is extremely severe (β is close to zero), the net gain from signal manipulation shrinks and even reaches zero when $\beta = 0$. The existence

of the social problem delivers a cost of signal manipulation, leading to truth-telling being the unique equilibrium for both high and low present-biased agents.

Proposition 2 also shows that a higher level of π leads to a larger space for the parameters to guarantee the existence of signal manipulation equilibrium. In other words, a lower frequency of the social problem improves the cooperation outcomes. This is because, in the individual problem, the self-control problem provides an incentive to manipulate the bad signal. Thus, the more frequently the individual problem occurs, the more likely the individual enhances his self-confidence, boosting his cooperation tendency. This implication partly explains why complicated interperson relations in certain cultures (a high frequency of the social problem) may sometimes be associated with noncooperation or even infighting. Conversely, in some environments with simple interperson relations and praising independent personality, people may perform better in teamwork.

Remarkably, the incidence of the self-control problem promotes cooperation among agents through signal manipulation, alleviating the free-riding problem. If the agent reports the bad signal truthfully, he will contribute to the social project when $e < \theta_L W$, while if he transmits a fake but good signal to maintain his self-confidence, he will contribute to the social project when $e < \theta_i^*(H)W$, i.e., signal manipulation makes the individual more likely to cooperate with others. This implication is broadly supported by the evidence in the psychology literature documenting the positive relation between self-confidence and prosocial behavior discussed in the introduction. Suppose we only consider the social problem, as mentioned above. Truth-telling that corresponds to a low tendency to cooperate and a high level of free-riding is the unique perfect Bayesian equilibrium, even if it is not in the agents' best common interests to do so. Two agents has distribution functions of e $G(e)$ and $G'(e)$, with density functions $g(e)$ and $g'(e)$. The increase of social welfare from mutual signal manipulating is given by

$$\int_{\theta_L W}^{\theta_i^*(H)W} (2\theta_L W - e)[g(e) + g'(e)]de.$$

Simple calculation shows that when θ_H is not much higher than θ_L, or when p is low with a sufficiently large θ_H, mutual signal manipulation improves social welfare. In this case, the cost of overinvestment caused by a large $\theta^*(H)$ is limited, the equilibrium of signal manipulation with more cooperation and less free-riding behavior is a desirable outcome for both. Thus, the presence of the individual self-control problem provides not only an incentive for the agents to enhance their self-confidence in order to solve the underinvestment problem, but also has a spillover of encouraging cooperation and resolving the free-riding problem, resulting in greater joint benefits from the social interactions. This is summarized in the following observation.

Observation 3 *The cooperation tendency is positively correlated to overconfidence.*

3 Cross-Country Survey Evidence

Our empirical analysis in Sections 3 and 4 closely follow the theoretical implications of the model in the last section. We will test the model implications at two levels: the country level and the individual level. At the country level, we look for evidence from a comprehensive cross-cultural survey dataset; at the individual level, we conducted a large-scale incentivized online experiment to measure the variables of interest from subjects.

In this section, we argue that the model implications about motivated beliefs can be largely reflected in the cross-country heterogeneity in culture dimensions, which is therefore widely studied in cross-country surveys. This argument is closely related to the second strand of literature about the functional value of motivated beliefs at the societal level and third strand of literature about cross-country heterogeneity in motivated beliefs.

3.1 Variable Measures

3.1.1 Rosenberg's self-competence as self-confidence

To measure self-confidence, we adopt the large-scale survey conducted by Schmitt and Allik (2005), which studied the cross-country heterogeneity regarding Rosenberg (1965)'s self-esteem scale and subscales.[13] This study on subjects' self-esteem involved asking them to report their opinions about a series of questions regarding their self-evaluations with a Likert scale.[14] The Rosenberg's self-esteem scale has been widely applied in economics and psychology.[15] Self-esteem scores are not only found to be heterogeneous among individuals but also appear to differ substantially across societies and cultures. East Asian individuals are found to value modesty more and thus have lower self-esteem scores than North Americans. North American

[13]This study was carried out in 2000. Approximately 17 thousand people in 53 countries participated in the survey.

[14]The Rosenberg self-esteem scale is developed as 10-item scale that measures global self-worth by self-reporting both positive and negative feelings about the self. All survey items are answered with a 4-point Likert scale format ranging from "strongly agree" to "strongly disagree". One example of a positively worded item is "I am able to do things as well as most other people." One example of a negatively worded item is "All in all, I am inclined to feel that I am a failure." The former statement necessarily proxies one's belief about one's own capabilities and talents, while the later captures other determinants of an individual's self-esteem.

[15]In economics, for example, using Rosenberg's self-esteem as a proxy of the subjects' self-image, Bursztyn et al. (2018) find experimental evidence that an increase in the salience of self-image causally decreases the demand for status goods, suggesting that social image and self-image are substitutes, rather than complements.

subjects, in particular, tend to score higher in most survey items of Rosenberg self-esteem scale, especially for those items regarding one's belief in one's own capabilities and talents.[16] The Rosenberg's self-esteem entails two distinct but related subscales: "self-competence" and "self-liking". The subscale of self-competence is particularly close to self-efficacy beliefs relating to competence and performance, which are essentially cognitive rather than affective (Mar et al., 2006). It is defined as the self-assessment of one's capability, evaluated based on positive experiences of goal pursuits in the past (Tafarodi and Swann Jr, 2001), and therefore proxies one's belief about one's own ability in successfully achieving the goal. In our empirical analysis, we use self-competence as the measure of self-confidence in one's ability or the success rate of the project in our model.[17] Figures F.1A and F.1B in Appendix F map the global distribution of self-competence and self-liking, respectively.

3.1.2 Hofstede's indulgence vs. restraint (IVR) as present-biased preference

We use the score of the "indulgence vs. restraint (IVR)" cultural dimension from Hofstede's cultural dimensions theory as the measure of cross-cultural heterogeneity in the degree of allowing instant gratification of human desires, which is closely related to β in the model. The cultural dimensions theory (Hofstede, 2001; Hofstede, Hofstede, and Minkov, 2010) is a conceptual framework for intercultural management, developed by the social psychologist Geert Hofstede. This theory uses factor analysis to quantify the effects of a society's cultures on its members' values, norms, and behaviors.

The indulgence vs. restraint dimension refers to the degree of freedom that social norms provide to citizens in satisfying needs and cravings (Minkov, 2007; Hofstede, Hofstede, and Minkov, 2010). An "indulgent" society encourages free gratification of human desires related to pleasure and enjoyments, while individuals in a "restrained" society tend to suppress instant fulfillment of happiness, following stringent societal rules or social norms. In brief, indulgent cultures are more present-focused, while restrained ones are more future-oriented.[18] Therefore,

[16] See, e.g., Schmitt and Allik (2005) in psychology and Dessi and Zhao (2018) in economics.

[17] The dataset of Schmitt and Allik (2005) contains more country-level measures of self-confidence. To check the robustness of the empirical results reported in Tables E.1 and E.3, we use these additional measures instead of self-competence as a complementary analysis. Specifically, these additional self-confidence measures include self-esteem, self-liking, positively worded items, and negatively worded items. See Subsection C.1 of Appendix C for the variable definitions and the complementary analysis results. The correlation analysis of these self-confidence measures is reported in Table E.5 in Appendix E.

[18] In addition to indulgence vs. restraint (IVR), long-term orientation (LTO) is another cultural dimension reflecting time preference. LTO is negatively correlated with IVR, with a pairwise correlation coefficient of -0.27 in our sample (statistically significant at the 10 percent level). Long-term orientation is future-focused and connects future outcomes with attitudes and behaviors at present. Long-term-oriented societies value persistence,

the country differences in their IVR scores partly reflect the average of present-biased preference parameter β in their populations.[19] It has been found that indulgence scores are highest in Nordic cultures, the Anglo sphere, Latin America, and some regions of Africa, while restrained cultures are prevalent in Eastern Europe and East Asia. Figure F.1E in Appendix F maps the global distribution of indulgence vs. restraint (IVR).

3.1.3 Population density and extended family system as frequency of social interactions

While finding a perfect cross-country measure of the frequency of social interactions $1-\pi$ in the model does not appear to be straightforward, our study attempts to use population density and the extended family system to proxy $1-\pi$.[20]

Population density can be used as the measure of the frequency of interperson interactions between any two members of society. In a high population density society, people have sufficient opportunities to be in contact and communicate and thus cooperate with others. Research in psychology, sociology and urban studies has found that population density is positively correlated with social interactions with strangers (Brueckner and Largey, 2008) or friends (Hawley, 2012), face-to-face interactions (Büchel and Ehrlich, 2020), digitally mediated interactions (Büchel and Ehrlich, 2020), and social capital (Brueckner and Largey, 2008).

Apart from cooperation between society members, intrahousehold cooperation among family members may be more prevalent (see Alesina and Giuliano, 2014; Barr et al., 2019; Akresh, Chen, and Moore, 2012). In terms of intrahousehold cooperation, the domestic organization

perseverance, thriftiness, and adaptability. Citizens in high LTO societies would like to postpone instant or short-term gratification in exchange for larger rewards in the future. Arguably, LTO is closer to δ in the model while IVR is closer to β in definitions.

[19] He et al. (2020) propose a behavioral mechanism in which political style and individual preferences affect consumption by influencing the personal attributes of self-restraint and future focus, which are captured by the present bias parameter β in the behavioral literature on time preference. Their theoretical model suggests that an increase in self-restraint and future focus (β) leads to a decrease in overall consumption. Galor and Özak (2016) use long-term orientation (LTO) and indulgence vs. restraint (IVR) as two measures of cultural attributes relating to time preference in studying how the crop yield experienced by local ancestors can positively influence the time preference of the later generations. However, they focus their empirical analysis mainly on the cultural dimension of LTO, rather than IVR, as their theory does not explicitly incorporate the present-biased preference parameter β.

[20] To further lessen the concern of endogeneity of population density due to simultaneity between population density and self-competence score, we also use historical population densities instead of the contemporary population density for robustness checks. Specifically, we use log population density in 1950 and log population density in 1900 as two historical proxies of $1-\pi$. The empirical results using historical population densities are reported in Subsection C.2 of Appendix C.

system of a country can be used as the measure of the frequency of intrahousehold interactions between any two family members. Whether the conventional family structure is the independent nuclear family or an interdependent extended family in one society is the key determinant of cooperation opportunities among family members. Residing in extended family systems can be regarded as an important indication of the presence of large interdependent family networks that foster ample opportunities for cooperation (Enke, 2019).

Living in the same family increases the cooperation opportunities; however, it does not guarantee intrahousehold cooperation outcomes between family members. In public goods game experiments with family members, it is often observed that their incentives were not always aligned and intrahousehold allocations could not achieve efficiency even though they knew each other well (Akresh, Chen, and Moore, 2012; Munro, 2018). In repeated public goods games, Barr et al. (2019) find polygynous households to be less cooperative than monogamous households. Similarly, Akresh, Chen, and Moore (2012) also find neither inefficiency nor symmetry was achieved in intrahousehold allocations when the local polygynous households played public goods games.

In Enke (2019)'s classification method, a society is regarded as having an extended family system if the prevailing domestic organization as recorded in the original data source Ethnographic Atlas (EA) is polyandrous, polygynous or extended. A society is categorized as using an independent nuclear family system if its prevailing domestic organization is monogamous or occasional polygynous. Following Enke (2019), we use a binary variable that equals one if this country's traditional domestic organization is that of the extended family and zero otherwise. As the historical observations of the original data source for domestic organization categories is at the ethnic-group level, the ethnic-group level observations are matched to contemporary countries, and then, the country-level measure is ancestry-adjusted as described in Enke (2019) with details. Figures F.1C and F.1D in Appendix F map the global distributions of contemporary population density and ancestry-adjusted extended family systems, respectively.

3.1.4 Agreeableness in Big Five personality traits as tendency to cooperate

The last variable we need to measure in the empirical analysis is people's tendency to cooperate. This study uses "agreeableness" in the Big Five personality traits to proxy the decision of cooperation in our model.[21] Among the Big Five personality traits, the agreeableness dimension primarily reflects individual differences in the tendency to cooperate, prosociality, and social

[21] In addition to agreeableness, the other four personality traits are extraversion, openness, conscientiousness, and neuroticism.

harmony. In experimental games, the agreeableness level of subjects can predict their cooperative behaviors such as cooperative contributions in one-shot and repeated public goods games (Volk, Thöni, and Ruigrok, 2011, 2012), cooperative behavior in finitely repeated simultaneous prisoner's dilemmas (Kagel and McGee, 2014), and reactive cooperation in ultimatum games (Hilbig et al., 2013). Agreeable subjects are also inclined to believe in reciprocal behaviors of the other player, and subjects' agreeableness score can predict their beliefs about the subsequent actions of the other player (Rustichini et al., 2016).

While personality traits are elicited at the individual level, cross-country Big Five surveys have been translated into different languages and conducted in many cultures and societies. Some studies use the country-level average value of personality traits as the cultural attributes of this country and find that cross-country personality heterogeneity around the globe have substantial explanatory power for the differences in economic development and political ideology. The cross-country survey data of personality traits used in our study are obtained from Schmitt et al. (2007).[22] Figure F.1F in Appendix F maps the global distribution of agreeableness scores.

The descriptions of all variables used in the empirical analysis of Section 3 together with their data sources are summarized in Appendix D. The descriptive statistics of the main variables of interest are summarized in Table E.6 in Appendix E.

3.2 Testable Predictions

To link those variables mentioned above with our theoretical model, we conjecture the following predictions to test:

Hypothesis 1 (β-θ^* Relationship) *Countries with indulgent (restrained) cultures tend to have populations with high (low) levels of self-competence.*

The first hypothesis examines the relationship between present bias β and self-confidence θ_i^* in theory. While there may be cases in which an individual tends to report the true signal when present bias is very severe because of the existence of the social problem, if the degree of present bias is not extremely high, we can still anticipate that the degree of self-competence is positively correlated to the degree of present bias measured by indulgent (restrained) cultures (especially when the frequency of social interactions is low).

[22] The two international surveys of Rosenberg self-esteem's scale and Big Five personality traits are both parts of the first wave of the International Sexuality Description Project (ISDP) (Schmitt, 2003), including samples from 56 nations representing 6 continents, 13 islands, and 28 languages.

Hypothesis 2 (π-θ^* Relationship) *(a) Countries with a high (low) population density tend to have populations with low (high) levels of self-competence. (b) Countries with extended (nuclear) family systems tend to have populations with low (high) levels of self-competence.*

The second hypothesis considers the relationship between the probability of the individual problem π and self-confidence θ_i^*. In this section, we use two variables, population density and scale of the family system, to capture the frequency of social interactions ($1 - \pi$ in theory).

Hypothesis 3 (θ^*-e Relationship) *Countries having populations with high (low) levels of self-competence tend to have high (low) agreeableness scores.*

The last hypothesis refers to the relationship between self-confidence θ_i^* and the tendency to cooperate e, which are positively correlated in theory.

3.3 Indulgence vs. Restraint and Self-competence

To test Hypothesis 1, we regress one country's self-competence score on its IVR score. Specifically, we estimate the following empirical specification:

$$SC_i = \beta_0 + \beta_1 IVR_i + \sum_p \beta_p X_{ip} + \varepsilon_i,$$

where SC_i is country i's self-competence score; IVR_i is the IVR score; X_{ip} is a set of country-level controls; and ε_i is the error term. In addition to the proximate determinants of one country's culture such as physical capital, human capital and age composition, we also incorporate several deep determinants that might account for the cross-country heterogeneity of self-competence scores. Specifically, the set of deep determinants includes the territory size, a landlocked dummy, an island dummy and a former European colony dummy.

The OLS estimation results in Table 1 are consistent with the model prediction. Countries with indulgent cultures tend to have higher average self-competence scores than those with restrained cultures. Specifically, if one country's IVR score increases by one standard deviation, then its self-competence score tends to increase by approximately 0.5 standard deviations, and this positive effect is statistically significant at the 1 percent level if more control variables are included in the regressions.

3.4 Population Density, Extended Family System and Self-competence

To test Hypothesis 2, we regress one country's self-competence score on its population density or family system. Specifically, we estimate the following empirical specification:

Table 1: Indulgence vs. Restraint and Self-competence

	Self-competence		
	(1)	(2)	(3)
Indulgence vs. restraint	0.46**	0.58***	0.59***
	(2.41)	(2.94)	(2.99)
GDP per capita	-0.77	-0.54	-0.49
	(-1.62)	(-1.22)	(-1.10)
Secondary school enrollment rate	0.46*	0.35	0.36
	(1.74)	(1.50)	(1.09)
Age dependency ratio	-0.35	-0.18	-0.2
	(-1.13)	(-0.55)	(-0.57)
Urbanization rate		-0.12	-0.12
		(-0.58)	(-0.42)
GDP per capita growth		0.062	-0.011
		(0.38)	(-0.062)
Unemployment rate		0.34**	0.19
		(2.41)	(1.26)
Total land area			-0.04
			(-0.15)
Landlocked			-0.27
			(-1.52)
Island			-0.37*
			(-1.79)
Former European colony			0.062
			(0.22)
Observations	48	48	47
R-squared	0.2	0.29	0.41

Note: The table reports OLS estimation results suggesting that countries with indulgent cultures tend to have populations with high self-competence (Hypothesis 1). All socio-demographic control variables are averaged over 1996-2005. All independent variables and the dependent variable have been standardized by subtracting their mean and dividing by their standard deviation. The standardized coefficients show that how many standard deviations the dependent variable will change, per standard deviation increase in the independent variable. Robust t-statistics are reported in parentheses. *** denotes statistical significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level, all for two-sided hypothesis tests.

$$SC_i = \beta_0 + \beta_1 POP_i(EXT_i) + \sum_p \beta_p X_{ip} + \varepsilon_i,$$

where SC_i is country i's self-competence score; IVR_i is the IVR score; POP_i is the log population density; EXT_i is the ancestry-adjusted index of extended family system; X_{ip} is a set of country-level controls; and ε_i is the error term.

Table 2: Population Density, Extended Family System and Self-competence

	Self-competence											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Population density (logged)	-0.39***	-0.36**	-0.56**				-0.42***	-0.33**	-0.58***			
	(-2.80)	(-2.34)	(-2.65)				(-3.15)	(-2.15)	(-2.89)			
Extended family system (ancestry-adjusted)				-0.19	-0.16	-0.15				-0.2	-0.14	-0.16
				(-1.21)	(-1.03)	(-0.72)				(-1.31)	(-0.94)	(-0.87)
Indulgence vs. restraint							0.33*	0.43**	0.47**	0.38*	0.48*	0.54**
							(1.81)	(2.04)	(2.42)	(2.02)	(1.97)	(2.19)
GDP per capita	-0.039	-0.039	0.06	0.08	0.065	0.24	-0.59	-0.52	-0.58	-0.59	-0.5	-0.51
	(-0.12)	(-0.11)	(0.18)	(0.21)	(0.18)	(0.68)	(-1.46)	(-1.25)	(-1.31)	(-1.14)	(-1.06)	(-0.98)
Secondary school enrollment rate	0.27	0.22	0.15	0.3	0.15	0.27	0.24	0.23	0.18	0.33	0.26	0.37
	(1.17)	(0.86)	(0.44)	(1.04)	(0.51)	(0.72)	(1.11)	(1.03)	(0.59)	(1.16)	(0.89)	(1.01)
Age dependency ratio	0.026	0.11	0.17	0.22	0.31	0.29	-0.46	-0.35	-0.41	-0.32	-0.19	-0.24
	(0.11)	(0.38)	(0.59)	(1.08)	(1.29)	(1.11)	(-1.67)	(-1.15)	(-1.27)	(-1.01)	(-0.58)	(-0.68)
Urbanization rate		0.12	0.07		0.24	0.048		-0.059	-0.09		0.0068	-0.13
		(0.56)	(0.31)		(0.99)	(0.18)		(-0.30)	(-0.38)		(0.024)	(-0.44)
GDP per capita growth		0.058	-0.097		0.1	0.038		0.02	-0.18		0.07	-0.033
		(0.40)	(-0.69)		(0.66)	(0.25)		(0.13)	(-1.16)		(0.40)	(-0.18)
Unemployment rate		0.099	-0.052		0.13	0.11		0.2	0.013		0.23	0.18
		(0.70)	(-0.42)		(1.04)	(0.79)		(1.35)	(0.093)		(1.35)	(1.08)
Total land area			-0.21			-0.15			-0.33			-0.15
			(-0.78)			(-0.47)			(-1.29)			(-0.47)
Landlocked			-0.39**			-0.27			-0.40**			-0.28
			(-2.55)			(-1.52)			(-2.69)			(-1.48)
Island			-0.35			-0.36			-0.35*			-0.38*
			(-1.55)			(-1.49)			(-1.75)			(-1.81)
Former European colony			-0.057			0.32			-0.063			0.15
			(-0.21)			(0.93)			(-0.23)			(0.42)
Observations	51	51	50	49	49	49	48	48	47	46	46	46
R-squared	0.22	0.24	0.42	0.11	0.16	0.3	0.33	0.35	0.52	0.18	0.23	0.36

Note: The table reports OLS estimation results suggesting that countries with high population density or extended family system tend to have populations with low self-competence (Hypothesis 2). All socio-demographic control variables are averaged over 1996-2005. All independent variables and the dependent variable have been standardized by subtracting their mean and dividing by their standard deviation. The standardized coefficients show that how many standard deviations the dependent variable will change, per standard deviation increase in the independent variable. Robust t-statistics are reported in parentheses. *** denotes statistical significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level, all for two-sided hypothesis tests.

The OLS estimation results in Table 2 suggest that countries with a higher population density have lower average self-competence scores than those with a lower population density; and countries with extended domestic organization systems have lower average self-competence scores than those with nuclear family systems.

Specifically, columns (1)-(3) and (7)-(9) suggest that if one country's log population density

increases by one standard deviation, then its self-competence score tends to decrease by approximately 0.4 standard deviations. This effect is statistically significant at the 1 percent level when we control for the IVR score. Columns (4)-(6) and (10)-(12) suggest that if one country's extended family index increases by one standard deviation, then its self-competence score tends to decrease by approximately 0.15 standard deviations, though the effect is not statistically significant at conventional levels. Although the variations in extended domestic organizations do not have strong explanatory power for the heterogeneity of the average self-competence, its negative effects on self-liking and negatively worded items are statistically significant at the 5 percent level (the results are reported in Subsection C.1 of Appendix C).

3.5 Self-competence and Agreeableness

Finally, we test the relation between self-competence and agreeableness as stated in Hypothesis 3 by regressing one country's agreeableness score on its self-competence score. Specifically, we estimate the following empirical specification:

$$AGB_i = \beta_0 + \beta_1 SC_i + \sum_p \beta_p X_{ip} + \varepsilon_i,$$

where AGB_i is country i's agreeableness score; SC_i is the self-competence score; X_{ip} is a set of country-level controls; and ε_i is the error term.

The OLS estimation results in Table 3 suggest that countries with higher average self-competence scores have higher average agreeableness scores. The baseline regressions results in columns (1) and (2) suggest that, if the average self-competence score increases by one standard deviation, then the average agreeableness score will increase by approximately 0.3 standard deviations, and this positive effect is statistically significant at the 1 percent or 5 percent level.

One concern threatening the robustness of the conclusion above is that there appear to be many historical factors, geographical determinants, and social norms that can drive the formation and evolution of cooperative tendency and social capital in societies. The literature on culture and economics has explored multiple accounts for the cross-country heterogeneity of cooperativeness and the causes of the long-term persistence of social capital (Enke, 2019; Guiso, Sapienza, and Zingales, 2008; Butler, Giuliano, and Guiso, 2016). It is also possible that cultures and norms vary in their work habits (e.g., Protestant ethic) which may also correlate with overconfident beliefs. To rule out the possibility that the statistically significant correlation between agreeableness and self-competence are due to the persistent environment (i.e., geography, history, and norms), instead of the strategic motivation, we attempt to include more deep determinants of cooperativeness as controls in Table 3. Specifically, in columns (3)-

Table 3: Self-competence and Agreeableness

	Agreeableness										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Self-competence	0.29**	0.32***	0.31**	0.33**	0.26**	0.31***	0.33***	0.35***	0.38***	0.25**	0.39***
	(2.17)	(2.83)	(2.64)	(2.65)	(2.44)	(2.75)	(3.05)	(3.06)	(3.08)	(2.33)	(3.23)
GDP per capita, PPP	0.3	0.78**	0.82***	0.69**	0.77**	0.78***	0.68**	0.70**	0.64	0.67**	0.80**
	(1.22)	(2.65)	(2.75)	(2.10)	(2.55)	(2.71)	(2.24)	(2.49)	(1.68)	(2.36)	(2.64)
Secondary school enrollment rate	-0.34*	-0.14	-0.13	-0.16	-0.18	-0.13	-0.18	-0.059	-0.089	-0.12	-0.14
	(-1.96)	(-0.83)	(-0.70)	(-0.75)	(-1.02)	(-0.75)	(-1.05)	(-0.32)	(-0.41)	(-0.72)	(-0.76)
Age dependency ratio	0.44**	0.60***	0.57***	0.47*	0.57**	0.58***	0.52**	0.56**	0.54**	0.3	0.65***
	(2.40)	(2.84)	(2.72)	(1.76)	(2.49)	(2.85)	(2.38)	(2.63)	(2.11)	(1.21)	(3.14)
Urbanization rate		-0.62***	-0.65***	-0.65**	-0.56**	-0.67**	-0.59**	-0.59**	-0.56*	-0.75***	-0.66***
		(-2.84)	(-2.72)	(-2.48)	(-2.49)	(-2.52)	(-2.68)	(-2.60)	(-1.77)	(-3.38)	(-3.25)
GDP per capita growth		0.11	0.12	0.14	0.11	0.11	0.063	0.052	0.12	0.17	0.11
		(0.70)	(0.80)	(0.87)	(0.73)	(0.70)	(0.41)	(0.36)	(0.67)	(1.20)	(0.69)
Unemployment rate		-0.11	-0.095	-0.096	-0.16	-0.12	-0.11	-0.094	-0.13	-0.039	-0.086
		(-0.87)	(-0.70)	(-0.64)	(-1.07)	(-0.93)	(-0.81)	(-0.76)	(-1.05)	(-0.29)	(-0.66)
Former European colony			0.094								
			(0.72)								
Communist regime in Post-WWII				-0.13							
				(-0.85)							
Confucian world					-0.17**						
					(-2.05)						
Percentage of population with native ancestry in 1500 CE						-0.074					
						(-0.56)					
Share of Protestants in the population							0.14				
							(1.33)				
Shares of major religions	No	No	No	No	No	No	No	Yes	No	No	No
Colonial origin dummies	No	No	No	No	No	No	No	No	Yes	No	No
Legal origin dummies	No	No	No	No	No	No	No	No	No	Yes	No
Geographical factors	No	No	No	No	No	No	No	No	No	No	Yes
Observations	51	51	50	48	51	51	51	51	50	51	51
R-squared	0.28	0.43	0.43	0.4	0.45	0.43	0.44	0.48	0.51	0.55	0.46

Note: The table reports OLS estimation results suggesting that countries having populations with high self-competence tend to have high agreeableness scores (Hypothesis 3). All socio-demographic control variables are averaged over 1996-2005. Shares of major religions include the shares of Protestants, Roman Catholics, Muslims, and other religions in 1980; colonial origins include Spanish, British, French, Portuguese, and other European colonial origin; legal origins include British, French, Socialist, German, and Scandinavian legal origin; geographical factors include log total land area, a landlocked dummy, and an island dummy. All independent variables and the dependent variable have been standardized by subtracting their mean and dividing by their standard deviation. The standardized coefficients show that how many standard deviations the dependent variable will change, per standard deviation increase in the independent variable. Robust t-statistics are reported in parentheses. *** denotes statistical significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level, all for two-sided hypothesis tests.

(11), we account for the potential confounding effects of being a former European colony, being a communist regime in post-WWII, being strongly influenced by Confucianism, the percentage of population with native ancestry in 1500 CE, the share of Protestants in the population, the shares of three major religions in the population, the colonial origin during the European colonial period, the legal system origin, and geographical factors. The regression results establish that, accounting for some deep determinants of the cooperative culture and social capital, such as historical factors, social norms, and geographical determinants, the coefficients on self-competence score remain statistically and economically significant.

4 Within-Country Online Experiment

In this section, we argue that the model implications about motivated beliefs can be largely reflected in the individual heterogeneity in economic preference, personality traits and beliefs. We therefore designed an online experiment to elicit or measure the subjects' overconfidence, time preference, frequency of social interactions, and tendency to cooperate. This argument is closely related to the first strand of literature about the functional role of motivated beliefs in resolving the self-control problem at the individual level.

4.1 Online Experiment

The individual-level data are collected from a large-scale incentivized online experiment to elicit subjects' time preference and overconfident belief, followed by a post-experiment survey. The online survey experiment was conducted on Wenjuanxing from September 10, 2022 to September 12, 2022. Wenjuanxing is a popular Chinese platform widely used by scholars for survey design and data collection. The entire online survey experiment consists of three stages. The first stage is a time preference elicitation task to measure the present-biased parameter β in the model, the second stage is to elicit the subject's overconfident belief about his ability, and the last stage is a post-experiment survey for subjects to self-report their information about the number of siblings, their tendency to cooperate in family issues, and several socio-demographic characteristics. A translated version of the online experiment instructions and materials is available in Appendix G (the original version is in Chinese).

We got a highly demographically varied sample representing the larger population in China from the online experiment, rather than a convenient sample of college students. A total of 1,679 subjects participated the online experiment. The average age of the subjects are 31.24, and 64.7 percent of them are females. The mean and median response times are 507 seconds and 437 seconds, respectively. More descriptive statistics of the variables of interest from the

subjects are summarized in Table E.9 in Appendix E.

4.1.1 Present-biased preference

We use a standard multiple-price list (MPL) design (Holt and Laury, 2002) to elicit each experiment subject's time preference. The MPL task was randomly incentivized with a lottery. The MPL task consists of a series of proximate intertemporal decisions (the proximate task) and distal intertemporal decisions (the distal task). For example, in one of the proximate intertemporal decisions, the subjects were asked "Would you rather receive ¥200 tomorrow or ¥220 after 31 days?" They can either choose to get ¥200 tomorrow, or get ¥220 after 31 days, but not both. The distal intertemporal decisions involve a choice between a monetary value after 31 days and another (usually larger) monetary value after 61 days. The degrees of time preference discount rates are elicited from comparisons between their trade-offs in the proximal task (next day versus 31 days later) and the distal task (31 days versus 61 days later). Specifically, the ratio of two values at the switch point (where subjects' choices switch from the early date option to the late date option) in the distal task elicits normal discount rate δ; while the ratio of two values at the switch point in the proximal task elicits near term discount rate $\beta\delta$. The ratio of two discount rates measures the present bias parameter β.[23]

4.1.2 Overconfidence

In studying the affective or functional role of overconfidence, most experimental studies elicit the overconfident beliefs of subjects' cognitive intelligence using Raven's progressive matrices (Chew, Huang, and Zhao, 2020; Zimmermann, 2020; Hagenbach and Saucet, 2022) or a quantitative literacy test (Burks et al., 2013). The correlation between present-biased parameter β and overconfidence in one's cognitive intelligence has been well documented in the experimental literature studying the functional value of motivated beliefs in resolving the self-control problem at the individual level (Chew, Huang, and Zhao, 2020). In our experiment design, instead of eliciting the subjects' overconfident belief about their cognitive intelligence, we elicit and study their emotional intelligence and the corresponding beliefs. Cognitive intelligence reflects an individual's capability of critical thinking, analytical reasoning, and mental focus, while emotional intelligence reveals an individual's capability of dealing with emotion recognition, social communication, and social relations. As our model discusses an ability used in a social project involving cooperation, emotional intelligence is used as the source of motivated belief

[23] Only 3.93 percent of the subject had multiple-switching behaviors in the time preference elicitation tasks (in either the proximal task or the distal task).

in our experiment. Overconfidence effect in emotional intelligence has also been explored in literature. For example, Maia, Bonfim, and Da Silva (2020) study the overconfidence effects of both emotional intelligence and cognitive intelligence, and they identify significant gender differences of emotional overconfidence. Riordan and Trichtinger (2017) also find that subjects tend to be optimistic and overconfident about their ways of interpreting others' affects and emotions in digitally mediated interactions.

Specifically, in our online experiment, we use a 6-item situational test of emotion management (STEM) to measure subjects' emotional intelligence. STEM is performance-based multiple-choice test developed by psychologists MacCann and Roberts (2008) to evaluate how well an individual can manage their emotions in different situations. The test simulates situations representing sadness, fear and anger in work life and personal life settings. It has been widely adopted as the paradigm to assess people's emotional intelligence (Allen et al., 2015). In STEM, each subject is presented with some brief descriptions of emotional situations and is asked to choose the best one action from four choices to manage emotional feelings and the problems they are facing. While more than one option may be possible, the subject is asked to choose what he thinks is the best way to react in that situation. In our experiment, the six items of STEM were carefully picked to be about personal life issues, and all items were translated into Chinese.

Different from cognitive intelligence test with single correct answers, an STEM item has multiple correct answers and it uses a weighted scoring scheme. For example, one STEM item has four candidate options A, B, C, D to be chosen from, and the weighted score distribution is A = 0, B = 0.167, C = 0.833, and D = 0. The subject gets 0 score for choosing option A or option D, 0.167 score for choosing option B, and 0.833 score for choosing option C. Due to the weighted scoring scheme of STEM, it is difficult for us to elicit the absolute overconfidence (i.e., overestimation of one's actual performance) from the subjects. Instead, we elicited their relative overconfidence (i.e., overplacement of one's performance relative to others). Adopting the method of eliciting relative overconfidence used by Burks et al. (2013), we asked the subjects to report their belief of their performance in STEM relative to the rest of the experiment participants by identifying the quartile of performance in which their score would fall (i.e., first quartile, second quartile, third quartile, or fourth quartile). With their answers to STEM, we can calculate their score and identify the quartile into which their score actually fell.[24] The positive difference between one subject's self-evaluated quartile and the actual quartile in which

[24] Burks et al. (2013) elicit overconfident beliefs from experimental subjects about their cognitive intelligence both before and after the IQ tasks. As the pre-test belief elicitation can affect the performance during STEM, we only conducted the post-test belief elicitation to avoid this concern.

his score falls in is the measure of relative overconfidence of his emotional intelligence.[25] Both STEM and confidence elicitation were randomly incentivized with lotteries.

The average score of STEM of all subjects is 3.224 out of 6. The average self-evaluated quartile in STEM is 3.13. There are 56.9 percent of the subjects who were overconfident and incorrectly believed that they were in the higher quartile than the quartile their score actually fell. On average, they overplaced themselves by 0.742 quartile. These results establish the common "overconfidence effect" in emotional intelligence.

4.1.3 The only child and the number of siblings as frequency of social interactions

We use two variables to proxy the frequency of social interactions within families. The first is a binary variable of indicating the subject is the only child in his family, and the second is the number of siblings the subject has. We argue that the number of children in Chinese families are exogenous variables in regressing Chinese subjects' overconfident beliefs on the binary variable of being the only child (or the ordinal number of siblings). First, in China, family planning and fertility decisions are primarily done by the parents with little involvement of their children. The first-born (or elder) children can rarely affect the fertility decisions of their parents. Therefore, the number of one's siblings is exogenous from the perspective of the children.

Second, we argue that the one-child policy in China can further ensure the exogeneity of the number of one's siblings from the perspective of the first-born children. The one-child policy was a program in China that limited most Chinese couples to have one child each. It was implemented nationwide by the Chinese government from 1980, and it ended in 2016. Beyond the control of Chinese families, the implementation of the one-child policy abruptly and exogenously decreased the probability of social interactions within the family, especially for those only children. The "little emperor syndrome" in China describes the phenomenon that the only children enjoy excessive attention from their parents since the implementation of one-child policy, therefore, they are often regarded as more self-centered, more detached, and less cooperative. They are also expected to have higher self-confidence and greater sense of security in social interactions because the only children's parents are more responsive to their needs (Cameron et al., 2013). However, in studying the "little emperor syndrome", Kadoya, Khan, and Sano (2018) examine whether Chinese employees born after the one-child policy are really less cooperative in the workplace but find evidence that the only child generation is no less cooperative than the older generation. Shi et al. (2017) find that students from one-child families are more likely to show high self-esteem than their counterparts.

[25] The correlation analysis of these subject-level STEM-related values is reported in Table E.7 in Appendix E.

In our experiment, after eliciting the overconfident belief, the subjects were asked to complete a post-experiment survey to provide information of their socio-demographic background, including their gender, birth year, marital status, household size, and highest degree. Besides the basic socio-demographic information, we also include two survey questions to proxy the frequency of within-family social interactions. The first question asks whether the subject is an "only child", and the second question asks the number of siblings in his family.[26] In our sample, 37.5 percent of the subjects are only children, and the average number of siblings they have is 1.314.

4.1.4 Tendency to cooperate

At the end of the post-experiment survey, we designed a 5-item measurement scale for subjects to self-report their tendency to cooperate. Specifically, the subjects were asked to read five statements each describing one common family situation, and then for each statement, they were asked to choose the option that can reflect the real situation of their family. The five statements are "(1) family members cooperate with each other", "(2) I cooperate with my siblings" (only for subjects with siblings), "(3) I contribute a lot to my family", "(4) payoffs are shared among family members", and "(5) family members with greater ability contribute more", respectively. The subjects can indicate the frequencies of specific family situations on a 5-point Likert scale ("never/almost never" = 1, "rarely" = 2, "occasionally" = 3, "often" = 4, and "always/almost always" = 5). The first three statements are used as the measures of the tendency to cooperate in family issues.[27] The last two statements are used to evaluate the validity of our model assumptions in the family context from the perspective of the subjects. The mean response values for the two statements "(4) payoffs are shared among family members" and "(5) family members with greater ability contribute more" are 3.585 and 3.924, respectively, on a 5-point Likert scale. This suggests strong validity of our model assumptions.

4.2 Testable Predictions

To link the online experiment with our theoretical model, we conjecture the following predictions to test:

[26] These two questions can reconcile with each other to detect disagreements of the answers from inattentive subjects. There are 7.8 percent of responses having conflicting answers to the two survey questions (i.e., only children have siblings, or non-only children do not have siblings) from inattentive subjects.

[27] The correlation analysis of the three tendency to cooperate measures is reported in Table E.8 in Appendix E.

Hypothesis 4 (β-θ^* Relationship) *Subjects with a lower (higher) value of β elicited from the MPL time preference task tend to exhibit higher (lower) relative overconfidence in estimating his quartile in STEM.*

The first hypothesis examines the relationship between present bias β and self-confidence θ_i^* in theory. Proposition 2 shows that when β is large enough, θ^* is significantly increasing in β. If not, the relation between θ^* and β may be close to be monotonic only when π is sufficiently large.

Hypothesis 5 (π-θ^* Relationship) *(a) Subjects who are (not) the only child tend to exhibit higher (lower) relative overconfidence in estimating his quartile in STEM. (b) Subjects who have fewer (more) siblings tend to exhibit higher (lower) relative overconfidence in estimating his quartile in STEM.*

The second hypothesis considers the relationship between the probability of the individual problem π and overconfidence θ_i^*. In this section, we use two variables, the only child and the number of siblings, to capture the frequency of social interactions in family context ($1 - \pi$ in theory).

Hypothesis 6 (θ^*-e Relationship) *Subjects who exhibit higher (lower) relative overconfidence in estimating his quartile in STEM tend to report higher (lower) tendency to cooperate in family issues.*

The last hypothesis refers to the relationship between overconfidence θ_i^* and tendency to cooperate e, which are positively correlated in theory.

4.3 The Only Child, Present Bias, and Overconfidence

To test Hypothesis 4, we regress the measures of subjects' relative overconfidence in emotional intelligence on the measure of β elicited from the MPL time preference task. To test Hypothesis 5, we regress the measures of subjects' overconfidence on the binary variable of being the only child in the family or the ordinal variable of the number of siblings. Specifically, we estimate the following empirical specification:

$$Overconfidence_i = \alpha_0 + \alpha_1 \beta_i + \alpha_2 OnlyChild_i(NoSiblings_i) + \sum_p \alpha_p X_{ip} + \varepsilon_i,$$

where $Overconfidence_i$ is subject i's measure of overconfidence elicited as the overplacement of his quartile in STEM; β_i is the measure of β elicited from the MPL time preference task;

$OnlyChild_i$ is a binary variable of being the only child in the family; $NoSiblings_i$ is an ordinal variable of the number of siblings in the family; X_{ip} is a set of subject-level controls; and ε_i is the error term.

The OLS and probit estimation results in Table 4 suggest that subjects with a lower value of β elicited from the MPL time preference task tend to exhibit higher relative overconfidence in emotional intelligence (though this result is not statistically significant at conventional levels), and subjects who are the only child or have fewer siblings tend to exhibit higher relative overconfidence.[28] The dependent variable "overconfidence in STEM" is an ordinal variable ranging from -3 to 3, and "be overconfident in STEM" is a binary variable with values $\{0, 1\}$.

Specifically, columns (1)-(3) suggest that, compared with subjects with siblings, the only children subjects tend to more aggressively overestimate their relative performance in STEM by about 0.17 quartile. This effect is statistically significant at the 1 percent or 5 percent level when we use different sets of control variables. Columns (7)-(9) suggest that, compared with subjects with siblings, the only children subjects are about 19 percent more likely to be overconfident in estimating their relative performance in STEM, and this effect is statistically significant at the 1 percent level even if we control the household size. Columns (4)-(6) suggest that, if the number of siblings increases by one, the subjects tend to less aggressively overestimate their relative performance in STEM by about 0.05 quartile, and this effect is statistically significant at the 5 percent level. Columns (10)-(12) suggest that, if the number of siblings increases by one, the subjects are about 5.3 percent less likely to be overconfident in estimating their relative performance in STEM, and this effect is statistically significant at the 1 percent or 5 percent level.

The effect of the present-biased parameter β is not statistically significant at conventional levels, as suggested by Table 4, while this is inline with our theoretical implications. Proposition 2 shows that when β is large enough, θ^* is significantly increasing in π. If not, the relation between θ^* and β may be close to be monotonic only when π is sufficiently large.[29]

[28] The subjects who had multiple-switching behaviors in time preference elicitation and/or conflicting answers to the survey questions about the only child and number of siblings are excluded from the regression sample. In the full sample, 3.93 percent of the subjects had multiple-switching behaviors. If we use the first switching point to calculate the present-biased parameter β, the regressions with the full sample lead to the same conclusions and the same statistical significance. In the full sample, 7.8 percent of the subjects had conflicting answers to the survey questions about the only child and number of siblings. If we ignore the conflicting answers, the regressions with the full sample lead to the same conclusions and the same statistical significance. The regression results with the full sample are available upon request.

[29] Another possible explanation for the statistical insignificance of the effect of the present-biased parameter β is based on the shortcomings of MPL time preference task in an online experiment context. First, it is difficult

Table 4: The Only Child and Overconfidence

	Overconfidence in STEM						Be overconfident in STEM					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
The only child	0.17***	0.18***	0.17**				0.19***	0.20***	0.19***			
	(0.065)	(0.065)	(0.065)				(0.071)	(0.071)	(0.072)			
Number of siblings				-0.053**	-0.053**	-0.051**				-0.053**	-0.053**	-0.048*
				(0.022)	(0.022)	(0.023)				(0.024)	(0.024)	(0.025)
β		-0.068	-0.067		-0.059	-0.06		-0.12	-0.11		-0.11	-0.098
		(0.18)	(0.18)		(0.18)	(0.18)		(0.21)	(0.21)		(0.20)	(0.21)
Female	-0.011	-0.0099	-0.0093	-0.02	-0.019	-0.018	-0.05	-0.049	-0.051	-0.061	-0.059	-0.061
	(0.064)	(0.064)	(0.064)	(0.064)	(0.064)	(0.064)	(0.071)	(0.071)	(0.071)	(0.070)	(0.070)	(0.071)
Age	0.010***	0.010***	0.011***	0.011***	0.011***	0.011***	0.0081**	0.0080**	0.0071	0.0081**	0.0081**	0.0072
	(0.0031)	(0.0031)	(0.0040)	(0.0031)	(0.0031)	(0.0040)	(0.0034)	(0.0034)	(0.0044)	(0.0034)	(0.0034)	(0.0044)
Married			-0.01			-0.014			0.0035			0.0015
			(0.075)			(0.076)			(0.084)			(0.085)
Household size			-0.009			-0.0055			-0.022			-0.02
			(0.019)			(0.020)			(0.021)			(0.022)
log seconds used in survey			-0.052			-0.055			0.03			0.026
			(0.080)			(0.080)			(0.097)			(0.095)
Constant	0.80***	0.87***	1.22**	0.99***	1.05***	1.39**	0.57	0.69	0.62	0.76*	0.87*	0.79
	(0.25)	(0.31)	(0.58)	(0.25)	(0.31)	(0.58)	(0.39)	(0.44)	(0.74)	(0.40)	(0.45)	(0.74)
Education level dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1490	1490	1490	1490	1490	1490	1490	1490	1490	1490	1490	1490
R-squared	0.034	0.034	0.034	0.033	0.033	0.033						
Chi-squared							40.2	40.4	41.5	37.2	37.4	38.6

Note: The table reports OLS and probit estimation results suggesting that the only children subjects or subjects with fewer siblings tend to be more overconfident in their emotional intelligence (Hypothesis 5). "Overconfidence in STEM" is an ordinal variable ranging from -3 to 3. "Be overconfident in STEM" is a binary variable with values $\{0, 1\}$. The subjects who had multiple-switching behaviors in time preference elicitation and/or conflicting answers to the survey questions about the only child and number of siblings are excluded from the regression sample. Robust standard errors are reported in parentheses. *** denotes statistical significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level, all for two-sided hypothesis tests.

4.4 Overconfidence and Tendency to Cooperate

To test Hypothesis 6, we regress three self-reported measures of the subjects' tendency to cooperate in family issues on the measures of their relative overconfidence in emotional intelligence. Specifically, we estimate the following empirical specification:

$$Cooperativeness_i = \alpha_0 + \alpha_1 Overconfidence_i + \sum_p \alpha_p X_{ip} + \varepsilon_i,$$

where $Cooperativeness_i$ is subject i's self-reported measure of his tendency to cooperate in family issues; $Overconfidence_i$ is subject i's measure of overconfidence elicited as the overplacement of his quartile in STEM; X_{ip} is a set of subject-level controls; and ε_i is the error term.

The OLS estimation results in Table 5 suggest that overconfident subjects tend to report higher cooperativeness in family issues. The dependent variables "family members cooperate with each other", "I cooperate with my siblings", and "I contribute a lot to my family" are ordinal variables ranging from 1 to 5, indicating the degree the subject agrees with the corresponding statement. Specifically, columns (1) and (2) suggest that the subjects who are more overconfident in estimating their relative performance in STEM report higher tendency to cooperate among family members, and this effect is statistically significant at the 1 percent level. Columns (3) and (4) suggest that, compared with non-over-confident subjects, the overconfident subjects report higher tendency to cooperate among family members, and this effect is statistically significant at the 5 percent level when a larger set of control variables is included. Similarly, columns (5)-(8) suggest that overconfident subjects report higher tendency to cooperate with their siblings, and columns (9)-(12) suggest that overconfident subjects report higher contribution to family issues (though not statistically significant at conventional levels).[30]

5 Concluding Remarks

While the relation between self-cognition and social behavior has been discussed in psychology, the recent economics literature only deals with these two topics separately. In this paper,

to guarantee the immediacy of early payment (and its consumption) because online subjects do not complete the experiment at the same time. The immediacy of early payment is crucial for the elicitation and estimation of β. Second, the credibility of the future payment is inherently lower for an online experiment.

[30] These results echo the experimental evidence of Sukenik, Reizer, and Koslovsky (2018), who find a strong association between subjects' agreeableness and overconfidence. In their study, one subject's overconfidence is measured as the gap between the belief in his performance in a research project and the true performance evaluated by another objective assessor.

Table 5: Overconfidence and Tendency to Cooperate

	"Family members cooperate with each other."				"I cooperate with my siblings."				"I contribute a lot to my family."			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Overconfidence in STEM	0.15***	0.17***			0.18***	0.21***			0.072	0.080*		
	(0.050)	(0.050)			(0.064)	(0.063)			(0.047)	(0.047)		
Be overconfident in STEM			0.14	0.19**			0.14	0.18*			0.033	0.058
			(0.088)	(0.087)			(0.11)	(0.11)			(0.080)	(0.077)
Score in STEM	0.22***	0.21***	0.22***	0.21***	0.21**	0.20**	0.20**	0.20**	0.12	0.12	0.13*	0.12
	(0.080)	(0.078)	(0.081)	(0.080)	(0.099)	(0.098)	(0.10)	(0.100)	(0.078)	(0.077)	(0.079)	(0.078)
Quartile in STEM	0.035	0.058	-0.056	-0.032	0.093	0.12	-0.022	-0.0032	0.012	0.023	-0.048	-0.035
	(0.076)	(0.075)	(0.070)	(0.069)	(0.095)	(0.095)	(0.089)	(0.088)	(0.074)	(0.074)	(0.067)	(0.067)
Female	0.062	0.053	0.066	0.058	0.045	0.051	0.047	0.054	0.15***	0.13***	0.15***	0.13***
	(0.054)	(0.054)	(0.054)	(0.054)	(0.068)	(0.068)	(0.068)	(0.068)	(0.050)	(0.050)	(0.050)	(0.050)
Age	0.0049*	0.0046	0.0056**	0.0053	-0.0039	0.0029	-0.0031	0.0036	0.035***	0.028***	0.036***	0.029***
	(0.0025)	(0.0034)	(0.0025)	(0.0034)	(0.0030)	(0.0039)	(0.0031)	(0.0039)	(0.0024)	(0.0032)	(0.0024)	(0.0032)
Married		0.14**		0.14**		-0.043		-0.04		0.31***		0.31***
		(0.068)		(0.068)		(0.080)		(0.081)		(0.062)		(0.061)
Household size		0.11***		0.11***		0.099***		0.096***		0.052***		0.051***
		(0.017)		(0.017)		(0.019)		(0.020)		(0.017)		(0.017)
log seconds used in survey		-0.14**		-0.15**		-0.23**		-0.23**		-0.051		-0.053
		(0.072)		(0.072)		(0.094)		(0.093)		(0.066)		(0.067)
Constant	2.01***	2.38***	2.19***	2.59***	2.07***	2.77***	2.31***	3.04***	2.34***	2.44***	2.47***	2.58***
	(0.41)	(0.58)	(0.40)	(0.57)	(0.50)	(0.74)	(0.48)	(0.73)	(0.31)	(0.49)	(0.30)	(0.48)
Education level dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1679	1679	1679	1679	1100	1100	1100	1100	1679	1679	1679	1679
R-squared	0.038	0.072	0.034	0.068	0.034	0.061	0.027	0.053	0.14	0.16	0.14	0.16

Note: The table reports OLS estimation results suggesting that overconfident subjects tend to be more cooperative in family issues (Hypothesis 6). "Overconfidence in STEM" is an ordinal variable ranging from -3 to 3. "Be overconfident in STEM" is a binary variable with values $\{0, 1\}$. "Family members cooperate with each other", "I cooperate with my siblings", and "I contribute a lot to my family" are ordinal variables ranging from 1 to 5, indicating how much the subject agrees with the corresponding statement. Robust standard errors are reported in parentheses. *** denotes statistical significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level, all for two-sided hypothesis tests.

we attempt to fill this gap by integrating the cognitive bias induced by internal motivation with interperson interaction in the external environment. We theoretically study a variety of aspects of behavioral differences and claim that idiosyncratic environmental parameters, including population density, generate the observed differences in self-cognition and prosocial behaviors. Specifically, we find that with certain costs of signal manipulation (such as the cost of overconfidence in the social problem in our theory), truth-telling is optimal in equilibrium when present bias is very severe. This nonmonotonic relationship between the incidence of motivated belief and present bias may be a subject of further investigation in a more general setting.

In the empirical analysis, we first use cross-country data that measure present bias, cooperative chance, overconfidence and tendency to cooperate at the country level to test three theoretical implications. The cross-country comparative analysis suggests that (1) people in countries with indulgent cultures (low β) tend to be more self-competent than people in countries with restrained cultures (high β); (2) people in countries with high population densities or extended family systems (low π) tend to be less self-competent than people in countries with low population densities or nuclear family systems (high π); and (3) people in countries with self-competent cultures are more agreeable in terms of personality traits.

To complement the empirical findings in cross-country analysis, we conducted a large-scale online experiment with a post-experiment survey in China to obtain the variables of present bias, cooperative chance, overconfidence and tendency to cooperate at the individual level. The subject-level analysis suggests that (1) subjects who are the only child or have fewer siblings (high π) tend to exhibit higher relative overconfidence in their emotional intelligence, and (2) subjects who are more overconfident in emotional intelligence tend to report higher cooperativeness in family issues. While it appears difficult to establish causal relations, our initial evidence is suggestive, and we leave a more thorough empirical strategy for future research.

From a practical point of view, our findings may have managerial implications in the context of urbanization. The increasing population density (or frequency of social interactions) in the process of urbanization may not only lead to an environmental damage, but also involve mental health issues associated with low self-esteem and free-riding problems within organizations, according to our study. This turns out to be a new managerial challenge in the modern urbanization era. Therefore, managers may benefit from creating relatively more independent working environment, promoting employees' self-confidence and prosocial behaviors, to achieve a sustainable corporate culture, especially in the post-epidemic days when "working from home" becomes a new normal (see Bloom et al. (2015)).

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A Proof of Proposition 1

The net gain of signal manipulation in social problem is

$$\upsilon(r_i^*) = \int_{\theta_L W}^{\theta_i^*(H)W} (\theta_L W - e) dG(e).$$

We can simply get $\partial \upsilon(r_i^*)/\partial r_i^* = (\theta_H - \theta_L)[\theta_L - \theta_i^*(H)]g[\theta_i^*(H)W]W^2 < 0$.

The net gain of signal manipulation in individual problem is

$$\psi(r_i^*, \beta) = \int_{\beta\theta_L V}^{\beta\theta_i^*(H)V} (\theta_L V - c) dF(c).$$

It is obvious that $\psi(r_i^*, 0) = 0$, $\psi(r_i^*, 1) < 0$, and $\psi(r_i^*, \beta) > 0$ for $\beta \in (0, \theta_L/\theta_i^*(H)]$. Additionally, for $\beta \in [\theta_L/\theta_i^*(H), 1]$, we have

$$\frac{\partial \psi(r_i^*, \beta)}{\partial \beta} = \theta_i^*(H)[\theta_L - \beta\theta_i^*(H)]f[\beta\theta_i^*(H)V]V^2 - \theta_L(\theta_L - \beta\theta_L)f(\beta\theta_L V)V^2 < 0.$$

Therefore, we must be able to find a unique $\tilde{\beta}(r_i^*) \in (\theta_L/\theta_i^*(H), 1)$ such that $\psi(r_i^*, \tilde{\beta}(r_i^*)) = 0$. Meanwhile, we have

$$\frac{\partial \psi(r_i^*, \beta)}{\partial r_i^*} = \beta(\theta_H - \theta_L)[\theta_L - \beta\theta_i^*(H)]f[\beta\theta_i^*(H)V]V^2.$$

Because $\tilde{\beta}(r_i^*) \in (\theta_L/\theta_i^*(H), 1)$, we must have $\partial \psi(r_i^*, \tilde{\beta}(r_i^*))/\partial r_i^* < 0$, and $\partial \tilde{\beta}(r_i^*)/\partial r_i^* < 0$ as well.

As $\tilde{\beta}(r_i^*) \in [q, 1]$, let $\underline{\beta} \equiv \tilde{\beta}(1)$ and $\overline{\beta} \equiv \tilde{\beta}(q)$. When $\beta \in (\overline{\beta}, 1]$, $\chi(r_i^*, \beta)$ must be negative for any $\pi \in [0, 1]$ and $r_i^* \in [q, 1]$, as both $\psi(r_i^*, \beta)$ and $\upsilon(r_i^*)$ are negative. In this case, there is only one pure strategy PBE with $h_A^* = 1$ and $h_B^* = 1$.

When $\beta \in [\underline{\beta}, \overline{\beta}]$, we have $\psi(q, \beta) > 0$ and $\psi(1, \beta) < 0$. Define $\pi'(\beta)$ to be the solution of the following equation

$$\pi\psi(q, \beta) + (1 - \pi)\upsilon(q) = 0.$$

We can get that when $\pi \in (\pi'(\beta), 1]$, $\chi(q, \beta)$ is positive, there is a pure strategy PBE with $h_A^* = 0$ and $h_B^* = 0$. Additionally, $\chi(1, \beta)$ is nagative for any $\pi \in [0, 1]$, so there is a pure strategy PBE with $h_A^* = 1$ and $h_B^* = 1$.

When $\beta \in [0, \underline{\beta})$, we have $\psi(r_i^*, \beta) > 0$ for any $r_i^* \in [q, 1]$.

Define $\pi''(\beta)$ to be the solution of the following equation

$$\pi\psi(1,\beta)+(1-\pi)\upsilon(1)=0.$$

We can get that when $\pi\in(\pi'(\beta),1]$, $\chi(q,\beta)$ is positive, there is a pure strategy PBE with $h_A^*=0$ and $h_B^*=0$. when $\pi\in[0,\pi'(\beta))$, $\chi(1,\beta)$ is negative, there is a pure strategy PBE with $h_A^*=1$ and $h_B^*=1$.

B Proof of Proposition 2

From proof of Proposition 1, we know that when $\beta\leq\theta_L/[q\theta_H+(1-q)\theta_L]$, $\chi(r_i^*,\beta)$ is always decreasing in r_i^*. Define $\tilde{q}$ as the solution of the following equation

$$\int_{\frac{\theta_L^2V}{q\theta_H+(1-q)\theta_L}}^{\frac{\theta_L\theta_HV}{q\theta_H+(1-q)\theta_L}}(\theta_LV-c)dF(c)=0.$$

The above integral is positive when $q=0$ and negative when $q=1$, and is decreasing in q. Therefore, when $q<\tilde{q}$, the above integral is positive, i.e., $\underline{\beta}$ is larger than $\theta_L/[q\theta_H+(1-q)\theta_L]$.

Let $\underline{\pi}$ be the solution of $\chi(q,\theta_L/[q\theta_H+(1-q)\theta_L])=0$ and $\overline{\pi}$ be the solution of $\chi(1,\theta_L/[q\theta_H+(1-q)\theta_L])=0$. Additionally, let $\underline{\underline{\beta}}<\overline{\overline{\beta}}$ be the solutions of $\chi(1,\beta)=0$ and $\chi(q,\beta)=0$ respectively.

When $\pi\in[0,\underline{\pi})$, $\chi(r_i^*,\beta)$ is always negative for any $r_i^*\in[q,1]$ and $\beta\in[\theta_L/[q\theta_H+(1-q)\theta_L],1]$, there is only one PBE with $h_A^*=1$ and $h_B^*=1$.

When $\pi\in[\underline{\pi},\overline{\pi}]$, we have $\chi(1,\beta)$ is always negative for any $\beta\in[\theta_L/[q\theta_H+(1-q)\theta_L],1]$, and $\chi(q,\beta)$ is positive for $\beta\in[\theta_L/[q\theta_H+(1-q)\theta_L],\overline{\overline{\beta}})$. Therefore, for $\beta\in(\overline{\overline{\beta}},1]$, there exists a perfect recall PBE; for $\beta\in(\theta_L/[q\theta_H+(1-q)\theta_L],\overline{\overline{\beta}})$, the two PBEs coexist.

When $\pi\in(\overline{\pi},1]$, $\chi(1,\beta)$ is negative for $\beta\in(\underline{\underline{\beta}},1]$, and $\chi(q,\beta)$ is positive for $\beta\in[0,\overline{\overline{\beta}})$. Therefore, when $\pi\in(\overline{\pi},1]$, for $\beta\in(\overline{\overline{\beta}},1]$, there exists a perfect recall PBE; for $\beta\in(\underline{\underline{\beta}},\overline{\overline{\beta}})$, the two PBEs coexist; for $\beta\in[\theta_L/[q\theta_H+(1-q)\theta_L],\underline{\underline{\beta}})$, there exists a signal manipulation PBE.

C Additional Analysis

C.1 Other Country-level Measures of Self-confidence

The dataset of Schmitt and Allik (2005) contains more country-level measures of self-confidence, including self-liking and self-esteem as aforementioned, though they are generally inferior to self-competence to proxy self-confidence in terms of rigorous definitions. To check the robustness

of the empirical results in Tables 1, 2 and 3, we use these additional measures instead of self-competence as a complementary analysis. These additional self-confidence measures include the following:

Self-esteem: The 10-item self-reported version of the Rosenberg self-esteem scale is the most widely used measure of global self-esteem. Global self-esteem is typically defined as one's overall sense of worth as an individual.

Self-liking: Self-liking is one of the two subscales of Rosenberg's global self-esteem scale. It is the intrinsic feature of the self as a social object, the sense that one is a good person, is socially relevant, and contributes to group harmony.

Positively worded items: Positively worded items refer to the five questions using positive words toward oneself in Rosenberg's 10-item survey. For example, "on the whole, I am satisfied with myself (strongly agree – strongly disagree)" is a positively worded item.

Negatively worded items: Negatively worded items refer to the five questions using negative words toward oneself in Rosenberg's 10-item survey. For example, "at times I think I am no good at all (strongly agree – strongly disagree)" is a negatively worded item. Negatively worded items are reverse scored.

[Insert Table E.1 about here]

The regression results in Table E.1 establish that if other measures of self-confidence are used instead of self-competence, the result of testing Hypothesis 1 is similar, although somewhat weakened compared to those reported in Tables 1. Specifically, if the IVR score increases by one standard deviation, then the self-esteem score will increase by approximately 0.5 standard deviations (statistically significant at the 5 percent level) and the positively worded items score will also increase by approximately 0.5 standard deviations (statistically significant at the 5 percent level). While the IVR score has much less explanatory power of the cross-country variations in its self-liking or negatively worded items. Although the signs are positive for self-liking or negatively worded items, the effect is smaller in size and less statistically significant. This is consistent with our expectations, as the additional measures have more noise in measurement and are inferior to self-competence in terms of serving as a belief in one's capabilities and talents. Hence, our baseline analysis focuses on self-competence.

[Insert Table E.2 about here]

The regression results in Table E.2 use other measures of self-confidence as the dependent variable instead of self-competence. In testing Hypothesis 2 (a) regarding population density,

the results are weakened if self-liking or negatively worded items are used as the measure of self-confidence instead of self-competence. The results are only slightly weakened if self-esteem or positively worded items are used as the dependent variable. However, in testing Hypothesis 2 (b) regarding ancestry-adjusted extended family, the results are improved if self-liking or negatively worded items are used as the measure of self-confidence instead of self-competence. The results are not weakened if self-esteem or positively worded items are used as the dependent variable.

[Insert Table E.3 about here]

In terms of testing Hypothesis 3, the regression results in Table E.3 indicate that if self-esteem or positively worded items are used instead of self-competence as the explanatory variable, the conclusions are only slightly weakened or not weakened. If self-liking or negatively worded items are used in regressions, they are not statistically significant at conventional levels, although their signs are still aligned with the testable predictions.

C.2 Historical Population Density as a Proxy of $1 - \pi$

One concern about the validity of using contemporary population density as the proxy of $1 - \pi$ lies in the simultaneity between population density and overall self-serving beliefs about one's ability. The negative effect of social interaction frequency, proxied by population density, is illustrated in our model; however, collective self-serving beliefs about one's ability might also influence a country's fertility rate and thus its population density. For example, one might believe that his above-average gifts and talents originate from superior genes or outstanding family traditions. Therefore, he also believes that these gifts and talents are inheritable by his children. Such overconfident parents might be willing to breed more offspring. As a consequence, at the country level, countries with high self-competence scores will have higher fertility rates and, therefore, a higher population density.

To lessen the concern of endogeneity of population density due to simultaneity, we use the historical population density for each country instead of the contemporary population density for robustness checks. Specifically, we use log population density in 1950 and log population density in 1900 as two historical measures of $1 - \pi$. The historical population densities in 1950 and 1900 are computed based on the grid cell level population density from the History Database of Global Environment (HYDE) data (Klein Goldewijk et al., 2017). The country average is calculated as the average population within contemporary boundaries of the country. If we regard self-competence as a type of national culture that is temporally stable and persis-

tent across generations for decades, the historical population density should also have strong explanatory power for self-competence.

[Insert Table E.4 about here]

The OLS estimation results in Table E.4 suggest that countries with a higher historical population density have lower average self-competence scores. Specifically, columns (1)-(3) and (7)-(9) suggest that if one country's log population density in 1950 increases by one standard deviation, then its self-competence score tends to decrease by approximately 0.4 standard deviations. This effect is statistically significant at the 5 percent level when we control for the IVR score. Columns (4)-(6) and (10)-(12) suggest that if one country's log population density in 1900 increases by one standard deviation, then its self-competence score tends to decrease by approximately 0.35 standard deviations. This effect is statistically significant at the 10 percent level when we control for the IVR score. Compared with the original regression results in Table 2 using current population density, the effect sizes are generally smaller and the significance levels are generally higher when the historical population density is used and IVR score is controlled.

D Variable Definitions and Data Sources

D.1 Country-level Measures of Self-confidence

Self-competence: Self-competence is one of the subscales of Rosenberg's global self-esteem scale. The survey of Rosenberg's global self-esteem scale was part of the first wave of the International Sexuality Description Project (ISDP) (Schmitt, 2003), a cross-country survey that included samples from 56 nations representing 6 continents, 13 islands, and 28 languages. The data are obtained from Schmitt and Allik (2005).

Self-liking: Self-liking is one of the subscales of Rosenberg's global self-esteem scale. The data are obtained from Schmitt and Allik (2005).

Self-esteem: The 10-item self-reported version of the Rosenberg self-esteem scale is the most widely used measure of global self-esteem. The data are obtained from Schmitt and Allik (2005).

Positively worded items: Positively worded items refer to the five questions of Rosenberg's 10-item self-reported global self-esteem survey using positive words toward oneself. The data are obtained from Schmitt and Allik (2005).

Negatively worded items: Negatively worded items refer to the five questions of Rosenberg's 10-item self-reported global self-esteem survey using negative words toward oneself. The data are obtained from Schmitt and Allik (2005).

D.2 Country-level Measures of Time Preference

Indulgence vs. restraint: This cultural dimension refers to the degree of freedom that social norms give to citizens in satisfying human needs and cravings. The data are obtained from Hofstede, Hofstede, and Minkov (2010) and are available at https://www.hofstede-insights.com/product/compare-countries/.

D.3 Country-level Measures of Frequency of Social Interactions

Population density (log): The population density is the midyear population divided by land area in square kilometers. The variable is taken from the natural log transformation and averaged over 1996-2005. The data are obtained from World Bank Open Data.

Population density, 1950 (log): The population density in 1950 is computed based on the grid cell level population density from the History Database of Global Environment (HYDE) data (Klein Goldewijk et al., 2017). The variable is taken from the natural log transformation. The country average is calculated as the average population within the contemporary boundaries of the country. The data are obtained from Enke (2019).

Population density, 1900 (log): The population density in 1900 is computed based on the grid cell level population density from the History Database of Global Environment (HYDE) data (Klein Goldewijk et al., 2017). The variable is taken from the natural log transformation. The country average is calculated as the average population within the contemporary boundaries of the country. The data are obtained from Enke (2019).

Extended family system (ancestry-adjusted): The extended family is a domestic organization system different from independent nuclear families. The original ethnicity-level data source of domestic organization is the Ethnographic Atlas (EA), which is a cross-society dataset that describes cultural values, norms, traditions, and practices for nearly 1,300 societies originally compiled by Murdock (1967). Enke (2019) generates a binary variable "nuclear family" based on Q8 of the EA to indicate whether a society or country's domestic organization is primarily the independent nuclear family (= 1) or not (= 0). In particular, the nuclear family takes a value of one if the domestic organization is "independent nuclear family, monogamous (122)" or "independent nuclear family, occasional polygynous (273)" and zero otherwise. To match the historical ethnicity-level dataset to contemporary countries, Enke (2019) also makes use of the matching procedures introduced by Putterman and Weil (2010) and Giuliano and Nunn (2018) to ancestry-adjust the country-level data. Our data are directly obtained from Enke (2019). "Extended family" is the reverse score of Enke (2019)'s "nuclear family": *extended family = 1 - nuclear family.*

D.4 Country-level Measure of Tendency to Cooperate

Agreeableness: Agreeableness is one of the Big Five personality traits primarily reflecting individual differences in the tendency to cooperate, prosociality and social harmony. The data are obtained from Schmitt et al. (2007).

D.5 Control Variables

GDP per capita: The gross domestic product converted to international dollars using purchasing power parity rates and divided by total population. The variable is taken from the natural log transformation. The data are obtained from World Bank Open Data.

Secondary school enrollment rate: The gross enrollment ratio is the ratio of total enrollment, regardless of age, to the population of the age group that officially corresponds to the secondary education. The data are obtained from World Bank Open Data.

Age dependency ratio: The age dependency ratio is the ratio of dependents – people younger than 15 or older than 64 – to the working-age population – those ages 15-64. Data are shown as the proportion of dependents per 100 working-age members of the population. The data are obtained from World Bank Open Data.

Urbanization rate: The urban population refers to people living in urban areas as defined by national statistical offices. The data are obtained from World Bank Open Data.

GDP per capita growth: The annual percentage growth rate of GDP per capita based on constant local currency. Aggregates are based on constant 2010 U.S. dollars. The GDP per capita is the gross domestic product divided by the midyear population. The data are obtained from World Bank Open Data.

Unemployment rate: Unemployment refers to the share of the labor force that is without work but available for and seeking employment. The data are obtained from World Bank Open Data.

Total land area: The land area is a country's total area, excluding area under inland water bodies, national claims to the continental shelf, and exclusive economic zones. In most cases, the definition of inland water bodies includes major rivers and lakes. The variable is taken from the natural log transformation. The data are obtained from World Bank Open Data.

Landlocked: A dummy variable to indicate whether a country is landlocked (= 1) or not (= 0). The data are obtained from the World Factbook by the Central Intelligence Agency (CIA).

Island: A dummy variable to indicate whether a country shares a land border with any other country (= 1) or not (= 0). The data are obtained from the World Factbook by the Central Intelligence Agency (CIA).

Former European colony: A dummy variable to indicate whether a country was a former European colony (= 1) or not (= 0). The data are obtained from Acemoglu, Johnson, and Robinson (2002) and are available at https://economics.mit.edu/faculty/acemoglu/data/ajr2002.

Communist regime in Post-WWII: A dummy variable to indicate whether a country was under a communist regime in the post-WWII period (= 1) or not (= 0). The data are obtained from Alesina, Giuliano, and Nunn (2013).

Confucian world: A dummy variable to indicate whether a country is strongly influenced by Confucianism (= 1) or not (= 0). The data are obtained from the Wikipedia.

Percentage of population with native ancestry in 1500 CE: The percentage of population with native ancestry in 1500 CE. The data are obtained from Galor and Özak (2016).

Share of Protestants/Roman Catholics/Muslims/other religions in the population: The percentage of the population that belonged to the three most widely spread religions in 1980. For countries of recent formation, the data are available for 1990–1995. The data are obtained from Galor and Özak (2016).

Spanish/British/French/Portuguese/Other European colonial origin: Dummy variables for the colonial origin during the European colonial period starting with the 15th century. The data are obtained from Enke (2019).

British/French/Socialist/German/Scandinavian legal origin: Dummy variables for the origin of legal system. The data are obtained from Galor and Özak (2016).

E Tables

Table E.1: Indulgence vs. Restraint and Other Self-confidence Measures

	Self-esteem			Self-liking			Positively Worded Items			Negatively Worded Items		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Indulgence vs. restraint	0.37*	0.51**	0.53**	0.18	0.31	0.32	0.44**	0.54**	0.55**	0.24	0.39*	0.41*
	(1.98)	(2.53)	(2.61)	(0.93)	(1.41)	(1.36)	(2.14)	(2.47)	(2.54)	(1.28)	(1.97)	(1.85)
Baseline socio-economic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional socio-economic controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Geographical and historical controls	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
Observations	48	48	47	48	48	47	48	48	47	48	48	47
R-squared	0.14	0.27	0.39	0.054	0.17	0.26	0.17	0.25	0.36	0.16	0.3	0.39

Note: The table replicates Table 1 regression results with the other self-confidence measures instead of self-competence. The baseline socio-economic controls include GDP per capita based on purchasing power parity, secondary school enrollment rate, and age dependency ratio; additional socio-economic controls include urbanization rate, GDP per capita growth, and unemployment rate; geographical and historical controls include log total land area, a landlocked dummy, an island dummy, and a former European colony dummy. All socio-demographic control variables are averaged over 1996-2005. All independent variables and the dependent variable have been standardized by subtracting their mean and dividing by their standard deviation. The standardized coefficients show that how many standard deviations the dependent variable will change, per standard deviation increase in the independent variable. Robust t-statistics are reported in parentheses. *** denotes statistical significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level, all for two-sided hypothesis tests.

Table E.2: Population Density, Extended Family System and Other Self-confidence Measures

Panel A	Self-esteem					
	(1)	(2)	(3)	(4)	(5)	(6)
Population density (logged)	-0.36**	-0.30*	-0.52**			
	(-2.48)	(-1.88)	(-2.48)			
Extended family system (ancestry-adjusted)				-0.28*	-0.27*	-0.3
				(-1.78)	(-1.73)	(-1.63)
Observations	51	51	50	49	49	49
R-squared	0.2	0.22	0.42	0.17	0.21	0.35
Panel B	Self-liking					
	(1)	(2)	(3)	(4)	(5)	(6)
Population density (logged)	-0.25*	-0.16	-0.35*			
	(-1.83)	(-1.09)	(-1.72)			
Extended family system (ancestry-adjusted)				-0.30*	-0.30*	-0.37**
				(-1.86)	(-1.92)	(-2.14)
Observations	51	51	50	49	49	49
R-squared	0.11	0.14	0.29	0.17	0.21	0.32
Panel C	Positively Worded Items					
	(1)	(2)	(3)	(4)	(5)	(6)
Population density (logged)	-0.41***	-0.38**	-0.62***			
	(-3.10)	(-2.60)	(-3.17)			
Extended family system (ancestry-adjusted)				-0.18	-0.16	-0.18
				(-1.10)	(-1.01)	(-0.92)
Observations	51	51	50	49	49	49
R-squared	0.23	0.24	0.4	0.09	0.12	0.27
Panel D	Negatively Worded Items					
	(1)	(2)	(3)	(4)	(5)	(6)
Population density (logged)	-0.25*	-0.16	-0.32			
	(-1.76)	(-1.09)	(-1.61)			
Extended family system (ancestry-adjusted)				-0.31**	-0.31**	-0.33**
				(-2.17)	(-2.14)	(-2.07)
Observations	51	51	50	49	49	49
R-squared	0.2	0.23	0.41	0.29	0.32	0.42
Baseline socio-economic controls	Yes	Yes	Yes	Yes	Yes	Yes
Additional socio-economic controls	No	Yes	Yes	No	Yes	Yes
Geographical and historical controls	No	No	Yes	No	No	Yes

Note: The table replicates Table 2 regression results with the other self-confidence measures instead of self-competence. The baseline socio-economic controls include GDP per capita based on purchasing power parity, secondary school enrollment rate, and age dependency ratio; additional socio-economic controls include urbanization rate, GDP per capita growth, and unemployment rate; geographical and historical controls include log total land area, a landlocked dummy, an island dummy, and a former European colony dummy. All socio-demographic control variables are averaged over 1996-2005. All independent variables and the dependent variable have been standardized by subtracting their mean and dividing by their standard deviation. The standardized coefficients show that how many standard deviations the dependent variable will change, per standard deviation increase in the independent variable. Robust *t*-statistics are reported in parentheses. *** denotes statistical significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level, all for two-sided hypothesis tests.

Table E.3: Other Self-confidence Measures and Agreeableness

	Agreeableness											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Self-esteem	0.28*	0.27*	0.32**									
	(2.00)	(2.01)	(2.22)									
Self-liking				0.18	0.13	0.14						
				(1.33)	(0.93)	(0.92)						
Positively worded items							0.33**	0.33***	0.35***			
							(2.67)	(3.14)	(2.97)			
Negatively worded items										0.2	0.17	0.23
										(1.29)	(1.11)	(1.34)
Baseline socio-economic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional socio-economic controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Geographical and historical controls	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
Observations	51	51	50	51	51	50	51	51	50	51	51	50
R-squared	0.27	0.4	0.46	0.24	0.36	0.4	0.3	0.44	0.48	0.24	0.36	0.42

Note: The table replicates Table 3 regression results with the other self-confidence measures instead of self-competence. The baseline socio-economic controls include GDP per capita based on purchasing power parity, secondary school enrollment rate, and age dependency ratio; additional socio-economic controls include urbanization rate, GDP per capita growth, and unemployment rate; geographical and historical controls include log total land area, a landlocked dummy, an island dummy, and a former European colony dummy. All socio-demographic control variables are averaged over 1996-2005. All independent variables and the dependent variable have been standardized by subtracting their mean and dividing by their standard deviation. The standardized coefficients show that how many standard deviations the dependent variable will change, per standard deviation increase in the independent variable. Robust t-statistics are reported in parentheses. *** denotes statistical significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level, all for two-sided hypothesis tests.

Table E.4: Historical Population Density and Self-competence

	Self-competence											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Population density, 1950 (logged)	-0.43***	-0.40**	-0.63**				-0.41**	-0.33*	-0.56**			
	(-2.69)	(-2.42)	(-2.69)				(-2.54)	(-1.97)	(-2.35)			
Population density, 1900 (logged)				-0.40**	-0.36**	-0.59**				-0.36**	-0.30*	-0.51**
				(-2.56)	(-2.35)	(-2.50)				(-2.25)	(-1.83)	(-2.16)
Indulgence vs. restraint							0.3	0.40*	0.48**	0.31	0.42*	0.50**
							(1.65)	(1.90)	(2.50)	(1.62)	(1.96)	(2.60)
Baseline socio-economic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional socio-economic controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Geographical and historical controls	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
Observations	50	50	50	50	50	50	47	47	47	47	47	47
R-squared	0.24	0.26	0.42	0.23	0.25	0.41	0.31	0.34	0.5	0.29	0.33	0.49

Note: The table replicates Table 2 regression results using population density in 1950 and 1900 instead of the average population density between 1996 and 2005. The baseline socio-economic controls include GDP per capita based on purchasing power parity, secondary school enrollment rate, and age dependency ratio; additional socio-economic controls include urbanization rate, GDP per capita growth, and unemployment rate; geographical and historical controls include log total land area, a landlocked dummy, an island dummy, and a former European colony dummy. All socio-demographic control variables are averaged over 1996-2005. All independent variables and the dependent variable have been standardized by subtracting their mean and dividing by their standard deviation. The standardized coefficients show that how many standard deviations the dependent variable will change, per standard deviation increase in the independent variable. Robust t-statistics are reported in parentheses. *** denotes statistical significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level, all for two-sided hypothesis tests.

Table E.5: Pairwise Correlations of Country-level Self-confidence Measures

	(1)	(2)	(3)	(4)	(5)
(1) Self-competence	1				
(2) Self-liking	0.61***	1			
(3) Self-esteem	0.91***	0.89***	1		
(4) Positively worded items	0.92***	0.66***	0.88***	1	
(5) Negatively worded items	0.73***	0.91***	0.92***	0.61***	1

Note: The table reports pairwise correlations of country-level self-confidence measures. *** denotes statistical significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level, all for two-sided hypothesis tests.

Table E.6: Summary Statistics of the Variables of Interest in the Sample

	N	Mean	St. Dev.	Max	Min
	(1)	(2)	(3)	(4)	(5)
Self-competence	53	16.24	0.868	17.76	13.33
Self-liking	53	14.29	0.823	16.05	12.3
Self-esteem	53	30.51	1.537	33.59	25.5
Positively worded items	53	16.13	0.787	17.7	13.1
Negatively worded items	53	14.39	0.93	16.2	12.4
Agreeableness	53	47.53	2.794	54.82	42.21
Indulgence vs. restraint	49	45.13	19.36	97	13
Extended family system (ancestry-adjusted)	51	0.501	0.443	1	0
Population density	52	279.8	886.1	6335	2.513
Population density, 1950	52	144.1	396.3	2749	0.712
Population density, 1900	52	65.13	104.2	576.2	0.403

Table E.7: Pairwise Correlations of Subject-level STEM-related Values

	(1)	(2)	(3)	(4)	(5)
(1) Score in STEM	1				
(2) Quartile in STEM	0.91***	1			
(3) Self-evaluated quartile in STEM	0.11***	0.09***	1		
(4) Overconfidence in STEM	-0.79***	-0.88***	0.40***	1	
(5) Be overconfident in STEM	-0.68***	-0.78***	0.27***	0.85***	1

Note: The table reports pairwise correlations of subject-level STEM-related values. *** denotes statistical significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level, all for two-sided hypothesis tests.

Table E.8: Pairwise Correlations of Subject-level Tendency to Cooperate Measures

	(1)	(2)	(3)
(1) Family members cooperate with each other.	1		
(2) I cooperate with my siblings.	0.67***	1	
(3) I contribute a lot to my family.	0.38***	0.22***	1

Note: The table reports pairwise correlations of subject-level measures of tendency to cooperate in family issues. *** denotes statistical significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level, all for two-sided hypothesis tests.

Table E.9: Summary Statistics of the Variables of Interest in the Online Experiment

	N	Mean	St. Dev.	Max	Min
	(1)	(2)	(3)	(4)	(5)
Seconds used in survey	1679	507	906.8	27178	96
Female	1679	0.647	0.478	1	0
Age	1679	31.24	10.08	72	6
Married	1679	0.457	0.498	1	0
The only child	1679	0.375	0.484	1	0
Number of siblings	1679	1.314	1.454	6	0
Household size	1679	3.559	1.63	10	1
Multiple switching	1679	0.0393	0.194	1	0
β	1679	1.038	0.17	1.6	0.625
Present-biased	1679	0.109	0.312	1	0
Score in STEM	1679	3.224	0.784	4.833	0.0833
Quartile in STEM	1679	2.388	1.072	4	1
Self-evaluated quartile in STEM	1679	3.13	0.564	4	1
Overconfidence in STEM	1679	0.742	1.165	3	-3
Be overconfident in STEM	1679	0.569	0.495	1	0
Family members cooperate with each other.	1679	3.13	1.067	5	1
I cooperate with my siblings.	1100	2.937	1.082	5	1
I contribute a lot to my family.	1679	3.446	1.036	5	1

F Figures

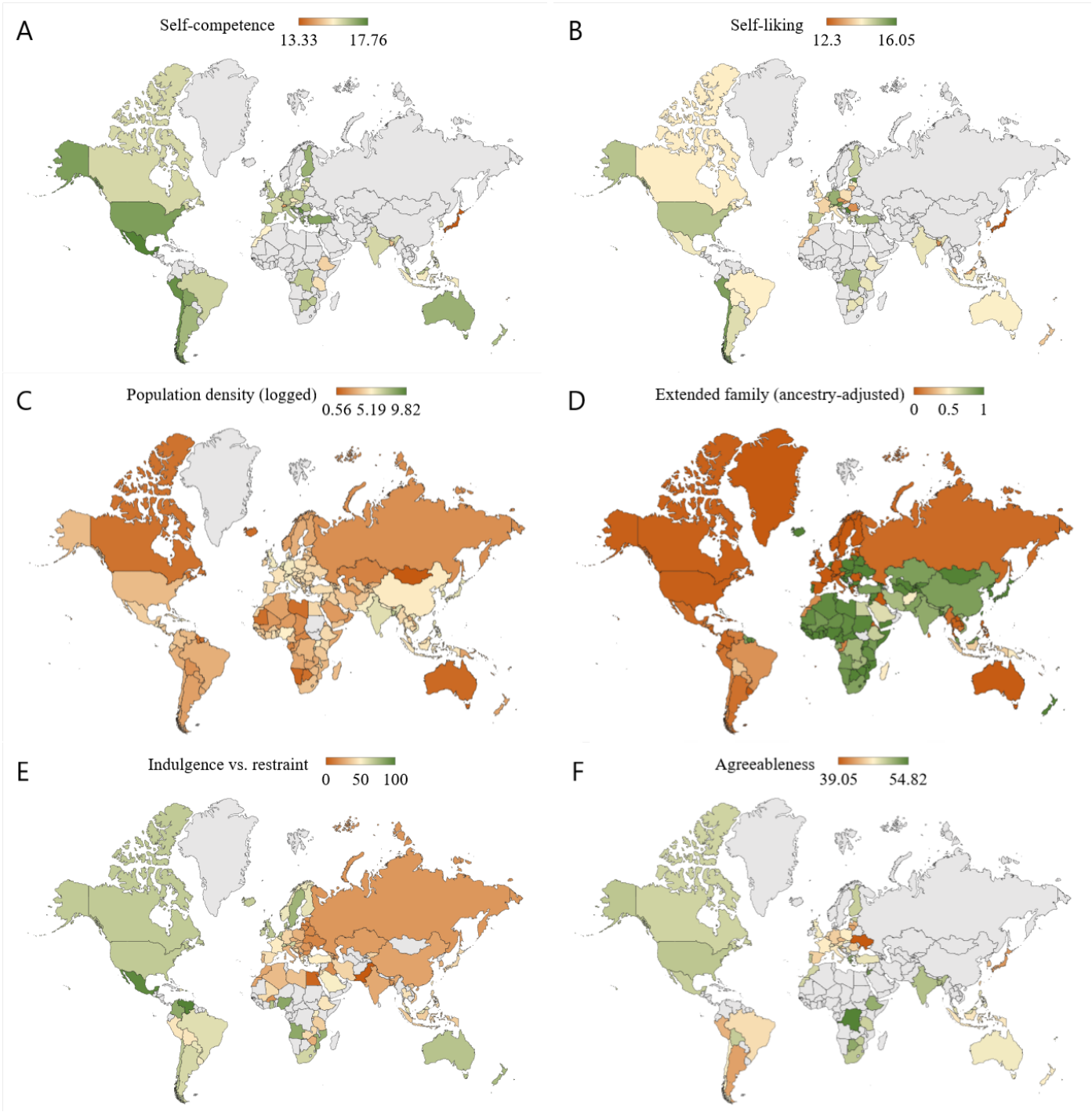

Figure F.1: Global distributions of the variables of interest

G Online Experiment Instructions

Emotion Experiment Questionnaire

Welcome to participate our online experiment questionnaire! Complete the whole questionnaire, then you will have multiple chances to win ¥100 cash rewards. The cash rewards will be paid through WeChat. This questionnaire will take about 10 minutes. (Questions with * are compulsory.)

Part 1: Economic multiple-choice questions.

We will randomly select 5 participants and randomly select one of the questions from the multiple-choice questions, and then reward the winner in WeChat based on the date and monetary amount chosen by the winner in that question.

(We will conduct a lucky draw for the economic multiple-choice questions on September 11 and 13, 2022 at 22:00, and announce the results of the lucky draw in the Moments of the WeChat account "Behavioral Economics Online Experiment". The QR code of the WeChat account will be displayed at the end of the questionnaire, and you can add the WeChat account as your friend.)

1. Would you rather get ¥200 tomorrow or ¥200 after 31 days? [Single-choice] *

(If you are the lucky winner and we draw this multiple-choice question to determine the prize amount -- If you selected "Get ¥200 tomorrow", then we will give you ¥200 tomorrow; If you choose "Get ¥200 after 31 days", then we will give you ¥200 after 31 days. The subsequent economic multiple-choice questions will be rewarded in the same way as this question.)

○Get ¥200 tomorrow
○Get ¥200 after 31 days

2. Would you rather receive ¥200 tomorrow or ¥220 after 31 days? [Single-choice] *
○Get ¥200 tomorrow
○Get ¥220 after 31 days

3. Would you rather get ¥200 tomorrow or ¥250 after 31 days? [Single-choice] *
○Get ¥200 tomorrow

○Get ¥250 after 31 days

4. Would you rather get ¥200 tomorrow or ¥280 after 31 days? [Single-choice] *
○Get ¥200 tomorrow
○Get ¥280 after 31 days

5. Would you rather get ¥200 tomorrow or ¥300 after 31 days? [Single-choice] *
○Get ¥200 tomorrow
○Get ¥300 after 31 days

6. Would you rather get ¥200 after 31 days or ¥200 after 61 days? [Single-choice] *

(If you are the lucky winner and we draw this multiple-choice question to determine the prize amount -- If you choose "¥200 after 31 days", then we will give you ¥200 after 31 days; If you choose "¥200 after 61 days", then we will give you ¥200 after 61 days. The subsequent multiple-choice questions will be rewarded in the same way as this question.)

○Get ¥200 after 31 days
○Get ¥200 after 61 days

7. Would you rather get ¥200 after 31 days, or ¥220 after 61 days? [Single-choice] *
○Get ¥200 after 31 days
○Get ¥220 after 61 days

8. Would you rather get ¥200 after 31 days or ¥250 after 61 days? [Single-choice] *
○Get ¥200 after 31 days
○Get ¥250 after 61 days

9. Would you rather get ¥200 after 31 days or ¥280 after 61 days? [Single-choice] *
○Get ¥200 after 31 days
○Get ¥280 after 61 days

10. Would you rather get ¥200 after 31 days or ¥300 after 61 days? [Single-choice] *
○Get ¥200 after 31 days
○Get ¥300 after 61 days

Part 2: Situational test of emotion management.

You are about to begin the situational test of emotion management, which consists of 6 questions. In this part, you will be presented with some brief descriptions of emotional situations and have to choose the best one action from four choices to manage the character's emotional feelings and the problems they are facing. While more than one option may be possible, you will need to choose what you think is the best way to react for the character in that situation. Remember, you don't have to choose what you would do or what would be the kindest thing to do, but rather the best way to react in that situation. For each question, you will only have 60 seconds to answer.

Two participants will be randomly selected to take one of the questions from the situational test of emotion management. If the winner gets the question right, they will receive a ¥100 reward, and if they get the question wrong, they will not receive a reward. You cannot go back and change your answer after you submit it by clicking "Next". Select "Start" and click "Next" to start the countdown.

1. Zhang Lei has been overseas for a long time and returns to visit his family. So much has changed that Zhang Lei feels left out. What action would be the most effective for Zhang Lei?
○Nothing – it will sort itself out soon enough.
○Tell his family he feels left out.
○Spend time listening and getting involved again.
○Reflect that relationships can change with time.

2. Li Na has not spoken to her nephew for months, whereas when he was younger they were very close. She rings him but he can only talk for five minutes. What action would be the most effective for Li Na?
○Realize that he is growing up and might not want to spend so much time with his family any more.
○Make plans to drop by and visit him in person and have a good chat.
○Understand that relationships change, but keep calling him from time to time.
○Be upset about it, but realize there is nothing she can do.

3. Li Xia and her sister-in-law normally get along quite well, and the sister-in-law regularly baby-sits for her for a small fee. Lately she has also been cleaning away cobwebs, commenting on the mess, which Li Xia finds insulting. What action would be the most effective for Li Xia?
○Tell her sister-in-law these comments upset her.
○Get a new babysitter.
○Be grateful her house is being cleaned for free.
○Tell her only to baby-sit, not to clean.

4. Wang Li's friend Xiu Ying is moving overseas to live with her partner. They have been good friends for many years and Xiu Ying is unlikely to come back. What action would be the most effective for Wang Li?
○Forget about Xiu Ying.
○Spend time with other friends, keeping herself busy.
○Think that Xiu Ying and her partner will return soon.
○Make sure she keeps in contact through email, phone or letter writing.

5. Li Juan's friend points out that her young children seem to be developing more quickly than Li Juan's. Li Juan sees that this is true. What action would be the most effective for Li Juan?
○Talk the issue over with another friend.
○Angrily confront her friend about making such statements.
○Realize that children develop at different rates.
○Talk to a doctor about what the normal rates of development are.

6. Xia Li hasn't seen Liu Fang for ages and looks forward to their weekend trip away. However, Liu Fang has changed a lot and Xia Li finds that she is no longer an interesting companion. What action would be the most effective for Xia Li?
○Cancel the trip and go home.
○Realize that it is time to give up the friendship and move on.
○Understand that participants change, so move on, but remember the good times.
○Concentrate on her other, more rewarding friendships.

7. For the situational test of emotion management you just completed, you are asked to guess: among all questionnaire participants, your score for this part is at _____.

We will randomly select 5 of the participants who guessed correctly on this question to receive ¥100 each. [Single-choice] *

○Top 25% (very good performance)
○Top 25% - Top 50% (fairly good performance)
○Bottom 25% - Bottom 50% (fairly poor performance)
○Bottom 25% (very poor performance)

Part 3: Personal information questionnaire.

We will never disclose any of your personal information.

1. Gender: [Single-choice] *

○Male
○Female
○Do not want to disclose

2. Year of birth [Single-choice] *
○2016
…
○1922

3. Marital status: [Single-choice] *
○Married
○Unmarried
○Other status

4. Total number of permanent household residents (including yourself): [Single-choice] *
○1 person
○2 persons
○3 persons
○4 persons
○5 persons
○6 persons
○7 persons
○8 persons
○9 persons
○10 or more

5. Highest education (including in-progress): [Single-choice] *
○Elementary school or below
○Junior high school
○Secondary school or high school
○University college or undergraduate college
○Master's degree or above
○Other education such as vocational education

6. Are you an only child (the only child of your parents now): [Single-choice] *
○Yes
○No
○Twins, adopted children, other cases such as early death of siblings

7. How many full/half siblings do you have: [Single-choice] *
(Full siblings refer to having the same father and mother. Half-siblings refer to having the same father but different mothers, or vice versa.)
○No
○1
○2
○3
○4
○5
○6 or more

8. The following statements describe common family situations. There are no right or wrong answers. Read each description carefully and choose the option that reflects the real situation of your family. [Matrix Scale Questions] *

	Never/almost never	Rarely	Occasionally	Often	Always/almost always
Family members cooperate with each other.					
I cooperate with my siblings.					
I contribute a lot to my family.					
Payoffs are shared among family members.					
Family members with greater ability contribute more.					

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